The Impacts of Mountain Biking on Wildlife and People -- A Review of the Literature

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"Every recreationist -- whether hiker, biker, horsepacker, or posey sniffer -- should not begin by asking, 'What's best for ME?' but rather 'What's best for the bears?'" Tom Butler

"Will we keep some parts of the American landscape natural and wild and free -- or must every acre be easily accessible to people and their toys? … Mountain bikes' impacts on the land are large and getting worse. … The aggressive push of mountain bike organizations to build ever-growing webs of trails poses serious problems of habitat fragmentation, increased erosion, and wildlife conflicts.

As interest in extreme riding continues to grow, as trail networks burgeon, and as new technology makes it possible for ever-more mountain bicyclists to participate, even the most remote wild landscapes may become trammeled -- and trampled -- by knobby tires. … The destruction of wilderness and the fragmentation of habitats and ecosystems is death by a thousand cuts. Will introduction of mountain bikes -- and their penetration farther into wilderness -- promote additional fragmentation and human conflicts with the natural world? Yes." Brian O'Donnell and Michael Carroll

"Some things are obvious: mountain bikes do more damage to the land than hikers. To think otherwise ignores the story told by the ground. Although I have never ridden a mountain bike, I am very familiar with their impacts. For the last seven years I have regularly run three to six miles several times a week on a network of trails in the Sandia Mountain foothills two blocks from my home. … These trails receive use from walkers, runners, and mountain bikers; they are closed to motorized vehicles.

Because I'm clumsy, I keep my eyes on the trail in front of me. I run or walk in all seasons, in all kinds of weather. I have watched the growing erosion on these trails from mountain bike use. The basic difference between feet and tires is that tire tracks are continuous and foot tracks are discontinuous. Water finds that narrow, continuous tire tracks are a rill in which to flow. Also, because many mountain bikers are after thrills and speed, their tires cut into the ground. Slamming on the brakes after zooming downhill, sliding around sharp corners, and digging in to go uphill: I see the results of this behavior weekly. …

I regularly see mountain bikers cutting off cross-country, even on steep slopes, for more of a challenge. They seem blind and deaf to the damage they cause. Admittedly, backpackers and horsepackers can cause damage to wilderness trails. But this is a poor argument to suggest that we add another source of damage to those trails." Dave Foreman

"Questioning what we believe and want is difficult at the best of times, and especially difficult when we most need to do it, but we can benefit from the informed opinions of others." Daniel Kahneman, p.3

"Studies show that bike impacts are similar to those of other non-motorized trail users." Jim Hasenauer (professor of rhetoric and member of the board of directors of the International Mountain Bicyclists Association)

"Some types of recreation have a greater impact than others. Hiking, for example, is relatively low-impact. Mountain biking is a greater disturbance, in part because bikers typically cover more area than hikers." http://www.bendsource.com/bend/near-and-mule-deer/Content?oid=2524009

Introduction:

I first became interested in the problem of mountain biking in 1994. I had been studying the impacts of the presence of humans on wildlife, and had come to the conclusion that there needs to be habitat that is entirely off-limits to humans, in order that wildlife that is sensitive to the presence of humans can survive (see Vandeman, 1998). But what is the best way to minimize the presence of people? Restricting human access is repugnant, and difficult and expensive to accomplish. It occurred to me that the best way to reduce the presence and impacts of humans is to restrict the technologies that they are allowed to utilize in nature: e.g. prohibit bicycles and other vehicles (and perhaps even domesticated animals, when used as vehicles).

Having been a transportation activist for eight years (working on stopping highway construction), and having a favorable view of my fellow bicyclists as environmentalists, I turned to them to help me campaign to keep bicycles out of natural areas. Was I ever surprised! I discovered that many bicyclists (e.g. many mountain bikers) aren't environmentalists at all, but are simply people who like to bicycle -- in the case of mountain bikers, many of them just use nature, as a kind of playground or outdoor gymnasium! (Of course, there are also hikers, equestrians, and other recreationists who fall into this category.) To my suggestion to keep bikes off of trails in order to protect wildlife, they reacted with hostility! (There is a degree of balkanization among activists, where some transportation activists ignore the needs of wildlife, and some wildlife activists eschew bikes and public transit.)

In 1994 I attended a public hearing held by the East Bay Municipal Utility (water) District to decide whether to allow bikes on their watershed lands. Mountain bikers were there asking for bike access, and the Sierra Club was there to retain the right to hike, while keeping out the bicycles. I said that I had no interest in using the watershed, but that I wanted to ensure that the wildlife are protected -- hence, I asked that bikes not be allowed. Afterward, the EBMUD Board of Directors took a field trip to Marin County, the birthplace of mountain biking, to see the effects of mountain biking there. While they were hiking along a narrow trail, a mountain biker came racing by, swearing at them for not getting out of his way fast enough. That helped them decide to ban bikes. Today bikes are still restricted to paved roads, and EBMUD is still one of the public agencies most protective of wildlife.

