Trail Access:  
Do Mountain Bikes Belong on our Nation's Trails?  

An Honors Thesis (HONRS 499)  

by  

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PROBLEM

Since the development of the mountain bike, cyclists have been taking to the nation's hiking trails. Hikers have complained that mountain bikes on trails cause increased erosion, are unsafe to other users, and just don't belong on trails. Most jeep roads and fire roads are open to mountain bikes, but bikes are banned from a large number of hiking trails. The debate about bicycle access centers around single-track hiking trails in non-wilderness areas. Mountain bikes are prohibited from designated wilderness areas by the Wilderness Act (52 p52). National Forest policy allows bicycle use on forest roads and trails unless specifically prohibited (9 p9), the National Park System prohibits bicycle use on park trails unless they are specifically designated for that use (11 p1). Although the two policies differ, they both seem to call for the examination of individual trails for appropriateness of bicycle use.

LITERATURE REVIEW

Several articles and studies have been written about mountain bike trail use. The articles, though well researched, are not quite as involved as the formal studies, which developed surveys, conducted public meetings, and performed environmental assessments. The most important points will be summarized here.
KEPNER-TREGO ANALYSIS

One of the first formal studies of mountain bike use on trails is the Kepner-Trego Analysis from August 1987. Three updates, one from October 1989, and two from November 1989, contain more recent information based on observations of the effects of the trail use that was allowed by the original report. In any instances where there is a conflict, the newer information will be assumed to be correct.

The Kepner-Trego Analysis recognized that the established users (hikers/equestrians) were resisting mountain bike access simply because they didn't want a new user group on "their" trails. Although this sense of ownership existed, the study did not consider it to be the main problem to focus on (9 p9).

A more valid concern is that of user safety. Near misses between mountain bikes and hikers & horses have occurred, indicating a safety hazard (9 p2). The problem is not with all riders, but with those riders that coast downhill at high speed (9 p4). Most conflicts occur at narrow portions of trails where bicycles are traveling fast, downhill (9 p7).

The report suggests slowing bicycle speed to make trails with bicycles less dangerous. One recommendation to slow bicycle speed which is repeated throughout the reports is to leave the trail rough and rocky, because a smooth surface can encourage speed (9 p6).
The report recommends trail user education. If a user awareness program promoting safe trail use by teaching about trail ethics, rights-of-way and user opportunity were begun, it is felt that hazards would be reduced (9 p3).

Erosion is another issue brought up by those opposed to mountain bike use. The original report considered erosion from mountain bike use to be at an acceptable level compared to other uses, and allowed mountain bike use to continue (9 p9). The later reports noted the effects of this use and made several recommendations on how to control erosion.

It was noted that waterbars are filled in and broken down by the breaking action and tire impact of mountain bikes (8 p1). The report recommended building self-cleaning waterbars that will stand up to mountain bike use or replacing them with rolling dips where that is practical (8 p2). The report states that waterbars built for mountain bike use last about twice as long as other waterbars (1 p2). Examples of these are illustrated in figure 1. Also, a volunteer program should be instituted to inspect and clean water bars at least once a month (8 p2).

Trail maintenance work that has widened brushline clearance has had two undesirable effects. First, it allows higher speeds from which the bikes skid to slow down, and second, the additional width is made up of uncompacted soil which forms ruts when it is ridden on. A specific trail width standard should be set and adhered to in maintenance work (4 p2).
Waterbars are set at an angle across a trail to direct water off the trail (10 p79). Self-cleaning waterbars are set at an angle of 30 to 40 degrees to the trail tread. Too shallow an angle slows the water and allows soil to be deposited and clog the waterbar (10 p83). Waterbars built for mountain bike use are made from larger logs than are used for hiking only trails. Logs up to 12 or 14 inches may sometimes be used (6 p77). Sketch obtained from the AMC Field Guide to Trail Building and Maintenance, p87.

