

MOUNTAIN GOATS IN THE GREATER YELLOWSTONE ECOSYSTEM: A PREHISTORIC AND HISTORICAL CONTEXT

Paul Schullery¹ and Lee Whittlesey¹

ABSTRACT.—Because the relatively recent colonization of portions of Yellowstone National Park by introduced mountain goats (*Oreamnos americanus*) from public game lands in Montana raises important policy and management questions for the park, it is necessary to understand the prehistoric and early historical record of mountain goats in the Greater Yellowstone Ecosystem. We reviewed previous paleontological, archeological, and historical studies of goat presence and examined a large body of historical material for evidence of goats. Native mountain goat range most closely approached the Greater Yellowstone Ecosystem to the west, but no modern authority claims goats were resident in the ecosystem in recent centuries. Historical accounts of goat presence in the region prior to 1882 (and thus prior to any known introduction of goats by Euro-Americans) are limited to one possible sighting by unreliable observers and a few casual mentions of goat presence by people of limited or unknown familiarity with the ecosystem. Other early observers in the region specifically stated that goats were not native. Between 1882 and 1926 other observers and residents agreed that mountain goats were not native to the park, or to the larger area around it. It is impossible to prove absolutely that there were no goats in the ecosystem prior to modern introductions, but historical evidence demonstrates that if present, such goats must have been exceedingly rare and uncharacteristically unsightable. National Park Service policy relating to exotic species developed gradually after the creation of Yellowstone National Park in 1872, moving from a general receptivity to introduction of at least some favored nonnative species to a general prohibition on all such introductions. Current policy, while disapproving of all nonnative species, seems to reserve special efforts at removal of nonnatives for those species that pose the greatest threat to native species and ecosystems. Current policy is not helpful in defining the minimum amount of evidence needed to prove a species was present or absent, or whether or not an introduced nonnative species is causing sufficient harm to justify its removal.

Key words: mountain goat, nonnative species, National Park Service policy, Yellowstone National Park, Greater Yellowstone Ecosystem, ecological historiography.

This paper will summarize the historical record of mountain goats in the Greater Yellowstone Ecosystem (GYE) and then will review the development of National Park Service (NPS) policy relating to exotic species. Finally, it will consider current goat colonization of the park in light of history and policy.

It seems especially appropriate, even if entirely accidental, that Yellowstone National Park (YNP) hosted a conference on nonnative species over Columbus Day weekend in October 1999. It has become a standard practice, almost a cultural act, among those concerned with the health of native ecosystems, to divide the history of the New World at a point that is our own equivalent of B.C.—Before Columbus. The enormously complex and breathtakingly swift overhaul of the North American landscape that has occurred since 1492 is now such a fact of life that most Americans give it little thought and may not even be aware of its

magnitude. In modern Montana, for example, the public depends upon the enjoyment or employment of brown trout (*Salmo trutta*), pheasants (*Phasianus colchicus*), horses (*Equus caballus*), cattle (*Bos taurus*), and many other species of animals and plants from other continents. Most of these species are deeply embedded in the national consciousness as constituting part of the “traditional” western scene.

Of course, the mountain goat is different: it is native to North America. Euro-American influences have not been confined to bringing new species to this continent. We have also transported native species long distances around the continent. Mountain goats in YNP provide an excellent case study of the complexities of issues relating to nonnative species in national parks.

Because the boundaries of YNP are largely artificial and reflect little regard for ecological

¹National Park Service, Yellowstone Center for Resources, PO Box 168, Yellowstone National Park, WY 82190.

realities, we will address the question of mountain goat prehistory and early history from the broader and slightly less artificial perspective of the entire Greater Yellowstone Ecosystem (GYE; Fig. 1), using recent definitions of it as an area upwards of 20 million acres encompassing the highlands in and around Yellowstone and Grand Teton national parks (Glick et al. 1991).

The prevailing scientific consensus is that native mountain goat populations existed most closely to the west of the GYE, in central Idaho along the Idaho-Montana border (Rideout 1978, Chadwick 1983, Laundré 1990). Perhaps the most popular contemporary definition of the GYE, proposed by the conservation group known as the Greater Yellowstone Coalition (Glick et al. 1991), places its western boundary somewhat short of that historic native goat range, perhaps less than 50 miles (imprecision is the result of vagueness of current definitions of GYE boundaries).

ISSUES OF EVIDENCE

The search for evidence that may not exist is one of historical scholarship's most interesting enterprises because investigators run the risk of committing what Fischer (1970) describes as the "fallacy of the negative proof":

It occurs whenever a historian declares that "there is no evidence that X is the case," and then proceeds to affirm or assume that not-X is the case. . . . [A] simple statement that "there is no evidence of X" means precisely what it says—no evidence. The only correct empirical procedure is to find affirmative evidence of not-X—which is often difficult, but never in my experience impossible (Fischer 1970:47).

In the case of mountain goats in the GYE, we suspect that Fischer would be faced with difficulty in describing for us "affirmative evidence of not-X." It appears that it will be extremely challenging to establish an unequivocal affirmative proof that absolutely no mountain goats inhabited the GYE prior to the arrival of Euro-Americans. We also believe that our study has provided an interesting test of the concept of negative evidence, a test that we will discuss later.

But Fischer's point about negative evidence is very important in the question of mountain

goats in the GYE. Paleontology, archeology, and history are more successful at establishing that a species *was* native than at proving that it was *not*. The prehistoric and historical evidence is always assumed to be incomplete. Even if it provides no indication a species was present, we are always left with at least a lingering uncertainty because negative evidence can always be overridden later by new positive evidence. The next paleontological investigation, the next archeological dig, or the next newly discovered early trapper's journal may yield suggestive or conclusive evidence that the species in question was here after all.

Several reasons have been suggested for possible underrepresentation of mountain goats in a survey of archeological and paleontological sites (Laundré 1990, Hutchins 1995, Lyman 1998). The use of evidence from such sites to determine presence or abundance of a given species in past times is fraught with difficulties (Grayson 1981), including the following:

1. Even if mountain goats have fully occupied the available habitat in a region, they will probably be neither as numerous nor as accessible to hunters as other ungulate species and thus may not be harvested as often, thereby not finding their way into archeological sites as frequently as other species might.

2. Living as they do in steep country, when they die their remains may fall considerable distances and be scattered rather than find their way into paleontological sites (e.g., pack-rat middens).

3. If most archeological and paleontological investigations are conducted at lower elevations, they may include only, or primarily, lower-elevation species.

4. The native people who occupied the site and left animal bones there were operating under unknown cultural systems, with now incompletely understood attitudes and preferences relating to which animals they killed and which they did not; they certainly would prefer some species over others, thus introducing a bias into what their archeological sites "collect" for us to study.

5. Last, even an identifiable piece of bone or horn from a mountain goat may in some cases not be proof the animal lived in the immediate vicinity of the site in which it was found. If the bone or horn had potential value (for example, as a tool or ceremonial device), it might have been carried a considerable distance to the site.

