

ASSESSMENT OF RECREATION IMPACTS ON WILDERNESS CAMPSITES, MARK TWAIN NATIONAL FOREST, MISSOURI

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Abstract

Congressional direction in the Wilderness Act mandates the natural condition of wilderness be managed to restrict human influenced impacts on wilderness landscapes while providing outstanding opportunities for recreation and solitude. Many times these opposing interests come in conflict leaving resource managers with the task of balancing recreation use with the preservation of natural conditions. In order to manage these conflicts, this study identifies the patterns and intensity of adverse impacts caused by overnight camping in three designated wilderness areas in the Mark Twain National Forest. This study quantifies the condition of 24 campsites located along 37 miles of trail, representing about 60% of known campsites, using condition classes, physical measurements, and land type associations. The results of this study will be used to develop campsite management strategies to help Forest Service wilderness managers reduce the ongoing effects of campsite degradation in the study area.

1.0 Introduction

Recreation in national forests, parks, and wilderness has become one of the most increasingly popular uses of public lands. This trend is especially apparent in designated wilderness across the nation. Since receiving legislative protection from the United States Congress, Cole (1996) found that wilderness recreation use has undergone a sixfold increase. Past research has shown that any level of recreation use will cause some degree of change in natural ecosystems (Marion & Snow 1989). Reducing the adverse environmental impacts from increasing recreation use in wilderness requires reactive management strategies aimed at minimizing and mitigating for environmental losses. Congressional direction in the Wilderness Act states, "the character of

wilderness is protected and managed to preserve natural conditions and to support primitive and unconfined solitude and recreation." It is not feasible, nor warranted, to entirely prohibit recreation in wilderness, so rather, the question then turns to how much impact from recreation use is acceptable?

Many management programs and techniques have been developed to assess current conditions and define actions to balance resource damage with the mandates of the Wilderness Act. Many of these programs have been accomplished in wilderness areas located in the mountainous regions of the western United States leaving a need for research in eastern wilderness areas (McEwen et al. 1996). Primarily, past studies in the east have been limited to highly visited areas such as the Boundary Waters Canoe Area Wilderness in Minnesota (Frissell 1978) and the Great Smokey Mountains National Park in the Appalachians (Marion & Leung 1998). A campsite impact study conducted in four wilderness areas in the South-Central United States by McEwen et al. (1996) found that needed research had been overlooked in geographical areas with high wilderness concentrations, such as the lower Midwest.

1.1 Recreation Use in the Mark Twain National Forest

The Mark Twain National Forest is Missouri's only National Forest and is approximately 1.5 million acres in size. Located in southern Missouri, the forest extends from the St. Francois Mountains in the southeast section of the state across the foothills and plateaus of the Ozarks to more rugged landscape near Table Rock Lake in southwest Missouri (USFS 1991). Seven congressionally designated wilderness areas are located in the Mark Twain and are managed solely by the Forest Service. Total wilderness lands comprise of more than 63,000 acres and primitive recreation is permitted in all wilderness areas on the forest.

With substantial overnight visitation, wilderness managers in the Mark Twain National Forest are presented with more of a challenge today than ever before in managing recreation use. The National Visitor Use Monitoring (NVUM) project was implemented by the Forest Service to better understand the satisfaction and

trends of national forest recreation visitors. The NVUM data from the Mark Twain National Forest estimated there were 22,809 wilderness recreation visits with an average stay of 33.4 hours for fiscal year 2002 (Kocis et al. 2003). This indicates many visitors to the wildernesses on the Mark Twain utilize the areas for overnight camping. In light of this data, ever-increasing trends in visitor use, and lack of up to date research underscore a need for an inventory to assess and monitor the related recreation impacts occurring in each wilderness on the Mark Twain National Forest.

1.2 Purpose and Objective

Building upon the campsite impact study conducted by McEwen et al. (1996) in the south-central United States, the purpose of this research is to evaluate recreation impacts associated with overnight campsites. More specifically, the research objectives are: (1) to collect field data on existing site conditions, (2) determine relationships between the degree of site disturbance and spatial and biophysical factors, and (3) recommend management options to reduce campsite degradation in the study area.

