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COLORADO STATE UNIVERSITY

July 12 1988

WE HERBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION
BY CHERYL ANNE ARNDT ENTITLED LLAMA USE ON PUBLIC LANDS BE ACCEPTED AS
FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

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ABSTRACT OF THESIS
LLAMA USE ON PUBLIC LANDS

Interest in utilizing llamas as packstock is affecting natural resource managers as requests to use llamas on federally-owned lands increases. To adopt effective management practices related to issues raised by this relatively new use of public lands, policies must be oriented to meet the specific needs of each different area and their diverse types of users and visitors. Identifying these needs is a necessary first step in policy formation, and is the focus of this study.

Members of the USFS, BLM, and NPS were surveyed by mail to obtain information on llama use characteristics and issues developing from the use of llamas as packstock. Research and policy relating to the use of llamas was reviewed and current needs were identified.

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Summer 1988

ACKNOWLEDGEMENTS

I would like to thank the generous people in the following organizations for helping to make this study possible:

Rocky Mountain Llama Association
International Llama Association
United States Forest Service
Bureau of Land Management
National Park Service
and
Llamas Magazine

My sincerest appreciation also goes to those individuals at

Colorado State University

who provide the inspiration and education
to make this type of research a reality.

Dedicated to

TREKKER

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I. INTRODUCTION

Resource managers are faced with the dilemma of having to accommodate human use of our national parks, forests, and other natural areas while protecting the quality and integrity of the natural resources these areas contain. Much of the outdoor recreation available occurs on public lands owned and managed by various agencies of the federal government, including the United States Forest Service, the National Park Service and the Bureau of Land Management. As use of these lands has grown and changed, management and policy formation within the management agencies has grown and changed as well. All of these factors play a part in the evaluation of packstock use on public lands, and of llama use in particular.

Recreational packstock use has been a traditional part of many places in the United States and is often considered part of our national heritage. Horses and mules were essential to the civilization of the country and aided in developing the early national parks and forests. Mining, grazing and timber production on the forests depended largely on draft and pack animals. The parks saw many visitors touring by horse or buggy and kept traditional packstock use as part of their cultural preservation mandate. Today, horse and mule use is still an integral part of the management of many areas.

Recently, a new type of pack animal has been introduced. Llamas, brought to the U.S. from South America in the early 1930's, are gaining popularity as an alternative to traditional types of packstock. They

are being used by management agencies and the public alike with reports such as the following appearing with increasing regularity.

"They're low-impact animals," observes Walter Kretzer, director of a three year acid rain research project in the Adirondacks. Kretzer heads a staff of twenty researchers who are assisted by two llamas. The llamas are used to carry the sampling gear, and Kretzer considers them indispensable to the project, reducing manpower needs and expenses. After one year of working with the llamas, he reports that they're "very low-maintenance" and "very adaptable." He adds, "I'm surprised we didn't take this route twenty years ago."

Appalachia Bulletin

"It's an unlikely apparition, both stately and a little bizarre -- a procession of pack llamas picking adept pathways across grassy meadows of California foothills or over the rocky shoulders of Colorado ranges. You might expect such a caravan in the remote Andes, where for centuries llamas have been the Inca's great domestic asset. All that is changing, as Westerners discover the quiet pleasures of back-country hiking with these sensitive, adaptable animals. The llama carries the camping gear -- 60 to 80 pounds' worth -- letting you move along freely, with only your own day pack on your back."

Sunset Magazine

Ancestors of the llama evolved in North America, where their origins can be traced back to more than 40 million years ago. North America was also the center of equid or horse evolution, but they, unlike camelids, were extinct in the New World by the end of the Pleistocene. The American plains and pampas, which proved to be ideally suited for the horses introduced by European explorers during the 16th century, were barren of equid life when first seen by these men. It was left to a pair of latter-day entrepreneurs do the same for the llama.

Smithsonian Magazine

This increasing interest in llamas is affecting natural resource managers as requests to use llamas on federally-owned lands increase. In order to develop effective management practices related to issues raised by such uses, policies must be oriented to meet specific needs.

Identifying these needs is a necessary first step in policy formation and is the focus of this study.

A. Purpose and Need

As use of our natural resources increases, efforts are being made to anticipate the impacts of new, traditional and accumulated uses. Progress, however, has been slowed by lack of adequate research on many types of use. These impacts are bound to differ between and even within each park, forest, or other recreational area due to differences in geographical location, terrain, agency mandates, user characteristics and local management policies.

The United States is fortunate to have a heritage which includes National Forests, National Parks, and other federally-owned lands with recreation areas open to public use. The USFS administers over 190 million acres of land throughout the United States. The NPS is responsible for 79 million acres in 49 states, the District of Columbia, Guam, Puerto Rico, Siapan and the Virgin Islands. The BLM administers 310 million acres of public land in 11 western states.

Different geographic locations, user preferences and management goals result in different environmental, social, and managerial impacts. These impacts affect the quality of experience the visitor has as well the operating budget of the area. Identifying and prioritizing impacts as they relate to packstock use, and llama use in particular, is the first step in their quantification and eventual mitigation through effective public use policy. While centralized management of federal lands is not necessarily desirable, consistent management is; and, although inconsistencies are inherent due to the diversity of resource areas and users, efforts should be made to develop management policies

with communication and cooperation between agencies, managers and users.

This study focuses on identifying issues and impacts related to llama use. Once these are identified, policies can be developed or reviewed to assure that they are mitigating the impacts as much as possible. It will also provide a means for communicating about llama use as it relates to federally-owned lands.

B. Problem Definition

Problems arise when goals are blocked or frustrated or when there is a conflict of interests. There is, typically, some desired state of satisfaction we want to progress to but circumstances, other people, policies, or finances prevent us from achieving that state.

The specific problems that exist regarding llama use on public lands depend largely on one's frame of reference. The individual who uses llamas or encounters one while hiking may see no problem in discovering an alternative to carrying a heavy backpack. The individual who has just been unseated from a horse or had a string of mules throw their packs may see the situation differently. One resource manager may report llamas cause no conflicts where allowed and another will report llamas cause no conflicts because they're not allowed. To some, llamas pose no environmental impact problems. However, any additional impact may be seen as a problem to managers of areas already experiencing heavy use. The individual who wishes to obtain a permit to operate a llama outfitting business may have a hard time getting one, yet those already holding permits may perceive this as advantageous due to the extra competition the new outfitters might represent.

These conflicts do exist, and they are part of a larger problem, or set of problems revolving around packstock use in general. The lack of adequate information on impacts from llama use is certainly part of the overall problem and is making it more difficult to deal with issues that arise in areas where llama use is occurring.

Although policy formulation dealing with packstock use, and llama use in particular, is complex, it is worth the effort to examine what policy exists and how it was formed. A unique situation presently exists in that there is little policy related to llama use. This presents the rare opportunity to observe the dogmatic nature of the policy process from the beginning and evaluate its effectiveness in a more detailed manner than usual.

C. Objectives

The objectives of the study are to:

1. Determine the geographic distribution of llama use by the National Park Service, Bureau of Land Management, United States Forest Service.
2. Determine the geographic distribution of llama use by the public on lands overseen by the NPS, BLM and USFS.
3. Identify, through mail survey, the social, managerial and environmental issues and impacts related to llama use on public lands.
4. Determine research and policy needs regarding llama use on public lands.

II. LITERATURE REVIEW

A. General Information

Practices and attitudes related to llama use are affected by several factors. Characteristics of the resource agencies and the lands they manage, the legislation that governs federal land management, the culture of the visitors and residents of those lands, and the history of the different types of pack animals themselves influence where and how llamas are being used in the United States. The following resources are useful in gaining insight into the scope of the situation.

The history of various types of packstock have affected when, where, and how each type has been used. Horse and mule use is traced in *The Evolution of Domesticated Animals* (Mason, 1984). The history of llama domestication and use is described in several publications, including: *Mammalian Biology of South America* (Mares, 1981); *Lama and Alpaca* (Novoa and Wheeler, 1984); and *Wonders of Llamas* (Perry, 1977). Current use is detailed in *Living with Llamas* (Hart, 1985) and *Speechless Brothers* (Tillman, 1981).

Brought to the U.S. as a novelty, llamas are currently being bred and used for packing, investments, pets and wool production in the U.S., Canada, Europe, Australia, New Zealand, and several countries in South America. As llama populations increase, users are becoming more active, seeking additional recreation areas and expanding into

commercial operations. Several books related to the commercial use of llamas are available. These include: Image of A Well-Trained Llama, A Trainers Guide (Barkman, 1985), Llama Training On Your Own (Bodington, 1986), A Handbook For Llamas: First Aid Techniques (Lewis, 1986), Living With Llamas (Hart, 1985), Speechless Brothers (Tillman, 1981), Llama Training: A Matter of Trust (Bozarth, 1985) and Llama Training - Who's in Charge? (Faiks, 1985). A trade magazine also exists, Llamas Magazine (aka The International Camelid Journal) and is an excellent source of all types of information regarding llamas. Llama Life is another periodical which contains the news and views of the llama community. Several videotapes are also available through the various llama organizations. Of interest also are the newsletters of the llama associations throughout the United States, including the International Llama Association and its affiliate chapters, Rocky Mountain Llama Association, Mississippi Valley Llama Association, Greater Appalachian Llama Association, Llama Owners of Washington State, Alaska Llama Club, Southwestern Llama Association, Llama Association of Southern California, and the Willamette Valley Llama Association, as well as the Llama Association of North America.

B. Research Review

Research specifically related to packstock use on public lands is limited. Two documents which deal with this subject are: Impact of Horse Traffic on Trails in Rocky Mountain National Park (Summer, 1980) and Trampling Effects of Hikers, Motorcycles, and Horses in Meadows and Forests (Weaver, 1978). Research on impacts related to hiking include, Trail Deteriorization in the Selway-Bitterroot Wilderness (Helgath, 1975), and Trampling Effects on Vegetation of the Trail Corridors of

Northern Rocky Mountain Forests (Dale, 1974) More generalized trail research is represented Trail Transect: A Method for Documenting Trail Changes (Leonard, 1977), and Assessing and Monitoring Backcountry Trails (Cole, 1983). Research related to llama use includes several internal reports by the USFS and NPS. Rocky Mountain National Park in Colorado, Sequoia-Kings Canyon National Park in California, and Mt. Rainier National Park in Washington have engaged in formal research on llama use, as have Arapaho-Roosevelt National Forest in Colorado, Klamath National Forest in California, the New York State Department of Environmental Conservation, and the University of Wyoming. The following is a review of the research conducted to date:

NATIONAL PARK SERVICE -- SEQUOIA-KINGS CANYON NATIONAL PARK

1979 - llamas were introduced to the managers of the park through a 110 mile trek which involved covering 26 miles in one day and two climbs totalling 5000'. The llamas were well received by the park officials. (Hoffman, 1986)

1983 - Two separate treks were completed with fully-loaded llamas. In both cases, the pack strings performed very well and park biologists gave llamas high marks for manageability and for their minimal impact on sensitive native plants. (Hoffman, 1986)

1984 - Management considered partial or extensive llama ban due to possibility of llamas acting as vector for scabies mite responsible for the decimation of the Sierra bighorn sheep.

Local llama owners asked for further assessment. (Hoffman, 1986)

1985 - Research was conducted through the summer on various aspects of llama use. Park officials and veterinarians specializing in llama

husbandry concluded that because the mite that affected the bighorn sheep is not the same mite that sometimes affects llamas, the llamas posed an inconsequential threat to the bighorn, less risk, in fact, than horses or people. Browsing habits were examined and the llamas were determined to have approximately one-third the impact of other packstock. The question of feral llamas was addressed and it was concluded that considering the llama's history of domestication and their monetary worth, the possibility was not very likely that llamas would be lost and become a nuisance species. The issue of horses being spooked at the sight of llamas was investigated and it was concluded that conflicts resulted from horses being unfamiliar with encountering llamas on the trail. A program of communicating with local packstock users and conditioning their stock to llamas was initiated and found to be very successful. Horses prone to spooking sometimes represented "green" or flighty animals that should be trained more thoroughly and conditioned to llamas or culled from backcountry use. (Hoffman, 1986)

ROCKY MOUNTAIN NATIONAL PARK

1984 - The park began to experiment with llamas. They leased 4 adult males to explore the practicality and feasibility of using such stock for backcountry-related work. The llamas were used for a variety of different backcountry-related projects. Park personnel utilized llamas to transport supplies and materials into backcountry campsites and patrol cabins, to transport supplies and materials needed in rehabilitation projects, and to transport personal supplies and equipment on two- and three-day backcountry patrols. In addition, they were used to carry fingerling trout to remote restocking sites and to service and remove dry waste residues from solar privy collectors.

Collectively, the llamas logged 790 trail miles and transported 7,013 lbs. of supplies and materials throughout the summer.

Individually, each llama averaged 198 miles (averaged 9 miles per trip) and 1,753 lbs. (average trip weight of 79 lbs. per trip). At the end of the field season, recommendations were made to continue the llama program as another "tool" available to managers. The animals displayed significant potential and capability as compared to horses. No conflicts with horses were experienced, perhaps due to the adherence of park personnel to guidelines established for the use of llamas, including several dealing with meeting horse parties on the trails. An attempt was made to make the public aware of the llama experiment and all liveries operating in the area were informed of the program. The two disadvantages noted were their lack of speed when hiking and time delays encountered when the llamas stop to rest. Visitor response to encountering llamas in the backcountry was primarily one of curiosity rather than issue-related. (Fiala, 1985)

1985 - Llama use by the park continued and additional research was conducted to assess the needs of visitors using llamas. It was concluded that llama users may need separate hitching posts if conflicts with horses occur. The decision was made to allow llamas to be tethered nearer to the campground if horses were present. (Arndt, 1985)

1986 - Commercial outfitting utilizing llamas was begun on an experimental basis. This program involves a two-year permit for day hikes with llamas.

1987 - No new research on llamas. Experimental commercial outfitting continues with a review due at the end of 1988.

MT. RAINIER NATIONAL PARK

1983 - Two llamas were used on an experimental basis to evaluate the potential for their use in the park. The llamas were used to hauling about 70 lbs. of tools and supplies. It was concluded that the llamas were capable of doing a great deal of work and though expensive, they offered the profound benefit that they did not create excessive, adverse resource impacts. They were pleasant and gentle, easy to handle and it was the opinion of the researcher that their use may be entirely appropriate in the backcountry of that particular park. (Thompson, 1983)

1984 - Two llamas were leased with an option to buy for experimental use in the backcountry. They were used a total of 61 days during the field season. It was concluded that the llamas were suited to the purpose for which they were leased, including periodic travel to backcountry locations to haul out human waste. The continued use of llamas in the backcountry was seen to improve the efficiency of trail, resources management crews, and backcountry rangers by relieving them of much of the tedious and time consuming heavy hauling associated with their various pursuits. The impacts that the animals created were considered to be extraordinarily light, and they could be used routinely where horses and mules cannot. Their use appeared to be totally consistent with many of the objectives for which the backcountry is managed and could create great efficiencies for operations in times of fiscal constraints. A rough cost comparison between the use of 2 llamas and 2 horses from time of purchase through two years of use was conducted with the following results:

Table 1.

Llamas		Horses	
<u>Year One</u>			
2 llamas	2000	2 horses	1500
tack	1500	tack	1500
feed	200*	feed	2000*
3/4 ton truck	10000-12000	3/4 ton truck	10000-12000
TOTAL	<u>13700-15700</u>	TOTAL	<u>23250-27250</u>
<u>Year Two</u>			
feed	200*	feed	2000*
vet	50	vet	100
farrier	0	farrier	250
TOTAL	<u>250</u>		<u>2350</u>
* 1 bale grass hay/week		* 1 bale of alfalfa hay/week	

Public acceptance of the llamas was found to be one of their most attractive features in that they facilitate communication with the public. The llama handlers had their pictures taken on a daily basis and all of the resulting media coverage was positive.

Disadvantages of llama use included their expense and the possibility of an animal spitting, although this never happened. Personnel handling llamas would have to be trained; a background in horse and mule packing is desired, but not mandatory.

GRAND TETON NATIONAL PARK

1987 - Ban on llamas in effect due to lack of designation as a pack animal. Plans are underway to do research regarding llama use in 1988.