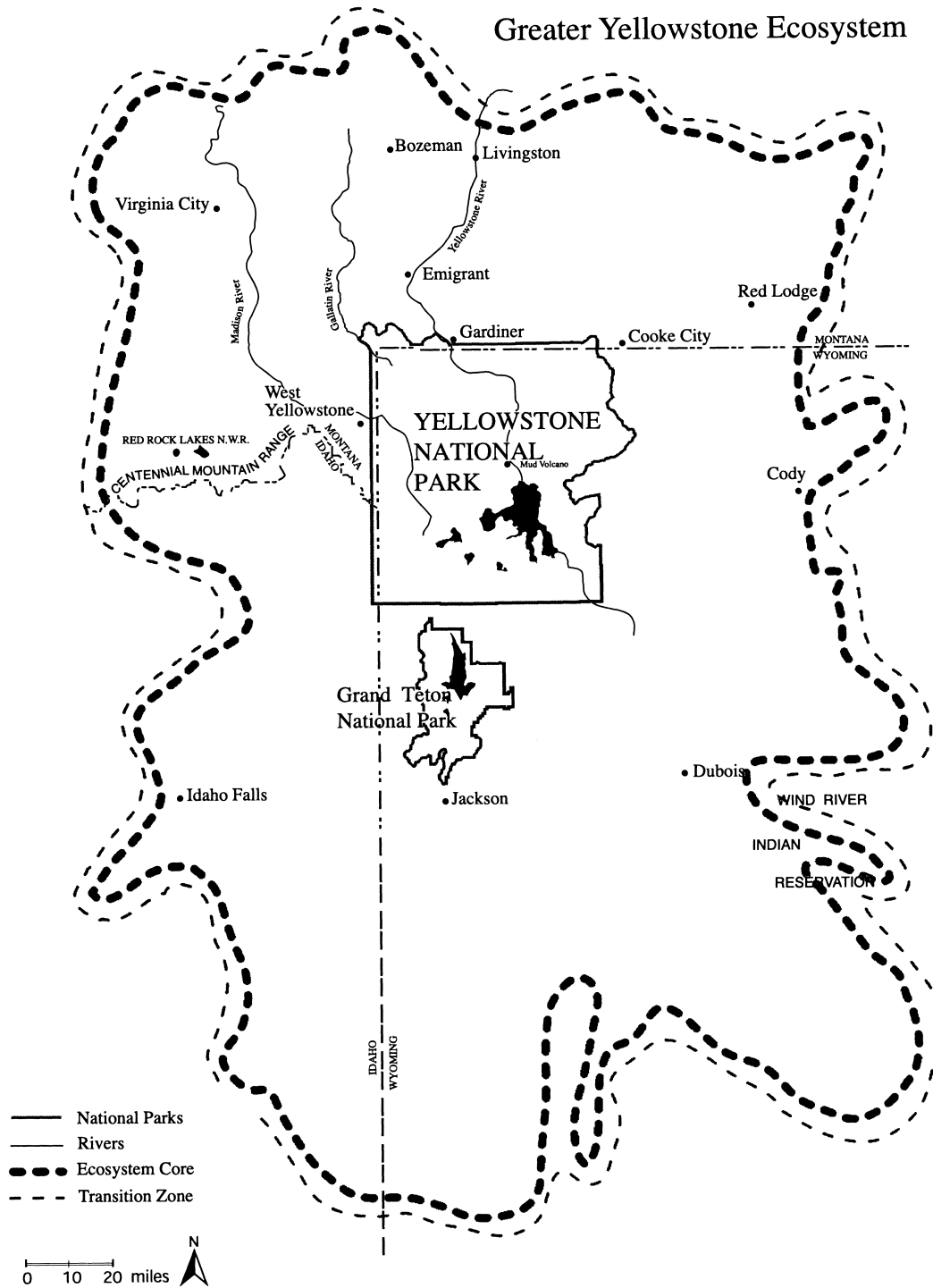


Fig. 1. The Greater Yellowstone Ecosystem. Figure by Renée Evanoff.

Another potentially useful kind of evidence of pre-Euro-American wildlife conditions is provided by rock art: pictographs and petroglyphs. These are sometimes problematic as well. A rock-art image does not necessarily prove that the animal represented lived nearby. Often it is difficult or impossible to identify the species depicted; sometimes the animal shown was not a “real” species but the product of visions that are closely associated with rock art in the region. Species represented in rock art in our region tended to have a set of cultural values unlike species preferred for food (J. Francis personal communication). Still, like other archeological as well as paleontological evidence, rock art images provide a potentially useful information source.

Written historical accounts likewise present researchers with a variety of obstacles. Accounts are often hard to locate or may not exist for all localities. Writers of early accounts were often of unknown education, familiarity with wildlife, and bias. These writers tend to exhibit preferences for topics depending upon personal interests; these preferences, while not predictable for each individual, can be gauged for certain types of observers. As a general rule, for example, commercial trappers emphasized fur-bearing animals and habitats in their written accounts. On the other hand, some wildlife species, such as grizzly bears (*Ursus arctos*), were of at least some interest to many types of travelers, probably because of their greater threat or their formidable presence in most northern human cultural traditions. From yet another perspective, very few early writers, of any persuasion, bothered to mention small mammals. Early visitors to YNP had still another bias introduced into their narratives: the park’s primary attraction was its geothermal activity. YNP visitors, though many did hunt in the park during its first 11 years, were here primarily to see the famous geological oddities. Wildlife did not become an important visitor attraction as an object of touristic attention (i.e., wildlife watching as recreation) until the later 1880s and 1890s (Schullery 1997).

It has also been pointed out that even in the earliest period of Euro-American visitation of lands that would eventually become national parks in the northern Rockies, roughly 1800–1880, various influences of Euro-Americans on the landscape—such as the effects of

European diseases on numbers and activities of native people; the adoption of the horse, firearms, and other iron tools by native people; and European livestock diseases—were all potentially at work affecting the landscape. Such effects may or may not have been pronounced enough to significantly alter plant or animal communities from their earlier appearance, but if they were, the first white observers would have been describing a landscape not entirely free of their own culture’s effects (Schullery 1984, 1997, Kay 1994).

Terminology is often treacherous in early historical accounts. For example, in some western 19th-century accounts, coyotes were known as “prairie wolves.” Black bears (*Ursus americanus*) were sometimes called “cinnamon” bears depending upon their color, but a cinnamon- or brown-colored bear might be a misidentified grizzly bear; and, of course, a black-colored grizzly bear might simply be described as a “black bear” with no intention of indicating species. Early 19th-century writers sometimes referred to elk as red deer, their European name. And quite a few early writers on the West, including some who traveled through the GYE, referred to pronghorn (*Antilocapra americana*) as “goats” (e.g., Stuart 1935, Lewis and Clark 1987). Casual use of other terms could complicate the problem, as when a writer referred to a “buck” but meant a “bull” elk (*Cervus elaphus*). Careful reading of the material and close attention to the context can settle many such confusions, but some are almost irresolvable and are always complicated by observer ignorance as well as *our* ignorance of just how well informed the observer might have been.

We do not wish to cast so much doubt on paleontological, archeological, and historical evidence as to suggest that these sources of information are valueless. They may be the best tools we have, and they are often excellent tools indeed. It is our experience, however, that the tools must be used with great care and discretion if they are to serve our needs.

PALEONTOLOGICAL AND ARCHEOLOGICAL EVIDENCE OF MOUNTAIN GOATS

Love (1972) conducted an archeological survey and historical literature review of the Jackson Hole region, and, though he discussed all other relevant large mammals, he mentioned

no mountain goats in either record. We assume this is because he found none. Cannon (1992) reviewed archeological and paleontological evidence for the northern and central Rockies physiographic provinces, including 31 late-Pleistocene–Holocene sites in northwestern Wyoming, southern and western Montana, and near the Idaho-Wyoming and Idaho-Montana borders in Idaho. No mountain goats were reported in any of these sites. It is interesting that 2 of the Idaho sites he reviewed, Veratic Rockshelter and Jaguar Cave, are relatively close to areas known to have been native mountain goat habitat along the Idaho-Montana border. Laundré (1990) also reviewed paleontological and archeological reports from the GYE and found no fossil or archeological evidence of goats in the Holocene. However, he reported that fossils of ancestral goats (*Oreamnos harringtoni*) at least 70,000 years old were recovered from a site at Palisades Reservoir in Idaho. This is in the southeastern quadrant of the GYE.

In an interesting interpretation of the paleontological evidence as it might be applied to modern management issues, Laundré (1990:40) suggested that because the GYE's "native floral and faunal components" are suitable for goats, "goats could also not be considered [an] ecological exotic." To our knowledge, this is the only time the concept of "ecological exotic" has been introduced into the published scientific dialogue relative to mountain goats in YNP. The concept has not fared well, or had noticeable effects on today's dialogues over mountain goats in YNP, perhaps because National Park Service (NPS) management policies do not endorse such a generous definition of native. However hospitable the ecosystem might be to introduced goats, a continuous 70,000-year gap in the known record of goat presence is too large to ignore. Though it could likewise be argued that Yellowstone Lake's native components are suitable for lake trout (*Salvelinus namaycush*), no one seems to be mistaking the clandestinely introduced lake trout that now threatens native fish in the lake for some type of "ecological native" (Varley and Schullery 1998).

Houston and Schreiner (1995) describe a parallel situation in Grand Canyon National Park, in which some paleontologists objected to the removal of burros (*Equus asinus*) from that park by NPS managers who regarded

them as nonnative. The paleontologists argued that burros were "the ecological equivalents of late Pleistocene equids" that had become extinct in the area about 11,500 years B.P. In this instance the ensuing court case supported the NPS managers' interpretation that the ecological equivalent argument was not in keeping with NPS policy.

To reach beyond published literature, we consulted with a number of experienced GYE archeological and paleontological investigators. Their familiarity with GYE sites, through their own published and unpublished work and that of others, included no knowledge of any mountain goat fossils from the Holocene (J. Francis, E. Hadly, C. Hill, A. Johnson, J. Schoen, personal communication).

Faunal images in rock art sites in the GYE have not to our knowledge been inventoried by species for the entire ecosystem. Greer and Greer (1998) reviewed images at 50 sites in southwestern Montana. A few contained "zoomorphs," including 7 bison (*Bison bison*), 4 bears (*Ursus* spp.), 2 deer (*Odocoileus* spp.), 2 snakes, 2 mountain sheep (*Ovis canadensis*), 2 horses, and 5 "four-legged generic descriptions that cannot be identified at this time due to lack of information on the site forms" (Greer and Greer 1998:61). Again, our consultation with a number of regional authorities on rock art revealed no knowledge of any mountain goat images in GYE rock art (S. Conner, J. Francis, M. Greer, A. Johnson, M. Pavesic, J. Schoen, personal communication).

So far, therefore, the archeological and paleontological evidence is entirely negative for mountain goat presence in the GYE prior to the arrival of Euro-Americans.