Given the recommendations of this study, the U.S. Forest Service will be able to implement a localized Limits of Acceptable Change (LAC) planning process (Stankey et al. 1985) to determine desired wilderness conditions and to take action to sustain these conditions in differing environments located in each wilderness. The LAC process first requires determining appropriate conditions in light of the unique situations present in each wilderness and then prescribing standards to manage acceptable levels of change. Within this framework this research will facilitate the start of a long term monitoring program to identify trends of campsite deterioration in the study area over periods of time and provide an inventory for the development of a LAC planning system.

2.0 Study Area

This study focuses on three wilderness areas in the Mark Twain National Forest: (1) Hercules Glades Wilderness, (2) Piney Creek Wilderness, and (3) Devil's Backbone Wilderness all located in the Ozarks of southern Missouri within the Ava/Cassville/Willow Springs Ranger District. The natural geology and soils of the Ozarks Highland

Area are of scientific interest because they have essentially formed in place; not having been subject to glacial movement like other parts of northern Missouri and the upper Midwest (USFS 1982). This unique landform, over millions of years, has been carved by the action of flowing water as it cut into the underlying sedimentary limestone and sandstone formations creating a deeply dissected, rugged terrain of narrow hollows and flat ridgetops (USFS 1982). Located in the Ozark Highland Area, each wilderness has its own unique character and contains several land type associations, which is an integral factor in the development of this program.

Hercules Glades Wilderness contains large expanses of glades consisting of native prairie plant associations with interspersed eastern red cedar (*Juniperus virginiana*) on shallow, droughty soils. These glades extend over numerous balds and knobs and contain limestone outcroppings typical of the glade environment. Hercules Glades also is comprised of vast sections of oak-hickory forest that transition to bottomland hardwood riparian areas towards Long Creek, which is the primary drainage of the area. Hercules, the largest wilderness studied, contains 32 miles of designated non-motorized trail and is 12,315 acres in size. There are three wilderness trailheads located on the east, west, and southern boundaries. Hercules received official wilderness designation in 1976 in Public Law 94-557.

Piney Creek Wilderness is known for its rigid, karst topography, seeps, deep hollows and ephemeral headwater streams that drain into Piney Creek. The entire 6-mile Piney Creek sub-watershed is located within the wilderness and drains to the James River Arm of Table Rock Lake. The vegetation of the area is mostly mixed hardwood forest. However, the ridgetops demonstrate a codominance with shortleaf pine (*Pinus echinata*) and small open glades that disrupt the forest cover (Rebman, 1989). Piney Creek contains 16 miles of trail, has two trailheads, each located on the northern and southern sides of the wilderness, was designated in 1980 and is 8,412 acres in size.

Devil's Backbone Wilderness has rugged topography that drains to the center of the wilderness, the Northfork White River, and contains large tracts of mixed hardwood forest interspersed with compartments of shortleaf pine.

The Northfork River has been classified as a candidate wild and scenic river and receives heavy recreation use during the summer. Over 1.5 miles of the river flows through the wilderness and facilitates recreational camping, canoeing, and trout fishing. Devil's Backbone Wilderness was designated in 1980 in Public Law 96-550. This 6,595 acre wilderness contains 13 miles of designated non-motorized trail and has three trailheads located on the northern and southern boundaries. Devil's Backbone is the only wilderness in the study area that has a developed camping facility adjacent to the wilderness boundary.

3.0 Methods

3.1 Site Selection

Site surveys were conducted to assess the existing conditions of primitive campsites in the study area. Surveys were conducted within trail corridors and in popular destination spots in the wilderness areas. Sections of the wilderness were selectively (not randomly) sampled that tend to receive higher amounts of visitation and overnight use. Approximately 60 percent of trail corridors in each wilderness were surveyed in this study. Within this 60 percent sample, 19 miles of linear trail corridor was surveyed in Hercules Glades, 10 miles in Piney Creek, and 8 miles in Devil's Backbone were assessed to uncover campsite impacts in each wilderness.

3.2 Condition Class Estimate System

To gain a measurable understanding of overnight camping impacts, an adapted condition class estimate system was used (Frissell, 1978). This method was developed by Frissell (1978) for use in the Boundary Waters Canoe Area Wilderness and described in detail by Cole (1989) in a sourcebook for wilderness campsite monitoring. The system assigns a condition from four possible classes that provide a description of each site in the wilderness. The measurements for each class are as follows:

- 1 - Ground vegetation flattened but not permanently injured. Minimal physical change except for possibly a simple rock campfire ring.
- 2 - Ground vegetation worn away around campfire ring or center of activity. Tree damage is low.
- 3 - Ground vegetation lost on most of the site, but humus and leaf litter is present in all but a few areas. Tree damage is low to moderate and site uncleanness is low to moderate.

