Recreational Pack Stock Management in Sequoia and Kings Canyon National Parks

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HORSES, MULES, BURROS, AND RECENTLY llamas and goats, are used to transport visitors and their supplies to backcountry and wilderness areas in the western United States. These animals were so synonymous with backcountry travel that Aldo Leopold (1921) defined the minimum size of wilderness area as a continuous stretch of country big enough to absorb a 2-week trip with pack stock. Although pack stock use has declined in the past 30 years, approximately 11% of all visitors use stock when visiting wilderness areas (Washburne and Cole 1983). Of particular interest to resource managers is the status of pack stock management in these backcountry areas. The history of pack stock use and management in Sequoia and Kings Canyon National Parks provides an excellent case study to evaluate the application of traditional range management principles in a non-traditional, recreation setting.

Sequoia National Park was established in 1890 to protect the magnificent groves of giant Sequoia trees *(Sequoiadendron gigantea),* and expanded to its current boundaries in 1926. Initially, Kings Canyon National Park was withdrawn from the public domain as part of the Forest Reserve System in 1891, and in 1940 was transferred to the National Park Service. Although legally separate parks, their proximity logically led to joint administration (Fig. 1). Located in the southern Sierra Nevada, the parks encompass over 850,000 acres, of which 85% is part of the National Wilderness Preservation System. Both parks are also part of the United Nations Man and the Biosphere Programme's International Biosphere Reserve network of outstanding protected samples of the world's major ecosystems.

Backcountry elevations range from 2,000 ft to 14,495 ft at the crest of Mt. Whitney, the highest point in conterminous United States. Topography varies from U-shaped glacial valleys with steep, sheer walls, to subalpine tablelands perched above these valleys, and massive jumbles of house-sized granite boulders and jagged spires that pierce the passing clouds. Plant communities vary from oak woodland and chaparral at lower elevations; mixed conifer and giant Sequoia forests to 6,500 ft; lodgepole pine *(Pinus contorta)* dominated forests to 9,500 ft; treeline forests of foxtail pine *(P. balfouriana)*; and alpine fell fields above 11,000 ft. Over 200 meadows are scattered along drainages and stacked behind glacial moraines and debris from 6,000–11,000 ft (Fig. 2). Variation in species composition and productivity in these meadows is due mainly to elevation effects on growing season length and water table depth (Ratliff 1985).

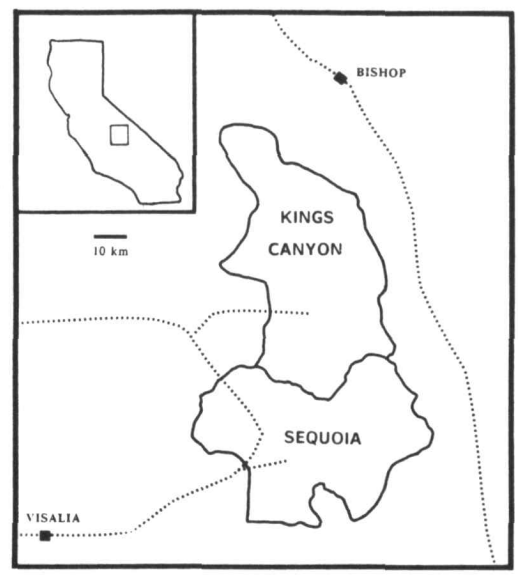

Fig. 1. *Location of Sequoia and Kings Canyon National Parks, California. Dotted lines are main access roads; there are no roads that cross east-west through the Parks.*

Like other federal land management agencies, the National Park Service attempts to satisfy multiple goals. Two goals that appear to conflict are preservation of natural resources and providing recreational opportunities. Enabling legislation directed the Service "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations" (United States Congress 1916). Park Service regulations permit pack stock to graze backcountry vegetation at levels that do not significantly alter native animal and plant populations or conflict with other recreational uses (National Park Service 1988).