THE HISTORICAL RECORD

The earliest review of the historical record (i.e., written documents and recollections of early residents) of YNP for evidence of mountain goats was probably that conducted by novelist Owen Wister, who sought references to goats anywhere in the state of Wyoming (Wister 1904). Wister's report, though informal, was apparently based on considerable effort in communicating with experienced local residents and hunters. He concluded:

There seems to be a sort of goat tradition in Wyoming, here and there. This myth is, to be sure, highly sublimated. You don't hear that

goat used to be upon this or that definite mountain, or that So-and-So saw a man who saw a goat, or whose wife or uncle saw one; it never comes as near as that; yet still faintly in the air of the Continental Divide there hovers this vague rumor of the animal (Wister 1904:248).

A more formal search for historical evidence of mountain goats in Wyoming was made by Skinner (1926), who interviewed many knowledgeable locals and found no reports of goats anywhere in Wyoming or in YNP. Laundré (1990) reviewed a few early accounts of the GYE and reached the same conclusion.

For some years we have been searching all available documentary evidence of wildlife in the GYE prior to 1882 (Schullery and Whittlesey 1992, 1995, 1999a, 1999b, Whittlesey 1992, 1994, Schullery 1997). We are unaware of any previous investigator who has used more than about 20 early accounts of YNP to determine wildlife conditions and abundance in the early historical period (roughly 1800–1880). As mentioned above, the overwhelming majority of early accounts of YNP were concerned with other matters, especially the park's well-advertised geothermal wonders and scenery, but a surprising number of people did at least mention wildlife in their accounts. We are now well past 250 separate accounts of pre-1882 wildlife in the GYE and are preparing a book-length manuscript analyzing them.

In that considerable body of material, observations of mountain goats are practically nonexistent, and even discussions of mountain goats are very rare. Because these few discussions are of interest both historically and geographically, we will review them in detail here.

Two early accounts by actual visitors to the region stated that mountain goats were present in the GYE. Both are instructive examples of the difficulties of using these early accounts. In September 1864 a prospector named Robert Vaughn and companions traveled from the gold diggings at Alder Gulch, Montana, near present-day Virginia City, to newly discovered gold-bearing areas at Emigrant, Montana, on the Yellowstone River north of present YNP (Fig. 1). Vaughn's account of their trip is brief and vague as to their travel route. He said they crossed "the headwaters of the Madison, Jefferson, and Gallatin rivers" (Vaughn 1900:35). The true headwaters of the Madison and Gallatin rivers are in YNP, but it

seems to us highly improbable that the party would detour 50 or more miles south of their intended goal (Emigrant is about 60 miles due east of Alder Gulch) to reach the true headwaters of these streams. We suspect that they simply traveled east and crossed those streams well above their best-known reaches but also well below their true headwaters. We recognize that this is conjecture on our part, but it seems unlikely that these men would have detoured so far out of their way, or that they could have done so and still reached the Emigrant area in the time they did. Due to the rough country (e.g., "we were delayed several times by the dense pines that grew so thick in some places that we had to chop our way through" [Vaughn 1900:35]), it took them 7 days to reach the Yellowstone River somewhere "many miles" upstream from Emigrant. This would suggest that they reached the Yellowstone River not far north of present YNP (the north boundary of present YNP is roughly 30 river miles south of Emigrant).

Vaughn mentioned that on their way to Emigrant, in unspecified mountains, they discovered "a great quantity of petrified wood" in a small valley (Vaughn 1900:35). Petrified wood exists in the Specimen Creek drainage of northwestern YNP and is common in drainages farther north in the Gallatin National Forest as well. We assume that the petrified wood was found in one of these drainages. It was also in these mountains, apparently, that they made their mountain goat sighting:

The mountains were very steep. On a cliff about one hundred yards off stood a Rocky mountain goat. At first we thought it a domestic sheep, for it was very white, bleated, and acted as if it was glad to see us. But then, as there were no settlers within several hundred miles, we could not imagine how a sheep could get to such a place. While we were discussing the matter, the animal leaped over cliffs and up the mountain as if it was on level ground, and this satisfied us all that it was a Rocky mountain goat. Not one of us had seen one previously (Vaughn 1900:35).

This is the only firsthand report of an observed mountain goat in the GYE that we have yet located from the period before 1882. For several reasons, it is problematic as evidence. These observers had never before seen a mountain goat. We do not know if Vaughn was able to distinguish a goat from a bighorn sheep. For

all we know, he was like many first-time visitors to present-day YNP and other western mountain parks, who, in our long experience with such people, refer to bighorn sheep as goats. Some of these people are simply unaware that there are two animals, or that the distinction between them might be significant to other people. Others confuse the names, the way many regional residents today refer to local ground squirrels (*Spermophilus armatus*) as “gophers” (*Thomomys talpoides* is the local pocket gopher, but most people are probably unaware of what gophers look like specifically, and just assume that small burrowing animals can fairly be called gophers).

There are also questions about the description of the animal itself. Bighorn sheep are often quite pale and, again in our experience, are sometimes described as white by YNP visitors. Bighorn sheep ewes have small horns about the same size as goat horns. Sheep are quite agile on cliffs. Again, based on our own experiences, we know that some park visitors see sheep in conditions like these and call them goats (on the other hand, it is likewise possible that some early traveler who did see goats might have called them sheep).

Yet, though the account is speculative, it cannot absolutely be proven in error. We must consider the known proclivity of the occasional mountain goat to make a long-distance foray, such as is occasionally witnessed in YNP today. Apparently, it is not impossible that a goat from the native population farther west was just then traveling in this region, just as it is possible that this was not only a goat but a member of some resident band of goats that Vaughn and his companions did not see. After all, it is an interesting coincidence that of all the locations in the GYE in which such a sighting could have been reported, this one occurred reasonably close to the western edge of the ecosystem, that being the edge closest to known native mountain goat habitat farther west.

Our conclusion is that this report must be treated as modern park naturalists would treat a similar report. Based on the low level of knowledge of the observers and the vagueness of the description (Were the horns light or dark? Was the hair long or short? Did the body have the angularity of a goat's?), such a sighting would be regarded as intriguing but unreliable. In many years of dealing with the public in YNP, we have both dealt with great

numbers of visitors as they reported wildlife sightings; neither of us would regard this as a trustworthy mountain goat sighting and would consider it more likely to have been a sighting of a bighorn sheep ewe or young ram.

The second report is not an actual observation but a statement of mountain goat presence. Photographer Henry Bird Calfee and his companion Macon Josey visited the park area in 1871 and left several mentions of wildlife there. Calfee stated that while the two were camped near Mud Volcano (Fig. 1), and nearly out of provisions, there was no cause for concern:

Meat however was in abundance. It consisted of buffalo, moose, elk, bear, wolverine, black and white tail deer, antelope, mountain sheep, goat or ibex, wolf, lion, fox, coyote, badger, otter, beaver, mink, marten, sable, rabbit, muskrat, porcupine, rock dog, squirrel, chipmunk, grouse, goose, duck, swan, pelican, crane, brant, eagle, owl, hawk, crow, raven, blackbird, blue-jay, snow bird, curlew, sage hen, prairie chicken, and wormy trout, with which the upper Yellowstone and Lake abounded. This bill seems elaborate, but all could be gotten within five miles of our camp and in a very short time (Calfee 1896:2).

This is a singular list, not only because it seems to suggest that Calfee was willing to eat quite a few things most modern travelers would not consider appetizing, but also because he mentioned both sheep and goat. Calfee would make later visits to the park area, but this was probably his first. He is to some extent a known personage, with a documented local history that gives us no particular reason to discount his observations outright.

Nevertheless, his statement's worth as evidence is compromised in at least 3 ways.

First, there is no suitable mountain goat habitat within 5 miles of Mud Volcano (nor is there suitable sheep habitat). This is a key point because if Calfee had not placed that limitation on his statement, and were it not compromised in the other ways listed below, he potentially would be a considerably more credible witness than Vaughn.

Second, the sequence of the naming is confusing. When he wrote “mountain sheep, goat or ibex,” was he in fact giving 3 alternative names for the same animal (as a writer today might say “the wolverine, glutton or carcajou”)? Or was the mountain sheep meant to be one

animal, and the “goat or ibex” meant to be another?

If the latter, then we have our 3rd compromise of the evidence, because if he regarded “goat” and “ibex” as interchangeable terms, it seems likely that he was thinking of a sheep-like animal rather than a mountain goat-like animal. Ibex (*Capra ibex* and others) are Eurasian and African animals with relatively long, curved horns; in both coat and general conformation they much more nearly resemble North American bighorn sheep than North American mountain goats (Nowak 1991).

This reasoning on our part necessarily assumes that Calfee was in fact knowledgeable enough to know what an ibex looked like. It is our suspicion, in any case, that Calfee was merely listing any and all even marginally edible species of Rocky Mountain wildlife he could think of at the time, rather than intending for readers to draw a 5-mile-radius circle around Mud Volcano and seriously expect to find inside it everything he mentioned.