It is obvious that mountain biking is harmful to some wildlife and people. No one, even mountain bikers, tries to deny that. Bikes create V-shaped ruts in trails, throw dirt to the outside on turns, crush small plants and animals on and under the trail, facilitate increased levels of human access into wildlife habitat, and drive other trail users (many of whom are seeking the tranquility and primitiveness of natural surroundings) out of the parks. Because land managers were starting to ban bikes from trails, the mountain bikers decided to try to shift the battlefield to science, and try to convince people that mountain biking is no more harmful than hiking. But there are two problems with this approach: (1) it's not true, and (2) it's irrelevant.

I will examine (1) in a moment. But first, let's look at relevance: whether or not hiking (or All Terrain Vehicles or urban sprawl or anything

else) is harmful really has no bearing on whether mountain biking is harmful: they are independent questions. Such a comparison would only be relevant if one were committed to allowing only one activity or the other, and wanted to know which is more harmful. In reality, hiking is always allowed, and the question is whether to add mountain biking as a permitted activity. In that case, the only relevant question is: Is mountain biking harmful? Of course, it is. However, since many people seem interested in the outcome of the comparison, I will examine the research and try to answer it.

The mountain bikers' other line of research aims to prove that mountain bikers are just like hikers, implying that they should have the same privileges as hikers. (Of course, they already have the same privileges! The exact same rules apply to both groups: both are allowed to hike everywhere, and neither is allowed to bring a bike where they aren't allowed.) Using surveys, they have tried to show that mountain bikers are really environmentalists, lovers of nature, and deep ecologists. Of course, surveys are notoriously unreliable: statements of belief don't easily translate into behavior. I'm going to ignore this research, since I am (and the wildlife are) more interested in actual impacts, not intentions.

The International Mountain Biking Association (IMBA) has done me the favor of collecting all the research they could find that seemed favorable to mountain biking. Gary Sprung (2004) summarized it in his carefully worded essay, "Natural Resource Impacts of Mountain Biking". Gary says "the empirical studies thus far do not support the notion that bikes cause more natural resource impact". I will show that this is not true; in fact, those studies, if their data are interpreted properly, show the exact opposite: that mountain biking has much greater impact than hiking! Gary says that we should make "make rational, non-arbitrary, less political decisions regarding which groups are allowed on particular routes". This is disingenuous. Mountain bikers (but not bikes) are already allowed on every trail.

Impacts on Soil (Erosion):

Gary says "No scientific studies show that mountain bikers cause more wear to trails than other users". He cites Wilson and Seney (1994) and claims that "hooves and feet erode more than wheels. … Wilson and Seney found no statistically significant difference between measured bicycling and hiking effects". He quotes the study: "Horses and hikers (hooves and feet) made more sediment available than wheels (motorcycles and off-road bicycles) on prewetted trails" (p.74).

This study is frequently cited by mountain bikers as proof that mountain biking doesn't cause more impact than hiking. But it has a number of defects that call its conclusions into question. The authors used a "rainfall simulator" to measure "sediment made available" by the various treatments. They "[collected] surface runoff and sediment yield produced by the simulated rainstorms at the downslope end of each plot", which they claim "correlates with erosion" (they don't say what the correlation coefficient is). This doesn't seem like a good measure of erosion. For example, if a large rock were dislodged, the very weak "simulated rainfall" wouldn't be capable of transporting it into the collecting tray; only very

fine particles would be collected. In fact, they admit that the simulator's "small size … meant that the kinetic energy of the simulated rainfall events was roughly one-third that of natural rainstorms". Another reason to suspect that the measurements aren't valid is that "none of the relationships between water runoff and soil texture, slope, antecedent soil moisture, trail roughness, and soil resistance was statistically significant".

Another problem with the study is that the hikers and mountain bikers used trails that were significantly different, prior to the experiment!: "The results from Part A of Table 4 suggest that the trails used for the five treatment types were not similar in terms of their sediment yield behavior prior to the treatments. Trail plots used for hikers were statistically different from one of the other groups (off-road bicycles) at the .05 level" (p.84). This makes it even less likely that the hiker-mountain biker comparison is valid.