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The author wishes to thank Paul Fodor and his staff of backcountry rangers at Sequoia and Kings Canyon National Parks for inspiration and assistance, and Audrey Goldsmith for constructive comments on an earlier draft of this article. Photograph by Ansel Adams courtesy of the Trustees of the Ansel Adams Publishing Rights Trust.

Natural Resource Plans are developed for each Park to meet the dual objectives of preservation and visitation. Sequoia and Kings Canyon National Parks recently finished a Stock Use and Meadow Management Plan as a supplement to the Natural Resource Plan (Sequoia and Kings Canyon National Park 1986). The objectives of the plan call for pack stock use to continue at current levels, while establishing regulations based on range management principles to keep stock use within the carrying capacity of the basic natural resources.

History of Recreational Pack Stock Use

Changes in pack stock use have been influenced by increased ecological awareness, new backpacking equipment, and changing perspectives of visitors and administrators.

Recreational pack stock use was initially limited by low demand and lack of forage due to sheep and cattle grazing before park establishment. Early park staff spent much of their time pursuing trespass livestock and lamenting the lack of feed for recreational stock users prior to the expansion of Sequoia National Park in 1926. In 1910 Superintendent E.S. Wright noted that "Tourists in the Kern Country find scant feed for their stock; a few thousand head of cattle are driven in every year from the south..." (National Park Service 1910). Four cattle allotments grandfathered into Kings Canyon National Park limited forage for pack stock, but by the late 1950's cattle numbers had been reduced and the last allotment was closed in 1986 following the death of an original permittee.

By the 1930's recreational pack stock use in the entire Sierra Nevada increased significantly, and by the 1940's 60 pack stations were in operation with over 3,000 horses and mules for hire (Livermore 1947). The history of pack stock use in Sequoia and Kings Canyon can be traced from the evolution of Sierra Club sponsored outings since the turn of the century.

The Sierra Club sponsored their first annual High Trip in 1901. As many as 250 people spent a month in the backcountry, moving camp 1–2 times a week. More than 100 pack and saddle stock and 15–20 packers were commissioned from nearby pack stations to move commissary and 50 lb of each member's dunnage to and from the trailhead and between camps. Most members chose to hike, but some opted to ride, especially over steep terrain. High Trips were the heart and soul of the club; old friendships were renewed, new ones born, and new members recruited while in the Sierran backcountry (Fig. 3). The latter was given as the most significant reason to continue the High Trip in the face of mounting criticism of the disturbance to meadow and other natural resources by such large groups (Brower 1948).

To reduce their impacts, the Sierra Club commissioned E.L. Sumner to evaluate and recommend improvements in their backcountry pack stock practices. After forty-two High Trips (no trips were held in 1918,

Fig. 2. *Lower Ranger Meadow at 8,700 ft in Kings Canyon National Park is a popular destination for private pack stock parties. Photograph by Michael J. Neuman.*

Fig. 3. *A typical pack stock train crossing Black Rock Pass in Sequoia and Kings Canyon National Parks. This photograph entitled "High Sierra Pass" was taken by Ansel Adams in 1934. Mr. Adams was a frequent member of early Sierra Club High Trips.*

1942–45), efforts were made to minimize the impacts of the High Trip by limiting the trip to 125 people and 30 lb of personal dunnage in 1947. Pack animal impact to the meadows was also reduced by pushing stock into seldom used areas during layovers and using wrangler horses to gather the animals when needed. In addition, a relay system of portage was employed; only necessary commissary and personal supplies were transported on moving days, and the rest was brought later. Group size was reduced to 100 in 1967, 50 in 1969, and 25 in 1973 before the High Trip was abandoned in 1974.

In 1958, the Sierra Club began offering High Light trips that were limited to 15–25 people and 20 lb of dunnage per person. Also, hiking trips with a maximum of 20 burros per party were started in 1938. These types of outings are still sponsored by the Sierra Club. In addition, from 1939–1983, a total of sixteen 2-week Saddle Trips were offered for a maximum of 25 riding enthusiasts per trip.