- 4 - Bare mineral soil and soil compaction is obvious. Tree roots exposed on the surface and tree damage is high. Site uncleanness is moderate to high.

3.3 Site Measurements

During the surveys, thorough site inventories were accomplished and each site was assigned a condition class estimate as previously described. Physical site measurements were taken and proximity to water sources and fragile areas was established using a Global Positioning System (GPS) and Geographic Information Systems (GIS). Also, a general land type was assigned where the site was located. Land type classifications include: mixed hardwood/riparian and glade/grassland. Most grasslands are typically fallow fields that received some level of anthropogenic disturbance prior to wilderness designation. Other land type classifications were parts of the wilderness that had relatively gone unaltered by human influence in the past.

Individual site location was mapped using GPS technology so site information can be efficiently recovered, maintained, and located in the field for future reference. Also, using GPS to map the site allowed for an interface with GIS for spatial database development to better assist in identifying trends and developing strategies to effectively manage campsite deterioration. Site attributes were cataloged and filed using a hardcopy method with data sheets, location, and photographic information included. By using both GIS and keeping hardcopy data, site information can be passed on to more than one individual and maintained over a period of time in the event of personnel changes. It is suggested the wildernesses in this study be re-inventoried at a minimum of every 5 years to determine the progression of impacts and condition changes in existing sites as well as new site additions to the wilderness.

3.4 Rationale and Logistics

The methodology was chosen for several reasons. First, the Mark Twain wilderness land type associations are well suited for this type of measurement. All of the wildernesses in the study area contain expanses of oak-hickory forest and many sites are located in bottomland areas near water features. Impacts in these areas are readily noticeable due to the sensitive vegetation and thick understory in the bottomlands. In the limestone glades found in Hercules and Piney Creek, shallow soils

Table 1.—Inventoried Campsite Impacts in Hercules Glades Wilderness

Parameter	Mean	(n)
Disturbed Campsite Area (total) (ft ²)	302.1	17
Disturbed Campsite Area (hardwood/riparian) (ft ²)	488.5	10
Disturbed Campsite Area (glade/grassland) (ft ²)	35.9	7
Overall Condition (total)	2.2	17
Condition (hardwood/riparian)	2.8	10
Condition (glade/grassland)	1.1	7

and susceptible glade vegetation allow for this condition class system to represent site conditions as well. Also, all wildernesses in the study area have relatively small acreages and contain a limited number of land type associations. Differing from wilderness preserves located in the western United States that contain a wide range of land types over hundreds of thousands of acres this system accurately addresses campsite impacts in a smaller, more confined study area. Secondly, this system is inexpensive and required only minimal training of personnel to collect data. Each site evaluation only took five to ten minutes to complete. Seasonal and volunteer personnel assist in many programs in the Mark Twain wildernesses. For future use, this system will be the most conducive by allowing the greatest number of personnel to collect data with the smallest amount of time spent in the office for training.

4.0 Results

4.1 Hercules Glades

The highest campsite density, 0.9 sites per surveyed trail mile, was found in Hercules Glades Wilderness. Overall, these sites showed a mean condition class of 2.2 and the mean disturbed campsite area was 302 ft². Table 1 illustrates the impacts in Hercules Glades Wilderness and Figure 1 shows the clustered distribution of campsite locations and impact classifications. Out of the 17 sites inventoried, 41 percent were assigned a condition class estimate of three or four. All of the heaviest impacted sites were located in mixed hardwood and riparian areas adjacent to water sources. In contrast, all sites inventoried in glade habitat showed a condition class estimate of one and only one field site was found and showed a condition class of two. Site measurements reflect a similar pattern with a significant difference in disturbed campsite area in mixed hardwoods when compared with the glade

and grassland land types. Sites located in the wooded streamside zones had a mean disturbed campsite area of 489 ft². In comparison, sites located in the glades and grasslands showed minimal patterns of disturbance with a mean campsite area of 36 ft².