GRAND CANYON NATIONAL PARK

1985 - Llama owner, escorted by park personnel, attempted a trip to the bottom of the canyon to assess the llamas packing attributes. The animals failed due to sickness from inoculations administered the day

of the trek. They also suffered from other care and training-related problems. The trip resulted in llamas being banned from Grand Canyon. (Hoffman, 1986)

UNITED STATES FOREST SERVICE -- KLAMATH NATIONAL FOREST

1979 - A trail crew had access to one llama for one month to be used in connection with wilderness and backcountry operations. The evaluation concluded that, owing to its size, the llama was more compatible with a foot crew than was a mule. The llama's needs were minimal, making due with practically everything available for food. It was easy to pack, requiring little or no experience or knowledge beyond common sense.

It was confirmed that llamas are generally docile and calm, presenting a significantly lessened safety hazard than the more temperamental mules and horses. They require a gentle but firm hand, responding poorly when misused or abused. Their only means of defense is spitting which they resort to only when teased. As a result of their temperament and agility, they were excellent to work with in heavy brush or rocky terrain when lightly and properly loaded -- areas which can present difficulties with conventional livestock. One of the biggest advantages to llama packing was that there was no need for a specialized (and expensive) stock truck. An ordinary pickup, or even an economy sized rig with a stock rack is suitable for hauling one or two to the trailhead. Loading and unloading requires no ramps or loading platforms; the animals jump in and out of a pickup or van and usually lie down while the vehicle is in motion.

At first there was some concern about the reaction of other backcountry users to meeting exotic-looking animals on the trail.

Experiences were generally favorable. Horses tended to overreact, however, and it could be predicted that the more traditional packers might feel threatened by llamas as pack animals after the novelty wears off. The more environmentally oriented wilderness users seemed to think it was an attractive alternative to horses, having less impact on the area. On the negative side, the animals could not pack as much as a mule. They lacked the strength and speed of a horse or mule. Overall, within the inherent limitations of the animal, there was a definite use for llamas in the F.S. backcountry operations. Specifically, they would be of good service in support of a backpacking trail crew and possibly of use to Wilderness patrolmen. Other uses probably exist. (Smith, 1979)

Bighorn National Forest - no documented research. Informal findings include lower trail impacts, no browsing impacts, and fewer employee injuries with llamas. (Nelson, 1988)

ARAPAHO-ROOSEVELT NATIONAL FOREST

1980 - Report by trail maintenance crew foreman on using llamas to support trail maintenance work. Comments included the following information on safety, payload, training, visitor reaction, animal care and cost.

Safety was the number one priority when considering any project, especially in remote areas of the forest. Llamas seldom offer to kick or bite, although they can do both. Their padded feet keep them from injuring the person leading them if they happen to step on their feet. Their agility makes rough, rocky terrain and stream crossings safer for the animal.

When considering weight ratios, a 1200 pound horse would have to carry 400 pounds to compare with the llama's maximum load. Llamas can carry a load weighing 25 - 30% of their body weight while horses can carry loads weighing up to 40% of their body weight. A horse could carry an injured person out where a llama might not be able to without a travois which could be used in an emergency. The llama carried 60 pounds of equipment consistently. The heaviest load for any distance was 80 pounds. Training requirements for personnel handling llamas is minimal. An hour or two of training is enough to explain what to look for and how to pack and care for the animal. There are no shoes required for llamas and the packing gear is very simple.

Two types of visitors were encountered on the trails, hikers and horseback riders. Hikers were totally impressed with the llama except for one person. One horse did shy a little, but in general horse users were as enthusiastic as the hikers and enjoyed comparing animals. The llama attracted immediate attention and was a great tool when explaining wilderness ethics.

Animal care entails checking the animals feet periodically for cuts or bruises although the structure of legs and feet prevented any cuts during the use period. Feed consisted of half a pound of grain per day as a treat as the llama did quite well on any browse it found. Water requirements were 1 to 2 quarts in the first 3 days. Transporting the llama required a half-ton pickup with a stock rack.

Purchase prices for llamas run slightly higher than they do for a good horse. Rental prices vary. If purchase cost is equal for a horse and a llama, the llama would save over 50% on expenses for food and transportation. Over-winter maintenance of a horse would 3-4 times

that of a llama due to the differences in food and board requirements. Llamas require about 1/5 the food and space that a horse does.

In general, the llama proved to be very intelligent and a hardy pack animal. Its docile disposition made it perfect for inexperienced people and around visitors, proving that it and comparable llamas could definitely be an important tool for future backcountry trail crews.

BUREAU OF LAND MANAGEMENT

No research to date.

Other agencies conducting llama research include:

NEW YORK STATE DEPARTMENT OF CONSERVATION

1984 - The eastern portion of the acid rain survey provided an opportunity for the NYDOC to research the feasibility of using pack animals due to the 70 lbs. of gear each member of the ALSC project required. Alternatives researched included horses, mules and llamas. After examining the variables (i.e. weight, carrying capacity, food need, disposition, terrain, capability, cost) llamas proved to be the "best-fit" animal for the project. Use of llamas was concluded to be a preferable alternative to other packstock. Llamas were consequently used to perform many functions within the scope of the project. (Kretzer, 1984)

UNIVERSITY OF WYOMING

1985 - A study was done by the university on llamas as a solution to sheep predation. Because llamas will run off a strange dog in their territory, research was conducted into their ability to protect sheep from dog attacks. The findings include the following conclusions: 1) Llamas helped to reduce problems with stray dogs, 2) they were effective against dogs that hadn't killed previously, less effective against

previous offenders, 3) they were not as much help in extensive range conditions where sheep could scatter, more useful where sheep were penned, and 4) imprinting llamas to lambs may be helpful. Eventual castration of the llamas is preferable because of sexual aggression against the ewes (Botkin and Taylor, 1985). (It is worth noting that dogs are a major cause of losses for those who raise llamas, thus it should not be assumed that a dog or other canine will not injure or kill a llama. There have been several documented cases of such attacks taking place.)

C. Policy Review

Current policy directly related to llamas is limited to four formal documents. The first, a USDA regulation addressing importation of llamas to the United States. Importation of llamas has been banned since the 1930's due to the perils of foot-and-mouth disease. The second document outlining policy related to llamas is the Sequoia-Kings Canyon National Forest Backcountry Management Plan (1983). The plan outlines packstock use regulations for the Forest and is the first plan to address llamas as a distinct type of pack animal. Proposed changes in the federal register that year also refer to llama use as well. The third document addressing llama use is the stock management plan for Rocky Mountain National Park (1987). Policy clarification and guidelines for llama use were developed because of increasing use of llamas in the park. The backcountry travel plan for the Lewis and Clark National Forest outlines packstock use for the forest, including special signing for horses and llamas on certain hazardous trails. This is the first policy to be introduced in response to conflicts occurring between horse and llama users.

Policy on llama use varies among the USFS, NPS and BLM. Llama use regulations are included in the regulations governing general packstock use. In most cases, differences occur at the BLM district, individual park, forest level, if they exist at all. The BLM does not distinguish between llamas and other packstock, regulating each one the same. The USFS follows this same rationale. The NPS regulations are stated in the CFR (1.4, 1.5, 1.7). The wording of 1.4 allows the definition of packstock to vary between parks. Most parks include llamas with traditional packstock, regulating them the same even though llamas are not specifically included in the NPS definition. Grand Teton and Grand Canyon National Parks are the exceptions, choosing to prohibit llama use. As mentioned in the research review, Grand Teton is planning research on llamas in 1988 and they may reconsider this position. Grand Canyon has yet to lift its ban on llamas resulting from the incident previously described in the research review. Rocky Mountain National Park has the most extensive llama use policy of all the respondents. Their stock management plans have listed llamas as a recognized type of packstock since 1984. Each year new information obtained through research is incorporated into the management plan. At present, llamas are regulated the same as other packstock for the most part; on some trails, however, llamas are being allowed to go farther than traditional packstock due to the lighter impact of the llamas. There are also plans to expand campsite facilities and restrict use of some campsites to llamas only due to the very real differences in environmental impact. The plan's objectives are designed to promote cooperation between new and traditional packstock users, visitors, and managers.

Various states have differing local laws as to the status, certification and transport of llamas, many of which are under constant revision. A list of these regulations is available through the state veterinarian's office.

Policy relating to general packstock use can be found in the USFS Code of Federal Regulations (36 CFR 261.14(1)), Forest Management Plans, and in Special Orders issued by the Superintendent at each individual forest. The NPS packstock guidelines are set forth in the Code of Federal Regulations also (36 CFR 1.1). Each park is governed by management plans for packstock and resource use in addition to the CFR. The BLM packstock regulations are also found in the CFR. Each District has a general management plan and more specific regulations regarding packstock use is contained therein.

III. METHODOLOGY

A. Questionnaire Development

A mail survey was used to obtain information about location of llama use and to identify issues and concerns related to such use. The questionnaire was formulated according to the Total Design Method, outlined in Mail and Telephone Surveys (Dillman, 1982). In short, the method entailed three mailings, the first and third of which contained the questionnaire and a cover letter, and a second mailing which consisted of a reminder postcard. Each mailing was spaced approximately one month apart. An additional survey of the final non-respondents was undertaken to better define that population. Details and drafts of the agency and user questionnaires are included in Appendix A and Appendix B, respectively.

The agency questionnaire was reviewed by five managers in the USFS, three with the NPS and two from the BLM. Comments were also solicited from at least ten llama owners and outfitters. Input from both RMLA and ILA was sought in the preparation of both questionnaires. They were then pretested; the agency questionnaire was sent to three members of each agency two weeks prior to the first formal mailing and the public use survey was sent to five llama breeders and commercial outfitters before it was released through Llamas Magazine. A copy of the review form is included in Appendix E.

B. Sample Selection

In order to determine the extent of llama use and to identify impacts related to llama use, three of the major federal land holding agencies were surveyed. They were chosen as being indicative of the remaining resource agencies in the United States. The survey sample included the population of natural resource managers as defined by the 1987 agency directories of the NPS, USFS, and BLM. It represented a purposive sample of resource managers at relatively equal levels of middle management. The questionnaires were mailed to the Resource Manager, the Recreation Staff Officer and the District Manager of the NPS, USFS, and BLM respectively; names of individuals were used whenever possible. The respondents were self-selected into the sample. Responses were also solicited from a sample of private individuals defined by the population of readers of Llamas Magazine. This sample population represented a purposive sample based on ownership of and/or interest in llamas and their use. Again, the subjects were self-selected into the sample.

C. Study Design

The study design was largely determined by the fact that direct control of the subjects was not possible due to the sample selection process. The respondents were self-selected into the samples in a non-random fashion. Since pretest information on the sample groups was not available, the study follows a quasi-experimental, ex post facto, posttest-only design. The study was modeled after a similar survey by the U.S. Forest Service, Problems and Practices in Wilderness Management: A Survey of Managers (Washburne and Cole, 1983).

IV. ANALYSIS AND INTERPRETATION

A. Data Analysis

Once the questionnaires were returned, data entry was completed by the staff at the USFS Rocky Mountain Forest and Range Research Station in Fort Collins. Response frequencies were calculated with the "frequencies" portion of the Statistical Package for the Social Sciences (SPSS), run on an IBM personal computer. A content analysis was completed for the open-ended questions. This included listing all given responses, paraphrasing each one, and determining the frequency of like responses. The paraphrased responses were listed on a computer file and processed using the "frequencies" portion of LOTUS 1-2-3, run on an IBM personal computer.

Response rates from the agency questionnaire were greater than anticipated. The following table includes the return responses from the agency survey.

The first mailing consisted of 354 questionnaires, 55 of which were sent to the BLM, 178 to the USFS, and 121 to the NPS. Of these, 52.7% were returned by the BLM, 65.7% by the USFS and 73.6% from the NPS. The second mailing included 122 postcards, 29 to the BLM, 32 to the USFS and 61 to the NPS. These were not intended to be returned. They resulted in an additional 36.7% of the questionnaires returned by the agencies. The third mailing included 105 questionnaires to 21 BLM districts, 25 forests and 59 parks or monuments or recreation areas. Of these, 66.7% were returned by the BLM, 72.0% by the USFS, and 61.0%

by the Park Service. Of the 354 intended respondents, 311 returned the questionnaire for an overall response rate of 87.9% for the agency survey.

Table 2.

Agency Survey - Return Response			s = sent			r = returned			
	BLM			NPS			USFS		
	s	r	%	s	r	%	s	r	%
1st Mailing	55	29	52.7	178	117	65.7	121	89	73.6
2nd Mailing*	(reminder postcards not to be returned)								
3rd Mailing	21	14	66.7	59	35	61.0	25	18	72.0

Total		53	96.4		150	84.8		107	88.4
% rate of response:	87.9			sent	354				
				received	311				

					43		non-respondents		

The 43 individuals who did not respond to the three mailings were then surveyed to gather information about this population. A postcard was sent to each location, asking the respondent to indicate whether there was packstock use and/or llama use, and if not, why neither occurred. Of those surveyed, four responded that there was no packstock use, 15 reported that use of packstock was not allowed, 5 responded that the climate or terrain was unsuitable and one indicated that llamas were being used by the public but the extent of use was unknown. A total of 25 responses were returned, resulting in a response rate of 58.1% for the non-respondent survey. (See Appendix A.)

The public llama use survey was sent to solicit the opinions of that portion of the public sector either knowledgeable about or interested in llamas and their use. The trade publication, Llamas

Magazine, offered to include the survey in its September/October issue in 1986. The magazine has a circulation of approximately 3,000 readers. A response rate of 8.9% had been achieved on a reader's poll previously conducted by the magazine. The response rate for the llama survey, however, was less than that, with only 78 of the questionnaires returned for a response rate of 2.6%. Due to the low response rate, a statistical analysis of the data received from the public llama use survey has been included in Appendix B, but no interpretation of the analysis was possible because generalizations from such a small sample to the entire population would not be reliable. The information received regarding locations of public packstock use was used, however, and proved to be very informative, as did the comments from this survey sample.

B. Data Interpretation

The 87.9% response from the natural resource management agencies was more than adequate to perform the necessary statistical functions to determine response frequencies for each question. Again, this information is presented in tabular form in Appendix A. The remainder of this paper will focus on the interpretation of this data and the conclusions which can be drawn as a result of the information obtained.

Section one of the questionnaire was designed to assess geographic distribution of llama use within the agencies and by the public (i.e. to locate where llamas were being used as packstock). Question 1., parts a - d, asked each respondent to indicate whether packstock were used by management officials on the land overseen by their particular agency; to identify the type of pack animals used, whether they were owned or leased and the number of days used seasonally; to indicate

the frequency and purpose of packstock use; and to describe any trends in agency use of llamas as packstock.

Agency packstock use was found to exist on less than half of all management units surveyed. Figure 1 illustrates levels of packstock use by management agencies as well as the number of units using llamas.

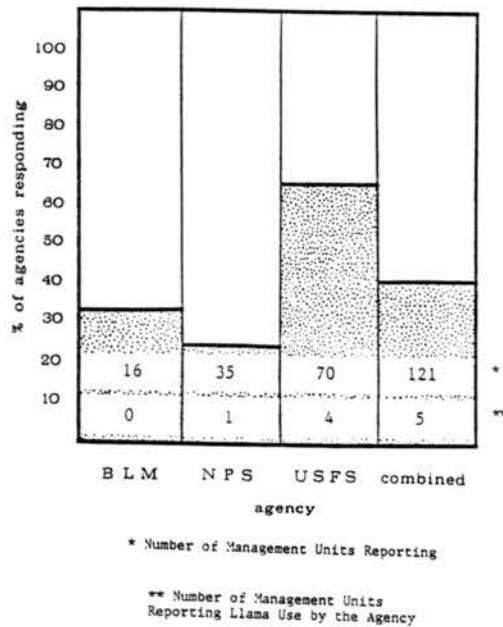


Figure 1. Llama Use by Management Agencies

Of the possible 311 respondents, 39.4% reported that packstock were being used by the management agency at the time of the survey. The USFS reports the most use, with 66.7% of the forests using packstock, followed by the BLM with 30.2% of the districts indicating they use packstock. The NPS reported the least packstock use, with 23.6% of the parks, monuments or recreation areas indicating they used packstock on a regular basis at the time of the survey. The primary reason for lack of packstock use by the management agencies was that no need for

packstock existed. Other reasons given included the use of other means of transport, lack of sufficient room or unsuitable terrain, potential conflicts with wildlife and the fact that packstock were not permitted or available in some areas.

Those respondents who confirmed that packstock were used by the management agency went on to provide further information about such use, and about llama use in particular. Of those areas surveyed, the USFS reported the most llama use, with five forests either buying or leasing llamas in 1986 and/or 1987. Only one park reported having a llama use program and no use of llamas was reported by the BLM. This compares with ownership or leasing of 1,267 horses, mules or burros reported by respondents from the USFS, 452 by the NPS respondents, and 86 by the BLM respondents. Packstock used by the agencies included goats and dogs as well as those listed above.