As pack stock trips were being reduced, knapsack and later backpacking trips without pack stock increased in popularity. Knapsack trips were initiated in 1954, and only 10 trips were offered in the Sierra Nevada in 1967. By 1981, 20 trips were sponsored, and the name was changed to Backpack trips. Thirty-eight backpack trips were offered in the Sierra Nevada in 1988.

Currently, over 670 miles of maintained trails provide both the backpacker and pack stock user with excellent opportunities to explore the Sequoia and Kings Canyon backcountry. Most backcountry travel occurs between spring snowmelt and early winter snowfalls. Backpackers greatly outnumber stock users, but this is a recent phenomenon (Fig. 4). Over 10,000 recreational pack stock nights per year were recorded in Sequoia and Kings Canyon National Park since 1977 (Sequoia and Kings Canyon National Parks 1986). Forty-three percent of these were from 17 commercial pack stations servicing riding and spot trips (dropping supplies to base camps), 28% were private groups using their own animals, and National Park Service trail crews and backcountry rangers accounted for the remainder. Currently, less than 5% of all backcountry

visitors use recreational stock in the parks.

Freeze-dried food, plastic gear, goose down sleeping bags, vibram sole boots, and the aluminum pack frame enabled backcountry visitors to shun the once necessary pack animal. However, stock use remains as a regular backcountry travel method despite the popularity of backpacking (Fig. 4).

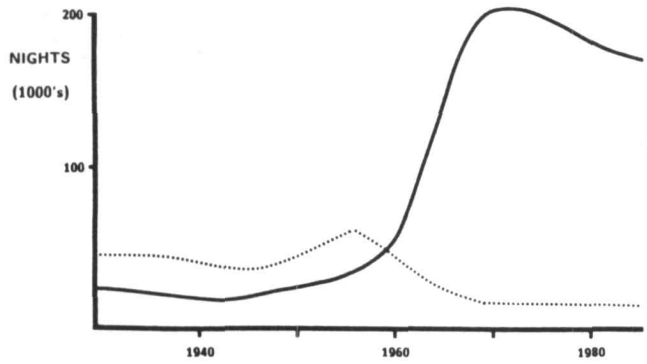

Fig. 4. *Estimated backcountry use in Sequoia and Kings Canyon National Parks 1930-1987. The dotted line represents pack stock nights, and the solid line represents human nights.*

History of Management

Range managers combine the goals of resource protection and herbivore production by applying the principles of proper herbivore intensity (numbers), frequency (interval), and season of use to remain within the carrying capacity of the basic natural resources. Recreation managers apply these same principles to contain human use within a recreational carrying capacity (Heady and Vaux 1969, Shelby and Heberlein 1986). The concept of recreational carrying capacity grew out of an herbivore carrying capacity problem. E.L. Sumner (1942), a Park Service biologist, first defined recreational carrying capacity when he prescribed remedies to curtail excessive pack stock grazing in the backcountry meadows of Sequoia and Kings Canyon National Parks, California.

Overuse of strategic meadows by recreational pack stock was officially acknowledged by the National Park Service in 1936 when Sumner (1936) reported on his reconnaissance of Yosemite and Sequoia National Parks, and the proposed Kings Canyon National Park. Park Service actions to abate these problems were slow to surface and unevenly applied in spite of a series of recommendations by Sumner to apply range management principles (Sumner 1941, Sumner and Leonard 1947). After several backcountry visits between 1940–47, he suggested that the carrying capacity for all heavily used meadows be determined before establishing party size, length of stay, and opening date regulations. To achieve these objectives he suggested structural and educational improvements to facilitate better animal distribution and compliance with regulations. These improvements included drift fences with trail bars and new trails, signs, maps, and guides to lesser known meadows. He also suggested closure of some representative meadows to evaluate the effects of grazing on meadow vegetation. Unfortunately, the Park Service took no actions on Sumner's recommendations.