Rolling, or drainage, dips involve digging a trench across a trail at an angle and making a fairly substantial mound (one to two feet high) on the downhill side with the soil. Dips should be dug at a sharp angle (45 to 50 degrees) and are effective only if the soil is quite stable (10 p89). Sketch obtained from the AMC Field Guide to Trail Building and Maintenance, p89.

- Figure 1 -
MARIN TRAIL USE DESIGNATION

The staff of the Golden Gate National Recreation Area (GGNRA) also had to make some decisions regarding mountain bike use as mountain bike use increased in that park. Their report is dated November 6, 1990.

This report contains a summary of four alternative proposals regarding trail use recommended by an environmental assessment, and the public comment on the proposals. A final plan is recommended based on the major issues identified in the public review.

The GGNRA first addressed the "Purpose of the park/appropriate park uses." The GGNRA recognizes that bike use on many trails is appropriate, but points out that it has the responsibility to protect the scenery and wildlife within the park, which consists of ten federally listed endangered species of plants and animals, and twenty-three additional species of plants and animals which are official candidates for federal listing. The park provides seasonal migration routes for several animals and contains an unprecedented number of historic structures and landscapes. The GGNRA asserts that although trail use is compatible with the preservation of these resources, it is important to evaluate the impact of this use, and avoid those uses which may damage them (11 pp13-14).

The GGNRA links the issues of safety and visitor enjoyment together, as visitors perceive a threat to their safety as an impairment of their experience. Bicycle use on
single track trails was more of a concern than on wider double track fire and administrative trails (11 p14).

Most of the accidents that are reported to the GGNRA involve only a cyclist, but there have been several incidents involving cyclists and equestrians which have resulted in collisions and injuries. The GGNRA provides a guided ride program to the public which involves many novice riders, and must ensure the safety of the users of the program, as well as the safety of other equestrian users (11 p14). Safety has been less of a concern with cyclists and hikers sharing the same trails, but many hikers have expressed a change in the quality of their experience on trails shared with cyclists, presenting a loss of solitude and the need to be on the defensive as examples. Due to the many ardent comments of this nature that are received, the GGNRA recommends some trails for the exclusive use of hikers and equestrians. This is more important on single track trails, and less important on wider trails and roads (11 p15).

Discussion over the impact of bicycle and equestrian use on the environment can be heated. Dry, level, well maintained trails generally hold up well to bicycle and equestrian use. On steep or narrow trails, or where waterbars, stair steps or other trail structures are present, there is much disagreement. There is general agreement though, that both these uses increase trail
maintenance needs, and that some trails should have seasonal restrictions (11 pl5).

The GGNRA has several trails which grow endangered species of plants, or food plants for endangered species of animals. After informal discussion with the U.S. Fish And Wildlife Service Endangered Species Office, the GGNRA concluded that bicycles and horses should not use these trails (11 pl6).

The most controversial subject has been whether or not to allow bicycles on single track trails. The GGNRA considered mainly two questions when deciding single track access: user conflicts and resource preservation. Most of the single tracks are narrow and located on steep hillsides. One or the other trail user is required to step or ride off the trail when passing, resulting in damaged vegetation and erosion. Cyclists point out that it is easy to walk a bike past another user without stepping off the trail, or to allow another to walk past them, but in practice it is observed that hikers generally step out of the way of an approaching cyclist. On a trail less that 36" wide, the GGNRA believes a hiker would be forced to step off the trail, trampling plants (11 pp16-17).

In making its trail use designations (hiking only, hiking/equestrian only, or multiple use), The GGNRA staff states that they tried to provide reasonable trail access to all users, with some trails for hikers and equestrians that are free from bicycles. The designations allow bicycles on
most wider park trails. Multiple use trails that dead-end into a hiker only single track trail will be designated as hiker only. The GGNRA believes that the desire to continue beyond the multiple use section will create enforcement problems. An information and education program will also be established (11 p23).