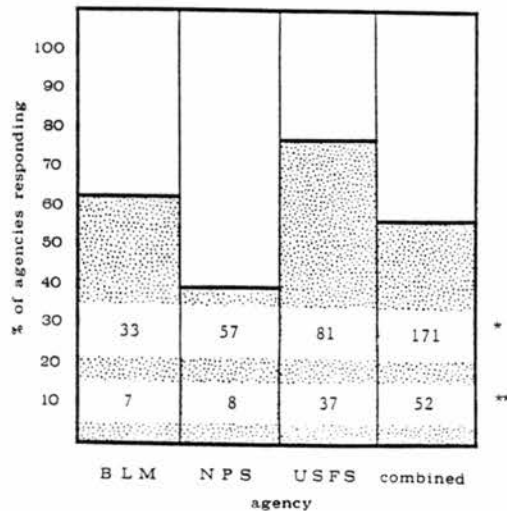
Among the reported uses of agency packstock, trail and facility maintenance was the most common use by all agencies, with backcountry supervision ranking second and use for environmental studies, research projects and rescue efforts occurring seldom or never. Other uses of packstock included range, livestock and fire management, packing equipment and supplies, patrol and tours.

The question dealing with trends in the use of llamas by the management agency was found to be somewhat difficult for the respondents to answer. Most respondents commented that the trend was unchanging, based on the fact there was no observable use occurring to begin with. Therefore, 95% of the respondents reported use of llamas as unchanging, with 2 locations reporting a decrease in llama use and 5 reporting an

increase. The decreases were reportedly due to preferences for traditional packstock and cost of obtaining trained packing llamas. Among the reasons given for increased use were lower impacts from llamas, improved productivity of backcountry crews and visitor appeal.

Question 2, parts a-d, asked the managers to provide the same information about public packstock use as was requested regarding agency llama use in Question 1. After determining whether packstock use by the public occurred at the area, the question asked about the type and amount of packstock use, the most common reasons for packstock use, and whether use of llamas by the public showed any trends.

Use of packstock by the public was described by the respondents as taking place at 55.7% of the areas surveyed, with use on 75.7% of the forests, 38.0% of the parks, and 62.3% of the BLM districts. Figure 2 shows public packstock use levels and indicates how many respondents reported llama use by the public within their management unit.



* Number of Management Units Reporting

** Number of Management Units Reporting Llama Use by the Public

Figure 2. Llama Use by the Public

The primary reasons given for lack of use of packstock by the public were unsuitable terrain or climate, good road access or other means of transport used. No demand, no backcountry use, and conflicts with wildlife were also mentioned.

Of the respondents reporting use of packstock by the public, 37 forests, 8 parks and 7 BLM districts indicated llamas were used by the public during 1986, for a total of 2,812 8-hour days of use. This compares with 14,614 8-hour days of horse, mule or burro use.

Use of packstock by the public was primarily day-trip oriented. Backcountry travel was most frequent on lands managed by the Forest Service. Overnight trips and backcountry travel accounted for a significant amount of use as did hunting trips. Packstock were used least often for livestock roundups and research projects. Other uses of packstock included fishing and livestock management. These should have been included with either day or overnight trips and livestock roundups, although these categories may have been too confining. Concerning use of llamas by the public, 76.5% (or 137 of the respondents) reported use unchanging. Once again, many commented that this was based on no use to begin with. Two areas were reported to have decreasing llama use due to a preference for traditional packstock, and 40 respondents indicated that llama use was increasing in their area, mostly due to their lower impact, ease of transport and use, low maintenance costs and versatility.

Section two of the questionnaire dealt with environmental, social and managerial issues and impacts currently facing managers of many public lands. Questions about environmental issues included inquiries about packstock-related trail and campground erosion as well as

vegetation related impacts. Questions concerning water pollution, loose pets and introduction of exotic plants or animal diseases were also included. Social issues and concerns included questions regarding trash from hikers and packstock users, conflicts between different types of users, and objections to packstock feces as well as whether llamas were considered to be pets or exotic animals. Questions about management issues focused on those aspects of packstock use which most concerned the manager such as agency budgetary allotments for packstock, the amount and type of use an area receives and safety related to packstock use.

Of the environmental issues, the problem of packstock-related trail erosion ranked highest among all the agencies, (although the percent of areas reporting major problems of any kind was small); 9.4% of the BLM, 15.3% of the NPS, and 18.7 % of the USFS respondents reported trail erosion to be a major problem. Introduction of exotic plant species and packstock-related campground erosion ranked second among the agencies a major problems. Packstock-related grazing impacts and vegetation trampling ranked third with the BLM and NPS while campground erosion due to packstock use was third with the USFS. Of least concern to all the agencies was the introduction of exotic animal diseases, with only 0.9% of the USFS, 4.0% of the NPS, and none of the BLM respondents reporting it to be a major problem.

Social issues of most concern to the management officials were trash due to hikers and trash due to packstock. Both ranked as major problems by 3.8% of the BLM and were the only major social issues reported by that agency; 10.0% of the NPS and 15.0% of the USFS considered trash due to hikers a major problem; 13.1% of the USFS

considered trash due to packstock users to be a major problem, ranking it second with that agency while objections due to packstock feces ranked second with the NPS. Of least concern to the agency managers were conflicts between llamas and hikers, with only 0.6% of the agencies combined reporting this as a major concern. Of specific interest to this study were the responses to questions about conflicts between llamas and other stock and conflicts between hikers and other stock, as well as whether llamas are considered to be pets or exotic animals. Only two NPS locations reported conflicts with llamas and other packstock to be a major problem while 6 indicated conflicts existed between hikers and other types of packstock. Two forests reported major conflicts between hikers and other packstock compared with none reported with llamas. The BLM districts reported no major problems with any type of packstock. Only three parks and two forests, for a total of five locations, reported that considering llamas as pets or exotic animals was prevalent.

Management issues listed as major problems most frequently included decreased budget for maintaining packstock and insufficient area to accommodate packstock users. Of those management units responding, 7.5% of the BLM districts, 6.0% of the parks, and 15.0% of the forests indicated decreased budgets for packstock maintenance. Insufficient room to accommodate users was reported by 5.7% of the BLM districts and 13.3% of the forests surveyed, ranking it second as a major management problem at those locations. Two questions focused on the safety-related aspects of packstock use. In particular, they asked about employee injuries from llamas and from other packstock. Two locations, one park and one forest, considered employee injuries from packstock to be a

major problem, compared to no reports of major problems with injuries resulting from llama use, which was of least concern to the agency officials.

Section three of the questionnaire was designed to gather additional information about the respondents and their management unit, and to allow them to express their personal feelings about the use of llamas as pack animals. Question 4 determined whether there were any commercial outfitters or guides operating in the area, how many existed and of those, how many used llamas as their principal pack animal. A list of projects using llamas during 1985-86 was the focus of Question 5. The managers were also asked to rate the services or the individual or organization involved with each project.

Commercial guides and/or outfitters were reported to be present on 27 BLM, 32 NPS and 70 USFS locations surveyed. Reasons given most often for lack of such commercial services included no demand, no need, insufficient area or area well-roaded. Of the 290 outfitters operating on BLM lands, 4 used llamas; of the 98 businesses operating on NPS land, 9 used llamas; and of the 1270 businesses operating on national forests, 33 used llamas as the primary pack animal. Twelve projects utilizing llamas took place in national parks, 1 on BLM land, and 6 on national forests with 8 ratings of adequate services and 7 ratings of services more than adequate. None of the services provided were considered less than adequate.

The topic of Question 6 was whether or not the managers had any personal experience with llamas and, if so, what kind. Figure 3 illustrates the amount of experience the respondents had with llamas.

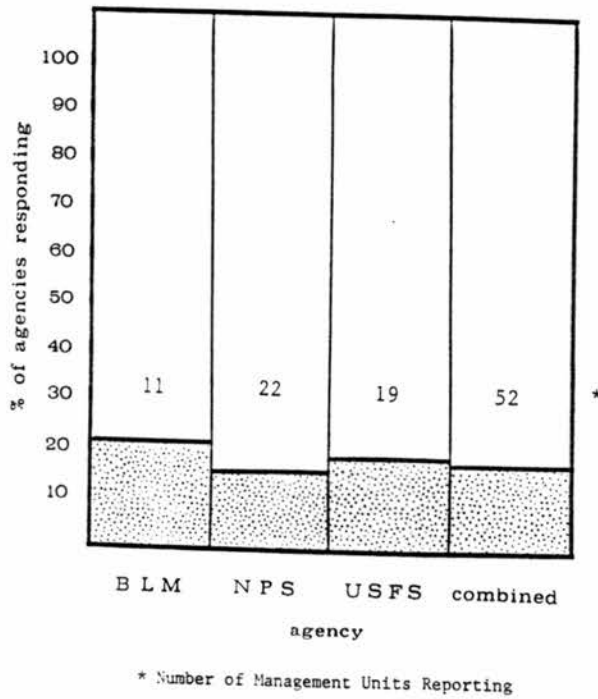


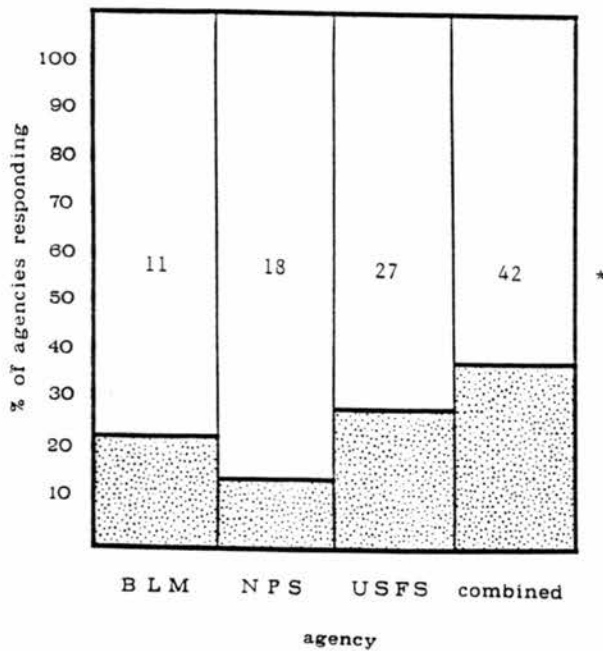
Figure 3. Agency Personnel Experienced With Llamas

Of the 311 management officials answering the questionnaire, 11 from the BLM, 22 from the Park Service and 19 from the USFS report having personal experience with llamas, resulting in 17.2% of the managers having such experience. Types of experience range from seeing llamas in the zoo to day or overnight packtrips with llamas to workshops and packing clinics on llama use in the backcountry. At least 14 managers indicated they had personally used llamas at some time.

Questions 7, 8 and 9 were designed to obtain more detailed information about the particular location where the respondent was employed, including what percent of the land is roaded, the ecological diversity of the area and the length of a typical field season. Statistical analyses were completed for these questions but has not been included for the purposes of this study.

Questions 10, 11, and 12 once again focused on llama use, asking the managers to state their opinions regarding the usefulness of llamas to their unit in the future, what types of research are needed to sufficiently investigate llama impacts, and what policy recommendations they might have for areas experiencing llama use.

As for the usefulness of llamas to those areas already using packstock of some kind, 11 BLM districts, 18 NPS and 27 USFS locations indicated that llamas would be useful in the future. Figure 4 reflects the respondents feelings about the usefulness of llamas to those management units already using packstock.

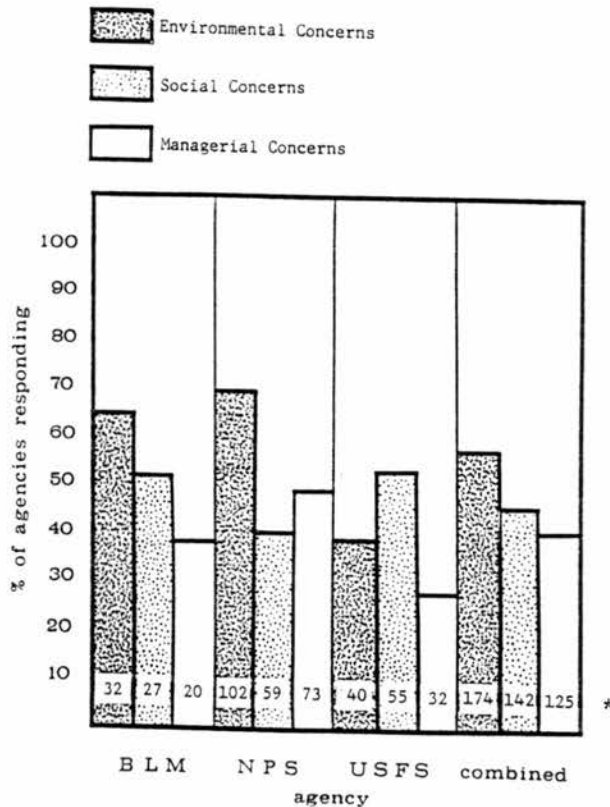


* Number of Management Units Reporting

Figure 4. Llamas Useful To Agency Personnel

Reasons for their need included reports that they have lower or more acceptable impacts as well as ease of handling and transport and low maintenance costs. Reasons given for deciding llamas would not be useful included no need for llamas or other packstock due to insufficient room for use or unsuitable terrain. The high cost and light load capacity of llamas were also mentioned as factors discouraging use of llamas, as were potential conflicts with wildlife and preference for more traditional types of packstock.

Among the research needs defined, environmental concerns ranked highest with the BLM and NPS, while social concerns ranked first with the USFS. The types of research the respondents felt necessary are reflected in Figure 5.



* Number of Management Units Reporting

Figure 5. Research Needs Regarding Llama Use On Public Lands

Managerial concerns ranked last, yet 40.2% of the population surveyed indicated that research regarding management concerns needed to be done. Social research was considered to be important by 45.7% of the managers and 55.9% considered environmental research necessary, resulting in its first place ranking. Of major importance to this study were the suggestions for types of research which included comparative studies between different types of packstock, contrasting the cost, usefulness and impacts of llama use versus traditional types of packstock. Transmission of diseases was also listed as needing research, as was research relating to trail impacts and maintenance.

Equally important were the suggested policy needs for areas experiencing llama use. Managers indicated that no specific policy related to llama use be considered. Several suggested that llamas be treated the same as other packstock or given more access than other packstock due to their lower impact. A few respondents voiced a preference for traditional packstock and some indicated that packstock use of any kind should be reevaluated. Several indicated that they had no background in llamas use and needed more information upon which to base any recommendations.

The last page of the questionnaire was left blank and the managers were encouraged to elaborate on any questions or answers, or to include any additional information they felt was pertinent to the study. The Notes and Comments section yielded results much the same as the other sections of the questionnaire with some additional detail provided. The more interesting and useful responses included suggestions to leave specific policy making up to the local land manager, to provide more information about llamas and to conduct more comparative studies

regarding packstock impacts in general. Of particular interest were comments made about the possibility that newer employees of the agencies may not have the opportunity to work with packstock and the drastic need for trail impact studies and closer examination of all types of packstock use on public lands.

V. CONCLUSIONS

A. Geographic Distribution of Llama Use

1. Geographic Distribution of Agency Llama Use

Llama use as reported by the managers of the various BLM districts, parks and forests is documented on the first map (refer to the large maps at the end of the document, see Plate 1). The map is based on results from the original survey and an update survey which was mailed in February, 1988.

There are six national forests and one national park which used llamas as part of their packstock program during 1986 and/or 1987. Gifford-Pinchot, Arapaho-Roosevelt, and Bighorn National Forests as well as Rocky Mountain National Park reported use during both years. Siskiyou National Forest reported use in 1986 alone, while Pike-San Isabel and Payette National Forests reported use of llamas in 1987.

2. Geographic Distribution of Public Llama Use

Llama use by the public occurring on BLM lands, national parks and forests as reported by the participants in the public llama use survey is documented by the second map (Plate 2). Additional information gathered through Llamas Magazine and personal contacts is represented on the map as well.

Seventy recreational areas in twelve states experienced llama use by the public during the years 1986 and/or 1987. Alaska, California, Washington, Idaho, Montana, Colorado, Nevada, Wyoming, Arizona, New

Mexico, Tennessee and Virginia are among the states reported to have llamas in use a packstock on public lands.

3. Geographic Distribution of Llama Ownership

The third map depicts llama ownership based on membership lists from the International Llama Association and Rocky Mountain Llama Association (Plate 3). The map is estimated to include at least 80% of the llama owners in the United States. The map includes census information from 1987 and 1988.

