

HUMAN DISTURBANCE AS A LIMITING FACTOR  
OF SIERRA NEVADA BIGHORN SHEEP

by

David J. Dunaway, Wildlife Biologist  
U.S. Forest Service, Bishop, California

ABSTRACT

The only native bands of California bighorn sheep (*Ovis canadensis californiana*) remaining in the United States are found on several small areas in the Sierra Nevada. Recent studies conducted by the Inyo National Forest indicate these small bands have suffered a decline over the past two decades. During this time span, the major impact on the sheep ranges has been the great increase in recreational use. Bighorn sheep numbers have apparently decreased on ranges that have been subject to large increases in human use. Statistical data are not available to support this hypothesis; however, field observations indicate the relationship does exist.

Bighorn sheep population in the western states experienced a large decline in numbers starting with the gold rush era and continuing through the turn of the century. Many wildlife scientists think this decline was mainly caused by human encroachment on bighorn sheep ranges. Buechner (1960) stated that excessive hunting, forage competition with domestic livestock, scabies disease and loss of key winter ranges to human development were the major factors causing the early decline among bighorn populations. Van Den Akker (1960) listed military uses of bighorn ranges, construction of barriers across migration routes and upsurping of water holes for human uses as additional factors responsible for bighorn sheep losses. Human disturbance and loss of habitat due to urban development are the greatest threats to the continued survival of desert bighorn in the Santa Rosa Mountains of Southern California (Blong 1967).

The human disturbance factors mentioned above are normally apparent and lend themselves to measurement and evaluation of their effect on bighorn populations. The effect of the mere physical presence of humans on bighorn sheep is more intangible and very difficult to evaluate; however, many feel it can be detrimental to bighorn sheep in certain cases. It is frequently stated that bighorn sheep require living space that is subject to a minimum of human disturbance (Wilson 1969, Monson 1966, Nelson 1966). On the other hand, bighorn sheep have been reported living in close association with humans such as in Death Valley (Welles and Welles 1961) and the Buckskin Mountains near Parker Dam on the Colorado River (Nelson 1966).

The possible adverse effect of human disturbance on bighorn sheep in the Sierra Nevada was mentioned by Dixon in 1936. He felt that the increase in recreational camping on the bighorn summer ranges was one

of the major limiting factors of the bighorn sheep in the Sierras (Dixon 1936). Jones (1949) thought bighorn sheep in the Sierra Nevada required the solitude provided by the wilderness environment as part of their habitat needs. He cited the disappearance of bighorn from the Humphreys Basin area following a sharp rise in human use.

It appears that bighorn sheep response to contact with humans is quite variable. Bighorn reactions to human contacts in one area may not apply to bighorn-human contact in a different location.

#### BACKGROUND

Prior to the arrival of white man, California bighorn sheep (*Ovis canadensis californiana*) were present in scattered abundance along the Sierra Nevada crest northward through the Cascade Range and lava beds of Northern California, through Oregon and Washington into British Columbia. By the early nineteen-thirties the only surviving members of this subspecies of bighorn remaining in the United States were found in scattered bands in the Sierra Nevada. The early decline in numbers was due to illegal hunting, scabies disease, and forage competition with domestic livestock (mainly sheep).

Wildlife conservationists became alarmed by the drastic reduction of the Sierra Nevada bighorn populations. In 1941, a sanctuary was proposed to protect part of the remaining bighorn sheep and their habitat. Due to lack of concrete data regarding the actual status of the bighorn numbers, the sanctuary proposal was abandoned (Cronemiller 1941).

The first detailed study of the California bighorn sheep in the Sierra Nevada was conducted by Fred L. Jones during the summer of 1948. He located five ranges occupied by bighorns between Monache Meadows and Convict Creek. These were called the Mt. Langley, Mt. Williamson, Mt. Baxter, Birch Mountain and Convict Creek ranges (Jones 1949). The estimated number of California bighorns remaining in the Sierras was placed at 390 animals (Jones 1949).

#### CURRENT STATUS

The California bighorn sheep was classed as a rare animal in the United States in 1966 by the U.S. Fish and Wildlife Service's Committee on Rare and Endangered Wildlife.