A 3rd statement from the period (though just after 1882) also suggested by implication that mountain goats were present. In the announcement of the prohibition of public hunting in YNP, issued on 15 January 1883, Acting Secretary of the Interior H.M. Teller said this:

The regulations heretofore issued by the Secretary of the Interior in regard to killing game in the Yellowstone National Park are amended so as to prohibit absolutely the killing, wounding or capturing at any time, of any buffalo, bison, moose, elk, black-tailed or white-tailed deer, mountain sheep, Rocky mountain goat, antelope, beaver, otter, martin, fisher, grouse, prairie chicken, pheasant, fool-hen, partridge, quail, wild goose, duck, robin, meadow-lark, thrush, goldfinch, flicker or yellow hammer, blackbird, oriole, jay, snowbird, or any of the small birds commonly known as singing-birds (Teller 1883).

Like Calfee’s list quoted above, this list reveals a curious mixture of ignorance and knowledge of the native fauna of YNP. Some listed species did not occur in the park, and at least one other is listed twice (bison and buffalo). It has been suggested that this list was most likely compiled in Washington, perhaps by a clerk with limited knowledge of the park (Schullery 1997). The text of the letter, including the mention of mountain goats, reappeared

in later documents relating to park management, such as Senator George Graham Vest’s unsuccessful 1885 bill to strengthen law enforcement in the park (e.g., Forest and Stream 1885).

It must be kept in mind that most observers of that period, including almost all park administrators, had no formal scientific training and little awareness of taxonomy (in 1880, Superintendent Philetus Norris stated that there were 6 kinds of bears in Yellowstone). In any case, no park administrator from this period suggested that mountain goats actually did reside in the park.

On the other hand, Superintendent Norris specifically stated that he was unaware of any goats in the park. In his annual report for 1880, Norris said that

although the web-footed, snow-loving white sheep, or Rocky Mountain goats are numerous in many of the adjacent snowy regions, I have never seen one within the Park, but the true big-horn sheep are abundant on all the mountain crests, as well as on their craggy spurs and foot-hills throughout the Park, which they never leave (Norris 1881:40).

Here again we see the interchangeability of names: to Norris, the mountain goat was also the “white sheep.” Also, Norris suggested that goats inhabited “snowy regions” adjacent to the park. Whether by this he meant neighboring mountain ranges or had in mind some farther-reaching sense of the word *region*, we cannot tell. Writing in the somewhat florid prose of the day, Norris tended sometimes to speak in sweeping terms, so we are hesitant to interpret “adjacent snowy regions” to mean lands immediately adjoining the park.

The only other specific mentions of mountain goats prior to 1882 were statements of their absence in large portions of the GYE. Charles Blackburn spent nearly 2 years prospecting “in the country lying about the headwaters of the Yellowstone and the other great rivers that have their sources in the Wind River Mountains” (Blackburn 1879). The dates are uncertain, but he probably began in the region in 1877, and his article was published in July 1879. In a section entitled “Zoology,” he described the wildlife:

Elk and mountain sheep are very plentiful through all the ranges of the Yellowstone

country, being generally found near the snow in the summer, where the grass is new and tender. The mountain goat (*Aplocerus montanus*) was not observed in any of the ranges, but has been reported by Indians to exist in the mountains farther north (Blackburn 1879:2904).

Blackburn evidently understood that there is a distinction between sheep and goats (we are assuming he could likewise distinguish them in the field). Beyond that we know nothing of his qualifications as an observer of wildlife. His delineation of the country he had in mind is imprecise, but probably included the YNP area, and perhaps even the entire northern half of the GYE. Native mountain goat populations "farther north" apparently would be those populations associated with the Northern Continental Divide Ecosystem (Chadwick 1983), which is slightly west of north of the GYE.

Our last mention of goats also covered a wide and not clearly defined region. In an extended account of a trip through YNP in 1884, the naturalist-anthropologist George Bird Grinnell reported on the opinion of a local hunting guide, one of the Rea brothers. The Reas ran a stage station near the Henry's Fork, in eastern Idaho, not far west of YNP. The brother that Grinnell questioned had "been in the country seventeen years and may therefore be supposed to know it fairly well."

He stated in a conversation I had with him that game is still quite plenty here. There are a few moose; elk and deer are rather abundant, as are also bears, the black and cinnamon being common, while the grizzly is not often seen. Mountain sheep are very scarce. In reply to specific inquiries as to white goats and caribou, he stated that he had never known of either being found in the neighborhood or in the vicinity of the Park. The nearest points where goats are to be found is, he said, between Bitterroot and the Bighole, a long distance to the westward (Grinnell 1885:3).

Rea was an experienced local observer, but it is our impression based on our reading of this region's history that he was something of a self-promoter. He had some credentials as a wildlife expert. In 1874 he was apparently collecting specimens for "Prof. Ward's Natural Science Academy" in Rochester, New York (this

is the same Ward who would later become well known for his scientific instrument company). On the other hand, in 1875 he had been sentenced to 15 years in the territorial prison for his part in the wrongful death of another man (Bozeman Avant Courier 1874, 1875a, 1875b). This is not a feature of his biography that tends to strengthen confidence in his credibility (he evidently did not serve the full sentence because he was free to talk with Grinnell in 1883). Like many other early information sources, his reliability is not completely understood. Such are the vicissitudes of these anecdotal historical sources, but we know of no reason why Rea would intentionally misstate his impression of mountain goat absence from the region. If we assume that native mountain goat range was at that time similar to what we believe it is today, then it appears that Rea agreed with modern mountain goat authorities, as cited above, on the range of the species.

YELLOWSTONE NATIONAL PARK IN EARLY WILDLIFE MANAGEMENT

YNP was established by act of Congress in 1872, with very little institutional direction provided. Early managers were left largely on their own to develop policies (Haines 1977, Schullery 1997, Pritchard 1999). Some of the most important values we associate with national parks today were barely embryonic in American society at that time, and wildlife management policy in YNP could hardly be said to exist outside minimum standards common on other public lands. Public hunting was permitted in YNP until 1883 (see discussion of Teller letter, above). In that year political pressure, primarily from sportsmen, resulted in hunting being outlawed. Abruptly the park became a wildlife reserve of great size and unrealized opportunity.

But most details of management policy were still unresolved, or would undergo scrutiny and reconsideration. It was simply assumed, for example, that the landscape and its wildlife could be "improved" by the introduction of nonnative species. Several species of sport fish were successfully introduced; native fish species suffered tremendous declines and even disappearances in many drainages during this process (Varley and Schullery 1998).

Less well known now are numerous proposals to introduce a remarkable variety of nonnative birds and mammals to the park, including mountain goats. In 1902, Acting Superintendent John Pitcher pointed out that “the scarcity of birds [in YNP] has frequently been noted, and it has been suggested that the capercaillie and blackcock, game birds of northern Europe, might be introduced in the Park” (Pitcher 1902:7; he was apparently referring to Capercaillie, *Tetrao urogallus*, and Black Grouse, *Tetrao tetrix*). Captain Pitcher was enthusiastic about these proposals and pointed out that a further advantage of bringing in these birds would be that “they would spread into the neighboring country and soon afford fine bird shooting where there is little or none at present” (Pitcher 1902:7). In 1903 as distinguished a conservationist and naturalist as President Theodore Roosevelt wrote enthusiastically about “naturalizing” some species of pheasant and other game birds to YNP. He was also eager to bring chamois (*Rupicapra* sp.) in, “which certainly ought to do well there” (Roosevelt 1951:470–471). In 1907, Superintendent Samuel Baldwin Marks Young pointed out that “with intelligent management and comparatively little expense a greater variety of birds and mammals could be successfully added and propagated within the park” (Young 1907a).

Superintendent Young may have come closer than any other early manager to realizing the dream of an artificially enriched ungulate ecosystem in Yellowstone. In April 1907, in the final months of Major Pitcher’s acting superintendency, the secretary of the interior authorized the expenditure of \$300 “in relation to the procuring of white goats and domesticating the same in the Yellowstone National Park” (Garfield 1907). When Young replaced Pitcher in June 1907 (Haines 1977), he quickly pursued this project, corresponding with a variety of possible sources of goats in Montana and British Columbia. His plan included what would today be termed a “soft release,” in which the goats would be held in a pen for some time prior to release (Young 1907b). Dan Doody, of Nyack, Montana, on the southwest boundary of what would become Glacier National Park (GNP) a few years later, was selected to capture the goats, but had difficulty keeping them alive long enough to transport them (Doody 1907). Though Young continued

to correspond with one other possible source of mountain goats in 1908, it appeared that the project just fizzled. We find no record of goats purchased or goats shipped to YNP, or of goats released in YNP. We have not been able to determine why or when this idea was abandoned, though it could be that when Young left YNP late in 1908 he took with him all existing administrative enthusiasm for the project.