Llama ownership is distributed throughout the United States with concentrations along the west coast and in the Rocky Mountain region. California, Washington, Oregon and Colorado are among the states with over 100 owners. Ownership in the Great Lakes area, along the East Coast and in the Southern States is less dense. Arkansas, Delaware, North Dakota, Rhode Island, Alabama and West Virginia are the only states not represented by members in ILA or RMLA. There may still be llama owners in these states, and others, who do not belong to any llama organizations but do own llamas.

B. Research and Policy Needs

1. Research Needs

Members of each agency had diverse opinions on the relative importance of environmental, social and managerial issues related to llama use, thus research needs among the agencies vary. Environmental impacts ranked highest with the BLM and NPS and second with the USFS. Social concerns ranked first with the USFS, second with the BLM and third with the NPS. Managerial issues ranked second with the NPS and third with the BLM and USFS.

Environmental impacts mentioned most often were vegetation, soil and wildlife effects. Among the research needed on vegetation impacts are quantification of forage requirements and the effect the browsing habits of the llamas have on native vegetation. Because the llama diet is so varied, the impact is spread out over many plant species. Even so, continued tethering in a confined area can create a 'canopy' effect, where vegetation is removed from ground level to as high as a llama can reach. Documentation on the actual variety and consumptive needs of a pack llama's diet has not been established, although much can be extrapolated from what is known about their nutritional requirements. Regrowth of plants may need to be measured to determine how much browsing pressure they can withstand.

Another concern managers voiced was the transmission of exotic plant species from domestic or native food sources. Research on the ruminant digestive system of the llama and its affect on seeds from different sources might provide some insight into what types of plants might be transmitted in the feces of llamas. Because the digestive system is more efficient than that of most other mammals, the llama should pose no greater threat than other packstock or humans in this regard. Transmission of plant diseases was mentioned as a minor concern and may need to be researched in areas where specific problems exist.

Vegetation trampling effects can easily be researched with trail and campsite impacts. Soil-related impacts were among the environmental research concerns mentioned most often. The unique foot of the llama has been observed to have less impact on plants and soils than traditional packstock, but how much less cannot be determined until impacts are quantified. Comparative studies should be done using recognized

trail and campsite vegetation monitoring techniques. Such research could lead to more efficient use and maintenance programs. Although packstock related erosion is not listed as a major problem for most areas, it is a minor concern in others and almost all areas have localized problems. Different soil types and soil systems (such as fragile desert and alpine soil profiles) should be tested under various types of use and weather. Again, quantification and documentation is the most pressing of current research needs.

Interaction of llamas and wildlife was also among the more important concerns. Issues such as transmission of diseases to indigenous species including bighorn sheep were raised. The reactions of llamas to bears, wolves and coyotes was also questioned. Research to date indicates that llamas do not carry the same scabies mite that decimated the bighorn sheep in Sequoia-Kings Canyon. Experiences reported by various llama packers indicate that bears are inquisitive, but do not approach llamas staked in front of campers tents during the night. There has been an incident reported, however, in which a bear who had become conditioned to the presence of llamas attacked one while it was picked near a residence. Llamas have a distinctive alarm call which they use when threatened by dogs; they would likely do the same if threatened by wolves or coyotes, but this cannot be taken for granted. Continued use of llamas will increase documented observations of wildlife interactions. The habit of using bells on the llama's halters is a practice which has proven helpful with unwanted wildlife interactions and acts as a locating device for the llamas as well. Lost llamas can present problems to both llama owners and resource managers, although most are recaptured without incident.

Packstock related water pollution was listed by only one agency as a minor concern. Because llamas can be trained and encouraged not to defecate or urinate in water courses, they should pose no threat to water quality and no research is needed in this area. Water quality as it relates to soil erosion should be addressed in the aforementioned comparative trail and campsite studies.

Social impact research needs identified by the survey included investigation of packstock llama conflicts and the extent of traditional attitudes visitors may have towards types of packstock used, particularly in wilderness. Since llamas are a recent addition to the types of packstock available, visitor reaction has varied. The issue of social impact was of primary interest to the USFS and secondary concern to the BLM. Research on visitor knowledge and perception would be useful, especially to test the premise that llamas are often beneficial in initiating communications with visitors and enhance an agency's image of being environmentally-minded, as indicated by the research thus far. Increasing use by the public is an indication that management agencies may need to reexamine their current view of packstock use.

Conflicts between traditional packstock users and llama users were reported to be a minor problem within all the agencies. Although traditional attitudes are part of the problem, the reaction of horses to llamas upon encountering them for the first time is undeniably unpredictable. Fortunately, conditioning the horses to the sight of llamas is an effective answer to the problem, as is the practice of trail and campsite etiquette by all packstock users. Communication between llama users and traditional packstock users is necessary to

avoid conflicts. No research is needed; the problem and solution are equally apparent. Conditioning of horses solves the problem of having horses react unpredictably to the site of llamas. This knowledge is retained from season to season, even if the horses are not in constant contact with the llamas. The practice of trail and campground etiquette by all packstock users can also help to alleviate conflicts. Research is not mandatory in this area, although investigating knowledge and behavior of traditional packstock users towards llamas could be beneficial.

Managerial issues ranked second with the NPS and third with the BLM and USFS. In addition to environmental and social concerns previously discussed, issues listed most frequently were traditions of horse or mule use affecting management acceptance of llamas and cost versus benefits of llama use.

The question of impacts from packstock use in general has yet to be addressed by most areas because it is a traditional use. This will undoubtedly become an important issue in the future due to increasing packstock use resulting in higher facility and maintenance costs. Management acceptance of llamas will likely change as research provides quantitative information on other issues related to their use.

Comparative cost/benefit analysis should be done between use of horses, mules, burros, llamas or combinations thereof, and might even be expanded to include ATV's and other means of backcountry travel. Such analyses should include initial investment, yearly maintenance costs, related equipment costs, personnel training and safety aspects of each type of travel. Improvement in production of crews using llamas needs to be quantitatively documented. Cheaper sources of

Llamas such as auctions and sales should be researched as should the benefits of leasing versus purchasing. Other management concerns included the possibility of feral llamas.

Surveys such as this one should be conducted and repeated with regularity to record trends. This will provide a data base from which projections and predictions can be made. Research projects relating to llamas and their use should be encouraged as should the documentation and quantification of much of the information normally gathered in an informal fashion.

2. Policy Needs

Until the impacts from llama use are quantified, policy distinguishing llamas from traditional packstock is unlikely to be widespread. Despite their visible handling and impact differences, agencies have no choice but to show no preference for one type of stock over another. There are, however, policy choices the agencies can make now to lessen costs and conflicts in the future.

Despite the llamas lower impact, they are not impact-free. As the survey indicates, there are certain concerns about environmental impacts as well as managerial issues. These concerns can be addressed now with only minor policy changes. The major source of confusion regarding policy related to llama use is the ambiguity of the term 'packstock'. Each agency has a different definition; some include llamas, some do not. In addition, each park, forest, or district in the BLM can make decisions as to what animals are considered packstock (within federal regulations). To avoid confusion, llamas should be recognized as legitimate packstock and be included in the definition of packstock by all federal agencies. After considerable investigation,

Sequoia-Kings Canyon National Park resolved the question about llama use to the park's satisfaction with only one change in its stock management plan, that being to include llamas as a full status pack animal. This option should be considered by all management units, utilizing the information available to avoid the lengthy task of repeating the research Sequoia King-Canyon already did.

Once llamas are considered packstock, they can be regulated as such. Environmental impacts from all types of packstock use can and should be addressed. Use restrictions should be based on relative impact, with each type of packstock being used to its best advantage, with the "minimum" or "best fit" tool concept in mind. The practice of general backcountry ethics by all packstock users should be stressed, with specific information as to how to minimize all types of impacts.

Likewise, social impacts can be minimized through an education program for packstock users familiarizing them with all types of packstock use. Cooperation between outfitters using different types of packstock should be emphasized through information exchange programs. Llama owners frequently offer to condition horses and other stock to the presence of llamas; this practice should be encouraged to avoid trail and campground conflicts. The information contained in the draft for the Backcountry Llama Use Brochure (Appendix D) should be made available to the managers and visitors at each location where packstock are used.

Managerial issues include the same environmental and social concerns discussed before, as well as the added concerns of purchase and maintenance costs should they desire to utilize llamas as part of the agency packstock program. Many agencies have been reducing or

eliminating their packstock and related equipment due to the cost and paperwork involved in their use. Llamas may provide an alternative to those areas that need packstock support but cannot justify the expense of traditional types of packstock. Purchase and lease agreements for llamas are adequately provided for by each of the agencies surveyed.

Use trends for the agencies and public reflect the characteristics of the different areas. Most responses indicate that use is unchanging; this is largely due to the fact that there is no use occurring. Decreases in llama use are occurring in areas where traditional attitudes about packstock prevail, both within the agencies and amongst the public. Increases, though slight, reflect a substantial change over no use at all. Public use is increasing in all three agencies while agency use is increasing in the USFS alone. The number of outfitters using llamas parallels the number using packstock in that the USFS has the most, followed by the NPS and BLM. Responses about llama usefulness also followed the same pattern with the USFS indicating the most interest, followed by the NPS and BLM. This, despite the fact that the NPS managers have more experience with llamas than managers in the USFS or BLM.

Several conclusions can be drawn from the information obtained through the survey, the first of which is the major factor influencing llama use by management agencies. The proximity of llama owners to the locations which could benefit from their use appears to be the primary reason llamas are being used in some locations and not others. Use most often depends on availability, increasing if llamas are made available through employees or local owners. Llama use by the public

follows much the same pattern, with interest being heavier around areas where breeders are located.

Llama use by management agencies and llama use by the public appear to be limited by the same factors: 1) initial recognition of a need for packstock support, 2) lack of knowledge about llamas and their uses, 3) the cost and availability of trained pack llamas, and 4) the beliefs held by some persons regarding appropriate uses of packstock, especially in the wilderness.

As the population of llamas increases and expands, public use will likely increase and expand. As this happens, awareness within the management agencies will increase and managers will be better able to assess the llamas potential usefulness to the agencies. Anticipating this increased use will enable managers to examine current packstock policy in light of this new use, hopefully improving the backcountry experience for everyone while continuing to protect the source of the experience, the land itself.

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VII. APPENDICES

APPENDIX A

Non-Respondent Survey

4 - no packstock use allowed

15 - no packstock use allowed

5 - terrain or climate unsuitable

1 - llama use occurs by public but extent is unknown

25 Total

% rate of response:	58.1	sent	43
		received	25

			18 non-respondents

Public Llama Use Survey - Return Response

Surveys sent out - 2942

Surveys returned - 78

% rate of response - 2.6

APPENDIX B

Responses - Agency Questionnaire

	% of agency responding (number of areas responding)			
	BLM	NPS	USFS	Combined
Q.1.a. Agency Packstock Use				
no	69.8 (37)	76.4 (113)	33.3 (35)	60.6 (186)
yes	30.2 (16)	23.6 (35)	66.7 (70)	39.4 (121)

Reasons for no packstock use

37	no need
35	other means used
29	area too small
11	terrain unsuitable
10	area heavily roaded
5	no budget
	not practical
4	historical area
	area very accessible
3	potential conflict with brown bears
	not permitted
2	not available
	climate unsuitable
	too much impact
	helicopters used
	boat access
	cultural area
1	riding stock only
	management not in favor
	water-oriented recreation
	only occasional search and rescue
	air access only
	only hiking allowed
	day use area
	all mammals prohibited to protect wolves

no demand
 no overnight use of livestock permitted
 park too new
 don't pack enough times per year

	BLM	NPS	USFS	Combined
Q.1.b. Agency Llama Use				
Number Using Llamas	0	1	4	5
Llamas Owned	0	0	1	1
Llamas Leased	0	3	13	16
Days used	0	90	175	265

other:

2 sled dogs
 dogs
 goats

Q.1.c. Agency Packstock Uses

	BLM			NPS			USFS			COMBINED		
	o	s	n	o	s	n	o	s	n	o	s	n
1. backcountry supervision	1.90 1	11.30 6	30.20 16	8.0 (12)	10.7 (16)	10.7 (16)	38.30 41	22.40 28	7.50 8	17.40 54	14.80 46	12.90 40
2. trail/facility maintenance	1.90 1	15.10 8	28.30 15	10.0 (15)	10.0 (15)	10.7 (16)	43.90 47	24.30 26	3.70 4	20.30 63	15.80 49	11.30 35
3. environmental studies	0.00 0	13.20 7	30.20 16	0.0 0	11.3 17	14.0 21	7.50 8	39.30 42	13.10 14	2.60 8	21.20 66	16.40 51
4. research projects	0.00 0	7.50 4	35.80 19	1.3 2	11.3 17	12.7 19	0.09 1	23.40 25	30.80 33	1.00 3	14.80 46	22.80 71
5. rescue	0.00 0	9.40 5	32.10 17	8.7 1	15.3 23	11.3 17	1.90 2	36.40 39	19.60 21	1.00 3	21.50 67	17.70 55
6. other:												

8 range management
 3 livestock/horse roundups
 2 packing equipment and supplies
 plant management
 1 congressional visits
 grazing allotment management
 mineral management
 supplying wilderness camps

fire management
 supplying lookouts
 horse endurance events
 burro capture
 administrative tours
 patrol special events
 boundary patrol
 poaching patrol
 ranger patrol
 bear management activities
 fence maintenance
 recreation
 hauling trash

	BLM	NPS	USFS	Combined
Q.1.d. Agency Use Trends				
increasing	0 (0)	0 (0)	6.9 (5)	3.6 (5)
decreasing	0 (0)	2.4 (1)	1.4 (1)	1.4 (2)
unchanging	100 (53)	97.6 (41)	91.7 (66)	95.0 (132)

	BLM	NPS	USFS	Combined
Q.2.a. Public Packstock Use				
no	37.7 (20)	60.7 (91)	22.4 (24)	43.7 (136)
yes	62.3 (33)	38.0 (57)	75.7 (81)	55.0 (171)

reasons for no packstock use:

23 area too small
 22 good road access
 10 terrain unsuitable
 7 not allowed
 other means of travel available
 6 not needed
 5 climate unsuitable
 4 historical area
 3 no wilderness/backcountry
 no backcountry camping permitted
 no demand
 river access

- 2 cultural area
 - no backcountry use by public
 - day use area
 - potential conflict with brown bears
 - not practical
 - difficulty transporting stock and feed
 - all riding stock
 - air access
- 1 no interest
 - primarily backpacking
 - no public use
 - only hiking allowed
 - expense
 - all mammals prohibited to protect wolves
 - dog team access

	BLM	NPS	USFS	Combined
Q.2.b. Public Llama Use				
areas with public llama use	7	8	37	52
days used	185	300	2327	2812

Q.2.c. Public Packstock Uses

	BLM			NPS			USFS			COMBINED		
	o	s	n	o	s	n	o	s	n	o	s	n
1. day trips	34.00 18	22.60 12	15.10 8	10.70 16	20.00 30	10.70 16	49.50 53	23.40 25	3.70 4	28.00 87	21.50 67	9.00 28
2. overnight trips	20.80 11	37.70 20	13.20 7	6.70 10	20.70 31	14.70 22	48.60 52	25.20 27	0.90 1	23.50 73	25.10 78	9.60 30
3. backcountry travel	18.90 10	35.80 19	17.00 9	8.70 13	18.70 28	11.30 17	52.30 56	18.70 20	2.80 3	25.40 79	21.50 67	9.30 29
4. trail/facility maintenance	3.80 2	20.80 11	37.70 20	1.30 2	4.00 6	30.00 45	11.20 12	34.60 37	20.60 22	5.10 16	17.40 54	28.00 87
5. research projects	0.00 0	15.10 8	47.20 25	0.00 0	5.30 8	30.00 45	0.00 0	25.20 27	34.60 37	0.00 0	13.80 43	34.40 107
6. livestock roundups	26.40 14	17.00 9	20.80 11	2.00 3	6.70 10	26.70 40	29.00 31	25.20 27	13.10 14	15.40 48	14.80 46	20.90 65
7. hunting trips	30.20 16	32.10 17	11.30 6	1.30 2	8.70 13	26.00 39	52.30 56	16.80 18	5.60 6	23.80 74	15.40 48	16.40 51
8. other												

fishing
livestock management

	BLM	NPS	USFS	Combined
Q.2.d. Public Use Trends				
increasing	17.9 (7)	13.8 (8)	30.5 (25)	22.3 (40)
decreasing	0 (0)	0 (0)	2.4 (2)	1.1 (2)
unchanging	82.1 (32)	86.2 (50)	67.1 (55)	76.5 (137)