4.2 Piney Creek Wilderness

Using the same methods, campsites inventoried in Piney Creek showed a density of 0.5 sites per surveyed trail mile. Table 2 categorizes the impacts discovered during the site inventories and Figure 2 shows the inventoried site locations and condition classifications in the wilderness. Out of the five sites inventoried in Piney Creek, 100 percent were inventoried near a water source and the mean condition class was 2.2. Most notably, 80 percent were lakeside sites located less than 25 feet from Table Rock Lake. Even more pronounced than in Hercules, riparian and hardwood sites showed a mean disturbance area of 625 ft² whereas the grassland sites

Table 2.—Inventoried Campsite Impacts in Piney Creek Wilderness

Parameter	Mean	(n)
Disturbed Campsite Area (total) (ft ²)	257.0	5
Disturbed Campsite Area (hardwood/riparian) (ft ²)	625.0	2
Disturbed Campsite Area (glade/grassland) (ft ²)	11.8	3
Overall Condition (total)	2.2	5
Condition (hardwood/riparian)	4.0	2
Condition (glade/grassland)	1.0	3

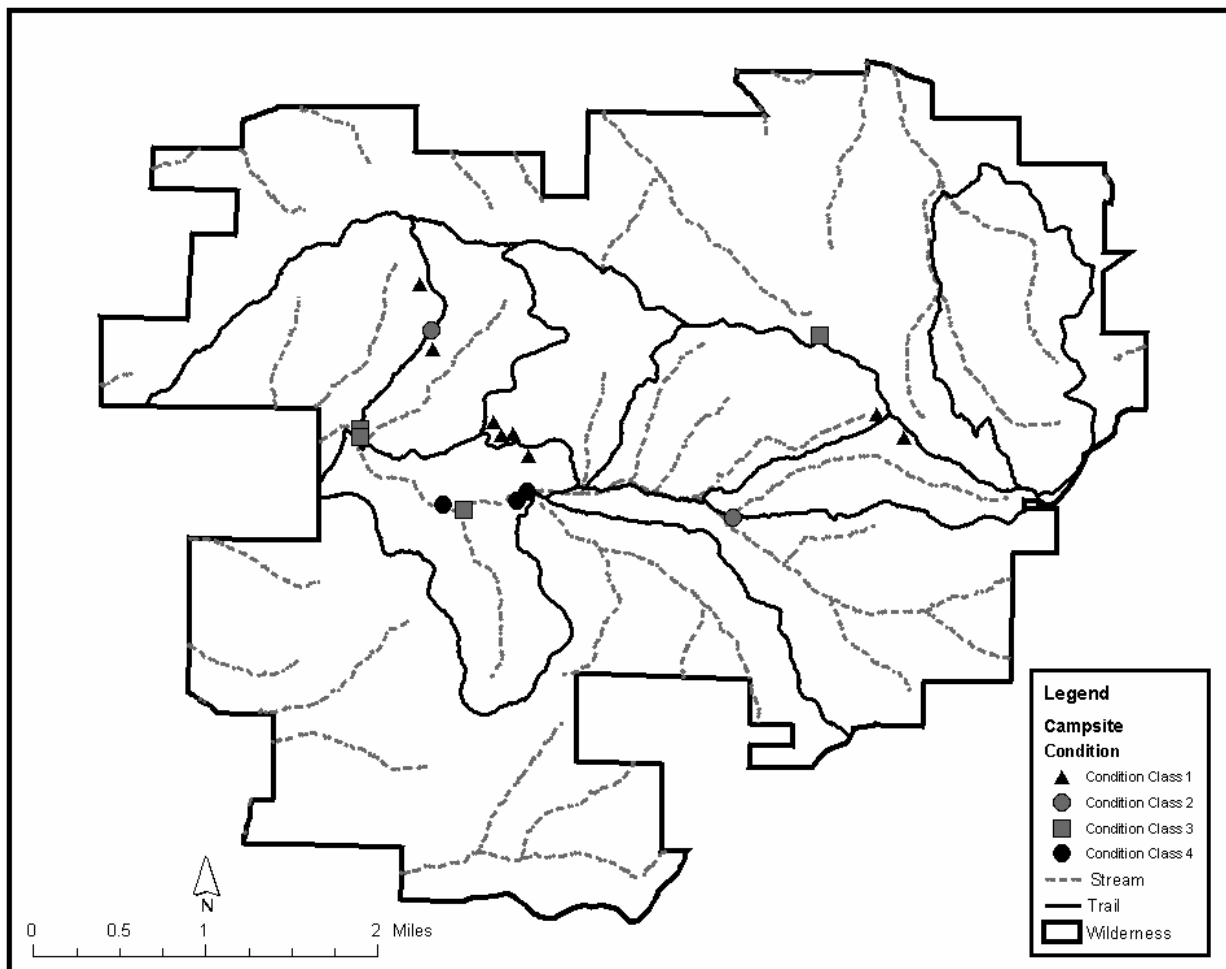


Figure 1.—Inventoried campsite locations and classifications in Hercules Glades Wilderness.

were found to have a mean campsite disturbance area of 12 ft². Likewise, the highest condition class estimates were assigned to sites located in the mixed hardwood land type (40%) and all were located near popular wilderness destinations. In contrast, 60 percent of the sites inventoried were located in fields and all of these sites showed a condition class of only one.

4.3 Devil's Backbone Wilderness

Table 3 and Figure 3 show the site impacts and their locations in the wilderness. Only two sites were found in Devil's Backbone and 100 percent of the sites inventoried were situated within 50 feet from the Northfork White River in riparian areas. Likewise, these sites both showed a condition class estimate of three, which predictably resulted in a mean condition class of 3.0. Both riverside sites were positioned in a central point in the wilderness

where all designated recreation trails converge. Mean campsite disturbance area was 721 ft² with a campsite density of 0.25 sites per surveyed trail mile.

5.0 Management Options

Applying more than one management strategy based on the specific problems of campsite deterioration in the study area will allow managers to tailor a program that will be most effective in controlling campsite degradation levels (Cole, 1990). In light of the overall low campsite density, strong regulatory actions may not be needed to reduce the current levels of campsite degradation in the wildernesses. However, a flexible LAC planning process that controls the intensity and concentration of highly impacted forested and water sites should be implemented. Zoning opportunity areas, such as trail corridors and more highly visited sections of each

