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PARK OPERATIONS

Managing overnight stock use at Yosemite National Park: A science-based approach

By J. Dan Abbe and Liz Ballenger

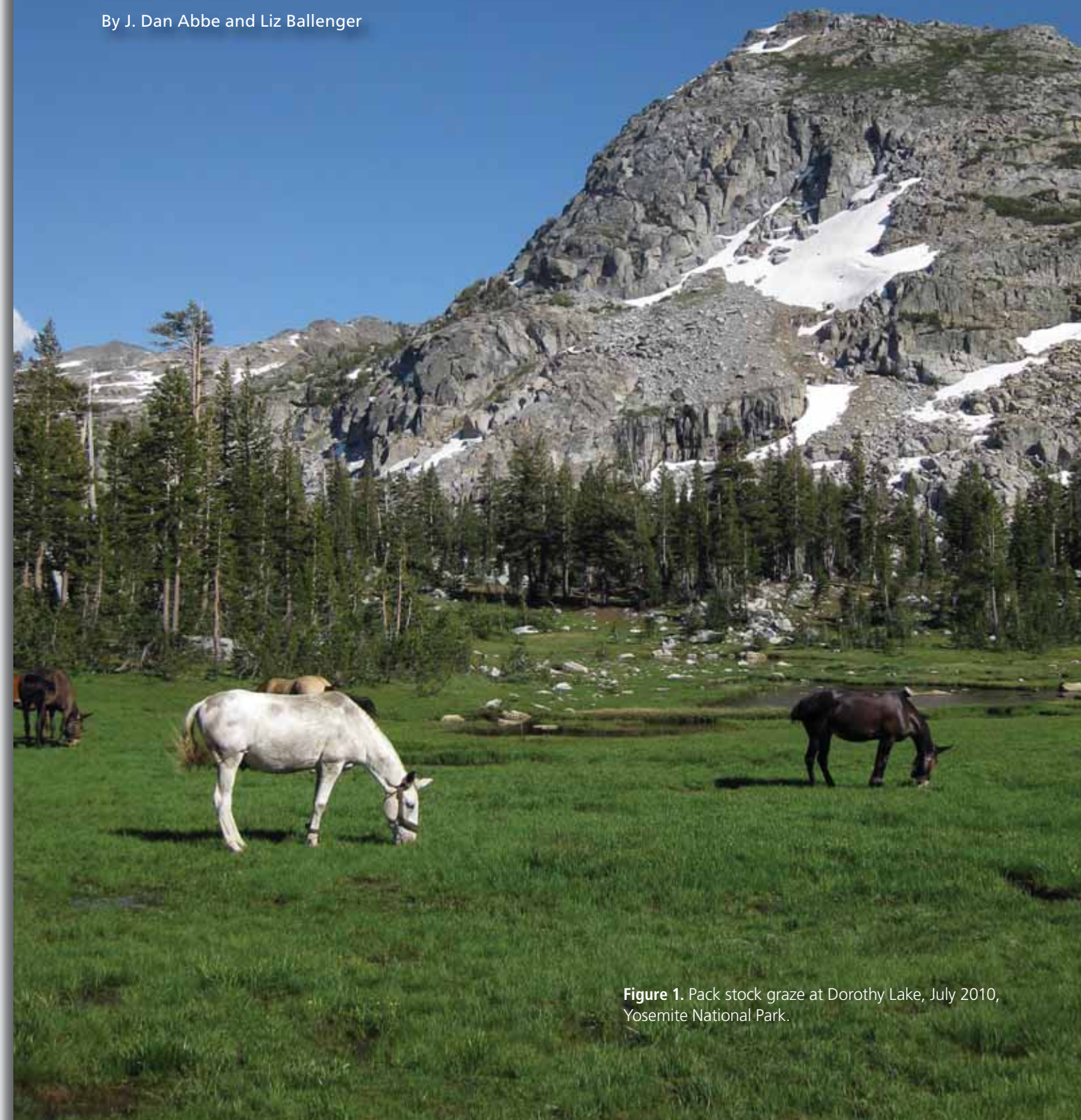

Figure 1. Pack stock graze at Dorothy Lake, July 2010, Yosemite National Park.

Abstract
Pack stock use in Yosemite National Park is an important part of the park's history, an inspirational experience for many wilderness visitors, and a vital element of park operations. Park staff recently identified threats to the ecological integrity of meadows related to high levels of stock grazing. They are working to address this issue by monitoring conditions and implementing a pilot management program in select stock use areas. This article describes how resource managers are calculating initial pack stock capacities for these areas and implementing changes to wilderness stock management. This ongoing quantitative work gives strong support to future management decisions and improves our understanding of overnight stock use and management.

Key words
available forage, Commercial Use Authorization (CUA), forage production, grazing limits, meadows, pack stock use, stock capacities, stock nights, wilderness stock management

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Figure 2. Pack stock at Emeric Lake in Yosemite, August 2006.

PACK STOCK HAVE BEEN PART OF THE HISTORY OF YOSEMITE National Park, California, since the mid-1800s, and they continue to play vital roles in wilderness recreation and park operations. Releasing stock for grazing in meadows is a common practice for overnight stock users (figs. 1 and 2); however, grazing and trampling can negatively affect meadows by decreasing vegetation cover and productivity, shifting plant species composition, damaging streambanks, exposing bare ground, compacting soil, and increasing erosion (Miller and Donart 1981; Kauffman and Krueger 1984; McClaran and Cole 1993; Olson-Rutz et al. 1996; Cole et al. 2004). A recent study in Yosemite identified impacts on subalpine meadows linked to stock use (Ballenger et al. 2010). Park staff is addressing this issue through a science-based pilot stock management program that monitors use levels and area conditions and recommends best management practices to mitigate resource damage. Because commercial pack trips account for approximately half of overnight stock use in Yosemite, the park has used the Commercial Use Authorization (CUA) permit as an interim management tool, as it gives the park superintendent discretion to establish specific terms and conditions of use.

