This roundtable will focus on recent studies regarding the impact of stock use, including commercial stock use, on mountain meadows. Discussion topics will include hydrology, ecology, biodiversity, endangered species implications, and knowledge gaps.

Moderator: Niki Nicholas (NPS-BISO, formerly YOSE Chief of Resources)

Part 1: 1-2:05pm

James Roche (UCM & NPS-YOSE), Steven Lohide (University of Wisconsin), Lisa Acree (NPS-YOSE), Liz Ballanger (NPS-YOSE), Jeff Holmquist (UCSB).

James Roche, UCM & NPS-YOSE

Assessing hydrogeomorphic impacts of stock use

Physical impacts from stock use often manifest more quickly than biological measures of impact and as such could prove to be effective indicators for responsive management of pack stock use. Stock use management may be divided among three main areas: 1) staging, camping, or corral operations, 2) trailing, and 3) grazing. In Yosemite, we have sought to minimize impacts from the first area through designating stock-use campsites and managing runoff from corrals. Trailing impacts can be mitigated through effective trail design and maintenance, though potential impacts to water quality remain a concern. Grazing by free-range stock has the greatest potential to impact water resources through soil compaction and shearing in meadows and along streams in meadows. Concomitant increases in overland flow and potential erosion on stream banks can lead to headcut formation and bank loss and subsequent channel widening as well as increased delivery of sediment and manure directly to water ways. While many meadows in Yosemite may have experienced heavy grazing more than a century ago, legacy impacts may remain and can complicate current impact assessments. We seek an objective methodology for assessing stock use impacts in meadows and associated stream systems. I will present early results from an application of the Multiple Indicator Monitoring protocol, a published methodology, and discuss advantages and drawbacks of this approach and others.

Steven Loheide, University of Wisconsin

The Hydroecology of Meadows in the Sierra Nevada, CA

Meadows area critical components of the Sierra Nevadan landscape providing local productivity, biodiversity, and hydrologic buffering of watershed processes. However, overgrazing, logging, and road/railroad construction have impaired the ecologic and hydrologic function of meadow systems altering the ecosystem services they provide. This presentation will focus on the interrelationships between groundwater and soil water availability, plant water use, and vegetation patterning in meadow ecosystems. Often, meadow degradation stems from human activities that increase the flashiness of watershed response, promote erosion, and/or disrupt the sediment balance of a stream, ultimately altering channel morphology. Once the channel has become incised or widened, the stage associated with any given streamflow is lowered. Lowered stream stage subsequently causes lower groundwater levels in the interconnected meadow aquifers. The lower water table regime and the reduced soil moisture affect vegetation composition by reducing the oxygen stress caused by water excess and increasing the water stress caused water limitation. This favors a shift in vegetation from wet meadow vegetation such as sedges and rushes adapted to low oxygen environments to drier vegetation communities including grasses and sagebrush that are adapted to water stressed environments. Quantitative modeling of the hydrologic response of meadows and the hydrologic niche of individual species or vegetation communities offers a means of predicting the effect of various types of
meadow degradation and intervention/restoration strategies on vegetation composition and distribution.

Lisa Acree, NPS-YOSE and Liz Ballanger, NPS-YOSE

Building a science strategy to address stock use management

Pack stock use is part of the history and tradition of Yosemite National Park. Wilderness meadows in Yosemite are regarded as landscapes of high ecological and aesthetic value, but they can be impacted by pack stock use in areas where stock are turned out to graze. Over the past several years, park staff investigated the effects of stock use in subalpine meadows, documenting impacts that included roll pits, manure, trailing, widened stream channel crossings, trampled and grazed areas, and found higher amounts of bare ground in meadows with high levels of stock use. Managers responded by designating campsites in the most popular stock use areas, closing one high risk meadow to grazing, and embarking on a pilot management program to develop stock capacities and meadow opening dates for wilderness meadows. This session discusses our efforts to gather and use data to inform pack stock management at Yosemite and increase understanding of the relationship between stock use and meadow condition. Lastly, the session will discuss how managers are integrating this information into the Yosemite’s formal park planning process.

Jeff Holmquist, UC Santa Barbara

Does pack stock grazing of mountain meadows impact invertebrates and vegetation in Sequoia National Park?