The dream of introducing mountain goats to YNP died slowly. As late as 1915, the Game Preservation Committee of the Boone and Crockett Club recommended that goats be introduced into YNP (Trefethen 1961). The general mood of these and other recommendations was that more was better—that nature could be enriched, indeed improved upon, by the judicious actions of humans. The wild setting was not seen as an ecological whole with some innate integrity; it was seen as the raw material for making the most of a good thing by adding more good things.

Such manipulations of natural settings and nonnative species were simply routine in North America at the time; they were undertaken widely—and often failed—but have been a staple of professional wildlife management since the late 1800s. But opposing views were surfacing as well in the early 1900s. In their important article, “Animal Life as an Asset of National Parks,” published in *Science* in 1916, professional biologists Joseph Grinnell and Tracy Storer said that just as dogs (*Canis familiaris*) and cats (*Felis catus*) must be kept from roaming free in national parks,

equal vigilance should be used to exclude all non-native species from the parks, even though they be non-predaceous. In the finely adjusted balance already established between the native animal life and the food supply, there is no room for the interpolation of an additional species (Grinnell and Storer 1916: 379).

Without specifically saying why, beyond the assertion that it would upset a “balance,” these naturalists firmly opposed any additions to park fauna.

These sentiments were soon echoed and broadened by the scientific profession. By the 1920s, as the community of wildlife scientists and management professionals matured and grew, a number of societies, such as the

Ecological Society of America and the American Association for the Advancement of Science (AAAS), spoke out against adding more nonnative species to national parks. In 1921 the AAAS clarified its opposition to introducing nonnative species: national parks were “rich fields for the natural sciences . . .” where the native flora and fauna were “more nearly undisturbed than anywhere else” (Wright 1992:37). In the 1870s, YNP had been recognized by its first scientific explorers as a kind of laboratory; the AAAS resolution of 1921 suggested that the park’s value was now increasing because its wilderness setting and undisturbed biotic community were becoming increasingly rare elsewhere. YNP was being perceived more broadly as a living museum of primitive conditions, and the value of such an institution was likewise being more broadly appreciated (Pritchard 1999).

AN EMERGING NPS AND YNP POLICY AGAINST NONNATIVES

Starting after 1900, YNP seemed to develop a policy on nonnative species in rather haphazard fashion, on a case-by-case basis. The earliest official rejection of a nonnative species probably occurred in the area of fisheries management:

In 1907 a U.S. Fish Commission employee, D.C. Booth, was given a reprimand by his superior for planting rainbow trout in Yellowstone Lake. This is the earliest instance of which we are aware of Yellowstone fisheries managers overtly seeking to protect native strains of fish from dilution. And in 1908, when no less a heavyweight than the U.S. Commissioner of Fisheries proposed that smelt be stocked in Shoshone and Yellowstone Lakes, it couldn’t have been easy to say no—but the park’s military managers did (Varley and Schullery 1998:97).

For many years after 1908, nonnative species of fish that were already in the park at that date were still managed and fostered as part of the park’s very popular sport fishery. All that happened in 1908 was that the addition of new species was officially disallowed. But that was an impressive development considering that at this same time Superintendent Young was shopping for mountain goats.

The sentiment of opposition to nonnatives in parks was translated into formal policy in

1936, based on the 1933 publication of what is now known as Fauna No. 1, an influential report on park animals by George Wright, Joseph Dixon, and Ben Thompson. The report, which reviewed nonnative animal problems in several parks, emphasized in all its proposed regulations the protection of and preference for native species. Native species that had been extirpated were to be brought back (if the species in question had become generally extinct and no source could be found, it was not to be replaced with some “related form” of animal). Nonnative species already established in parks were to be eliminated. If elimination was not possible, their numbers were to be “held to a minimum” (Wright et al. 1933). In a passage that might be especially relevant to the current YNP mountain goat situation, Wright and his colleagues warned that it was not enough to wait until nonnative species were established:

That the threatening invasion of the parks by other exotics shall be anticipated; and to this end, since it is more than a local problem, encouragement shall be given for national and State cooperation in the creation of a board which will regulate the transplanting of all wild species (Wright et al. 1933:148).

Since 1936, then, nonnative animals have been officially and decisively regarded as unwelcome in YNP. Since that time, through a series of revisions and modifications of policy statements, the agency’s position on nonnative animals has been reaffirmed. All stocking of park waters (with native or nonnative fishes) ceased about 40 years ago (Varley and Schullery 1998). The language of policies on nonnatives has evolved to reflect changing understanding of ecological communities, but the statements against exotics have remained. For example, in the 1970 version of Administrative Policies for the National Parks and National Monuments of Scientific Significance (Natural Area Category), the policy was about as unequivocal as was practically possible: “Nonnative species of plants and animals will be eliminated where it is possible to do so by approved methods which will preserve wilderness qualities” (NPS 1970:56).

In 1988, after additional revisions, the policy seemed rather less absolute. On the one hand, the definition of an exotic species was still reasonably concise:

Exotic species are those that occur in a given place as a result of direct or indirect, deliberate or accidental actions by humans (not including deliberate reintroductions). For example, the construction of a fish ladder at a waterfall might enable one or more species to cross that natural barrier to dispersal. An exotic species might also be introduced through seeds in the droppings of an animal that has fed on an exotic species outside the park. The exotic species introduced because of such human action would not have evolved with the species native to the place in question and, therefore, would not be a natural component of the ecological system characteristic of that place (NPS 1988a:4.11).

On the other hand, the agency's responsibility toward exotic species was not as absolute as it had been in earlier policy expressions. Instead, agency obligation to control exotics operated on the basis of a continuum of risk. According to NPS-77, the Natural Resources Management Guideline that complemented and interpreted the policy for managers, exotic species most likely to cause harm to the ecological system were to be fought most aggressively, and those that were relatively benign could apparently be ignored:

Control or eradication will be undertaken, where feasible, if exotic species threaten to alter natural ecosystems; [or] seriously restrict, prey on, or compete with native populations (NPS 1988b:289).

It appears that this guideline would allow ecological specialists to determine if mountain goats that have colonized YNP in recent years have exhibited any of these listed effects, and are thus in grave enough violation of policy. The policy does not quantify what constitutes a sufficiently harmful alteration of a natural ecosystem, or what exactly is meant by serious restriction, predation, or competition.

A spectrum of interpretations of this policy is possible, and such interpretations are informally offered by people engaged in conversations over mountain goats invading YNP. On one end of the spectrum are those who take what might be called the philosophical high road and regard any nonnative presence as necessarily a violation of the NPS mandate and the ecosystem's fundamental purity. On the other end of the spectrum are those who selectively welcome some nonnative species,

whether because the species serves to fill a role vacated by an extinct native or because the species is merely appealing for aesthetic reasons. It is both interesting and a little puzzling that neither the policy nor NPS-77 seems to reflect aesthetic concerns, such as the possibility of a visitor experience being compromised by viewing nonnative species in a national park, as significant factors in deciding whether or not to remove such animals.

AN INTRIGUING DEVELOPMENT IN RECENT HISTORY

The more recent history of mountain goats in the GYE provides a fascinating example of the complexities of policy interpretation. In the past half century, mountain goats have been established by state game managers of Idaho and Montana in hospitable habitats to the north, northwest, west, and southwest of YNP (Peck 1972, T. Lemke and N. Varley personal communication). Goats from populations introduced into Montana north of the park are already established in northeastern and northwestern YNP. However, it is regarded as conceivable that *native* goats currently residing farther west of the GYE could also make their way into the park by following the crest of the Centennial Mountain Range east to the Gallatin Mountain Range in northwestern YNP (Laundré 1990, Wilkinson 1990; Fig. 1).

A decade ago the very suggestion of the possibility of such a situation attracted the attention of the media, as well as then-prominent animal-rights advocate Cleveland Amory (Wilkinson 1990). The media report posed an interesting dilemma facing managers. By policy, YNP managers should resist or at least disapprove of the northern invasion because these goats were from introduced populations. But if native mountain goats moving in from the west were part of a non-human-caused colonization, policy direction seems to be that the animals would simply be accepted as a new native species. National park ecosystems, like all others, have hosted invasions of new species for thousands of years; such changes occurred ever since the ice retreated more than 10,000 years ago, long before Euro-Americans arrived to influence the setting. By implication, at least, the current policy (quoted above) seems to accommodate late arrivals: species colonizing parks today unaided are apparently welcome.

In discussing the possibility of dual mountain goat colonizations from both native and nonnative populations, former YNP Superintendent Robert Barbee, a pragmatic and realistic manager, said that to fight off the species on one boundary and welcome it along another did not “pass the red-face test” of real-world management. No matter how closely such an approach might adhere to policy, it would look idiotic to the public (R. Barbee personal communication). Whether it would actually *be* idiotic is another question, but it seems safe to say that few NPS managers would disagree with Barbee’s prediction of a negative public reaction.

The issue is not without opportunities for scientific inquiry. First, could it be established which population the invaders were from? Or, are the native goats west of the GYE and the introduced goats in Montana too closely related for distinctions to be genetically meaningful (if *meaningful* can even be defined in this context)?