The GGNRA staff recommends the adoption of the following rules (11 p27):

A maximum speed limit of 15 miles per hour was proposed for bicycles on all trails, with a maximum speed of 5 miles per hour when passing or on blind corners. In order to establish an enforceable speed limit, the park would be required to post each trail with traffic speed limit signs. To post each trail which is open to bicycle use would require over 50 additional signs, and accurate speed measuring devices such as radar would be required to enforce the limits.

In lieu of establishing legal speed limits, GGNRA recommends prohibiting the operation of a bicycle without due care or at a speed greater than that which is reasonable and prudent considering wildlife, traffic, weather, road and light conditions and road character. Any speed in excess of that which is reasonable under the circumstances present would be a violation.

All hand outs, informational brochures and trail head information pamphlets will recommend the 15 miles per hour speed limit as the maximum safe speed, however that will be advisory and not mandatory.

All routes not posted as open to bicycle use or equestrian use will be closed to that use. Possession of a bicycle or horse in an area closed to that use is prohibited.

The Superintendent may impose use restrictions or seasonal closures during periods of wet trail conditions, when sensitive species are affected, or for other management needs.

No bicycle may be operated on park trails between sunset and sunrise unless exhibiting on the
bicycle or the operator, a white light which is visible from a distance of 500 feet to the front, and a red light or reflector visible from at least 200 feet to the rear.

Operating a bicycle abreast of another bicycle is allowed except when passing is prohibited.

Horses are not permitted on park roads except where travel is necessary to cross to or from designated trails, or where the road has been closed to motor vehicle use.

Bicycles shall yield the right of way to pedestrians and equestrians.

There have been several articles written in response to the controversy surrounding mountain bikes on trails. Articles have appeared in magazines as diverse as *American Forests*, *Bicycling*, *Backpacker*, and *Western Wildlands*. The magazine articles, whether they have a pro or con point of view, try to be fairly objective and all make some important points to be considered when deciding trail access.

Richard T. Grost, author of "Managing The Mountain Bike" in the March/April 1989 issue of *American Forests*, supports mountain bike use on trails. He points out that mountain bikes use no gas, produce no noise or fumes, and are rugged. Comparing it to hiking on wheels, he says it can be used in outdoor hobbies like photography, camping, fishing, and hunting (6 p50).

Mountain bikers can also be a good source of volunteer labor for trail maintenance. Grost writes about a group called Winter Park FATS (FAr Tire Society) in the Arapaho National Forest which is involved in a trail management program with the Sulphur Ranger District. FATS marks and
maintains specified trails and roads, and in return receives free Forest Service special use permits (6 p77).

For addressing the environmental impact of bicycles, Grost turns to soil scientist Jim O'Hare. O'Hare believes that the differences in erosion rate attributed to hiking, equestrian, and biking activities is insignificant when compared to the erosion caused by the existence of the trail itself, though this may not hold true when trails are wet. In a sidebar to the article, Grost compiles a list of hints for mountain bike trail construction provided to him by soil scientists, foresters, and mountain bikers (6 p76):

Utilize abandoned or four wheel drive roads whenever possible. They have a harder surface, wider path, less brush, and fewer obstacles than most hiking trails...not to mention fewer hikers.

Make sure trail drainage is sufficient to prevent extensive muddy sections and high erosion.

Use large, heavy logs for waterbars and steps, and secure them in the trail solidly to withstand the bumping of bike tires.

Leave or place rocks, roots, and other natural obstacles in the trail to act as natural speed barriers and to discourage reckless bike racing.

Keep trails about 18 inches wide and maintain visibility with occasional brush cuttings.

Involve local bikers in trail designations, design, and maintenance whenever possible.

Discourage or prohibit bike use on trails that are already crowded with hikers and where environmental damage is imminent (bogs, sand dunes, etc.).

Explicitly denote areas where bikes are prohibited, and promote the suggested biking trails with signs and maps.
In the January 1987 issue of Backpacker, Jim Chase tackles the issue of mountain bikes on trails strictly from an environmental viewpoint: do mountain bikes damage trails?