Q.3. Issues and Concerns

EXTENT OF PROBLEM

	BLM			NPS			USFS			COMBINED		
	none	minor	major	none	minor	major	none	minor	major	none	minor	major
a. Environmental Issues												
1. packstock-related trail erosion	47.20 25	30.20 16	9.40 5	33.30 50	20.70 31	15.30 23	21.50 23	50.50 54	18.70 20	31.50 98	32.50 101	15.40 48
2. packstock-related camp-ground erosion	64.20 34	20.80 11	1.90 1	44.70 67	14.00 21	8.70 13	35.50 38	35.50 38	17.80 19	44.70 139	22.50 70	10.60 33
3. packstock-related grazing impacts	54.70 29	30.20 16	1.90 1	41.30 62	21.30 32	4.00 6	33.60 36	46.70 50	9.30 10	40.80 127	31.50 98	5.50 17
4. packstock-related vegetable trampling	50.90 27	34.00 18	1.90 1	34.70 52	26.70 40	6.70 10	29.00 31	49.50 53	11.20 12	35.40 110	35.70 111	7.40 23
5. packstock-related water pollution	58.50 31	28.30 15	0.00 0	43.30 65	18.00 27	6.00 9	42.10 13	43.00 45	2.80 46	45.30 141	28.30 38	3.90 12
6. loose pets or packstock	64.20 34	22.60 12	0.00 0	32.70 49	30.70 46	4.00 6	52.30 13	32.70 56	2.80 35	44.70 139	29.90 93	2.90 9
7. introduction of exotic plant species	52.80 28	24.50 13	7.50 4	26.70 40	25.30 38	14.00 21	39.30 13	40.20 42	8.40 43	35.40 110	30.40 94	10.90 34
8. introduction of exotic animal disease	75.50 40	9.40 5	0.00 0	48.00 72	10.00 15	4.00 6	71.00 76	15.00 16	0.90 1	60.50 188	11.60 36	2.30 9
b. Social Issues												
1. trash due to hikers	30.20 16	52.80 28	3.80 2	14.70 22	43.30 65	10.00 15	10.30 11	67.30 72	15.00 16	15.80 49	53.10 165	10.60 33
2. trash due to packstock users	52.80 28	28.30 15	3.80 2	32.70 49	24.70 37	7.30 11	24.30 26	53.30 39	13.10 14	33.10 103	35.00 109	8.70 27
3. conflicts between llamas and other stock	69.80 37	5.70 3	0.00 0	52.00 78	6.00 9	1.30 2	62.60 67	0.90 21	0.90 1	58.50 182	10.60 33	1.00 3
4. conflicts between llamas and hikers	77.40 41	0.00 0	0.00 0	53.30 80	4.00 6	1.30 2	71.00 21	9.30 76	0.00 0	63.30 197	5.10 16	0.60 2
5. conflicts between hikers and other stock	56.60 30	30.20 16	0.00 0	41.30 62	20.70 31	4.00 6	30.80 33	56.10 60	1.90 2	40.20 125	34.40 107	2.60 8
6. llamas considered pets or exotic	73.60 39	3.80 2	0.00 0	50.70 76	6.00 9	2.00 3	68.20 73	8.40 9	1.90 2	60.50 188	6.40 20	1.60 5
7. objections to packstock feces	45.30 24	39.60 21	0.00 0	30.70 46	26.00 39	9.30 14	20.60 22	68.40 70	2.80 3	29.60 92	41.80 130	5.50 17

EXTENT OF PROBLEM

	BLM			NPS			USFS			COMBINED		
	none	minor	major	none	minor	major	none	minor	major	none	minor	major
c. Management Issues												
1. overuse of packstock areas	62.30 33	15.10 8	7.50 4	42.00 63	18.00 27	5.30 8	29.90 32	45.80 49	13.10 14	41.20 128	27.00 84	8.40 26
2. insufficient area to accommodate stock users	66.00 35	13.20 7	5.70 3	42.00 63	16.00 24	6.70 10	43.00 46	34.60 37	12.10 13	46.30 144	21.90 68	8.40 26
3. greater demand than supply of outfitting permits	81.10 43	1.90 1	1.90 1	55.30 83	6.00 9	1.30 2	57.00 61	21.50 23	9.30 10	60.10 187	10.10 33	4.20 13
4. decreased budget for leasing packstock	56.60 30	22.60 12	0.00 0	50.70 76	6.70 10	0.70 1	48.60 52	29.00 31	5.60 6	50.80 158	17.00 53	2.30 7
5. decreased budget for purchasing packstock	52.80 28	15.10 8	7.50 4	46.00 69	9.30 14	4.00 6	39.30 42	34.60 37	10.30 11	44.70 139	19.00 59	6.80 21
6. decreased budget for maintaining packstock	50.90 27	17.00 9	7.50 4	39.30 59	14.70 22	6.00 9	32.70 35	36.40 39	15.90 17	38.90 121	22.50 70	9.60 30
7. employee injuries from use of llamas	75.50 40	1.90 1	0.00 0	55.30 83	1.30 2	0.00 0	76.60 82	0.90 1	0.00 0	65.19 205	1.30 4	0.00 0
8. employee injuries from use of other stock	75.50 40	5.70 3	0.00 0	47.30 71	12.00 18	0.70 1	53.30 57	30.80 33	0.90 1	54.00 168	17.40 54	0.60 2
9. overcrowding on trails where stock are allowed	75.50 40	7.50 4	1.90 1	51.30 77	10.00 15	1.30 2	54.20 58	32.70 35	1.90 2	56.30 175	17.40 54	1.60 5
10. overcrowding in campgrounds with stock facilities	75.50 40	9.40 5	0.00 0	48.00 72	10.00 15	2.00 3	56.10 60	25.20 27	5.60 6	55.30 172	15.10 47	2.90 9

	BLM	NPS	USFS	Combined
Q.4.a. Outfitter Present				
no	41.9 (26)	78.6 (118)	34.6 (37)	58.5 (182)
yes	50.9 (27)	21.3 (32)	65.4 (70)	41.5 (129)

reasons for no outfitter:

28 no demand
 15 small area
 17 no need
 5 not allowed
 4 many roads
 1 no interest
 little or no packstock use
 river access
 no overnight use
 not practical
 not appropriate
 no profit
 use motor vehicles
 potential safety conflicts
 liability insurance expensive
 urban forest
 backcountry closed
 small cultural resource area
 on leased, tribal land
 archeological area
 park too new
 historical area
 water-oriented recreation

	BLM	NPS	USFS	Combined
Q.4.b. Outfitters Operating	290	98	1278	1666

	BLM	NPS	USFS	Combined
Q.4.c. Number of outfitters				
Using Llamas	4	9	33	46

Q.5.a. Llama Projects (during 1985-86)

NPS

Central Oregon Packers - packing trips
 Steve Rolfig - outfitting
 Cordillera Llamas - wilderness restoration, packing trash
 Taquitz Farms - outfitting
 Sierra Llamas - outfitting
 Siskiyou Llamas - trail maintenance
 Judy See Llama Treks - outfitting
 Sunset Llama Treks - day trips
 Trail Blazer Llamas - day and overnight trips
 Mamas Llamas - outfitting
 Llama Journeys - outfitting
 Noah Llama Treks - outfitting

USFS

EPA - acid rain survey
 Volunteers for Outdoor Colorado - trail maintenance
 REI - wilderness site rehabilitation
 USFS - campsite and trail maintenance
 LeConte Lodge - carrying supplies to wilderness lodge
 Bill Nelson - District Ranger - trail maintenance

BLM

Central Oregon Packers - packing trips - Steers Mountain

	BLM	NPS	USFS	Combined
Q.5.b. Llama Services				
# rating services:				
more than adequate	1	2	4	7
adequate	0	1	7	8
less than adequate	0	0	0	0

	BLM	NPS	USFS	Combined
Q.6. Experience With Llamas				
no	71.8 (41)	84.7 (122)	82.1 (87)	82.8 (251)
yes	21.2 (11)	15.3 (22)	17.9 (19)	17.2 (52)

types of experience:

- 5 saw on trail in forest or park
- 3 overnight packtrip with llamas
- know llama owners
- saw in zoo
- 2 helped write regulations
- caught loose llama
- observed demonstrations
- petted one once
- 1 hiked with llamas
- discussions with others
- llama ranch in area
- packing clinic
- workshop
- packing signs into wilderness
- friend owns one
- backcountry use in Ecuador
- saw in Andes
- used as pack animals at GWNF
- leased a pair to test for the NPS in 1984
- own llamas
- employee owns llamas

	BLM	NPS	USFS	Combined
Q.10. Llamas Useful to Areas Currently Using Packstock				
no	77.6 (38)	87.1 (21)	71.6 (68)	61.5 (67)
yes	22.4 (11)	12.9 (18)	28.4 (27)	38.5 (42)

reasons: not useful

- 40 no need
- 37 little need for packstock
- 13 area too small
- 11 cost
- load capacity light

- 10 atv's/vehicles used
- 8 forest well roaded
- other livestock meets needs
- terrain unsuitable
- 7 no demand
- 4 conflict with horses or mules
- potential conflict with brown bears
- 3 cultural resource area
- day use area
- expense of transporting
- cannot ride
- prejudice against llamas
- 2 maintenance costs
- no source
- climate unsuitable
- limited opportunity for packstock
- easy access
- no versatility
- all mammals prohibited to protect wolves
- historical area
- horses used for packing
- 1 no knowledge of llamas
- archeological area
- backcountry not developed
- air access
- boat access
- non-traditional use
- maintenance and cost exceed time benefits
- river access
- not indigenous/compatible with wilderness
- not possible
- horses used for riding
- wilderness administration done by backpack
- single purpose
- personnel training costs
- not practical
- inability of animal to adapt to insular barrier life
- too much resource impact
- bias toward horses
- weren't as good as expected
- wilderness ethics
- not unless advantages become more evident

reasons: useful

- 6 impacts lower/more acceptable
- 4 easier on the land
- 3 for trail work/maintenance
- for wilderness maintenance
- easier to handle
- 2 easier to handle with less experience and personnel
- low cost
- easy to keep

- 1 lower impact than horses
 offers an alternative tool
 easy to transport
 lower impact than horses
 reduced injuries
 reduced costs
 offers an alternative tool
 if large island is acquired
 to start pack operations on trails not used
 versatile
 small
 as the need develops
 easy to use
 lower ecological impact
 lack of grazing competition
 limited usefulness
 using them now
 could fill niche between backpacking and mules
 limited impact for use by wilderness ranges
 agile
 supply backcountry ranger camps
 backcountry work and resource management
 as a horse substitute
 packing with minimal impacts
 almost impact free
 o.k. to work with
 more useful for visitors than agency
 their temperament
 have not heard of any problems

	BLM	NPS	USFS	Combined
Q.11. Research Needed				
environmental	60.4 (32)	68.0 (102)	37.4 (40)	55.9 (174)
social	50.9 (27)	39.9 (59)	51.4 (55)	45.7 (142)
managerial	37.7 (20)	48.7 (73)	29.9 (32)	40.2 (125)
other:				
66	none			
61	no problem			
24	n/a			
16	packstock conflicts/interactions			
12	visitor-user reactions			

- 10 contrast usefulness and impacts w/horses and mules
 9 no research needed
 8 llamas considered exotic/not indigenous/non-traditional
 llamas have less/lower impact
 7 forage consumption impact
 transmission of diseases
 6 not needed
 5 area has tradition of horse/mule use
 anticipated impacts
 no opinion
 4 soil/trail compaction
 soil/trail erosion
 cost effectiveness
 disbelief of survey
 3 no experience with llamas
 no current need
 treat same as other livestock
 can't ride
 environmental consequences
 interaction with wildlife
 2 no
 no llama use at present
 availability
 little use of llamas
 little known about llama use
 no background to make recommendations
 hiker/llama conflicts
 terrain/climate unsuitable
 loose llamas
 introduction of exotic plant diseases
 introduction of new species
 interaction with bears
 stream pollution/water quality
 vegetation impacts
 cost of llamas high
 load capacity light
 llama/livestock conflicts
 need more information about llamas
 safety aspect
 1 no knowledge of llamas
 no packstock use
 horses used
 horses leased
 packstock used
 llamas useful for backcountry work/patrol
 have educational program on use
 horse/llama controversy
 management acceptance/attitudes
 budget constraints
 research
 range management
 competition with indigenous species
 indigenous species impacts
 management consequences

flies attracted by horses
 exotic organisms
 anticipated problems
 concept new
 demand
 buy in pairs
 considered pets

Q.12. Policy Recommendations

64 no
 22 none
 13 treat same as other packstock
 11 no background to make recommendations
 8 n/a
 7 packstock conflicts/interactions
 6 anticipated impacts
 5 wilderness aspects
 llamas considered exotic/non-traditional/not indigenous
 no experience with llamas
 4 contrast usefulness and impacts with horses
 research
 3 no problem(s)
 not needed
 little known about llama use
 horse/llama controversy
 transmission of diseases
 leave it up to the local land manager
 ban from wilderness
 2 no knowledge of llamas
 area has tradition of horse/mule use
 have educational program on use
 limit # of groups, # per group if impacts are high
 environmental consequences
 introduction of exotic plant species
 interaction with wildlife
 soil/trail erosion
 vegetation impacts
 forage consumption impacts
 llamas have less/lower impact
 exclude from other packstock regulations
 llamas considered pets
 1 no llama use at present
 no research needed
 no anticipated use
 no opinion
 management acceptance
 atv's/motor bikes used
 boats used
 river access
 packstock used
 little use of llamas
 llamas offer an alternative

hiker conflicts
 visitor/user reactions
 competition
 interstate transport of llamas
 identification of llamas
 loose llamas
 stream pollution/water quality
 soil/trail compaction
 unknown
 feasibility
 cost effectiveness
 llamas cost too much
 need outriders
 llama/livestock conflicts
 more information on llamas needed
 safety aspects
 willing to experiment with llamas
 too much overall use already
 hiking only
 might need separate hitching areas for llamas
 research needs for llama camps
 investigate commercial vs. private use
 investigate on vs. off trail use
 establish use guidelines
 see 36 CFR 1.5, 1.7, 1.4, 2.16
 livestock interactions

Notes and Comments

- 10 little packstock use
no packstock use
- 7 saddlestock used
area well roaded
llamas have less/lower impact
- 6 no problems
not needed
not enough land base
- 5 day use recreation
area has tradition of horse/mule use
terrain/climate unsuitable
- 4 no experience with llamas
packstock used
water-based recreation
little use of llamas
packstock conflicts/interactions
soil/trail erosion
- 3 not an issue at present
boats used
little known about llama use
llamas useful for backcountry work/patrol
visitor/user reaction
budget constraints
forage consumption impacts
load capacity light

2 no
 n/a
 no interest
 horses used
 aircraft used
 atv's/motorbikes used
 dog teams used
 llamas considered exotic/non-traditional/not indigenous
 no background to make recommendations
 using llamas now
 llamas useful for outfitter guides
 llama outfitters currently operating
 contrast usefulness and impacts w/horses and mules
 transmission of disease
 flies from horses
 introduction of exotic plant species
 interaction with wildlife
 interaction with bears
 soil/trail compaction
 overgrazing problems already
 llama impact less than current overgrazing
 disbelief in survey
 concept too new
 expense of off season maintenance

1 no knowledge of llamas
 no research needed
 no trails/facilities
 no public access to areas
 no current need/demand
 not aware of any llama use
 not useful
 burros used
 helicopters used
 foot travel/backpacks used
 river access
 vehicles used
 impacts not a problem
 llamas fill niche between backpacking and packstock
 treat same as other packstock
 distinguish between ridingstock and packstock
 need "undesignated wilderness" category on survey
 distance for hiking in our area limited
 research
 llamas useful for supplying/patrolling wild. facilities
 management consequences of interest
 environmental consequences of interest
 loose llamas
 stream pollution
 llama impact less than current management problems
 unknown
 impractical
 budgetary benefits
 wilderness aspects
 low maintenance costs of llamas

easy to transport
llamas cost too much
need more info on llamas
not as good as expected
willing to experiment with llamas
is there competition between horse and llama outfitters
interested in using llamas
hiking only
cultural are
ban all packstock use
improves production of backcountry crews 20%
livestock interactions
llamas not specified as packstock, thus not allowed