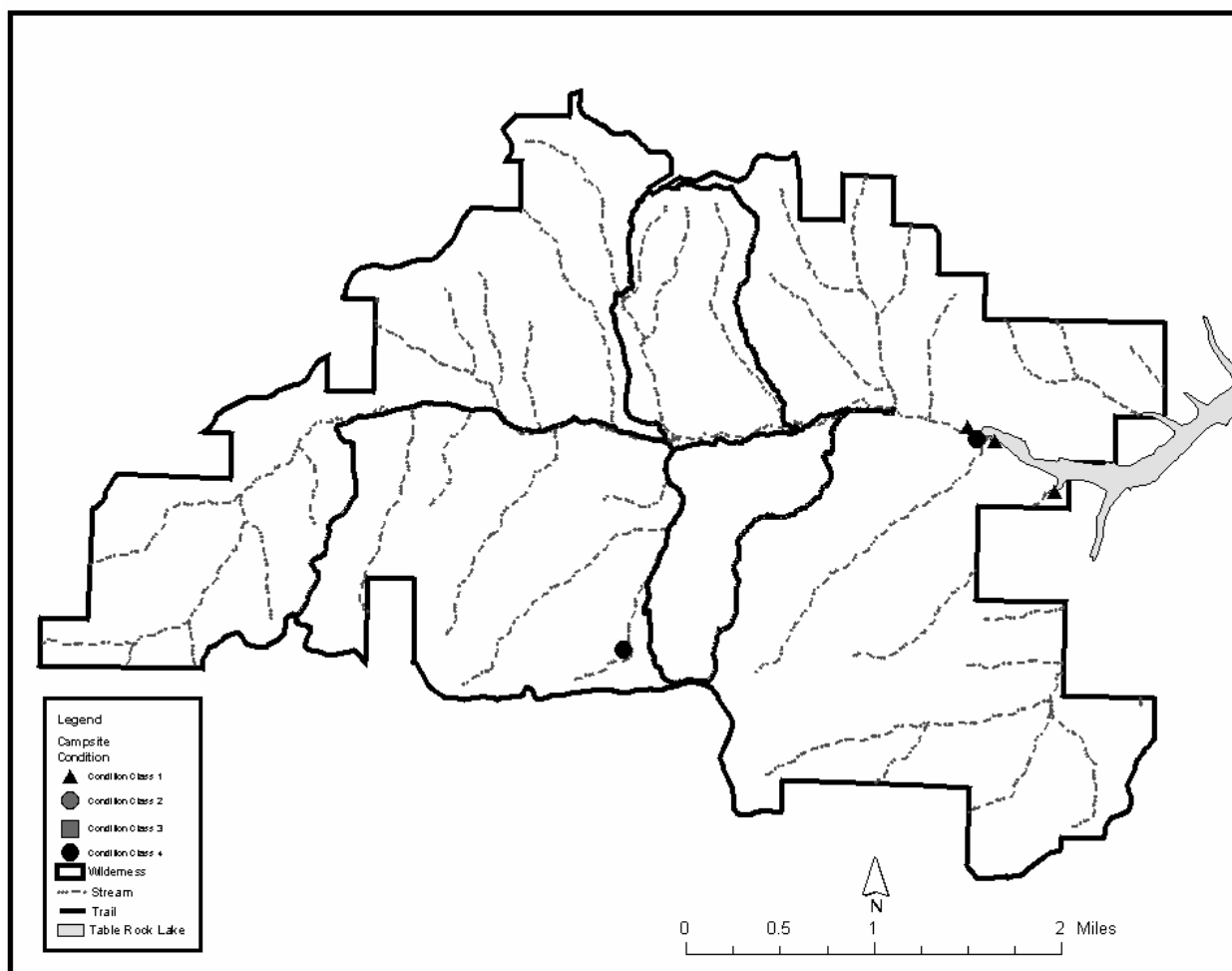


Figure 2.—Inventoried campsite locations and classifications in Piney Creek Wilderness.

Table 3.—Inventoried Campsite Impacts in Devil’s Backbone Wilderness

Parameter	Mean	(n)
Disturbed Campsite Area (total) (ft)	721.0	2
Disturbed Campsite Area (hardwood/riparian) (ft)	721.0	2
Overall Condition (total)	3.0	2
Condition (hardwood/riparian)	3.0	2

wilderness to allow for a semi-primitive and primitive experience while zoning other less visited areas to pristine standards will prescribe allowable campsite deterioration levels. Implementing desired planning standards, such as not allowing more than two condition class three sites or one condition class four site per watercourse half-mile in the semi-primitive zone will assist managers to reduce heavy site concentrations and impacts in riparian habitats. For future planning, setting zones and standards

will help balance use between the different wilderness land types and allow for management aimed at preserving natural conditions while meeting the demands of recreation use (Figure 4).

To achieve desired planning conditions minimum impact education tactics, such as posters at trailheads, “Leave No Trace” materials, and interpretative programs may best minimize current site degradation. Also,