To find the answer, Chase went to Ranger Peter Fish of New York State's Department of Environmental Conservation and Ranger Dwight Johnson of Oregon's Deschutes National Forest. Fish complained that bikes do damage on hills, and leave tracks in wet ground and spongy soil for water to flow in. Likewise, Johnson complained that they spin their wheels going uphill, and skid going downhill. Both agreed, however, that mountain bikes do little damage on flat ground (5 p36).

Chase conducted his own test by riding a mountain bike in a park in New York State. He found that mountain bikes spin their wheels uphill when the grade gets to about ten or fifteen degrees, and skidding will result going downhill unless you go very slowly (5 pp36-37).

Chase concludes that there are some kinds of terrain, soil and ground cover that can't stand up to a bicycle wheel, and that access questions should be handled case by case. To cyclists who balk at having restrictions applied to them, he points out that hikers for years have had to live with rules, including trail and campsite closures (5 p37).

In August 1990, John Viehman, Executive Editor of Backpacker Magazine, wrote the official stand of that magazine to allow mountain bikes on trails in non-wilderness
areas. This is not an unconditional approval, of course. Viehman outlined restrictions that multiple use trails should meet (12 p3):

Trail surfaces should be such that erosion from the additional use will be minimal. Trails must be closed to mountain bikes in wet weather or rainy seasons.

Signs should indicate a multiple use trail, low speed areas, and potential hazards.

The trail must be wide enough to let mountain bikers and hikers pass each other safely.

There must be adequate visibility to avoid collisions.

Viehman suggests establishing a probationary period of two years. If, during that period, any trail shows signs of deterioration or user conflict from the additional use, it will be closed (12 p3).

In the spring of 1990, writing in *Western Wildlands*, Jill Jacoby identifies the problems that mountain bikes face as user conflict and environmental damage. Jacoby surmises that people don't like mountain bikes because they look like motorcycle dirt bikes, and identifies two common environmental problems: first, water and mud forces users off the trail, making it wider, and second, compacted soil on trails causes vegetation loss and increased run-off, increasing erosion (7 p28).

To slow erosion, Jacoby recommends draining water from the trail, surfacing it with a durable material, or placing barriers where erosion is more likely (to encourage riders to get off and walk). Jacoby also recommends using unused
or seldom used roads, abandoned railroads, and jeep trails (7 p28).

To avoid user conflict, Jacoby suggests creating single use and one-way trails similar to cross country ski trails: wide curves, ample trail width, and straight run-outs at the bottom of hills. She says trails of this type would reduce the chance for accidents and eliminate user conflicts (7 p28).

Bicycling Magazine, being targeted at cyclists, has articles that are intended to inform cyclists what they can do to help keep trails open to them. These articles are good news to other trail users in that they indicate that cyclists realize and understand the conflicts surrounding the trail access issue, and that they are trying to take responsible steps to help resolve these conflicts.

In May 1990, Hank Barlow wrote an article about "soft cycling." The idea behind soft cycling is to minimize one's impact on the environment and to treat other trail users with respect. He gives as examples for protecting the environment carrying one's bike across delicate or muddy soil, rather than riding through it, or taking the time to clear a trail or carry the bike over when a tree falls across a trail, rather than creating a new path around it. To give others proper respect, Barlow says you should ride slow enough and with enough control that there is enough time to avoid a collision should another trail user suddenly appear (2 pp104-105).
Barlow believes that one word sums up soft cycling: responsibility. He calls soft cycling a way of life and a way of thinking that goes beyond mountain biking, under which we are totally accountable for our actions. "Always," he says, "have in mind that we're only visitors in the backcountry, and so treat it accordingly. We respect our fellow visitors and their dreams, too, and treat each other with honor (2 p105)."

Riding softly is not the only thing cyclists can do to help preserve the sport of mountain biking. Tim Blumenthal, also writing in the May 1990 issue of Bicycling, gives a few ideas (3 p110-111):

Work on trails. Trail maintenance is a never ending job. Many trails have been neglected because of the lack of money and volunteers. Most land managers would appreciate a sincere offer of help.