Pack stock are often used in mountain environments and are grazed in uplands and wetlands, particularly subalpine wet meadows. Effects of pack stock on wetland invertebrates are unknown. Sequoia National Park was an ideal location for the study of lasting stock impacts on fauna, because a) there is a 20-year database of stock usage, b) there are meadows with little grazing that can be contrasted with grazed meadows, c) there is a long winter with no stock use, and d) the start of grazing for each meadow is controlled, so we could sample after greenup but just before stock arrived. We could thus address persistent conditions produced by many years of stock use in isolation from any potential short term impacts. We sampled terrestrial arthropods in paired "grazed" and "ungrazed" meadows across the Park and collected associated vegetation data. We found some negative effects of grazing on vegetation structure, but few lasting negative or positive effects of long-term stock grazing on arthropods in these wetlands. Although it appears that pack stock do not cause lasting damage to this arthropod assemblage, we are currently investigating potential impact at the height of the grazing season.
Sylvia Haultain, NPS-SEKI Plant Ecologist, Aimee Smith (USFS-Sierra, Range Ecologist), Eric Berlow (UC Merced), David Cole (Aldo Leopold Wilderness Research Institute), Robert Burns (West Virginia University).

SESSION 4: Research Results - Impacts of Commercial Use on Sub-Alpine Sierra Meadows

Part 2

Sylvia Haultain, NPS-SEKI Plant Ecologist

TWENTY-FIVE YEARS OF MONITORING GRAZING EFFECTS ON MEADOW VEGETATION IN MOUNTAIN MEADOWS: WHAT DO THE DATA TELL US?

Sequoia and Kings Canyon National Parks, protecting over 700,000 acres of designated wilderness in the southern Sierra Nevada of California, have a long tradition of pack stock use. Pack animals are used extensively for administrative use, supporting trail crews and horse-mounted rangers. Approximately a dozen commercial outfitters operate in the two parks, providing packing services to visitors and also supporting research and management activities. Use of the Sequoia-Kings Canyon and John Muir Wilderness areas by pack animals is guided by two planning documents: the Stock Use and Meadow Management Plan, and the Backcountry Management Plan. Adopted in 1986, these plans also established the basis for a long term monitoring program to provide managers with information regarding the impacts of pack animals on mountain meadows.

To evaluate packstock grazing effects on plant species composition, data are collected from a set of five paired grazed-ungrazed meadows. The monitoring program began collecting data on the first meadow pair in 1985 and subsequently initiated sampling on four other pairs, resampling each pair on an approximately 5-year rotation. Meadows selected for species composition monitoring represent several different meadow types, and now provide over twenty-five years of trend data. In 1991, SEKI ecologists began testing a residual biomass monitoring program that eventually grew to include 38 montane and subalpine meadows in order to evaluate the impact of pack animal use on meadow productivity and to inform grazing management decisions. Finally, site-specific data are collected on all packstock use, including the timing, duration, and intensity of grazing, through a combination of self-reporting, ranger observation, and data-mining from the wilderness permit system.

Key results from these three long-term datasets will be presented, and how this information is used by park managers briefly discussed.

Aimee Smith, Rangeland Management Specialist, US Forest Service

Protecting Wilderness Character – An overview of Incidental Grazing in the John Muir and Ansel Adams Wildernesses

Grazing in wilderness areas, both livestock and recreational, also known as incidental grazing are controversial. The wilderness act allows for grazing in wilderness areas. The Act states, Commercial Services may be performed “to the extent necessary for realizing the recreational or other wilderness purposes of the areas.” 16 U.S.C. 1133(d). Wilderness Purposes include Recreational, Scenic, Scientific, Educational, Conservation, and Historical Use. The John Muir and Ansel Adams Wildernesses make up a total of total 883,271 acres, and are adjacent to Yosemite and Sequoia Kings Canyon NP. In 1999 a lawsuit was filed by the High Sierra Hikers Association and Wilderness Watch that alleged failure to comply with the wilderness act on multiple accounts. A few of the allegations included that the assessment to determine the “extent necessary for commercial service was not adequately addressed” and the Forest Service continued to allow degradation of hydrologic function condition and grazing utilization. The Inyo and Sierra National Forests
released the Draft Management Direction for the John Muir and Ansel Adams Wildernesses (which also included Dinkey Lakes Wilderness) at the time the lawsuit was filed and a Record of Decision was signed in 2001. The subsequent multi-year planning effort addressed the data and analysis gaps. The plan analyzed effects of authorizing commercial pack stock grazing in these wilderness areas. The lawsuit was resolved in 2008 and outlined injunctive relief requirements for the Forest Service to adhere to in order to continue to authorize special use permits for commercial pack station activities. A significant amount of new direction for the management of the affected wildernesses has been incorporated into the Inyo and Sierra National Forest’s Land and Resource Management Plans with the completion of the Wilderness Plan and supporting EIS and Needs Assessment in May of 2001. The planning team assessed “need for change” and made determinations of whether selected meadows could be grazed without lasting impacts. Suitability factors included: extent and duration of saturated soils in the meadow, sensitive species habitat, forage production, evidence of historic impacts (e.g. stream channel degradation and undesired shifts in species composition) and hydrologic function of associated stream channels within or adjacent to the meadows. These determinations were part of the analysis of effects of permitting commercial pack stock grazing on the Sierra National Forest and the Inyo National Forest. The Forest Service applies standards and guidelines to limit resource impacts (e.g. maximum allowable forage use (utilization) and stream bank stability standards). Compliance and effectiveness monitoring is conducted to determine if management objectives are being met. Annual compliance monitoring includes measuring forage utilization (percent by weight) at designated benchmark meadows. Long term effectiveness monitoring is conducted to evaluate ecological status (condition) and trend of designated benchmark meadows. The injunctive relief monitoring includes the requirement of follow up surveys of meadows with stream channels to determine proper functioning condition by assessing sites previously considered hydrologically functional-at-risk. Restrictions on commercial activities during the breeding and rearing season for Yosemite toad (*Bufo canorus*), a candidate species for listing under the Endangered Species Act, have also been applied. The current direction includes terms and conditions in the Special Use Permits and associated Operating Plans, with respect to operations in the wilderness, to mitigate non-compliance with the new standards and guidelines and required significant revision from past authorizations. Key revised or new standards and guidelines that effect stock supported commercial use have been implemented since May 2008.