The Park Service did begin active management of pack stock soon after their funding of a survey of backcountry meadow conditions by Carl Sharsmith, a professor of botany at San Jose State College in 1958. He recommended the closure of 6 meadows based on his opinion that excessive recreational pack stock use was causing accelerated encroachment of lodgepole pine, willow, and falsehellebore *(Veratrum californicum),* and stream incision problems (Sharsmith 1959). Between 1959–1961, pack stock use in 17 backcountry meadows was regulated: 8 meadows were closed to stock use, 6 had a length of stay limits of 24–48 hr, 6 had opening dates, and 3 had party size limits ranging from 12–20 animals (Thede et al. 1961). Maximum pack stock party size was limited to 20 animals by 1966.

Peter Bennett, a student of Sharsmith's, measured condition and trend in 10 backcountry meadows and suggested that the pack stock regulations were leading to improvement of most meadows. He recommended that existing regulations remain in place for most areas, while some closed meadows should be available for stock use in the near future (Bennett 1965). After a quick reconnaissance by helicopter in 1968, Sumner (1968) found that most of the heavily used meadows had improved due to the enactment of regulations in the early 1960's.

The Park Service continued its reactive approach to recreational pack stock management in the early 1970's. Some meadows were reopened and closed; and opening dates and length of stay limits appeared sporadically. A sign of the times was the proposal in the 1971 Master Plan to eliminate stock use in the backcountry (Sequoia and Kings Canyon National Parks 1971). During this period growing backpacker numbers were exceeding the recreational carrying capacity and the institutional capacity to administer them (Fig. 4). Consequently, attention was directed away from pack stock management, and focused instead on elimination or significant reduction of stock use.

A more proactive approach to pack stock management was proposed in the 1976 Natural Resources Plan (Sequoia and Kings Canyon National Parks 1976), where carrying capacity for most meadows was to be determined, the level of stock use recorded, and current-year use termination when use exceeded a meadow's carrying capacity. These sound objectives were not fully realized before the next round of recrea-

tional stock use management planning in the early 1980's.

Comprehensive Pack Stock Management

Sequoia and Kings Canyon National Parks began to develop a more comprehensive recreational pack stock management plan in 1981, and completed that effort in 1986 (Sequoia and Kings Canyon National Parks 1986). The Plan's thrust was very similar to Sumner's proposals in the late 1940's. In keeping with the multiple purposes of the National Park Service, the goal was "to allow recreational use of saddle and pack stock with guidelines that will protect the Park's natural resources and values, the processes that shape them, and the quality of experiences distinctive to them". There were 5 plan objectives relevant to the principles of range management.

1. Continue current use levels and patterns when possible.
2. Establish regulations and facilities to protect meadow areas from changes in species composition and soil erosion from stock use, and to allow improvement of meadow resources.
3. Establish a series of ungrazed meadows to serve as undisturbed examples for scenic enjoyment, scientific inquiry, and benchmarks to measure the impacts of pack stock in grazed meadows.
4. Establish levels of acceptable changes in species composition and soil disturbance.
5. Establish a monitoring system to signal when unacceptable levels of stock use, changes in species composition, and soil disturbance occur.
6. Establish an educational program to minimize impacts of backcountry use, and cultivate participation from both stock user and backpacking visitors.

To meet these objectives park managers set carrying capacity, party size and opening date regulations for all backcountry areas. Carrying capacity was set at one acre of meadow per animal unit month (AUM). One AUM was set at 30 days of horse or mule use. Burros were counted as 0.5 horse equivalents, and llamas as 0.33 horse equivalents to calculate total use. Party size was limited to 20 animals; however, fewer animals were permitted in 8 popular areas. Opening dates were based on when sod was dry enough to withstand hoof impact, and the ability to limit animal access. In most cases the opening date was set for an entire drainage to facilitate implementation. Once an average opening date was established, variation in snowpack moisture levels on May 1 could hasten or delay the opening by 2-3 weeks. Length of stay limits were established for 13 heavily used areas.