Form a local mountain bike club or an off road committee within your existing club. Make trail advocacy a priority. Land managers will listen to responsible representatives of serious organizations. They'll respect people who share the responsibility of educating trail users.

Start a mountain bike patrol. This concept is working well in California. Bikes are sometimes criticized for their ability to get deep into the backcountry so quickly. But when someone is hurt in a remote area, a skilled rider can often get there first to administer emergency aid and arrange evacuation. Bike patrols can provide first aid to any trail user, report and repair trail damage, and encourage responsible trail use.

Educate yourself about responsible and safe off road cycling techniques, then carry the message to others. Invite a hiker, horseback rider, or land manager on a mountain bike ride. Introduce them to the sport and try to instill an appreciation for its nuances. Also, contact your local school and offer to speak about responsible mountain
biking. Children are taught to ride properly on pavement, so why not on trails?

DISCUSSION

It was pointed out several times that traditional trail users don't want mountain bikes on trails because they just don't like the look of them. Traditional users complain that the quality of their experience is lessened because they suffer a loss of solitude and must be on the defensive where bikes are allowed. Generally, this was not considered enough of a reason by itself to ban bicycles from trails, but restrictions for safety and environmental reasons should provide for those users a large number of trails on which bicycles are not allowed.

Most cyclists ride carefully enough so that they do not pose any great threat to the safety of other trail users (The Kepner-Trego Analysis involved a survey of 1401 trail users. 67% of the hikers and equestrians felt bicycles are not a safety hazard (9 pp7-8)). But there are some riders that race down hills and can be a danger to others. Mountain bikes should not be raced on public land, but rather on private land or other lands designed and intended for racing. Mountain bike use on public land should be restricted to transportation to facilitate other activities (such as camping or fishing) or to provide an alternative to hiking, not to see how fast one can go from point A to point B.

Measures should still be taken to help prevent an otherwise careful rider from riding too fast. One method
that was frequently mentioned was to keep trails rough and rocky, thereby forcing riders to slow down to retain control.

User safety can be controlled in ways other than or in conjunction with reducing speed. Little used fire or administrative roads could be made available for bicycle use. These would have the advantage of simply having fewer hikers and equestrians on them, as well as being wider than single track trails, providing more room to avoid other users that do happen to be on the roads. Wider roads also have greater visibility than narrower trails. Trails and roads specified for bicycle use should be wide enough to allow two users to pass each other safely. A catalog from Performance Bicycle Shop lists mountain bike handlebars as wide as 23 inches. For two bicycles to safely pass each other, a minimum trail width of twice this, or about four feet, should be present. A bicycle and a hiker would probably require less width, a bicycle and horse, more. Although this won't provide the narrow single track experience that some cyclists desire, and is wider than what others recommend, bear in mind that this is still only about as wide as a hallway in your home.

Trails that are opened to bicycles should not include those that are already crowded. Introducing bikes onto trails that are already heavily traveled would be hazardous at best. Trails should also be signed to indicate low speed areas and other hazards.
Bicycles can travel and leave practically no trace on ground that is dry, flat and level, but can leave devastation in its wake under other conditions. When a bicycle travels on wet, soft, or spongy soil, it can leave behind a rut in which water will channel, carrying away soil. Trails made up of soft or spongy soil must simply be avoided at all times, but wet trails are often suitable for riding when dry.

Many trails channel water with or without bicycle use, so they are drained with waterbars. Waterbars that are durable under normal hiking conditions are often filled in and broken by bicycle use. Waterbars for bicycle trails should be self cleaning and should be built of well secured, larger logs that can better withstand the bumping of bike wheels. If it is practical, rolling dips can be used instead of waterbars. A regular schedule should be set up to inspect and clean these, to be sure they continue to be effective.

Trail maintenance sometimes widens the brushline so much that the edges of the trail are exposed and makes it possible to ride on the uncompacted soil next to the trail, forming ruts. A specific trail width standard should be set and adhered to. As previously mentioned, a width of four feet is suggested.