APPENDIX C

Responses - Public Survey

	No Problem	Minor Problem	Major Problem
Q.1.a. Environmental Issues			
1. Packstock related erosion	37.3 (25)	26.9 (18)	35.8 (24)
2. " " campground erosion	47.7 (31)	27.7 (18)	24.6 (16)
3. " " grazing impacts	53.1 (34)	29.7 (19)	17.2 (11)
4. " " vegetation trampling	51.5 (34)	37.5 (19)	10.9 (9)
5. " " water pollution	51.6 (24)	37.5 (7)	10 (9)
6. Loose pets or packstock	68.2 (45)	27.3 (18)	4.5 (3)
7. Exotic plant introduction	75.4 (11)	18.0 (4)	6.6 (12)
8. Animal disease introduction	91.7 (55)	8.3 (5)	0.0 (0)

	No Problem	Minor Problem	Major Problem
Q.1.b. Social Issues			
1. Trash from hikers	25.0 (17)	61.8 (42)	13.2 (9)
2. Trash from packstock users	37.9 (25)	50.0 (33)	12.1 (8)
3. Llama/packstock conflicts	68.2 (45)	31.8 (21)	0.0 (0)
4. Llama/hiker conflicts	95.5 (64)	3.0 (2)	1.5 (1)
5. Hiker/packstock conflicts	51.6 (33)	45.3 (29)	3.1 (2)
6. Llamas considered exotic	65.2 (43)	30.0 (20)	4.5 (3)
7. Packstock feces objections	45.5 (30)	40.9 (27)	13.6 (9)

	No Problem	Minor Problem	Major Problem
Q.1.c. Managerial Issues			
1. Packstock overuse	47.0 (31)	30.3 (20)	22.7 (15)
2. Insufficient room	56.1 (37)	22.4 (16)	19.7 (13)
3. Packstock permit deficit	56.4 (31)	24.2 (14)	18.2 (10)
4. Trail overcrowding	59.1 (39)	37.9 (25)	3.0 (2)
5. Campground overcrowding	54.0 (34)	33.3 (21)	12.7 (8)
6. Lack of llama grazing permits	76.3 (45)	16.9 (10)	6.8 (4)

Q.2. Experience with llamas

none	-	4.2 (3)
one to two years	-	26.8 (19)
three to four years	-	38.0 (27)
five years or more	-	31.0 (20)

Q.3. Pack trips per year

one or two	-	23.8 (15)
three to four	-	34.9 (22)
five to ten	-	28.6 (18)
ten or more	-	12.7 (8)

Q.4. Types of Research Needed

environmental	-	52.5 (31)
social	-	23.7 (14)
managerial	-	48.8 (27)
other:	-	0.08 (5)

research suggestions:

- 4 none - no research needed
research horse and mule impacts compared to llamas
llama impact less than horses
- 3 llama impact very low
- 1 forest rangers most accommodating
educate administrators and managers
permit on all hiking trails

horse impact high
 treat same as other livestock
 give llamas preference in fragile areas
 impact depends on packstock users and their ethics
 take lesser safety hazards into consideration for policy
 research llama trail impacts
 horse/llama conflicts overstated
 research distance and terrain limits
 enforce current packstock regulations for horses
 research all areas and document findings

Q.5. Policy Recommendations

responded	34.2 (25)
did not respond	65.8 (48)

policy suggestions:

7 llama impact very low
 6 educate administrators and managers about llamas
 llama impact less than horses
 4 allow greater use than horses
 3 no problem with forest management
 encourage llama use
 treat same as other packstock
 take lesser impact into consideration when making policy
 2 permit on all hiking trails
 horse impact high
 recreation vehicles are a major impact problem
 research horse and mule impacts and compare to llamas
 need llama use information for packers
 need standard use/etiquette requirements for llamas
 take lesser safety hazards into consideration for policy
 experience lots of questions while hiking with llamas
 need information about llamas for other hikers
 off-trail use avoids trail-related problems in forests
 need more positive p.r. about llamas
 need more affordable llamas
 forest rangers most accommodating
 1 most parks restrict or prohibit llama use
 do not restrict use to other packstock areas
 research impacts on fragile desert environments
 research grazing/browsing/foraging impacts
 no overcrowding experienced
 managers have lack of knowledge
 allow off-trail use of llamas
 yield right-of-way to horses
 stop treating llamas as exotic

don't let horse users exclude llamas due to competition
impact depends on packstock users and their ethics
conflict with trail bikes and their high impact
kick feces off trail and tether away from campers
conflict with horses
require health certificates for packing
consider llamas 1/4 impact of horses
llamas should be led not driven loose along trails
llama users should announce presence
llamas should have full packstock status
research terrain and distance limits
see NPS regulations for RMNP re: packstock designation
need education on use of all packstock and impacts
llama use increases trail condition awareness
limit horse use
allow llama use when other animals are inappropriate
see Sequoia-Kings Canyon Backcountry plan 1983-84

APPENDIX D

As part of the project and in conjunction with their funding, ILA asked that a brochure be drafted noting some of the study's findings and discussing the topic of backcountry ethics in relation to llama use. This brochure is to be part of the ongoing series of educational brochures produced by ILA.

BACKCOUNTRY LLAMA USE BROCHURE

Purpose and Need

- 1) to inform backcountry users about llama use
- 2) to document acceptance and practice of informal trail etiquette
- 3) to provide information regarding llama use to public land managers
- 4) to restate backcountry ethics as accepted by the USFS and NPS
- 5) to encourage visitors to know agency regulations
- 6) to encourage proper use of llamas in the backcountry

INTRODUCTION

(Quotes about the importance of a land or environmental ethic can be gathered from several sources to set the mood of the brochure. Perhaps you have some favorites; an example is given below.)

"It would promise us a more serene and confident future if, at the start of our sixth century of residence in America, we began to listen to the land, and hear what it says, and know what it can and cannot do." Wallace Stegner

WHY ALL THIS INTEREST IN LLAMAS?

Today's resource managers are faced with the dilemma of having to accommodate human use of our national parks, forests, and other natural areas while protecting the quality and integrity of the natural resources they contain. Visitors to our national wildlands also have the same moral obligation and share in this struggle. A variety of influences affect desired conditions, including grazing, recreation, and research among others. Requests for these and many other uses are increasing across the country as the population and economy continue to grow and leisure time increases. Through the years, man has filled his idle time with leisure activities of many kinds. Much of the outdoor recreation occurred on public lands owned and managed by the federal government. Use of these lands has grown and changed, as has management and policy formation within the management agencies. All of these factors play a part in the evaluation of packstock use on public lands, and of llama use in particular.

Packstock use has been a traditional part of many places in the United States and is often considered part of our national heritage. Horses and mules were essential to the civilization of the country and aided in developing the early national parks and forests. Mining, grazing and timber production on the forests depended largely on draft and pack animals. The parks saw many visitors touring by horse or buggy and kept traditional packstock use as part of their cultural preservation mandate. Today, horse and mule use is still an intricate part of many areas.

Recently, a new type of pack animal has been introduced. Llamas, brought to the U.S. from South America in the early 1930's, are gaining

popularity as an alternative to traditional types of packstock. They are currently being used by management agencies and the public alike with reports such as the following appearing with increasing regularity.

"They're low-impact animals," observes Walter Kretzer, director of a three year acid rain research project in the Adirondacks. Kretzer heads a staff of twenty researchers who are assisted by two llamas. The llamas are used to carry the sampling gear, and Kretzer considers them indispensable to the project, reducing manpower needs and expenses. After one year of working with the llamas, he reports that they're "very low-maintenance" and "very adaptable." He adds, "I'm surprised we didn't take this route twenty years ago."

Appalachia Bulletin

"It's an unlikely apparition, both stately and a little bizarre -- a procession of pack llamas picking adept pathways across grassy meadows of California foothills or over the rocky shoulders of Colorado ranges. You might expect such a caravan in the remote Andes, where for centuries llamas have been the Inca's great domestic asset. All that is changing, as Westerners discover the quiet Pleasures of back-country hiking with these sensitive, adaptable animals. The llama carries the camping gear -- 60 to 80 pounds' worth -- letting you move along freely, with only your own day pack on your back."

Sunset Magazine

HISTORY AND USE IN SOUTH AMERICA

Including:

- evolution in North America
- movement to South America
- history of domestication in South America
- present status of llamas in South America

HISTORY AND USE IN NORTH AMERICA

Including:

- importation by R. Hearst
- first major breeders
- current ownership (including map)
- use by public (including map)
- use by management agencies

BACKCOUNTRY ETHICS

(and additional practices by llama owners and users)

- Respect and communicate with governing officials and other users.
- Do not allow stock to roam freely on trail or around camp.
- Restrict llamas to areas where browsing and foraging will cause the least impact. Avoid areas of fragile soil or vegetation.
- Be aware of the possibility of introducing unwanted species of plants from domestic feed and minimize activities which could cause impacts.
- Avoid using metal pickets or free-roaming grazing apparatus that may make noise if an animal is spooked or lodge between rocks or trees if an animal bolts. A bungi cord, piece of surgical tubing, bicycle inner tube or other stretchy material attached to the tether line may lessen the shock if an animal is spooked and attempts to run.
- Uphold wilderness ethics regarding trash. Follow "pack it in - pack it out" practices. Always try to leave an area cleaner than you found it.
- Keep animals within sight whenever possible. Never leave stock unattended for extended periods of time.
- Cooperate with management officials and know the regulations of the area you are using.
- Make each encounter with management or other visitors a positive one.
- Take time to acquaint horses with llamas if encounters are likely.
- Disperse manure at least 100 ft. from camps, trails or water courses
Kick manure off trails and crush if possible for better decomposition.

Trail Practices

- Travel outside of peak use on trails. Try to go with the flow on heavily used trails.
- Expect questions and try to provide polite, knowledgeable answers.
- Avoid allowing animals to defecate or urinate in water courses by training and handling them properly.
- Riders are recommended to dismount and walk horses past llamas if trails are steep or precipitous. On level ground, it may be best to say mounted, whatever gives greater control over the horse.

- The burden lies with the llama user to inform, instruct, encourage and yield the right-of-way to the horse user; whatever is necessary for a safe passage.
- Animals must be trail-worthy, that is, trained and conditioned.
- Know your animal's temperament and capability. Know their needs for water, feed, rest and control.
- Take time to help clear and maintain trails when necessary.
- Right of way should be given to horses by llama users.
- A verbal warning of the presence of llamas should be given to those on horseback as soon as they are within hearing range.
- Llama users should pull well off the trail and remain stationary until horses have passed.
- A lead person should walk 25 yards in advance of llamas when possible or on precipitous terrain to forewarn those on horseback.
- It is the llama owners responsibility to back up a trail if an impasse is reached. Llamas have an advantage of control and agility in such situation.
- Tie stock to trees only while loading or unloading.

Campground Practices

- Check for the presence of other packstock before entering a campground.
- Animals should be tied to a line between two trees during the night when possible. If bears or other potentially dangerous animals are present in the area, securing llamas in front of the tents may be preferable for the safety of both animals and persons.
- Metal pickets can be dangerous and should be avoided.
- Tie animals at least 100 ft. from lakes, streams, trails and campsites. Avoid areas where stock are prohibited.

APPENDIX E

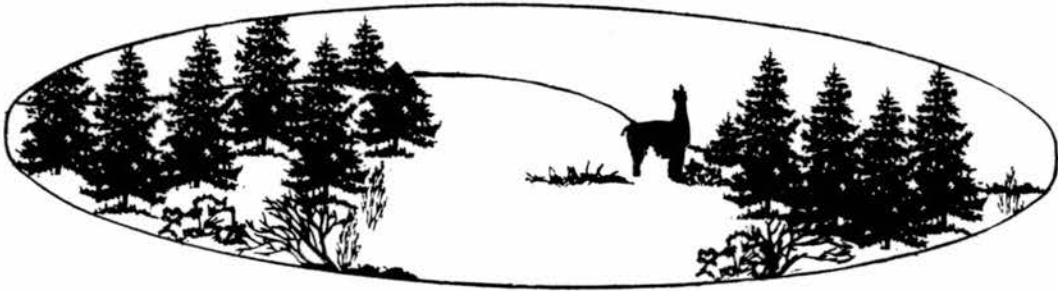
The survey method used in this study is that of a mailed questionnaire. The questionnaire is designed to assess location of, issues related to, and policy needs regarding llama use. Since llama use is only a part of total packstock use, there are a number of questions which deal with this factor as well. The questions are divided into three sections: 1) use characteristics, 2) issues and concerns, 3) and background information. The survey and questionnaire were designed following the Total Design Method for Mail and Telephone Surveys by D. Dillman (1982).

The booklet form and layout of the questionnaire have several advantages. The form helps add interest and variety while allowing for a convenient size product. It compliments the sections of questions and offers plenty of blank space and room for comments. The layout is designed so that the booklet can be folded in half and is ready for mailing. It is pre-stamped to eliminate any cost to the respondent.

The return incentive is enhanced by enclosing a bookmark with each questionnaire. (This was not possible with the Public Llama Use Survey for logistical reasons.) The marker has a picture of the study logo for recognition and reminder purposes. A piece of llama wool spun into yarn is tied to the top. The item weighs very little and can be produced at minimal cost. An example of the bookmark is included as are

drafts of each of the measurement instruments and their related correspondence.

LLAMA USE ON PUBLIC LANDS



Check Management Agency: _____ U.S. Forest Service
_____ National Park Service
_____ Bureau of Land Management

Individual Reporting:

Name _____
Title _____
Location _____ State _____
Phone Number _____

September 5, 1986

To the Participant,

Your work with the United States Forest Service, National Park Service or Bureau of Land Management, gives you special insight into the potential of using llamas as pack animals on public lands. By completing this short questionnaire, you can share this insight in a meaningful way.

Your views and experiences are important in identifying trends, issues, and policy needs regarding llama use on the land your agency presently manages. Your input, with that of agency members throughout the United States, will help reveal changes occurring due to llama use and minimize potential conflicts. The survey will be used as part of my master's degree research focusing on the social, environmental, and managerial impacts of packing with llamas on public lands. The results of the study will lead to further research on those issues and impacts which most concern you as a resource manager.

As a token of appreciation, I have enclosed a bookmark for you to keep or pass along to a friend. It is my way of thanking you personally and professionally. I assure you that your response will be held in strict confidence and will be used for the purpose of this study alone.

After you complete the questionnaire, please fold it in half with the mailing address to the outside, and staple or tape it closed. No postage is necessary. Make sure you include your return address and indicate whether you would like to have a copy of the study results sent to you. Please return the questionnaire by September 21. Thank you once again for being part of the study.

Sincerely,



Cheryl Anne Arndt
College of Forestry
and Natural Resources
Colorado State University
Ft. Collins, CO 80523
(303) 663-7557

CA/kt
enc

Llama Use On Public LandsSection I. Use Characteristics

The following questions concern the use of llamas and other types of pack animals such as horses, mules, donkeys, and ponies, by land management personnel and the public. Place an X on the blank to the right of the answer which is most appropriate for your district, forest, park or monument. You may elaborate on your answers in the NOTES and COMMENTS section at the back of the questionnaire.

- Q-1. a. Are packstock used by the management agency on the land your agency oversees? (Mark the most appropriate answer with an X.)

1. NO _____ WHY NOT? _____

. . . . 2. YES _____ [GO ON TO QUESTION 2.]

- b. Indicate the number of each type of animal the agency uses and whether they are owned or leased; estimate the amount of use the animals receive during a normal field season.

Animals Used by Agency

	<u>Owned</u>	<u>Leased</u>	<u>Number of Days Used Seasonally</u>
1. HORSES	_____	_____	_____
2. MULES	_____	_____	_____
3. DONKEYS	_____	_____	_____
4. PONIES	_____	_____	_____
5. LLAMAS	_____	_____	_____
6. OTHER:	_____	_____	_____

(Please specify.)

- c. How often are packstock used by the agency for the following purposes?
 OFTEN = more than 10 days of use per month during the field season.
 SELDOM = less than 10 days of use per month during the field season.
 NEVER = no use by agency. (Mark the most appropriate answer with an X.)

Frequency of Agency Packstock Use

	<u>Often</u>	<u>Seldom</u>	<u>Never</u>
1. BACKCOUNTRY SUPERVISION	_____	_____	_____
2. TRAIL OR FACILITY MAINTENANCE	_____	_____	_____
3. ENVIRONMENTAL STUDIES	_____	_____	_____
4. RESEARCH PROJECTS	_____	_____	_____
5. RESCUE EFFORTS	_____	_____	_____
6. OTHER:	_____	_____	_____

(Please elaborate.)

- d. Is agency use of llamas increasing, decreasing, or relatively unchanging on the land your agency manages? (Mark the most appropriate answer with an X.)

1. INCREASING _____
 2. DECREASING _____
 3. UNCHANGING _____

Section I. Use Characteristics (cont.)