Then, if goats from a native population did migrate to the park, was their migration facilitated by humans? For example, could predator control either in the home range of these animals or along the migration route have made travel easier for them than it would have been 200 years ago? For another example, it appears that between about 1830 and 1880, bighorn sheep numbers declined dramatically in some parts of the GYE, perhaps in part because of introduced livestock diseases (Schullery and Whittlesey 1992); did this emptying of habitats have any effect on the hospitality of the GYE to colonizing mountain goats since then? Last, the native range of the mountain goat has changed dramatically with the retreating ice of the last ice age and should not be regarded as having achieved some stable state (Chadwick 1983). Ongoing mountain goat distribution changes independent of human activities may have been underway at the time of Euro-American arrival in the GYE, and these could also affect the “nativeness” of goats. It may be necessary to address questions like these to fully consider how “natural” a mountain goat colonization of the GYE would be, even if it were effected by goats from native populations.

One somewhat caustic reader of an earlier version of this manuscript said that the previ-

ous paragraph’s questions amounted to “milking mice,” that is, dealing with trivially obscure issues. We disagree. If the mountain goat invasion of YNP ever became a controversial enough issue to result in a court case, we believe the judge would require the milking of these very mice, and probably quite a few others. Nativeness is the central issue in this situation, and the court would certainly recognize that science can be applied to clarify the origin of the goats in question (it seems likely to us, for example, that if these questions ever did have to be answered in court, DNA analysis would probably be called for, in an attempt to distinguish goats from different regions).

But the current status and source of YNP mountain goats is reasonably clear. T. Lemke (personal communication) reported that the only persistent concentrations of mountain goats in YNP occur in the northeast and northwest corners of the park, with occasional appearances by wanderers in other park locations. According to Lemke, these colonies are extensions of known introduced populations in the Gallatin and Absaroka Mountain ranges to the north of the park. As of 1999, then, YNP is known to have been colonized only by goats from introduced populations in Montana. The suggestion that some or any mountain goats could enter the park from native populations moving from the west appears to be just that: a suggestion.

On the other hand, there is some uncertainty about how close native goats have approached the GYE. In 1990 the Bureau of Land Management (BLM), Dillon Resource Area, prepared a draft environmental assessment (EA) to “reintroduce mountain goats in the Sheep Mountain area adjacent to Red Rock Lakes National Wildlife Refuge” (Lewis 1990; Fig. 1). Sheep Mountain is well within current definitions of the GYE (Glick et al. 1991). The EA stated that “mountain goats are considered as being historic residents of this area” (Roscoe 1990) but provided no documentation on this point. The author of the EA recently explained to us that the introduction process stopped when the BLM was unable to find evidence that goats were native; introducing a nonnative species in these circumstances would have been against BLM regulations. “So at that point the project stopped” (J. Roscoe personal communication).

In this situation the BLM was in a dilemma much like that currently faced by YNP. According to the EA, goats were already close and even had been observed nearby in the Centennial Range:

No recent observations of mountain goats have been made in the proposed release area. A single adult goat was observed on Slide Mountain on the west side of the Odell Creek drainage by refuge manager Barry Reiswig on October 25, 1983. Several observations of mountain goats were made in 1984 and 1985 near Spencer, Idaho, which is approximately 25 miles southwest of the project area (Roscoe 1990).

It was not possible at that time to know the source of the goat seen on Slide Mountain, which is about 10 miles west of the proposed introduction site (but still in the GYE). It could conceivably have been either from farther west (the direction of the native populations) or from an introduced population in the Madison Range to the northeast (J. Roscoe personal communication). It is also interesting to note that the proposed source of goats for this project was Olympic National Park (ONP).

The issue of a potential native mountain goat migration to YNP was perhaps first brought to the attention of the scientific community by Laundré (1990) and was picked up by the media about the time his report was published. In his report Laundré said:

Given time, goats might have eventually moved back into the Yellowstone Ecosystem, as they may presently [*sic*] be doing from historic range into the Centennial Mountains. Currently, all this is speculation and the rapid expansion of goat range in the mountains north of Yellowstone Park would tend to contradict this hypothesis (Laundré 1990:40).

Notice that Laundré said only that goats “may” be migrating into the Centennial Mountains, a range west of YNP. He did not suggest that they were on their way to YNP, and he seemed uncertain if such a migration was a likelihood. As the situation in the Centennial Range described above suggests, by the time that Laundré was writing, it was already very difficult to establish the “identity” of mountain goats moving through the gap between known native goat habitat farther west and introduced mountain goat habitat in the GYE.

Meanwhile, the hypothetical dual nature of the mountain goat colonization of YNP has somehow risen from the status of an academic but very interesting “what if” question to the status of a genuine dilemma. Though all mountain goats currently in YNP are reasonably traced to the introduced Montana populations, the possibility of a migration of goats into the GYE or YNP from native populations farther west seems to have become, at least in recent dialogues, almost equal in significance to the reality of the known migrations from the north. The possible immigration of native goats has become, in the words of Wister, highly sublimated. Rather like scholarship’s inability to demonstrate absolutely that there were no mountain goats in the GYE prior to 1882, scholarship’s apparent inability to determine absolutely the origin of every single mountain goat that has entered or may enter YNP may be adding to the current institutional timidity over what to do next. Those concerned with the mountain goat issue seem stymied by Wister’s “vague rumor of the animal.”

CONCLUSION

In this paper we have reviewed all early mentions of mountain goats in the GYE that we have found. If those early accounts were read alone, removed from their full documentary context, they might give the casual reader reason to suspect that at least a few goats were present in the GYE in the mid-1800s. Indeed, we recognize that the possibility may have existed for the occasional exploration-minded goat to have entered the GYE from the west. There may even have been a possibility that a small, unnoticed population of mountain goats existed in the GYE before 1882. But the historical material we have examined so far provides no convincing evidence of either individual animals or a population existing in the GYE before 1882.

Brandborg (1955), in attempting to make the best use of early travelers’ accounts of mountain goats in Idaho, has pointed out that

the absence of references to mountain goats in early journals is not proof that they did not exist in an area. The route of the travelers along valley bottoms and through open terrain during midsummer, when the goats were at high elevations, precluded observations of them (Brandborg 1955:16).

As we have explained in some detail above, we agree that travelers who wrote about their journeys could neglect to mention wildlife they saw. In fact, we think many if not most early travelers in the GYE did just that. It is certain that virtually none of them kept conscientious records of every animal they saw. However, in the case of the GYE and many early accounts of it that we have analyzed, Brandborg's 2nd statement, about the route traveled, does not apply. Many of our observers, being trappers, prospectors, hunters, and other adventurous types, did not confine themselves either to the valley floors or to the summer season (Schullery and Whittlesey 1992). It is our opinion, based on experiences in observing goats in GNP, Mount Rainier National Park, and YNP, that, had goats been present in a region as thoroughly traveled as was the GYE in the early historical period, they would have been seen. It could be argued that with the possible exception of Dall's sheep (*Ovis dalli*), no other North American ungulate species is so perfectly designed by nature to be observed from a great distance. Not only does the mountain goat stand out brightly against the often dark background of its preferred habitat, but also it does so at sufficient elevations that it is visible from much of the surrounding lower country.

We therefore believe that Fischer's fallacy of negative proof, though a valid and essential guide in the use of historical material relating to wildlife, needs a kind of corollary. This corollary is that it is possible to accumulate such a large volume of negative evidence as to leave very little room for the affirmative alternative. The negative evidence will never absolutely establish that no animals of a given species existed in a region, but it can accumulate to a volume and depth sufficient to demonstrate beyond any reasonable doubt that such animals were scarce at best.

On the simplest level, that of reported sightings, the great wealth of firsthand observations we have examined makes it clear to us that if mountain goats did indeed exist somewhere in the GYE in the early historical period, they were extraordinarily and uncharacteristically invisible to virtually all travelers who were interested enough in wildlife to record their observations. Without a single verifiable or even reliable sighting to prove goat presence, with a few reports that state that goats were not present, and with many more sources that

simply do not mention goats, we believe that managers are justified in declaring the mountain goat a nonnative species in the GYE and YNP.

National park managers must often make decisions based on incomplete information, and they must often acknowledge that complete information is not attainable. Determining the nativeness of a species may be such a situation, and the YNP mountain goat issue is not the first time it has arisen. Attempts to reduce mountain goat numbers in ONP have featured disagreements over whether the animals were truly nonnative. These disagreements focus largely on competing interpretations of surprisingly few problematic early historical sources (Lyman 1994, 1998, Houston 1995, Houston and Schreiner 1995, Hutchins 1995). Rocky Mountain National Park and Grand Teton National Park also face similar decisions concerning managing goats, as well as questions over the nativeness of the species (Gross et al. 2000). Houston and Schreiner (1995) review other variations on the native-nonnative issue in other national parks.

