



## ALDO LEOPOLD WILDERNESS RESEARCH INSTITUTE

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### LLAMAS, HORSES AND HIKERS: DO THEY CAUSE DIFFERENT AMOUNTS OF IMPACT?

**Keywords:** recreation impacts, erosion, trail degradation, llama, horse, pack stock, hiking



**Background & Management Issues:** In areas where motorized travel is prohibited, the two primary trail user groups are hiking groups and groups that travel with pack stock. Traditionally, pack stock have included horses, mules and occasionally donkeys. Over the past few decades the use of non-traditional pack stock, particularly llamas, has increased markedly. Proponents of llama use claim that llamas cause less ecological impact than traditional pack stock. However, beyond anecdotal references, relatively little is known about how different types of traffic impact hiking trails. Managers hoping to mitigate trail degradation need quantitative data on the relative impacts of different user groups in order to make sound and effective management decisions.

#### **Project Objectives:**

- To quantify the relative impact of horses, llamas and hikers on established trails by evaluating their effect on sediment yield following a simulated rainfall event.
- To better understand the mechanisms by which trail traffic leads to increased erosion.

**Project Description:** Experiments were conducted during June and July of 1995 at the University of Montana's Lubrecht Experimental Forest in western Montana, USA. Study plots on established recreation trails were either dry or pre-wetted (to simulate wet soil conditions). Low and high levels of hiker, horse and llama traffic were simulated by 250 passes and 1000 passes of each user group. Following trampling, a rainfall event was simulated and the soil erosion

potential of each user group was quantified by the resulting sediment yield and runoff, changes in soil bulk density and changes in soil surface roughness.

**Results:** Horse traffic resulted in statistically significant higher sediment yields (the primary indicator of trail deterioration) than either hiker or llama traffic following simulated rainfall. Differences in sediment yield between hikers and llamas were not statistically significant. Sediment yield from all user types did not vary significantly between dry and pre-wetted trails. The low level (250 pass) horse treatment caused more impact than the high level (1000 pass) llama and hiker treatments, suggesting that horses can cause at least four times as much impact to trails under the conditions simulated in this experiment. In addition, under dry trail conditions horse traffic caused significant reductions in soil bulk density (a measure of how compacted the soil is) compared to llama and hiker traffic. Horse traffic also caused significant increases in soil roughness compared with llama and hiker traffic. This suggests that the greater impact of horses on trails is a result of soil loosening of trail surfaces that are otherwise compacted, thereby increasing the detachability of soil particles and increasing sediment yield and erosion.



photo by Bob Lucas

**Management Implications:**

- ❖ Different types of trail users are not equivalent in the extent to which they contribute to accelerated erosion.
- ❖ Horse traffic is capable of causing several times as much erosion as an equivalent amount of traffic by llamas or hikers.
- ❖ Trail managers may want to consider managing llamas separately from horses when applying restrictions to trail use.

**Publications / Products:**

- ❖ DeLuca, T. H.; Patterson, W. A.; Freimund, W. A.; Cole, D. N. 1998. Influence of llamas, horses, and hikers on soil erosion from established recreation trails in western Montana, USA. *Environmental Management*. 22:255-262. **Leopold Publication Number 319.**

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