The U.S. Forest Service is responsible for managing wildlife habitat on National Forest land. Of particular concern is the habitat of any species currently classed as rare or endangered. The Inyo National Forest administers more than ninety percent of the habitat that supports the remaining California bighorns native to the Sierra Nevada. Since 1967 the Forest has conducted field surveys on the five ranges described by Jones in 1949 to gather information on vegetative conditions on both summer and winter ranges. Data on bighorn

distribution and number were obtained to compare with the status reported in 1949 (Jones 1949).

Evaluation of the data collected from the surveys shows California bighorn ranges are generally in satisfactory condition (Dunaway 1970). Despite good range conditions the total numbers of bighorns appear to have declined over the past two decades. The largest losses have occurred on the Convict Creek, Birch Mountain and Mt. Langley ranges. Bighorn numbers on the Mt. Baxter and Mt. Williamson ranges, although somewhat lower than those reported in 1949, have remained fairly stable. The total number of California bighorns remaining in the Sierra Nevada is estimated at 215 animals. Table 1 presents a summary of the current population estimates compared to those reported by Jones in 1949. Figure 1 shows the locations of the populations.

Table 1 - Status of California Bighorn Sheep on the Inyo National Forest, 1949 and 1970

Range	Area, Sq. Mi.	1949 <sup>1/</sup>	1970
Convict Creek	35	25	0
Birch Mountain	20	15	0
Mt. Baxter	75	135	95
Mt. Williamson	65	125	75
Mt. Langley	155	90	45
	<u>350</u>	<u>390</u>	<u>215</u>

<sup>1/</sup> Data from Jones, 1949

## DISCUSSION

The normal factors that limit the size of wildlife populations are operating at a low level among the California bighorn in the Sierra Nevada. Losses to illegal hunting are no longer a threat to the bighorn sheep. Excellent patrol by wardens of the California Department of Fish and Game and the difficulty involved in locating the sheep have discouraged poachers. Some natural predation no doubt occurs; however, it is thought that predation is not significant in limiting the population size. No predator kills have been located during the past four years or have any been reported by other people who hike the areas occupied by bighorn. Domestic livestock have not grazed on the bighorn ranges for many years. Domestic sheep, once a serious forage competitor with bighorn on the alpine summer ranges, no longer graze in the areas occupied by bighorn. Several cattle allotments are located along the broad alluvial fans at the base of the eastern Sierra scarp. These allotments adjoin the bighorn winter range at several points; however, there is no overlap due to the extremely rugged terrain occupied by the sheep. It is doubtful competed with the California bighorn on the winter ranges.