Q-2. a. Are packstock used by the public on the land you are involved in managing? (This does not include commercial outfitters.) (Mark the most appropriate answer with an X.)

1. NO _____ WHY? _____

. . . . 2. YES _____ [GO ON TO QUESTION 3.]

b. Indicate the types of animals used as packstock by the public and estimate the amount of use during a typical field season.

Animals Used by Public

	Type	Estimated 8-Hour Days of Use
1.	HORSES	_____
2.	MULES	_____
3.	DONKEYS	_____
4.	PONIES	_____
5.	LLAMAS	_____
6.	OTHER:	_____

(Please specify.)

c. How often are packstock used by the public for the following purposes?
 OFTEN = more than 10 days of use per month during the field season.
 SELDOM = less than 10 days of use per month during the field season.
 NEVER = no use by public. (Mark the most appropriate answer with an X.)

Frequency of Public Packstock Use

	Often	Seldom	Never
1.	DAY TRIPS	_____	_____
2.	OVERNIGHT TRIPS	_____	_____
3.	BACKCOUNTRY TRAVEL	_____	_____
4.	TRAIL OR FACILITY MAINTENANCE	_____	_____
5.	RESEARCH PROJECTS	_____	_____
6.	LIVESTOCK ROUNDUPS	_____	_____
7.	HUNTING TRIPS	_____	_____
8.	OTHER:	_____	_____

(Please specify.)

d. Is public use of llamas increasing, decreasing or relatively unchanging on the land your agency manages? (Mark the most appropriate answer with an X.)

1. INCREASING _____
 2. DECREASING _____
 3. UNCHANGING _____

Section II. Issues and Concerns

This section deals with issues currently facing managers of many public lands. Please consider the following situations and mark the most appropriate answer for your unit.

Q-3. Indicate to what extent each issue is a problem for the majority of the areas where packstock are allowed on the land your agency manages. (Mark the most appropriate answer with an X.)

		Extent of Problem		
		No Problem	Minor Problem	Major Problem
a.	<u>Environmental Issues</u>			
1.	PACKSTOCK-RELATED TRAIL EROSION	_____	_____	_____
2.	PACKSTOCK-RELATED CAMPGROUND EROSION	_____	_____	_____
3.	PACKSTOCK-RELATED GRAZING IMPACTS	_____	_____	_____
4.	PACKSTOCK-RELATED VEGETATION TRAMPLING	_____	_____	_____
5.	PACKSTOCK-RELATED WATER POLLUTION	_____	_____	_____
6.	LOOSE PETS OR PACKSTOCK	_____	_____	_____
7.	INTRODUCTION OF EXOTIC PLANT SPECIES	_____	_____	_____
8.	INTRODUCTION OF EXOTIC ANIMAL DISEASES	_____	_____	_____
b.	<u>Social Issues</u>			
1.	TRASH DUE TO HIKERS	_____	_____	_____
2.	TRASH DUE TO PACKSTOCK USERS	_____	_____	_____
3.	CONFLICTS BETWEEN LLAMAS AND OTHER PACKSTOCK	_____	_____	_____
4.	CONFLICTS BETWEEN LLAMAS AND HIKERS	_____	_____	_____
5.	CONFLICTS BETWEEN HIKERS AND OTHER PACKSTOCK	_____	_____	_____
6.	LLAMAS CONSIDERED PETS OR EXOTIC SPECIES	_____	_____	_____
7.	OBJECTIONS TO PACKSTOCK FECEs	_____	_____	_____

Section II. Issues and Concerns (cont.)

Q-3. (cont.)

c. <u>Management Issues</u>	Extent of Problem		
	<u>No Problem</u>	<u>Minor Problem</u>	<u>Major Problem</u>
1. OVERUSE OF AREAS BY PACKSTOCK USERS	_____	_____	_____
2. INSUFFICIENT AREA TO ACCOMMODATE PACKSTOCK USERS	_____	_____	_____
3. GREATER DEMAND FOR PACKSTOCK OUTFITTING PERMITS THAN CURRENT SUPPLY MEETS	_____	_____	_____
4. DECREASED AGENCY BUDGET FOR LEASING PACKSTOCK	_____	_____	_____
5. DECREASED AGENCY BUDGET FOR PURCHASING PACKSTOCK	_____	_____	_____
6. DECREASED AGENCY BUDGET FOR MAINTAINING PACKSTOCK	_____	_____	_____
7. EMPLOYEE INJURIES FROM USE OF LLAMAS	_____	_____	_____
8. EMPLOYEE INJURIES FROM USE OF OTHER PACKSTOCK	_____	_____	_____
9. OVERCROWDING ON TRAILS WHERE PACKSTOCK ARE ALLOWED	_____	_____	_____
10. OVERCROWDING IN CAMPGROUNDS WITH PACKSTOCK FACILITIES	_____	_____	_____



Section III. General Information

These final questions are designed to gather additional information and to allow you to express your feelings about the use of llamas as pack animals. Please mark the appropriate answer with an X and write the requested information in the space provided. Use the NOTES AND COMMENTS section at the back of the questionnaire if you need additional space.

Q-4. a. Are there any commercial guides or outfitters who use packstock operating on the land your agency manages? (Mark the most appropriate answer with an X.)

1. NO _____ WHY? _____
 2. YES _____

b. How many such outfitters operate on your unit? _____

c. Of these, how many presently use llamas? _____

Q-5. List any projects that took place during the last two years (1985-1986) which used llamas. Please include the names of the individuals or organizations involved and the nature of the work where possible. Indicate your general impression of the services provided by the llamas and their handlers.

Individuals and/or Organizations
 Nature of Work

Impression of Services

More than Adequate Adequate Less than Adequate

1. _____ _____	_____	_____	_____
2. _____ _____	_____	_____	_____
3. _____ _____	_____	_____	_____
4. _____ _____	_____	_____	_____
5. _____ _____	_____	_____	_____
6. _____ _____	_____	_____	_____

Section III. General Information (cont.)

- Q- 6. Have you had any personal experience with llamas? (Mark the most appropriate answer with an X.)
1. NO _____
 2. YES _____ WHAT KIND? _____
- Q- 7. Estimate what percent of your unit is represented by the following land classifications.
1. NON-ROADED AREAS: DESIGNATED WILDERNESS _____
NON-WILDERNESS _____
 2. ROADED AREAS: LESS THAN 1 MI./ SQ. MI. _____
MORE THAN 1 MI./ SQ. MI. _____
- Q- 8. Estimate the ecological diversity within your unit. Diversity is defined here as having a combination of different ecosystems such as alpine, montane, desert, grasslands, forest, and wetlands. (Mark the most appropriate answer with an X.)
1. LOTS OF DIVERSITY _____ (5-6 of the ecosystems listed above)
 2. SOME DIVERSITY _____ (3-4 of the ecosystems listed above)
 3. LITTLE DIVERSITY _____ (1-2 of the ecosystems listed above)
- Q- 9. How many days are there in a typical field season in your area? _____
- Q-10. What is your opinion regarding the usefulness of llamas to your unit in the future? (Mark the most appropriate answer with an X.)
1. WOULD BE USEFUL _____ WHY? _____
 2. WOULD NOT BE USEFUL _____ WHY NOT? _____
- Q-11. What type(s) of research do you think are needed to sufficiently investigate the impacts llamas might have on public lands? (Mark the most appropriate answer(s) with an X.)
1. ENVIRONMENTAL IMPACTS _____
 2. VISITOR REACTIONS _____
 3. MANAGERIAL ISSUES _____
 4. OTHER _____
- _____
(Please elaborate.)

- Q-12. Do you have any recommendations for policy needs regarding those areas which are currently experiencing or could potentially experience llama use?
- _____

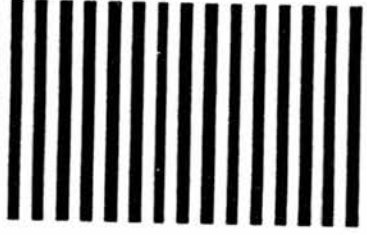
Thanks again!

NOTES AND COMMENTS

(Feel free to elaborate on any question or answer, or make any other notes or comments you wish to in the space provided below. Attach a separate piece of paper if more space is required for your comments.)



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Dr. Freeman Smith
Earth Resources Department
Colorado State University
Ft. Collins, CO 80523

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und No. 221309



* * * THIS IS YOUR SPECIAL OPPORTUNITY TO PARTICIPATE IN CURRENT LLAMA RESEARCH * * *

To the Participant,

Your interest in owning, raising and using llamas gives you special insight into the problems and potential of using llamas on public lands. The following questionnaire will allow you to share this insight in a meaningful way. The survey will be used as part of my master's degree research, focusing on identifying where llamas are being used and what impacts have been observed thusfar. With this knowledge, further research can take place on those impacts which concern both the llama users as well as those who manage our natural resources.

Your views and experiences are important in identifying trends, issues and policy needs regarding llama use on the lands the government owns and maintains. Your input, along with responses from members of the United States Forest Service, National Park Service and Bureau of Land Management throughout the United States and it's territories, will help us detect changes occurring due to llama use and aid in deciding how to minimize potential conflicts. I assure you that your response will be held in strict confidence and will be used for the purpose of this study alone.

When you have completed the questionnaire, fold it in thirds, with the mailing address to the outside, and staple closed. No postage is necessary when you mail it. You may include your name and return address if you wish but it is not necessary. Please return the questionnaire as soon as you can so the results can be analyzed in a timely manner. The research findings will be published in Llamas Magazine as soon as the project is complete. Thank you very much for being part of the study.

Sincerely,

Cheryl Anne Arndt
College of Forestry
and Natural Resources
Colorado State University
Fort Collins, CO 80523
(303) 491-5661

Management Issues Related to Llama Use on Public Lands

The following questionnaire deals with issues currently facing users and managers of many public lands. Please consider the following situations and place a check mark (or an X) on the blank to the right of each issue, indicating to what extent each issue is a problem in the national park, national forest, or BLM lands you frequent with your llamas. Please include the name of the area whenever possible. (Check the most appropriate answer)

	Extent of Problem			Name of Area
	No Problem	Minor Problem	Major Problem	
Q-1. a. <u>Environmental Issues</u>				
1. PACKSTOCK-RELATED TRAIL EROSION	_____	_____	_____	_____
2. PACKSTOCK-RELATED CAMPGROUND EROSION	_____	_____	_____	_____
3. PACKSTOCK-RELATED GRAZING IMPACTS	_____	_____	_____	_____
4. PACKSTOCK-RELATED VEGETATION TRAMPLING	_____	_____	_____	_____
5. PACKSTOCK-RELATED WATER POLLUTION	_____	_____	_____	_____
6. LOOSE PETS OR PACKSTOCK	_____	_____	_____	_____
7. INTRODUCTION OF EXOTIC PLANT SPECIES	_____	_____	_____	_____
8. INTRODUCTION OF EXOTIC ANIMAL DISEASES	_____	_____	_____	_____
b. <u>Social Issues</u>				
1. TRASH DUE TO HIKERS	_____	_____	_____	_____
2. TRASH DUE TO PACKSTOCK USERS	_____	_____	_____	_____
3. CONFLICTS BETWEEN LLAMAS AND OTHER PACKSTOCK	_____	_____	_____	_____
4. CONFLICTS BETWEEN LLAMAS AND HIKERS	_____	_____	_____	_____
5. CONFLICTS BETWEEN HIKERS AND OTHER PACKSTOCK	_____	_____	_____	_____
6. LLAMAS CONSIDERED AN EXOTIC SPECIES	_____	_____	_____	_____
7. OBJECTIONS TO FECES FROM PACKSTOCK	_____	_____	_____	_____

(continued on back)

Q-1. c. <u>Management Issues</u>	Extent of Problem			Name of Area
	No Problem	Minor Problem	Major Problem	
1. OVERUSE OF AREAS BY PACKSTOCK USERS	_____	_____	_____	_____
2. INSUFFICIENT ROOM TO ACCOMMODATE ALL PACKSTOCK USERS	_____	_____	_____	_____
3. GREATER DEMAND FOR PACKSTOCK OUTFITTING PERMITS THAN SUPPLY MEETS	_____	_____	_____	_____
4. OVERCROWDING ON TRAILS	_____	_____	_____	_____
5. OVERCROWDING IN CAMPGROUNDS	_____	_____	_____	_____
6. DIFFICULTY OBTAINING GRAZING PERMITS FOR LLAMAS	_____	_____	_____	_____

These final questions are included to allow you to express your personal feelings about the use of llamas as packstock. Please place a check mark (or an X) in the blank to the right of the most appropriate response or write an answer on the line provided. Attach a separate sheet of paper if more room is needed for your comments or additional questions you might have.

Q-2. How many years of experience have you had with llamas? (Check the most appropriate answer)

1. NONE _____
 2. ONE TO TWO _____
 3. THREE TO FOUR _____
 4. FIVE OR MORE _____

Q-3. How many times per year do you pack with llamas? (Check the most appropriate answer)

1. ONCE OR TWICE _____
 2. THREE TO FOUR _____
 3. FIVE TO TEN _____
 4. TEN OR MORE _____

Q-4. What types of research do you think are needed to sufficiently investigate the impacts llamas might have on public lands? (Check the most appropriate answer)

1. ENVIRONMENTAL IMPACT _____
 2. SOCIAL IMPACT _____
 3. MANAGERIAL ISSUES _____
 4. OTHERS: _____

(Please elaborate)

Q-5. Do you have any recommendations for policy needs regarding those areas currently or potentially experiencing llama use?

thanks again!

Fund No. 121390

BUSINESS REPLY MAIL
 FIRST CLASS PERMIT NO. 4 FT COLLINS, CO
 POSTAGE WILL BE PAID BY ADDRESSEE

Dr. Freeman Smith
 Earth Resources Department
 Colorado State University
 Ft. Collins, CO 80523

NO POSTAGE
 NECESSARY
 IF MAILED
 IN THE
 UNITED STATES

Review Form

1. Are all the words understandable?

2. Does each question have an appropriate response?

3. Does the questionnaire create a positive impression, one that motivates people to answer it?

4. Does any aspect of the questionnaire suggest bias on the part of the researcher?

5. Additional Comments:

October 9, 1986

Dear Resource Manager,

Recently, I sent you a questionnaire requesting your input concerning the use of llamas as pack animals on public lands. Your reply, however, is not among the many received to date. In case the questionnaire did not reach you or was accidentally overlooked, another is enclosed. It will take only 15 minutes to complete and will influence policy formation regarding the use of llamas and other packstock on federally-owned land for years to come.

It is very important that information on packstock use be obtained from each national park, national forest, and BLM district in the United States. Each area has unique use characteristics which dictate special policy needs. The only means of identifying the policy needs of your specific location is through information provided by you or one of your staff.

Policy changes regarding llama use are already being made by many parks and forests. This study offers you an opportunity to provide the information necessary to assure that these changes reflect your knowledge and feelings about the issues involved. Please share your expertise and help create a source of information from which sound decisions can be made. Mail your response today.

Sincerely yours,



Cheryl Anne Arndt
College of Forestry
and Natural Resources
Colorado State University
(303) 663-7557

ca/kt

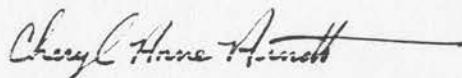
March 1, 1987

Dear Resource Manager,

Recently, we conducted a survey to gather information about llama use on federally-owned lands. For some reason, your response was not among the many we received. We would hate to complete the study without information about your particular area. Please take a moment and fill out the enclosed card, indicating which statement best describes the situation at the national park, forest or BLM district where you work. Then, just drop the card in the mail. No postage is necessary.

We have also enclosed a bookmark as a token of our appreciation. It is our way of thanking you in advance. Please note, this will be your last opportunity to provide input to this study -- don't forget to mail your response today.

Sincerely yours,



Cheryl Anne Arndt
College of Forestry
and Natural Resources
Colorado State University
Ft. Collins, CO 80523
(303) 663-7557

enc(2)

February 20, 1988



Dear Natural Resource Manager,

A little over a year ago, you received a survey regarding llama use on public lands. I am now updating the study and need a few more minutes of your time.

On your questionnaire, you indicated that the management agency at your park, forest, or BLM district uses packstock. I would like the study to include information about packstock use for both 1986, as represented by the original survey, and 1987, as represented by the update. The update will concentrate on llama use only, as that is the focus of the study.

Please complete the enclosed card and drop it in the mail. Only one third of the population surveyed utilizes packstock; therefore, your response is vital to the completion of this portion of the study. Response rate for the first portion of the survey was 88% and I hope this can be repeated for the update.

The project will be completed in May of this year. Those of you who indicated you wanted a copy of the results will receive one. If you would like a copy and have not yet requested one, you may do so now. I want to thank you once again for supporting this project and I look forward to sharing the results with you.