The authors also ignored the relative distances that various trail users typically travel (for example, bikers generally travel several times as far as hikers, multiplying their impacts accordingly) and the additional impacts due to the mountain bike bringing new people to the trails that otherwise would not have been there (the same omission is true of all other studies, except Wisdom et al (2004)). They do say "Trail use in the last ten years has seen a dramatic increase in off-road bicycles" (p.86), but they don't incorporate this fact into their comparison. In addition, there is no recognition of different styles of riding and their effect on erosion. We don't know if the mountain bikers rode in representative fashion, or, more likely, rode more gently, with less skidding, acceleration, braking, and turning. There was also no recognition that soil displaced sideways (rather than downhill) also constitutes erosion damage. It seems likely that they underestimated the true impacts of mountain biking. I don't think that these results are reliable. (Note that the study was partially funded by IMBA.)

Gary next cited Chiu (Luke.Chiu@utas.edu.au) and Kriwoken (L.K.Kriwoken@utas.edu.au), claiming that there was "no significant difference between hiking and biking trail wear". It is apparent he and the authors misstated the implications of the study. If we assume, as they claim, that bikers and hikers have the same impact <u>per mile</u> (which is what they measured), then it follows that mountain bikers have several times the impact of hikers, since they generally travel several times as far. (I haven't found any published statistics, but I have informally collected 72 mountain bikers' ride announcements, which advertise rides of a minimum of 8 miles, an average of 27 miles, and a maximum of 112 miles.)

Besides ignoring distance travelled, there were a number of other defects in the study. The biking that was compared with hiking was apparently not typical mountain biking. It was apparently slower than normal and included no skidding. Bikers who skidded (a normal occurrence) were not compared with hikers. Their erosion impacts were much greater than those of any hikers (judging from the study's graph labelled "Figure 3"). Bikers' impacts under wet conditions were also greater than those of the hikers, which probably would have been statistically significant, if the numbers (of data points) had been greater. One useful result was that the

bikers tended to create a V-shaped groove, whereas the hikers' impact was spread more evenly across the trail. They admit that this "could act as a water channel and increase erosion" (p.356). They also surveyed trail users: "34% of riders listed excitement/risk as a main reason for visiting [the park]. This, combined with the 57% of 'other users' who visit for relaxation, sets up a potential for goal interference, in that a rider aiming for an exciting/risky experience has the potential to interfere with a walker aiming to have a relaxing experience." (p.357) This would also tend to indicate that many bikers travel faster than those in this study, since they are seeking "excitement" and "risk".

Impacts on Plants:

Gary says "No scientific studies indicate that bicycling causes more degradation of plants than hiking. Trails are places primarily devoid of vegetation, so for trail use in the center of existing paths, impacts to vegetation are not a concern." However this is a concern for plants that try to establish themselves in the trail, and for roots that cross the trail and end up being killed or damaged.

He cites Thurston and Reader (2001), claiming that "hiking and bicycling trample vegetation at equal rates … the impacts of biking and hiking measured here were not significantly different". Actually, that is not true. Although overall impacts weren't significantly different, "soil exposure [was] greater on biking 500 pass lanes than hiking 500 pass lanes" (p.404). In other words, after 500 passes, mountain biking began to show significantly greater impacts. Thus their conclusion, "the impacts of biking and hiking measured here were not significantly different" (p.405) is unwarranted.

The authors said "Bikers traveled at a moderate speed, usually allowing bicycles to roll down lanes without pedaling where the slope would allow." Thus it would appear that the mountain biking that they measured is not representative: it was unusually slow and didn't include much opportunity for braking, accelerating, or turning, where greater impacts would be expected to occur.

The authors also said "Some hikers feel that bikers should be excluded from existing trails" (p.397). Of course, this is not true. Hikers are only asking that bikes be excluded, not bikers. On page 407 they admit the "possibility … that mountain bikers simply contribute further to the overuse of trails". In other words, allowing bikes on trails allows trail use to increase over what it would be if bikes weren't allowed. This is probably true, and deserves to be recognized and researched.

They found that "One year following treatments, neither vegetation loss nor species loss was significantly greater on treated lanes than on control lanes" (p.406). They conclude that the recreation impacts are "short-term", and experience "rapid recovery". This is unjustified. Killing plants and destroying seeds modifies the gene pool, and introduces human-caused loss of genetic diversity, and evolution. Dead plants and lost genetic diversity do not "recover" (see Vandeman, 2001).

However, the greatest defect of the study and its interpretation is that is that it doesn't consider the distance that bikers travel. Even if we accepted their conclusions that impacts per mile are the same, it would follow that mountain bikers have several times the impact of hikers, since they are easily able to, and do, travel several times as far as hikers. Try walking 25 or 50 or 100 miles in a day!