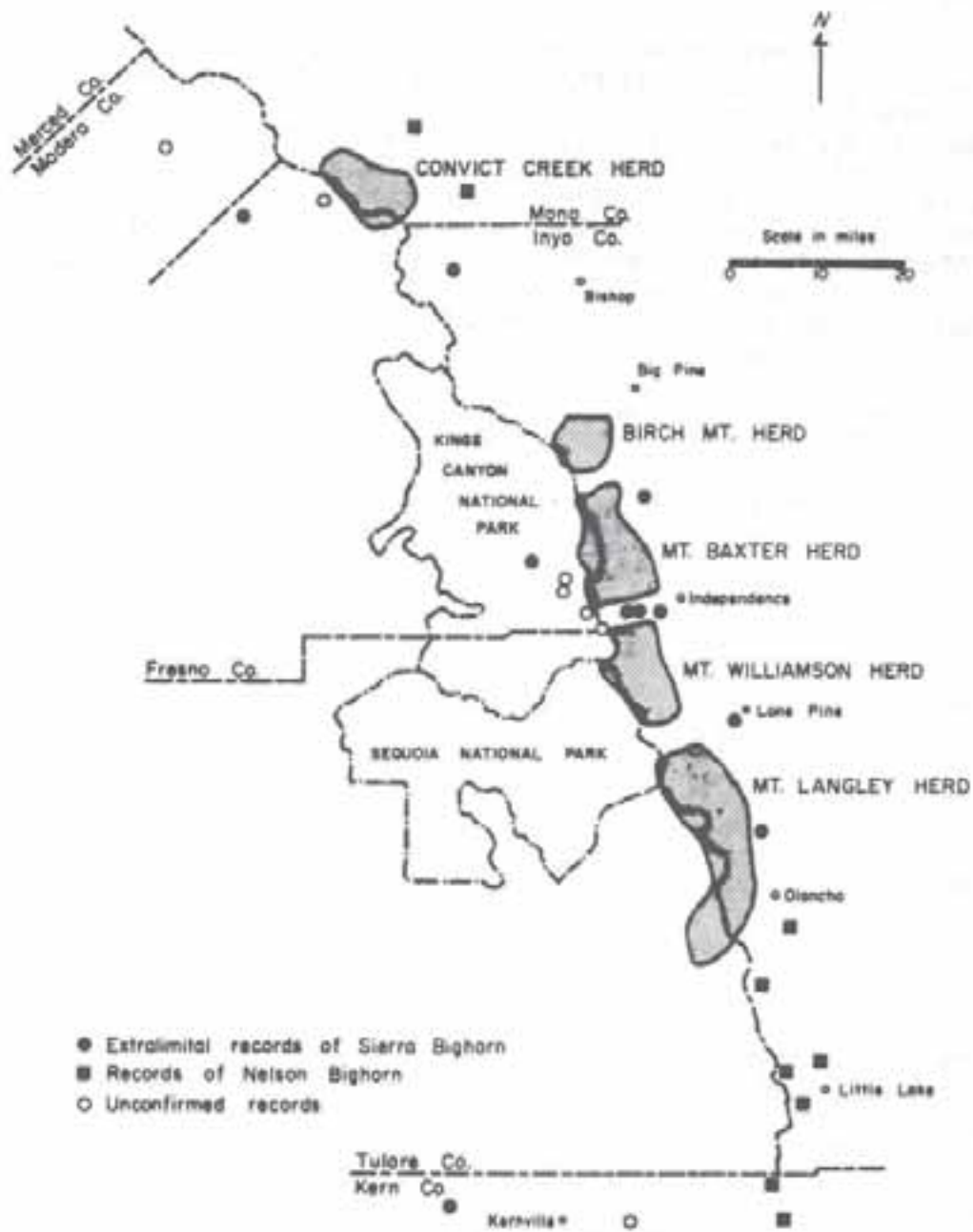


Figure 1. Distribution of California bighorn sheep in the Sierra Nevada in 1948. (From Jones, 1949).

Mule deer (*Odocoileus hemionus inyoensis*) and tule elk (*Cervus nannodes*) browse on winter ranges that are adjacent to several of the bighorn winter ranges but there is very little overlap between the two areas. At times bighorn move down onto the fringe area between the two winter ranges for the respective animals. There is some forage conflict in this narrow fringe area as all three animals use browse to a high degree during the winter months. At the present time the intensity of forage conflict among mule deer, tule elk, and California bighorn in these fringe areas between their winter ranges is well within acceptable limits. (Dunaway 1970).

Disease and parasites are not causing any significant losses of California bighorns at the present time. All the sheep observed in the field during the past four years have appeared to be in excellent condition. Fecal pellet samples collected from the winter ranges of the Mt. Baxter and Mt. Williamson bighorn herds were examined for internal parasites. Eggs and larvae of both lungworm (*Protostrongylus* sp) and threadnecked worm (*Nematodirus filicollis*) were found but at very low levels of occurrence (McCullough and Schneegas 1966, Dunaway 1970a).

When viewed individually the above factors probably have very little effect on limiting the bighorn populations in the Sierra Nevada. The combined effect is more significant but it is still probably not an effective population depressant. The current situation on Sierra Nevada bighorn ranges is similar to that reported by Jones in 1949 with one exception, that is the great increase in human use on these sheep ranges.

Recreational use of National Forest lands has increased at a rapid rate during the past twenty-year period. This large increase in use is readily apparent on the seventeen National Forests in California. The Report of the Chief of the Forest Service for 1969 states the total recreational use on all National Forests, National Grasslands, and other lands administered by the Forest Service for the year 1969 was more than 162 million days <sup>1/</sup>. Of this National total over 45 million visitor days (28%) were reported in California.