The pilot stock management program focuses on Lyell and Virginia canyons, northeast of Yosemite Valley, where approximately half of the park's commercial stock use occurs. We chose these sites because of high use levels and impacts compared with other areas, diversity of the two areas, and relatively easy access for monitoring. In August 2009, an interdisciplinary team of park biologists, wilderness managers, and trail maintenance staff visited both areas to observe and discuss pack stock issues in the field. As a result the team developed recommendations for management actions, some of which were implemented following management approval the following season. For example, in 2010, Yosemite designated stock camps and holding areas in Virginia and Lyell canyons, identified access routes to and from the camps, and clarified locations of grazing areas. Packers are expected to use the depicted access routes and camp locations, which we provide in the form of maps with GIS locations, as a condition of their CUA permit. The number of sites where stock are permitted was reduced and may help decrease the amount of grazing in meadows until science-based grazing limits can be established.

Determining grazing capacities

Another important aspect of the pilot stock management program is determining grazing capacities to protect against overuse. Grazing capacity models exist for meadows but not for forest understory, making establishment of grazing limits for Yosemite complex.

Pack stock capacities are often expressed in units of stock nights, or the amount of forage that one horse or mule consumes in a night of grazing. For instance, a meadow with a seasonal capacity of 100 stock nights would allow one pack trip with 10 animals for 10 nights. Seasonal capacities can be modeled with this simple equation:

$$\text{Available forage} \div \text{Nightly individual consumption} = \text{Number of stock nights}$$

A recent study in Yosemite identified impacts on subalpine meadows linked to stock use.

An accepted estimate for nightly individual consumption is 32.5 lb (14.8 kg) of vegetation per horse or mule, obtained from range management measures of consumption defined as "animal unit equivalents" (Society for Range Management 1989; Vallentine 1990). Estimating meadow forage production is more complicated because size, vegetation type, elevation, and ecological health ("range condition") all influence production (Ratliff et al. 1987). In addition, "available" forage is less than the total amount of forage produced, since excessive use can lead to the negative effects already mentioned. Cole et al. (2004) found that when grazing exceeded 25% of biomass in some common high-elevation meadow communities at Yosemite, bare ground increased while vegetation cover and productivity decreased. In light of these findings, we adopted this 25% threshold of the total estimated biomass for available forage on preferred species, mainly grasses and sedges such as *Deschampsia cespitosa* (tufted hairgrass), *Calamagrostis breweri* (Brewer's reedgrass), and *Carex vesicaria* (inflated sedge).

In Lyell Canyon, enough information is available to calculate initial capacities based on this model. Pack stock exclusively graze two meadows of known size and elevation adjacent to the stock camps. Vegetation studies in this canyon (Ballenger et al. 2010) evaluated the proportion of meadow occupied by preferred forage species. Data from these studies were adapted to an ecological condition model for meadows (Weixelman and Zamudio 2001) to evaluate range condition of the meadows in this canyon. Estimated forage production rates (pounds per acre) for specific elevations and condition classes of Sierra Nevada meadows (Abbott et al. 2003, adapted from Ratliff et al. 1987) were then multiplied by the area of preferred forage species in the canyon meadows to obtain an estimate of total forage (in pounds). Multiplying total forage by 25% (available forage) and dividing by 32.5 pounds (individual nightly consumption) provides a seasonal stock capacity estimate for Lyell Canyon.

The situation in Virginia Canyon is more complex. Several stock camps are situated along a 3-mile (4.8 km) length of canyon, and stock graze throughout this area of lush forest understory, pocket meadows, and small forest gaps. Determining the size of grazing area for each camp is difficult because published information on evaluating forage production and range condition in forest understories is lacking. Therefore, in 2011, park staff collected data to quantify forage in a quarter-mile buffer around each stock camp in Virginia Canyon. We targeted this zone around the camps because it is the most likely area to be grazed by stock, and it allows us to adapt the stock capacity model for meadows to reflect differences in the concentration of understory forage.

Future planning

Our work to date is a good start to providing a scientific basis for future management decisions regarding grazing limits. Though we can recommend grazing limits for the traditional meadow grazing environments in Lyell Canyon, we need to gather more data and further study the effects of grazing on forest understory in Virginia Canyon. In addition, holding off on establishing limits in these two canyons gives us time to explore methods of mitigating impacts from additional stock that may be needed to carry feed into the backcountry once grazing limits are set, and to address potential displacement of stock to surrounding areas that do not yet have grazing limits. As summer 2012 approaches, plans are moving forward to apply the meadow grazing capacity model to other wilderness meadows at Yosemite and to solicit peer review of the adapted model for calculating capacities for forest understory grazing. Within a few years we expect to be able to apply this modeling technique to establish grazing limits in both meadow and forest understory environments throughout the park.

The management of Lyell Canyon, part of the Tuolumne River corridor, may be affected by the impending Tuolumne River Plan, which will likely incorporate grazing limits and other stock management actions. A draft of this plan is expected to be released for public comment in 2012, and planning will include both broad and focused outreach efforts to engage the public. In addition, Yosemite is in the initial stages of developing a wilderness stewardship plan and expects to begin defining its scope in fall 2012.

The pilot stock use management program has already provided valuable information to park management and is a model intended to shape future management actions throughout the park. Further action, for example the establishment of grazing limits, is needed to continue this positive momentum and implement effective management of overnight stock use in Yosemite National Park.

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