Respectfully yours,

Handwritten signature of Cheryl Anne Arndt.

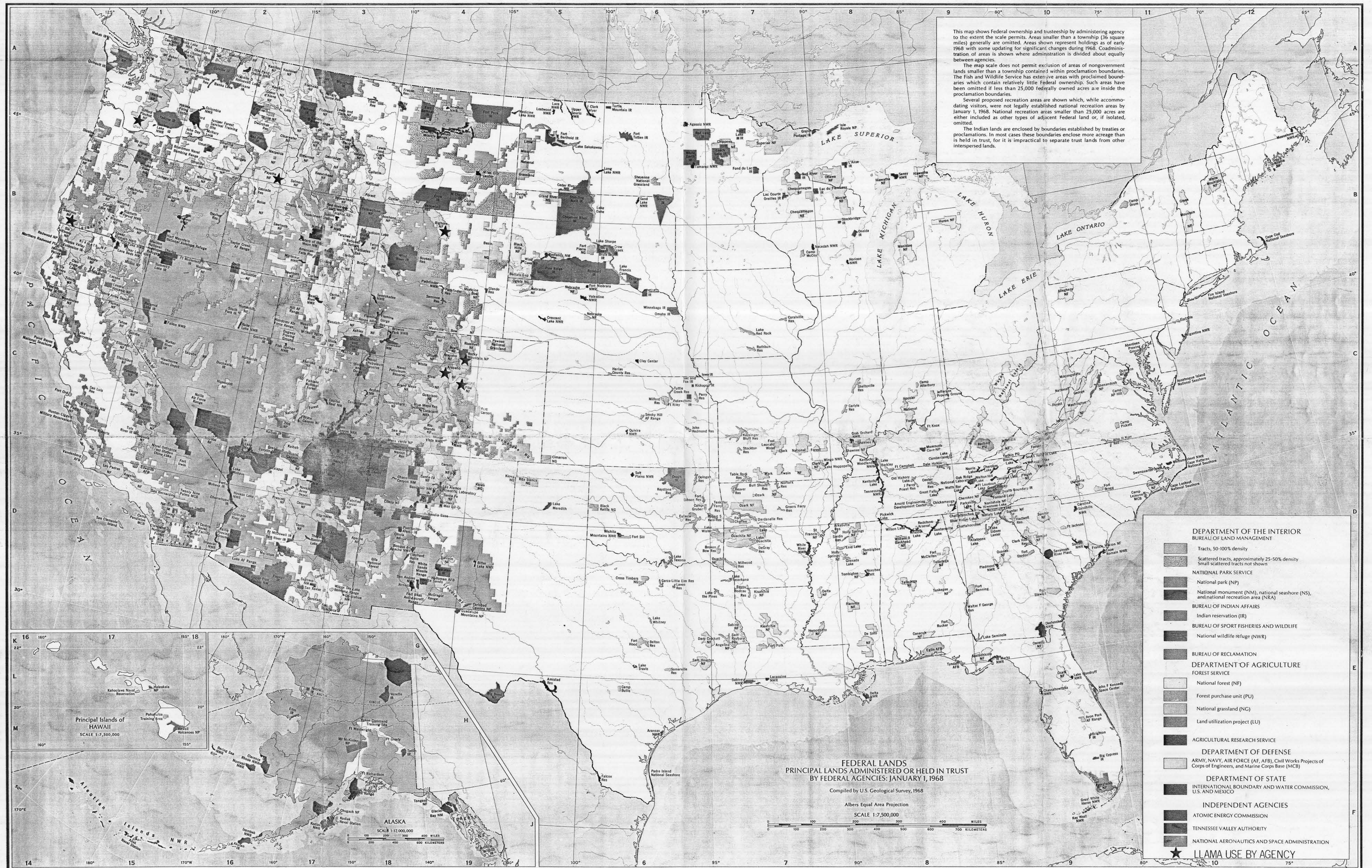
Cheryl Anne Arndt
College of Forestry
and Natural Resources
Colorado State University
Ft. Collins, CO 80523
(303) 663-7557

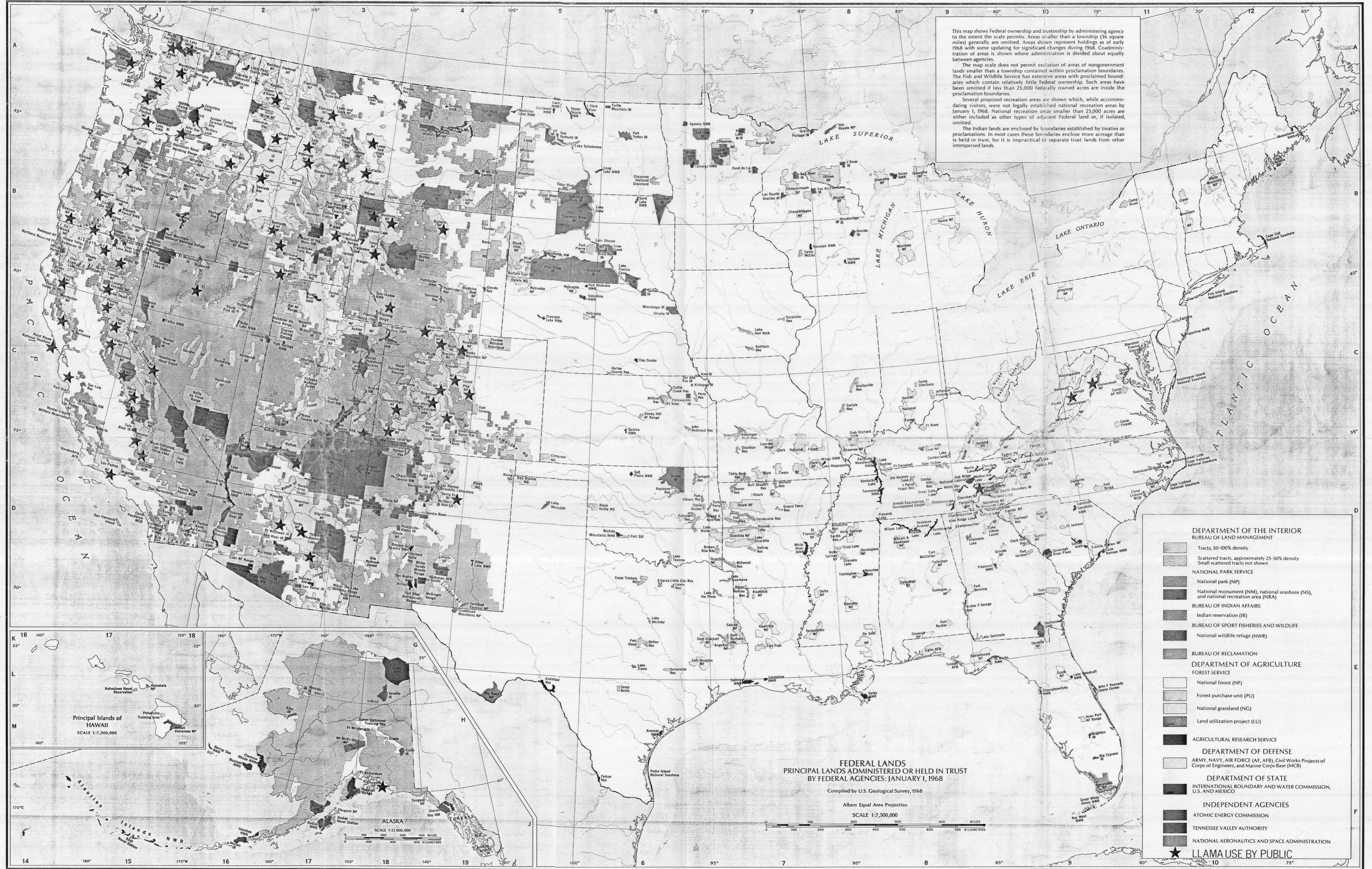
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APPENDIX F

MAPS

1. Plate 1 - Geographic Distribution of Agency Llama Use
2. Plate 2 - Geographic Distribution of Public Llama Use
3. Plate 3 - Geographic Distribution of Llama Ownership





This map shows Federal ownership and trusteeship by administering agency to the extent the scale permits. Areas smaller than a township (36 square miles) generally are omitted. Areas shown represent holdings as of early 1968 with some updating for significant changes during 1968. Co-administration of areas is shown where administration is divided about equally between agencies.

The map scale does not permit exclusion of areas of nongovernment lands smaller than a township contained within proclamation boundaries. The Fish and Wildlife Service has extensive areas with proclaimed boundaries which contain relatively little Federal ownership. Such areas have been omitted if less than 25,000 Federally owned acres are inside the proclamation boundaries.

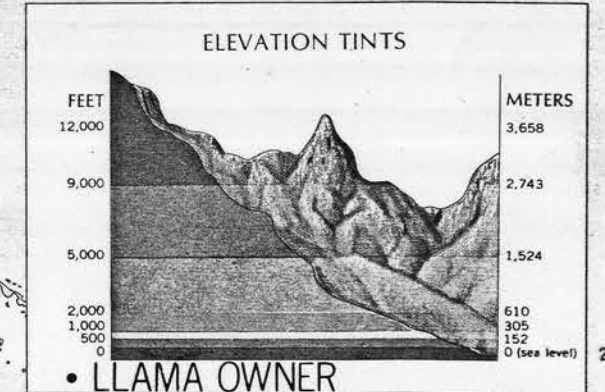
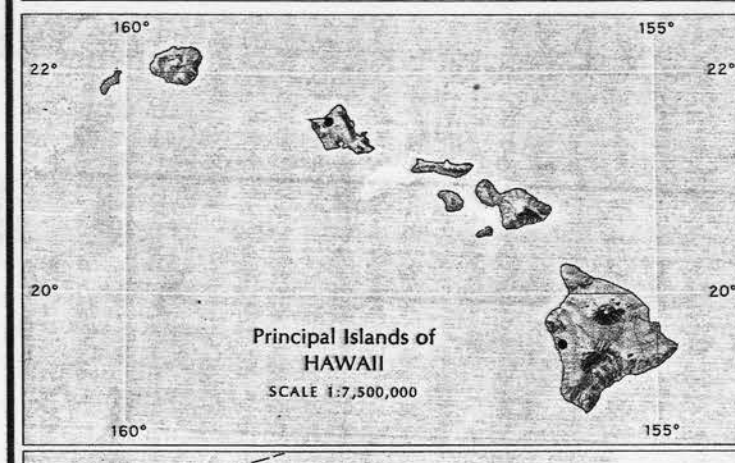
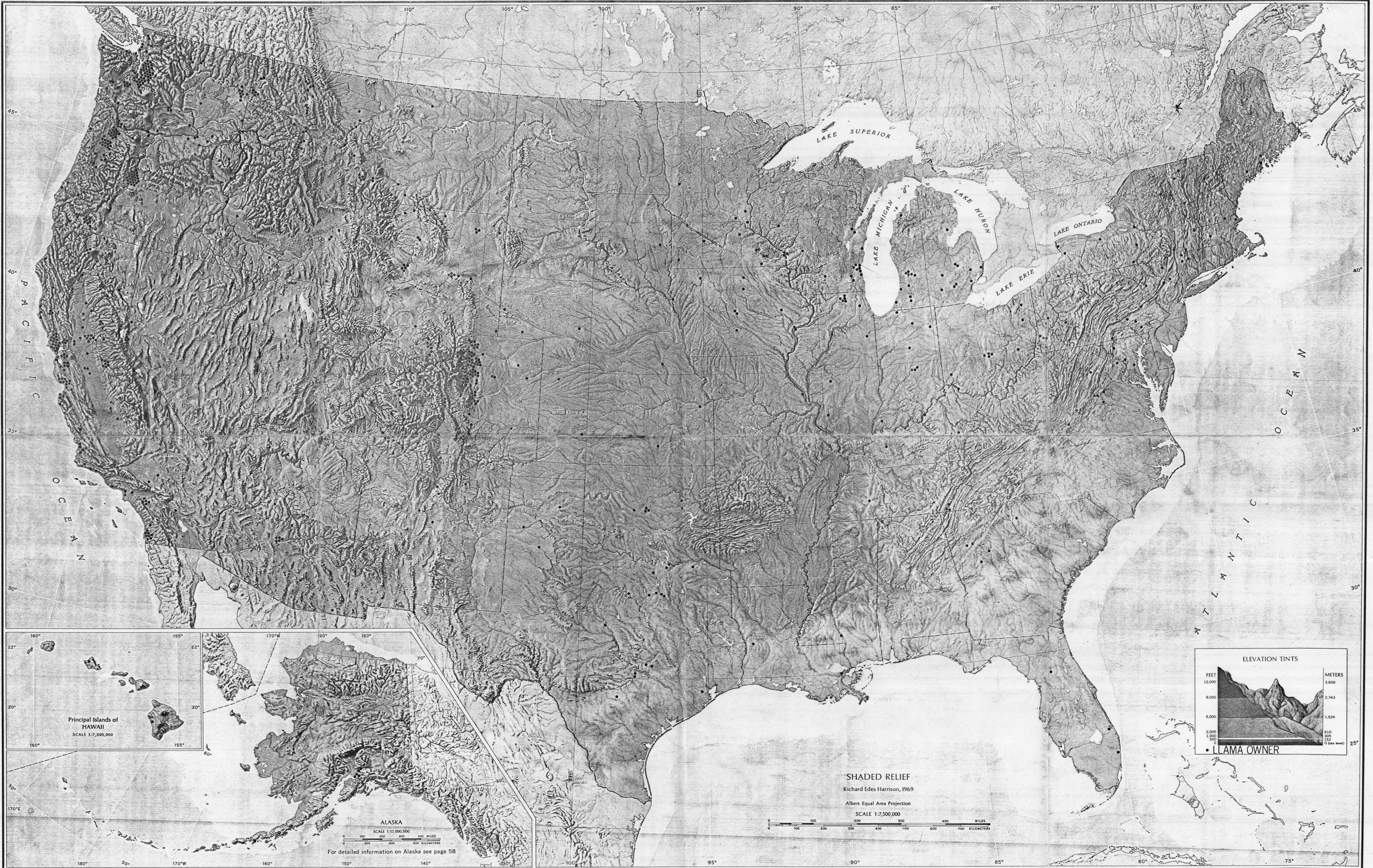
Several proposed recreation areas are shown which, while accommodating visitors, were not legally established national recreation areas by January 1, 1968. National recreation areas smaller than 25,000 acres are either included as other types of adjacent Federal land or, if isolated, omitted.

The Indian lands are enclosed by boundaries established by treaties or proclamations. In most cases these boundaries enclose more acreage than is held in trust, for it is impractical to separate trust lands from other interspersed lands.

- DEPARTMENT OF THE INTERIOR**
BUREAU OF LAND MANAGEMENT
- Tracts, 50-100% density
 - Scattered tracts, approximately 25-50% density
 - Small scattered tracts not shown
- NATIONAL PARK SERVICE**
- National park (NP)
 - National monument (NM), national seashore (NS), and national recreation area (NRA)
- BUREAU OF INDIAN AFFAIRS**
- Indian reservation (IR)
- BUREAU OF SPORT FISHERIES AND WILDLIFE**
- National wildlife refuge (NWR)
- BUREAU OF RECLAMATION**
- DEPARTMENT OF AGRICULTURE**
FOREST SERVICE
- National forest (NF)
 - Forest purchase unit (PU)
 - National grassland (NG)
 - Land utilization project (LU)
- AGRICULTURAL RESEARCH SERVICE**
- DEPARTMENT OF DEFENSE**
- ARMY, NAVY, AIR FORCE (AF, AFB), Civil Works Projects of Corps of Engineers, and Marine Corps Base (MCB)
- DEPARTMENT OF STATE**
- INTERNATIONAL BOUNDARY AND WATER COMMISSION, U.S. AND MEXICO
- INDEPENDENT AGENCIES**
- ATOMIC ENERGY COMMISSION
 - TENNESSEE VALLEY AUTHORITY
 - NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
- ★ LLAMA USE BY PUBLIC

FEDERAL LANDS
PRINCIPAL LANDS ADMINISTERED OR HELD IN TRUST
BY FEDERAL AGENCIES: JANUARY 1, 1968
Compiled by U.S. Geological Survey, 1968

Albers Equal Area Projection
SCALE 1:7,500,000
0 100 200 300 400 500 600 700 MILES
0 100 200 300 400 500 600 700 KILOMETERS



SHADED RELIEF

Richard Edes Harrison, 1969

Albers Equal Area Projection

SCALE 1:7,500,000