Pickering et al did a study comparing hiking and mountain biking impacts on plants and soil compaction. Like Thurston and Reader, they found that "Mountain biking does cause more damage than hiking, but only at the highest levels of use tested [500 passes] and only for some variables" (p.3056). In the long run, of course, users will exceed 500 passes. In fact, that could easily happen in a single day! Their abstract, however, continued the tradition, popular among mountain bikers, of using the unscientific, unquantifiable word "similar": "hiking and mountain biking appear to be similar in their environmental impacts" (p.3049). They also continued the tradition of testing only gentle, straight-line mountain biking with no skidding or speeding. That is not representative of real mountain biking.

They also make the same mistake as every other mountain biking researcher: they ignore distance travelled. Even if mountain bikers did no more harm per foot (which is what they measured) as hikers, the fact that they travel several times as fast and several times as far as hikers would imply that they do several times as much damage!

Impacts on Animals:

Gary cites Taylor and Knight (1993), claiming that "hiking and biking cause [the] same impact to large mammals on Utah island". First, as noted by Wisdom et al (2004), this study lacked a control group, and hence can't infer causation. Second, the authors made the same mistake that all other researchers made: they ignored the different distances that hikers and bikers travel. I also wonder how realistic it was to have all recreationists continue past the animals without stopping to look at them. (All of those researchers also failed to implement blind measurement and analysis: the researchers were aware, as they were measuring, which treatment they were testing. Only Wisdom et al were able to carry out their measurements (electronically) without any people even being present.)

This is a very informative paper. The authors "examined the responses of bison …, mule deer …, and pronghorn antelope … to hikers and mountain bikers … by comparing alert distance, flight distance, and distance moved" (p.951). They noted, significantly, that "Outdoor recreation has the potential to disturb wildlife, resulting in energetic costs, impacts to animals' behavior and fitness, and avoidance of otherwise suitable habitat. … outdoor recreation is the second leading cause for the decline of federally threatened and endangered species on public lands" (p.951). They also noted that "Mountain biking in particular is one of the fastest-growing outdoor activities, with 43.3 million persons participating at least once in 2000" (p.952). However, they didn't draw on this fact when they concluded "We found no biological justification for managing mountain biking any differently than hiking" (p.961).

The authors also surveyed the recreationists, and found that they "failed to perceive that they were having as great an effect on wildlife as our biological data indicated. Most recreationists felt that it was acceptable to approach wildlife at a much closer distance (mean acceptable distance to approach = 59.0 m) than wildlife in our experimental trials would typically allow a human to approach (mean flight distance of all species = 150.6 m). … Of all visitors surveyed, 46%, 53%, and 54%, respectively, felt that bison, deer, and pronghorn were being negatively affected by recreation on Antelope Island. … Visitors expressed little support for allowing only one type of recreational use on island trails, having fewer trails on the island, for requiring visitors to watch an educational video about the effects of recreation on wildlife, and for allowing recreation only on the north (developed) end of the island" (p.957). (Gary Sprung omitted this information from his summary.)

They noted that the wildlife might habituate to the presence of humans, but that exactly the opposite happened with the pronghorn: they "in fact used areas that were significantly farther from trails than they had prior to the start of recreational use on the island" (p.961). They also noted: "Because flushing from recreational activity may come at the cost of energy needed for normal survival, growth, and reproduction …, and because it may cause animals to avoid otherwise suitable habitat …, it is important that recreationists understand that their activities can flush wildlife and may make suitable habitat unavailable" (p.961). I think that the wealth of such information provided by the authors makes this paper especially valuable.

They concluded "Our results indicate that there is little difference in wildlife response to hikers vs. mountain bikers" (p.957). I was present when Ms. Taylor presented her findings at the Society for Conservation Biology meeting at the University of Kent, in Canterbury, England, in July, 2002. I pointed out to her that she wasn't justified in concluding, as she did, that "hiking and mountain biking have the same impacts", since she only measured impacts per incident. Since bikers are able, and typically do, travel several times as far as hikers, a more proper conclusion would be that bikers have several times as much impact on wildlife as hikers. That is why I am so disappointed to find her later concluding in this 2003 paper, "We found no biological justification for managing mountain biking any differently than hiking" (p.961). If mountain bikers can travel even twice as far as hikers, and disturb twice as many animals, I would think that that is biologically significant! It isn't much help that she goes on to admit that "because bikers travel faster than hikers, they may cover more ground in a given time period than hikers, thus having the opportunity to disturb more wildlife per unit time" (p.961). She has still drawn an unjustified conclusion, and it is certain to be frequently quoted (out of context) by mountain bikers, as they try to lobby for more trail access.