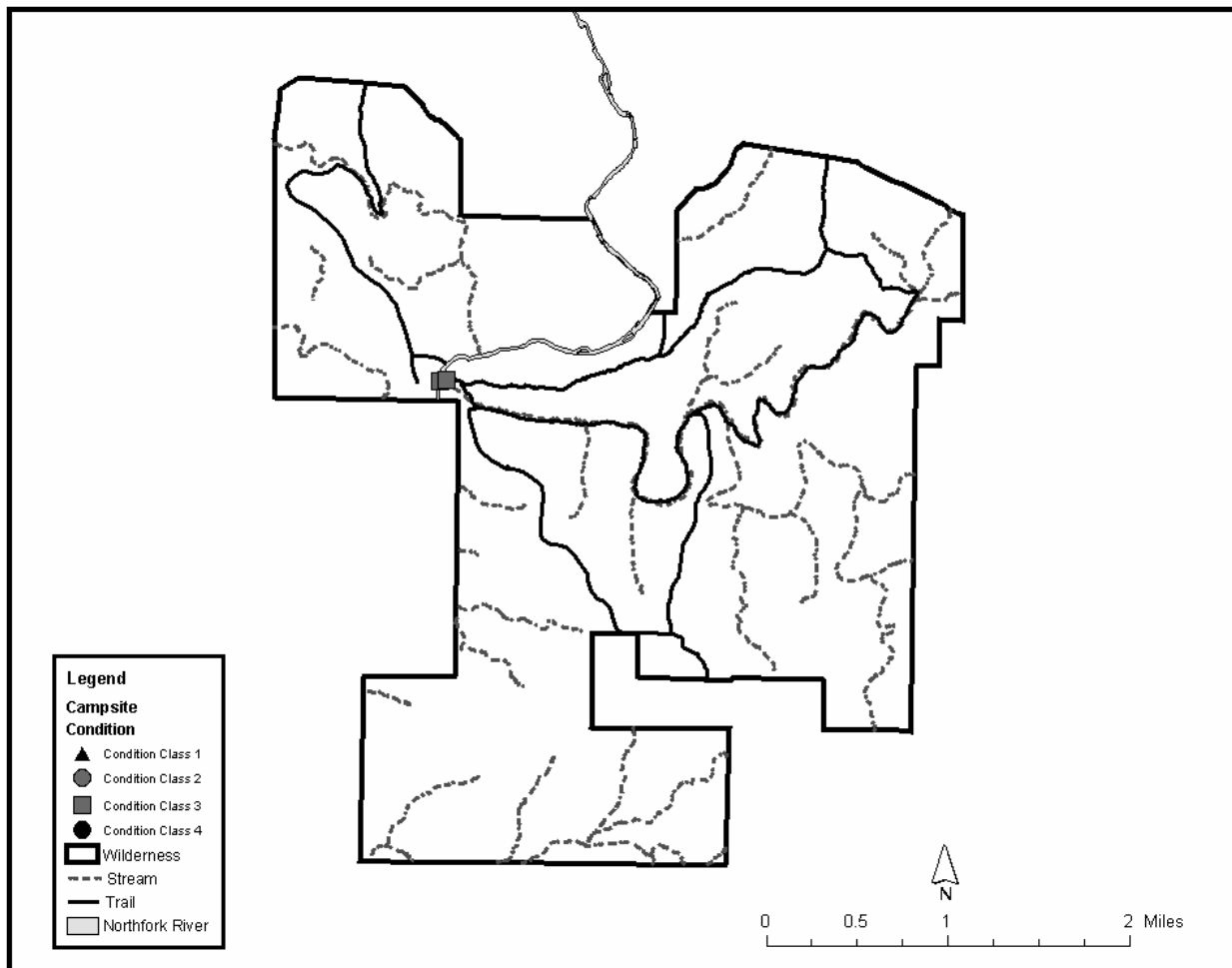


Figure 3.—Inventoried campsite locations and classifications in Devil's Backbone Wilderness.

educating visitors on current party limit and water setback regulations could improve compliance and result in a more successful campsite management program. Encouraging the use of the more durable glade and grassland sites can be included in an education program. By educating visitors on the benefits of glade and grassland campsites can reduce the current high levels of degradation on the forested and water sites by balancing use patterns between the two ecosystems.

In addition to an education program, applying a selective site closure strategy may prove to be beneficial in reducing the on-going degradation where sites were found in high concentrations in forested riparian habitats. Many highly impacted sites were concentrated in Hercules Glades near Longs Creek, in Piney Creek near Table Rock Lake, and in Devil's Backbone near the Northfork White River. Temporarily closing some of the more heavily impacted and concentrated sites in these

areas may be needed to aid in recovery. Although Cole (1990) found natural site recovery is at best extremely slow in western wilderness areas the more humid and adaptable environments in the east may be more amenable to a temporary site closure strategy augmented with physical restoration. Physical restoration tactics such as site revegetation along with conditioning existing soil and using natural barriers to slow site expansion could mitigate and contain campsite deterioration levels in these wildernesses (Cole, 1990).

6.0 Conclusion

The Wilderness Act of 1964 created the guiding principles of how wilderness should be managed. However, managing the wild, natural character of wilderness with human activities requires careful decision-making. Approximately 63,000 acres of wilderness are found in the Missouri Ozarks on the Mark Twain National Forest, and over 26,000 of these acres