Trails in some areas may have endangered species of plants or food plants for endangered species of animals growing alongside them. To ensure the safety of these
plants and animals, bicycles and horses should not be allowed to travel along the trails by which these plants grow.

On inclines of greater than about ten or fifteen degrees, bikes can be prone to spinning their wheels when ascending them. For this reason, trails with inclines of greater than fifteen degrees should be avoided for bike use.

Little used fire and administrative roads should be used whenever possible to reduce erosion. These roads already have a durable surface designed to stand up to heavy use. They also have previously mentioned safety benefits. Surfacing narrow trails and creating one-way single use trails for bicycles are not recommended because they would be, respectively, unsightly and impractical.

Establishing a bike patrol would be an effective way to report and repair damage, provide first-aid, and encourage proper trail use among other users. They could also help sign trails as to proper use and any special hazards.

POLICY RECOMMENDATIONS

Based on the information presented, any trail use policy should strive to protect the safety of its users and of its environment. The policies recommended here, partially gleaned from the reviewed material and partially original ideas of the author, attempt to take into account the safety of the trail user and the environment. They are as follows:

Soft soiled trails which can easily form ruts should be avoided.
Trails should be closed to bicycles during rainy or other wet seasons, to avoid forming ruts.

Trails should be wide enough to allow two users to pass each other safely. A width of four feet is recommended.

Little used roads, such as fire and administrative roads, should be used as often as possible. These roads are both wide, providing good visibility, and durable enough to stand up to bike use.

Waterbars should be self cleaning and be made of large logs, held in place by large rocks and/or stakes to withstand bike use. They should be regularly inspected and cleaned or repaired.

To help keep bicycle speed down, trail surfaces should be kept rough and rocky.

Steep hills with a greater than 15 degree incline should be avoided to reduce spinning wheels uphill and skidding downhill.

Every trail should be marked showing which uses are allowed and which are prohibited. Use of a trail for other than which it is marked will result in a fine. Signs should also mark low speed areas and potential hazards.

No bicycle may be operated on trails between sunset and sunrise unless exhibiting on the bicycle or operator, a white light which is visible from a distance of 500 feet to the front, and a red light or reflector visible from at least 200 feet to the rear.

Bicycles should be prohibited from trails that are already crowded with hikers.

Encourage mountain bike riders to get involved with trail maintenance.

Start a mountain bike patrol equipped with two way radios. Bike patrols can provide first aid, report and repair trail damage, encourage responsible trail use, and enforce rules and levy fines against "renegade" bikers and other users that break the rules.

Join forces with a local cycling club and create pamphlets or include articles in their newsletter that promotes responsible riding, or offer
scheduled group rides on which responsible riding techniques can be taught and demonstrated.

Bicycles should not be allowed on trails with endangered species of plants or food plants for endangered species of animals.

Trails should be monitored for wear. Any trails suffering excessive damage should either be closed to bicycles or brought up to a standard that will resist damage caused by bicycles, if practical.

Be flexible and adapt these policies to any special circumstances you may have, and try to work with all trail user groups so that they may have input into trail designations and will not be upset for being left out.

CONCLUSIONS

Some cyclists will take exception to the recommended policies as being too restrictive. A few will say that mountain biking is no fun unless you can go fast, but remember that speed is one of the factors most often cited as a cause of accidents and near misses. Trail systems can accommodate cyclists, but not when they are speeding down trails and posing a threat to the safety of fellow trail users. A few others will complain that mountain biking is not challenging enough unless riding on narrow single tracks that are barely wider than the bike, but narrow trails are also commonly linked to accidents. We are talking about public lands serving many different users, and safety must come first.

No set of rules will ever satisfy everyone or completely solve every problem it was intended to, but well thought out policies should come reasonably close. The policies in this paper were recommended because they were
thought to provide the best balance of erosion control, user safety, and user enjoyment based on the available information. That's not to say they can't be improved, with continued observation and feedback they probably can, but they should provide a good base from which to start.
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