To implement these regulations self-reporting stock use cards are issued to all pack stock users when they apply for required backcountry use permits. Users are asked to record when, where, and how many stock grazed in backcountry meadows; and return the cards to Rangers or via post. A list of party size, opening date, and length of stay regulations is also provided with the use permit. To facilitate better animal distribution and compliance with regulations, regular drift fence maintenance is planned.

To monitor pack stock induced changes in species composition and soil disturbance above background levels, comparable grazed and ungrazed meadows will be sampled at 3-yr intervals. Species frequency, percentage bareground, and hoofprint depth will be recorded in nested-quadrats and compared between comparable meadows. The meadows closed to grazing make these comparisons possible. Where ungrazed comparisons are not available, photographic recording of meadow conditions will be undertaken. The selection of photograph scenes will be guided by the availability of previous photographs taken as early as 1909, presence of erosion problems, and plant community ecotones.

Acceptable levels of pack stock use, changes in species composition, and soil disturbance will be based on grazed and ungrazed comparisons, photographic records, and stock use report cards. Changes in pack stock regulations will be initiated when (a) similarity of species composition in comparable grazed and ungrazed meadows changes more than 15% between sample dates, (b) similarity of bareground or hoofprint frequency in comparable meadows changes more than 15% between sample dates, (c) when photographic records show an encroachment of willow or lodgepole pine into 15% of the meadow since the initiation of the plan, or (d) when stock use exceeds one acre per AUM for a given meadow.

Educational efforts are emphasizing minimum impact techniques of backcountry horsemanship. Park staff are helping the Backcountry Horse Users of America develop a user guidebook. Staff have also frequented wilderness user conferences with informational displays on proper backcountry pack stock practices. Copies of past stock use studies, and matched photographs will be kept at backcountry ranger stations to enrich the visitor's and ranger's interpretation of the backcountry natural and cultural resource.

Perspective and Outlook

Pack stock management in Sequoia and Kings Canyon National Parks was slow to emerge, and fragmented in its original form with respect to early comprehensive management proposals. When a comprehensive management program was initiated in the 1980's, stock use was one-third to one-half that present in the 1930's and 1950's. Is this an example of "path of least resistance" management, or was there an increase

in awareness of stock use impacts and proactive management attitudes by the Park Service? Evidence for a proactive management interpretation is the reversal of the 1971 decision to eliminate pack stock use.

Full implementation and improvement of the current stock use management plan will require more realistic estimates of carrying capacity, utilization, and return rates of self-reporting stock use cards. A single carrying capacity of 1 acre per AUM does not reflect the range of meadow productivity from low elevation wet meadows to high elevation dry meadows. Utilization levels in each meadow are currently determined in the winter following use by tabulating the self-reporting stock use cards. In addition, these cards are used to trigger monitoring efforts and future use limitations. However, the return rate on these cards is not known. More accurate carrying capacity estimates and field measurements of current utilization similar to those proposed by Ratliff et al. (1987) will promote realistic levels of acceptable stock use and a more timely engagement of use restrictions when carrying capacities are exceeded. Determination of self-reporting stock use cards return rates should use methods developed to evaluate backpacker compliance with wilderness permit regulations (van Wagtendonk and Benedict 1980).

My involvement in the last stages of the Stock Use and Meadow Management Plan, and my efforts to assist in the development of a system to monitor stock use impact is one example of the opportunities for range managers in non-traditional settings. Our schooling in the principles of range management prepares us to comprehend problems and develop solutions to a variety of natural resource problems. In 1980, there were over 180 wilderness areas in the United States that had significant pack stock use. However, only 9% had season of use restrictions, 40% had party size restrictions, and 30% had no use restrictions at all (Washburn and Cole 1983). The absence of restrictions in many of these areas may be entirely justified, but those areas experiencing resource degradation are candidates for establishment of proper intensities, frequencies, and seasons of use. I am convinced that range managers are well equipped to assist with these backcountry pack stock use management challenges.

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