Eric Berlow, UC Merced

**Anecdote vs. Evidence – Science as a mediation tool in evaluating packstock impacts to meadow ecosystems.**

Natural variability among meadows poses a critical challenge to evaluating specific recreational impacts to wilderness meadows. In particular, this variability calls into question the reliability of anecdotal accounts for setting management policy. In this talk we discuss the role of science in parsing natural variation and, ideally, mediating conflict about packstock impacts to meadow ecosystems. We will also present preliminary data on a large scale analysis of packstock impacts to threatened Yosemite Toads.

David Cole, Aldo Leopold Wilderness Research Institute

In order to effectively protect wilderness from the adverse effects of recreation use, it is important to understand the impacts of different types of recreation use and develop a basis for making sound decisions about how much recreation impact is acceptable. A number of studies have shown that the impacts of stock use are both quantitatively and qualitatively different from the impacts caused by hiking. Studies have shown that stock use of trails has several times the erosive potential as hiker use of trails. In western Montana, for example, horse traffic on existing trails resulted in more than double the sediment yield caused by a comparable amount of hiking use. Trampling by horses also is more likely to damage vegetation. In another example from a forest in western Montana, 300 hiker passes eliminated 50% of the understory vegetation, an amount of impact caused by just 50 horse passes. The impacts of grazing are an example of a qualitative difference between horses and...
Managers need to make difficult decisions about how much impact should be accepted in order to provide the benefits that come from recreational use of wilderness. Questions of equity become particularly challenging when there are substantial differences between types of use in their potential to cause impact, as is clearly the case when comparing stock groups to hiking groups. Allocation of use between commercial and non-commercial use adds further to this complexity.

James D. Absher, US Forest Service and Robert C. Burns, West Virginia University

The “need” for commercial outfitters and guides: social, legal and definitional challenges to wilderness or river management

In the US, Forest Service managers have to justify and make informed, defensible decisions on the type and extent of commercial services allowed on these public lands. In particular, the permitting of commercial outfitter and guide services in federally designated Wilderness areas and along Wild & Scenic River system corridors has been undergoing some change over the past few years. These changes have been driven by both administrative and legal decisions. From a scientific viewpoint a crucial issue is the difference among the social, legal and administrative definitions of what constitutes “need” and the ways to use survey data to support decisions that sustainably and equitably incorporates commercial use with the Wilderness Act’s allowed purposes. This paper begins with a short review of these definitional issues and the administrative procedures in practice today. The scientific issues are investigated with survey data from two California case studies of visitors to a Wilderness and river areas with a subsample from commercial outfitter clients (Stanislaus and Klamath National Forests; n=1,252). The comparisons between the general backcountry recreationists and those who use commercial services to visit the same areas demonstrate the strong connections that all visitors have for the forest environment and a desire for similar recreation experiences. The data also reveal some specific “needs” to use commercial services to achieve types of recreation that may not be possible otherwise. Of particular importance are the differences in styles of wilderness use and the information about the extent to which the commercial services are essential to their visits. Next, this socially defined need is placed within the existing legal and administrative foundation for commercial services decisions (permit system) to show how these clients fulfill the purposes of the Act. The paper concludes with some discussion of the implications for management and further research about the future of such commercial services.

Prepared for a presentation at the Uncommon Dialogue on Commercial Outfitting and the Wilderness Act, Stanford University, C.A., Feb 24, 2012