Even in present-day national parks, there are disagreements over the presence or absence of a species. A persistent issue in the debate over Yellowstone wolf (*Canis lupus*) recovery involved the possibility of a lingering remnant population of native wolves (U.S. Fish and Wildlife Service 1994). Debate over the reintroduction of grizzly bears to the Bitterroot Mountains on the Idaho-Montana border now features disagreements over whether grizzly bears are totally absent from the area (Devlin 1999). When the debate over such an issue achieves its finest resolution—the analysis of limited evidence for which there are conflicting interpretations and which at best indicates the presence of a few animals—it is not clear with which party the burden of proof should lie, or how such disagreements might be resolved.

It is also not clear what managers are to do even if they are confronted with incontrovertible proof of the existence of a single animal of the species in question. For practical management purposes, past experience suggests that the demonstrated presence of a single animal may not be sufficient. In the case of wolf recovery in the GYE, for example, the U.S. Fish and Wildlife Service recognized that individual wolves seemed to exist in the GYE in the early 1990s (prior to the reintroduction of new

wolves), but regarded these rare animals as not constituting a "population" of animals that had any likelihood of sustaining itself over time (these animals' "quality" as evidence was also suspect because they may have been escaped pets, clandestinely released animals, or, as was established in one case, recent immigrants from other wolf populations beyond the GYE). At that point in the deliberations of the U.S. Fish and Wildlife Service, it became a matter of defining a population, which was done in terms of a certain number of successfully breeding pairs over a certain period of time (U.S. Fish and Wildlife Service 1994). It was regarded as proven that wolves inhabiting the GYE prior to the arrival of the introduced wolves in 1995 did not meet this definition.

Current NPS policy and guidelines do not provide much constructive guidance for managers facing uncertainties of this sort. There are no prescriptions for what qualities and quantities of evidence are the minimum acceptable amount to establish that a species was or is present or absent. Likewise, there are no prescriptions for establishing what numbers or population characteristics are necessary for a small number of animals to constitute a native presence *as a population*.

Thus, it appears there are no indisputable criteria by which modern YNP managers can judge the appropriateness of the present mountain goat colonization even if it were established that at least one goat did inhabit the GYE prior to the park's establishment. If it were shown that a single sighting of single mountain goat did occur—if, for example, Vaughn's 1864 sighting were somehow confirmed—how can that information be applied to the current situation? Does that single sighting justify or at least make tolerable the current goat colonization of YNP from multiple artificial introductions north of the park? Put yet another way, even if there were a reliable sighting of a single goat in the GYE in 1864, does tolerating the current goat colonization of YNP equate with assuming that the single goat was the vanguard of a much larger natural colonization on the scale of the one that is now occurring? Or, to place a broader interpretation on the policy, does the existence of a single native goat in 1864 endow managers with authorization such that they can disregard these questions and simply declare the current population of goats "native enough"?

It is also difficult to interpret policy guidelines relating to whether or not these mountain goats pose a threat to the native ecosystem and should be removed. Ecological evaluation is beyond the scope of this paper, but because the issue is social as well as scientific, we should at least mention it. N. Varley (personal communication) has reported that so far he can find no evidence of significant ecological effects of goats in YNP. But the invasion is young, and recent literature on ungulate grazing systems (e.g., McNaughton et al. 1989) suggests to us it is risky to assume that an ungulate population will not affect ecosystem processes and plant communities to some extent, and current knowledge of potential goat habitat in YNP may not be capable of measuring such effects as they happen. As important, the discussion that followed the panel session at which our paper was given made it clear that other participants in the dialogue hold to a traditional principle of "purity," by which the goats must be regarded as inappropriate simply because they are nonnative, regardless of any measured ecological effects they may have. Following this line of reasoning, even if mountain goats are ecologically benign, they are inappropriate. That is to say that aside from any ecological problems they pose, they compromise the experience the park is supposed to provide.

The social issue may be the more important one in the future of goat management in YNP. It is our opinion, based on the experience of managers in ONP and on our own observations of visitors enjoying mountain goats in YNP and GNP, that people who espouse the principle of ecological purity as a justification for removing mountain goats from YNP will not stand a chance against a pro-goat constituency for whom the animal's romantic image and beauty make it an exciting addition to their recreational experience. These recreationists have a demonstrated, even willful, lack of interest in any effects that the mountain goat's presence may have on those who come to YNP to experience native wild nature. If the state of Montana (which is, after all, the source of the "problem" because it introduced the goats into nonnative ranges north of the park and has not attempted to halt their spread) and the NPS choose to continue to accommodate the colonization of the park by mountain goats, the constituency of goat enthusiasts will grow at

least as fast as the goat population does and will no doubt be as strong willed and outspoken as it has been in ONP.

Management of YNP natural resources has evolved greatly since the park's creation. Such evolution has most often occurred as a matter of necessity, when an issue became politically or even ecologically pressing enough to require reconsideration. The invasion of Yellowstone Lake by nonnative lake trout, mentioned above, is an example of an issue that was immediately pressing, both because of its threat to native elements of the ecosystem and because of its potential impacts on regional recreational economics. The goats currently occupying the GYE and YNP have for some years threatened to become pressing enough as an issue, but only time will tell if they force an advancement in the complex wildlife policies of this region. Our reading of past Yellowstone history suggests that as long as no compelling ecological issue surfaces, the mountain goat colonization of YNP will probably never achieve adequate significance in the eyes of managers or other concerned constituencies to force the decision-making process into action. That is to say that so long as the goats seem benign, management reaction to them will likewise be benign, and colonization will proceed as the goats and their new environment allow.

ACKNOWLEDGMENTS

This work is part of the authors' ongoing National Park Service study of early Yellowstone wildlife history. We thank the organizers of the Fifth Biennial Scientific Conference on the Greater Yellowstone Ecosystem, and especially B. Smith, organizer of the mountain goat session at which these findings were presented, for providing such a stimulating forum. The manuscript was read by S. Consolo Murphy, D. Houston, A. Johnson, B. Smith, J. Varley, G. Wright, and 3 anonymous reviewers. B. Barbee, K. Cannon, S. Consolo Murphy, E. Hadly, A. Johnson, K. Jope, T. Lemke, T. McEneaney, G. Plumb, J. Roscoe, E. Schreiner, F. Singer, J. Varley, and N. Varley helped with answers to a variety of questions on policy history, taxonomy, and literature sources. J. Francis, E. Hadly, C. Hill, A. Johnson, and J. Schoen shared information about the absence of mountain goats in archeological and paleontological sites in the GYE. S. Conner, J. Francis, M. Greer, A. John-

son, M. Pavesic, and J. Schoen provided insights about rock art images in the GYE. We also thank Aubrey Haines for historical advice; Aubrey's death in September 2000 deprived all students of Yellowstone history of a treasured friend and an irreplaceable advisor.

LITERATURE CITED

- BLACKBURN, C.F. 1879. The wilderness at the head of the Missouri, Columbia, and Colorado rivers. *Scientific American Supplement* 8:2903–2904.
- BOZEMAN AVANT COURIER. 1874. Returned to the mountains. May 29, p. 3.
- _____. 1875a. The case of the territory against George Rea. March 2, p. 3.
- _____. 1875b. Sentenced. March 12, p. 3.
- BRANDBORG, S.M. 1955. Life history and management of the mountain goat in Idaho. State of Idaho Department of Fish and Game, Boise. 142 pp.
- CALFEE, H.B. 1896. Calfee's adventures—he and his companion's blood curdling trip to the park over a quarter of a century ago. Manuscript assembled from newspaper clippings. Yellowstone National Park Research Library, Yellowstone Park, WY.
- CANNON, K.P. 1992. A review of archeological and paleontological evidence for the prehistoric presence of wolf and related prey species in the northern and central Rockies physiographic provinces. Pages 1–175–1–265 in J.D. Varley and W.G. Brewster, editors, *Wolves for Yellowstone? A report to the United States Congress*. Volume 4, Research and analysis. NPS, Yellowstone National Park, WY.
- CHADWICK, D.H. 1983. A beast the color of winter: the mountain goat observed. Sierra Club Books, San Francisco, CA. 208 pp.
- DEVLIN, S. 1999. Grizzly bears—real or imagined? *Billings Gazette*, November 3.
- DOODY, D. 1907. Letter to the superintendent, incoming correspondence, document 8665. Yellowstone Archives, Yellowstone National Park, WY.
- FISCHER, D.H. 1970. *Historian's fallacies, toward a logic of historical thought*. Harper & Row, Publishers, New York. 338 pp.
- FOREST AND STREAM. 1885. The Vest Bill. *Forest and Stream* 25(23):446–447.
- GARFIELD, J. 1907. Letter to the acting superintendent, incoming correspondence, document 8079. Yellowstone Archives, Yellowstone National Park, WY.
- GLICK, D., M. CARR, AND B. HARTING. 1991. An environmental profile of the Greater Yellowstone Ecosystem. Greater Yellowstone Coalition, Bozeman, MT.
- GRAYSON, D.K. 1981. A critical view of the use of archaeological vertebrates in paleoenvironmental reconstruction. *Journal of Ethnobiology* 1:28–38.
- GREER, M., AND J. GREER. 1998. Southwestern Montana rock art. *Archeology in Montana* 39:55–64.
- GRINNELL, G.B. 1885. Through Two-Ocean Pass. *Forest and Stream* (January 29, 1885) 24:3–4.
- GRINNELL, J., AND T.I. STORER. 1916. Animal life as an asset of national parks. *Science* 44(1133):375–380.
- GROSS, J.E., M.C. KNEELAND, D.M. SWIFT, AND B.A. WUNDER. 2000. Scientific assessment of the potential effects of mountain goats on the ecosystems of Rocky Mountain National Park. Final report to the National