The Inyo National Forest ranks in the top three recreational use Forests in California. Recreational use pressures on the Forest resources has more than tripled during the past two decades. In 1950 total recreational use on the Forest was approximately 1.2 million visitor days. Forest statistics for 1970 show this use at more than 4.6 million visitor days. This upward trend in use has occurred in the wilderness areas on the Forest where the major portions of the California bighorn ranges are located.

---

<sup>1/</sup> Recreation use of National Forest land and water which aggregates 12 person-hours, may entail 1 person for 12 hours, 12 persons for 1 hour, or any equivalent combination of individual or group use.



Not only has the number of people using the wilderness increased but the mode of travel has changed. Prior to the fifties the most common method of travel in the Sierra high country was by horse with pack mule. This type of locomotion channeled the flow of people along the main trail network that traverses the Sierra Nevada high country. Human intrusion on alpine ranges occupied by California bighorn was at a low level. Foot travel was not strange to the Sierra at this time; however, hikers were generally in the minority among the back country recreationists. The early nineteen-sixties signaled a change in the method of travel in the wilderness. Hiking with a backpack became more popular as a way to see the high Sierra country. Today the major use of the wilderness is by hikers. The advantage the foot traveler has over the horseback rider is the ability to travel cross-country. Traversing through difficult terrain and mountain climbing are popular uses of the wilderness. One of the results of the change in the style of travel has been to place people in ever-increasing numbers on the rugged alpine bighorn ranges that were previously rarely visited by humans.

There are several areas in the Sierra where the relationship between heavy human use and absence of bighorn sheep can be seen. The five bighorn ranges first described by Jones (1949) have conspicuous gaps between them. These gaps were areas of high human use. For example, the gap between the Mt. Baxter and Mt. Williamson ranges contains Kearsarge Pass. This pass has been one of the favored routes across the Sierra crest for many years and receives extremely heavy human use. Mount Whitney is located in the gap between the Mt. Williamson range and the Mt. Langley range. Scaling the summit of the highest peak in the 48 states has been a popular event for many years. In 1970, approximately twenty-five thousand people hiked the Mount Whitney Trail from the trailhead at Whitney Portal on the Inyo National Forest.

All three bighorn ranges that have suffered losses in numbers of sheep have received major increases in recreational use. In contrast, the Mt. Baxter and Mt. Williamson ranges have not been exposed to this surge of recreationists seeking a wilderness experience. The California bighorn numbers for these two ranges have remained fairly stable over the past twenty-year period. There is no statistical data to prove the relationship between increased human use and decreased bighorn numbers in the Sierra Nevada; however, the relationship appears to be real.

## CONCLUSIONS

California bighorn populations in the Sierra Nevada have been at a low level for many years; however, the apparent loss of sheep numbers on three of the five occupied ranges during the past twenty-year period may place the subspecies in jeopardy. Continued losses may lead to the eventual extinction of the native stock of bighorn present in the Sierra. Although difficult to prove, it appears that human disturbance may be a major factor that limits the bighorn in the Sierra. It is realized that the most obvious conclusion can be completely wrong but we do not have the luxury of large bighorn populations on which to test

a variety of assumptions. Land managers charged with the responsibility of administering the natural resources must be aware of the needs of the bighorn sheep and make every effort to perpetuate the species. Only through awareness of the problems facing the bighorn and consideration for habitat needs in land management decisions will the California bighorn sheep remain as part of the native fauna of the Sierra Nevada.