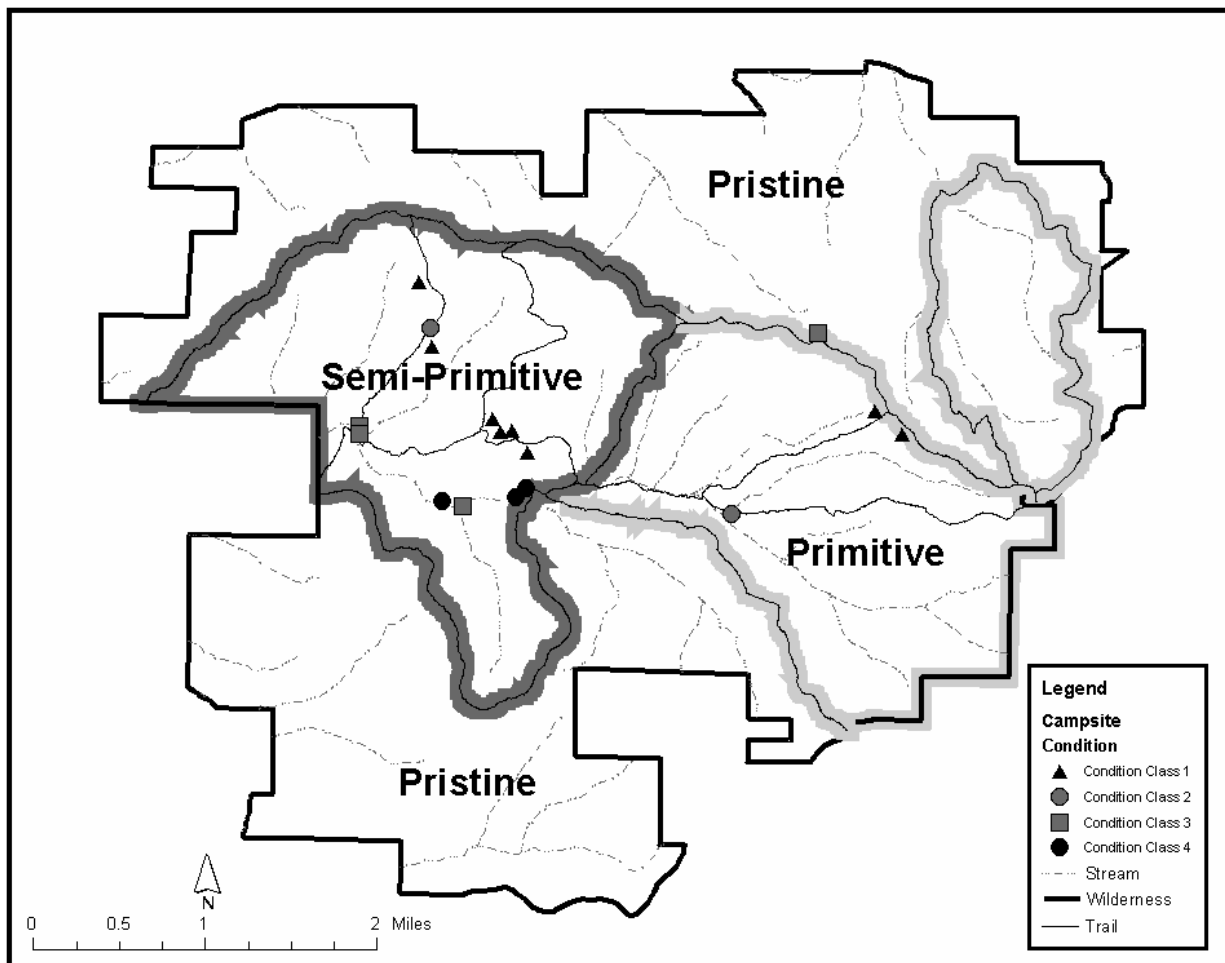


Figure 4.—A Limits of Acceptable Change planning model for Hercules Glades Wilderness.

are located in this study area. Within this vast amount of protected land, any level of human use in wilderness will result in some degree of change and undoubtedly impact the land. Resource specialists must design wilderness management programs that allow for recreation opportunities while maintaining untrammeled wilderness ecosystems. Evaluating the information collected from the site inventories it was shown that: (1) most (67%) of the 24 sites inventoried were located near water features, (2) disturbance was most notable in the hardwood/riparian sites, when compared to the glade/grassland sites, and (3) site conditions, such as excessive soil erosion and compaction may present a long term problem if not mitigated with effective management techniques. Using this research as a baseline and re-evaluating site conditions at a minimum of every 5 years will assist wilderness managers whose goals are to reduce campsite deterioration in the study area.

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