- Park Service, Contract 1443PX15099062. Rocky Mountain National Park, Estes Park, CO. 141 pp.
- HAINES, A.L. 1977. The Yellowstone story. 2 volumes. Colorado Associated University Press and the Yellowstone Library and Museum Association, Boulder, CO.
- HOUSTON, D.B. 1995. Response to "Inaccurate data and the Olympic National Park mountain goat controversy." *Northwest Science* 69:238–239.
- HOUSTON, D.B., AND E.G. SCHREINER. 1995. Alien species in national parks: drawing the lines in space and time. *Conservation Biology* 9:204–209.
- HUTCHINS, M. 1995. Olympic mountain goat controversy continues. *Conservation Biology* 9:1324–1326.
- KAY, C.E. 1994. Aboriginal overkill: the role of Native Americans in structuring western ecosystems. *Human Nature* 5:359–398.
- LAUNDRE, J.W. 1990. The status, distribution, and management of mountain goats in the Greater Yellowstone Ecosystem. Final research report, NPS Order #PX 1200-8-0828. 58 pp. Copy on file, Yellowstone Research Library and park files, Yellowstone National Park, WY.
- LEWIS, J. 1990. Memo to interested parties. Cover letter for environmental assessment on mountain goat introduction to the Centennial Valley, Montana. Bureau of Land Management, Dillon Resource Area, MT. 1 pp.
- LEWIS, M., AND W. CLARK. 1987. The journals of the Lewis and Clark expedition, G. Moulton, editor. Volume 4. Center for Great Plains Studies, University of Nebraska Press, Lincoln. 464 pp.
- LOVE, C.M. 1972. An archeological survey of the Jackson Hole region, Wyoming. *The Wyoming Archaeologist* 18:1–95.
- LYMAN, R.L. 1994. The Olympic mountain goat controversy: a different perspective. *Conservation Biology* 8:898–901.
- _____. 1998. White goats white lies, the misuse of science in Olympic National Park. University of Utah Press, Salt Lake City. 278 pp.
- MCNAUGHTON, S.J., M. OESTERHELD, D.A. FRANK, AND K.J. WILLIAMS. 1989. Ecosystem-level patterns of primary productivity and herbivory in terrestrial habitats. *Nature* 341(14):142–144.
- NATIONAL PARK SERVICE. 1970. Compilation of the administrative policies for the national parks and national monuments of scientific significance (natural area category). U.S. Government Printing Office, Washington, DC. 147 pp.
- _____. 1988a. Management policies, U.S. Department of the Interior, National Park Service. U.S. Government Printing Office, Washington, DC.
- _____. 1988b. NPS-77. Natural resources management guidelines. National Park Service, Washington, DC.
- NORRIS, P.W. 1881. Annual report of the superintendent of the Yellowstone National Park to the Secretary of the Interior for the year 1880. U.S. Government Printing Office, Washington, DC. 81 pp.
- NOWAK, R.M. 1991. Walker's mammals of the world. 5th edition, volume 2. Johns Hopkins University Press, Baltimore, MD. 1629 pp.
- PECK, S.V. 1972. The ecology of the Rocky Mountain goat in the Spanish Peaks area of southwestern Montana. Master's thesis, Montana State University, Bozeman. 54 pp.
- PITCHER, J. 1902. Report of the acting superintendent of the Yellowstone National Park to the Secretary of the Interior. U.S. Government Printing Office, Washington, DC. 22 pp.
- PRITCHARD, J. 1999. Preserving Yellowstone's natural conditions, science and the perception of nature. University of Nebraska Press, Lincoln. 370 pp.
- RIDEOUT, C.B. 1978. Mountain goat. Pages 148–159 in J.L. Schmidt and D.L. Gilbert, editors, *Big game of North America: ecology and management*. Stackpole Books, Harrisburg, PA.
- ROOSEVELT, T. 1951. The letters of Theodore Roosevelt, E.E. Morison, editor. Volume 3. Harvard University Press, Cambridge, MA. 718 pp.
- ROSCOE, J. 1990. Draft environmental assessment, Centennial Mountains goat reintroduction. Bureau of Land Management, Dillon Resource Area, Dillon, MT. 3 pp.
- SCHULLERY, P. 1984. A history of native elk in Mount Rainier National Park. Final report to the National Park Service, Mount Rainier National Park, WA. 110 pp.
- _____. 1997. Searching for Yellowstone: ecology and wonder in the last wilderness. Houghton Mifflin, Boston, MA. 338 pp.
- SCHULLERY, P., AND L.H. WHITTLESEY. 1992. The documentary record of wolves and related wildlife species in the Yellowstone National Park area prior to 1882. Pages 1.3–1.173 in J.D. Varley and W.G. Brewster, editors, *Wolves for Yellowstone? A report to the United States Congress*. Volume 4, Research and analysis. National Park Service, Yellowstone National Park, WY.
- _____. 1995. A summary of the documentary record of wolves and other wildlife species in the Yellowstone National Park area prior to 1882. Pages 63–76 in L.N. Carbyn, S.H. Fritts, and D.R. Seip, editors, *Ecology and conservation of wolves in a changing world*. Canadian Circumpolar Institute Occasional Publication 35.
- _____. 1999a. Early wildlife history of the Greater Yellowstone Ecosystem: an interim research report presented to National Research Council, National Academy of Sciences, Committee on Ungulate Management in Yellowstone National Park, July 1999. Copies available from the NRC or from the Yellowstone Center for Resources, Yellowstone National Park, WY.
- _____. 1999b. Greater Yellowstone carnivores: a history of changing attitudes. Pages 10–49 in T.P. Clark, P. Curlee Griffin, S. Minta, and P. Kareiva, editors, *Carnivores in ecosystems: the Yellowstone experience*. Yale University Press, New Haven, CT.
- SKINNER, M.P. 1926. Mountain goat (*Oreamnos montanus missoulae*) not found in Wyoming. *Journal of Mammalogy* 7:334–335.
- STUART, R. 1935. Pages 1–186 in P.A. Rollins, editor, *The discovery of the Oregon Trail*. Charles Scribner's Sons, New York.
- TELLER, H.M. 1883. Letter to the superintendent, incoming correspondence, document 162. Yellowstone Archives, Yellowstone National Park, WY.
- TREFETHEN, J.B. 1961. Crusade for wildlife, highlights in conservation progress. Stackpole Company and the Boone and Crockett Club, Harrisburg, PA. 377 pp.
- U.S. FISH AND WILDLIFE SERVICE. 1994. Final environmental impact statement, the reintroduction of gray wolves to Yellowstone National Park and central Idaho. U.S. Fish and Wildlife Service, Helena, MT.

- VARLEY, J.D., AND P. SCHULLERY. 1998. Yellowstone fishes: ecology, history, and angling in the park. Stackpole Books, Harrisburg, PA. 154 pp.
- VAUGHN, R. 1900. Then and now; or thirty-six years in the Rockies. Tribune Printing Company, Minneapolis, MN.
- WHITTLESEY, L.H. 1992. A history of large animals in Yellowstone National Park before 1882. In-house research report available in Yellowstone National Park Research Library, Yellowstone National Park, WY, 186 pp.
- _____. 1994. A pre-1905 history of large mammals in Pierre's Hole, Idaho; Jackson Hole, Wyoming; and the Bechler region of southwestern Yellowstone. In-house draft report, 2 August 1994. National Park Service, Yellowstone National Park, WY. 58 pp.
- WILKINSON, T. 1990. Yellowstone tackles goat troubles. The Denver Post, August 26, C1.
- WISTER, O. 1904. The white goat and his ways. Pages 227-289 in C. Whitney, G.B. Grinnell, and O. Wister, Musk-ox, bison, sheep and goat. The Macmillan Company, London.
- WRIGHT, G.M., J.S. DIXON, AND B.H. THOMPSON. 1933. Fauna of the national parks of the United States. U.S. Government Printing Office, Washington, DC. 157 pp.
- WRIGHT, R.G. 1992. Wildlife research and management in the national parks. University of Illinois Press, Urbana. 224 pp.
- YOUNG, S.B.M. 1907a. Annual report of the superintendent of the Yellowstone National Park to the Secretary of the Interior. U.S. Government Printing Office, Washington, DC. 27 pp.
- _____. 1907b. Letter to L.J. Lownds, June 27, 1907; letters sent, 1907. Yellowstone Archives, Yellowstone National Park, WY.

Received 14 March 2000
Accepted 22 January 2001