#### LITERATURE CITED

- Blong, Bonnar. 1967. Desert bighorn and people in the Santa Rosa Mountains. Calif.-Nevada Section meeting, The Wildlife Society, Transaction, pp. 66-70.
- Buechner, Helmut K. 1960. The Bighorn Sheep in the United States, its past, present, and future. The Wildlife Society, Wildlife Monograph No. 4, 174 p.
- Cronemiller, F. P. 1941. Memorandum to the files. U.S.D.A., Forest Service, San Francisco, Calif. 4/28/41. 2 p.
- Dixon, Joseph S. 1936. The status of the Sierra bighorn sheep. Proceedings, 1st. N.A. Wildlife Conf., pp. 631-643.
- Dunaway, David J. 1970. Status of bighorn sheep populations and habitat studies on the Inyo National Forest. Desert Bighorn Council Transaction.
- Dunaway, David J. 1970a. Internal parasites infecting bighorn sheep populations on the Inyo National Forest. Unpub. manuscript, Inyo National Forest files, 2 pp. mimeo.
- Jones, Fred L. 1949. A survey of the Sierra Nevada mountain sheep. M.A. Thesis, Univ. of Calif. July 1949, 154 pp.
- McCullough, D. R. and E. R. Schneegas. 1966. Winter observations on the Sierra Nevada bighorn sheep. Calif. Fish and Game 52(2), pp. 68-84.
- Monson, Gale. 1966. The place of refuges in desert bighorn management. Desert Bighorn Council Transaction, pp. 21-23.
- Nelson, Marcus 1966. Problems of recreation use of game ranges. Desert Bighorn Council Transaction, pp. 13-20.
- U.S.D.A., Forest Service 1969. Report of the Chief, Forest Service. U.S. Govt. Printing Office, 85 pp.
- Van Den Akker, John B. 1960. Human encroachment on bighorn habitat. Desert Bighorn Council Transaction, pp. 38-40.
- Welles, R. E. and F. B. Welles. 1961. The bighorn of Death Valley. National Park Service, Fauna Series No. 6, 242 pp.

Wilson, Lanny O. 1969. The forgotten desert bighorn habitat requirement. Desert Bighorn Council Transaction, pp. 108-113.

### DISCUSSION

QUESTION BY EUGENE DECKER, CSU: Would you tell us about the Forest Service proposal for a zoological area that resulted from your field study?

REPLY BY DUNAWAY: At last week's Desert Bighorn Council meeting we reported on a proposed zoological area that will be set up for the express purpose of perpetuating the California bighorn in the Sierras. We have taken the ranges for the two largest herds, the Mt. Baxter and the Mt. Williamson herds, and we have tried to delineate the exterior boundaries to include all the ranges for these two herd units. We have proposed setting these two areas up as zoological areas. The main objective is to provide the needs of the California bighorn sheep. The major part of these two areas is located in the John Muir wilderness. The key sections of the winter ranges are located on the eastern scarp of the Sierra at the lower section of the John Muir wilderness. This amounts to slightly more than 4000 acres. We have sent this proposal into the regional office for classification of the area into a "California Bighorn Sheep Zoological Area."

One of our main administrative objectives for the area will be to limit human use. For example, we will maintain existing trails that go through these two areas at the barest minimum. We will not construct any new trails within these two units. In certain segments of each unit, human use will be definitely controlled. Use will be limited to the major trails only and camping will not be allowed.

We worked closely with Sequoia and King's Canyon National Parks on setting up these two areas. They have classified their particular areas on the western side of the Sierra crest, where some of the California bighorns find summer ranges, as Class 4 lands. This amounts to roughly 61,000 to 65,000 acres which adjoins our proposed zoological area. Once these are established I believe we will be able to have a more definite control on the human use factor on these two areas.

REPLY BY DECKER, CSU: How have the wilderness advocates, the Sierra Club, etc., reacted to this proposal which would curtail their activities?

REPLY BY DUNAWAY: Surprisingly, they are in full support. I first considered this concept about a year ago. I sent out quite a few letters of inquiry to various persons to see what they thought about setting up such a unit. We were concerned about the reaction of the Sierra Club. They are one of the main users of the John Muir Wilderness area. One of the sections of the Sierra Club, the Sierra Peak section, spend the majority of their time climbing peaks along the Sierra crest. They have what they call the Sierra Peaks badge which is



their ultimate goal. They have to climb 50 peaks to get the badge. Several of these are within our proposed zoological area. Mount Williamson, for example, is one of their favorite areas and is used in their basic mountaineering training. Their base camps may have 150 to 200 persons for a weekend. Of course, we had to consider this. I met with the Sierra Peaks section twice explaining the problem of human disturbance. Surprisingly, the Sierra Peaks sections backed it 100 percent. They took the initiative and curtailed all their base camp use and all their wilderness outings in these two areas for the 1971 period. I was quite gratified when they did this. Of course, it was something they really couldn't turn down.

We held two public meetings during January 1971. One was in Bishop and one was in Pasadena. The public has universally endorsed our proposals to protect some of these real key areas for bighorn habitat. I have a file of 450 letters from the general public. Of these, only two are against our proposal. The rest fully agree to it.