I also wonder about the accuracy of their measurements of distance. Distance is notoriously difficult to measure accurately, especially when animals and recreationists may be hidden from view ("Due to the inherent errors in triangulating in the steep canyon country, only ground visual locations were used in the analysis" p.577). Bias may also have been introduced by the fact that researchers knew, as they were measuring, which treatment they were measuring.

Sprung next cited Papouchis et al (2001), claiming that "Hikers have [the] greatest impact on bighorn sheep [in Canyonlands National Park] … because the hikers were more likely to be in unpredictable locations and often directly approached [the] sheep". Actually, this is an artifact of the experimental design, and not a result of research: the researchers, for some reason, told the hikers (who were research assistants) to approach the sheep! So the study actually compared apples and oranges: bikers who stay on a road, vs. hikers who approach bighorn sheep! Nothing useful can be concluded from such a study, except that people who approach bighorn sheep disturb them. Of course, there is nothing to prevent mountain bikers from getting off their bikes and doing the same thing. It's unfortunate that the opportunity was lost to gain more valuable knowledge. I wrote the authors, asking why they had done this, but I got no reply. It would appear that the intention was to exonerate mountain biking (this also applies to most of the other studies).

It is interesting that "when bighorn sheep did respond to human activity, they noticed vehicles and mountain bikers, on average, from twice the distance they noticed hikers" (p.577). This would seem to imply that, were hikers to remain on the trail where the mountain bikers were, they might have equal or lower impacts than the mountain bikers.

It is also unfortunate that there was no control group, so that they could determine the effect of the presence of roads, with and without people on them. They did note that "avoidance of the road corridor by some animals represented 15% less use of potential suitable habitat in the high-[visitor-]use area over the low-[visitor-]use area. … human presence in bighorn sheep habitat may cause sheep to vacate suitable habitat" (p.573). This argues for eliminating all recreation in the area, especially since the absence of water forces recreationists to bring motor vehicles carrying water and other supplies: "mountain bikers frequently use the 161-km White Rim trail, a 4-wheel-drive road. Caravans of mountain bikers accompanied by support vehicles are common. Day use along the Shafer and White Rim trails exceeded 17,500 vehicles during the study period, 1993-1994. This use was concentrated from March to October, with peak use of 134 vehicles/day in May" (p.575).

The authors conclude "Contrary to our original expectations and the concerns of park managers, the increase in numbers of mountain bikers visiting the park does not appear to be a serious threat to desert bighorn sheep, probably because mountain bikers are restricted to predictable situations such as the currently designated road corridors" (p.580). For several reasons, this conclusion is not justified: (1) as they reported, all recreationists drive the sheep away from parts of their habitat, causing loss of energy as well as habitat; (2) permitting bikes causes the total number of visitors to increase significantly; (3) bikes can't travel alone -- they require motorized support vehicles, further increasing impacts (e.g. worsening air quality); (4) there is nothing to prevent mountain bikers from getting off their bikes and approaching the wildlife; if hikers do that, so will mountain bikers; there is no reason to exonerate mountain bikers.

They note, significantly, "However, these results should not be extrapolated to other public lands where mountain bikers are not confined to designated trails and may surprise sheep in novel situations" (p.580). Gary Sprung didn't mention this, thus encouraging inappropriate use of this study's already-questionable results.

I would like, however, to commend the authors for stating "we recommend that park managers manage levels of backcountry activity at low levels" (p.580). The best policy would be to ban all vehicles, including bicycles (as well as animals used as vehicles). That would reduce human impacts, without directly restricting who could go there (perhaps occasional exceptions could be made for the disabled).

Gary next cited Gander and Ingold (1997), claiming that "hikers, joggers & mountain bikers [are] all the same to chamois". But again, this is not an accurate representation of the results: "They fled over longer distances in jogging and mountain biking experiments … carried out late in the morning" (p.109). Also, "the three activities carried out on the ground could have long-term consequences as they prevent the animals from using areas near trails. Thus, depending on the density of trails and the intensity of recreational activities in a certain area, animals may lose a large part of their habitat" (p.109).

The authors conclude "Our results show that specific restrictions on mountainbiking above the timberline are not justified from the point of view of chamois" (p.109). Once again (is there a pattern here?), this conclusion is not justified. It ignores the fact that mountain bikers are able to travel several times as far as hikers, and thus negatively impact several times as much wildlife. It also ignores the fact that bicycles enable a large increase in numbers of human visitors (note that this places the blame on the <u>bicycle</u>, not the <u>bicyclists</u> -- my argument doesn't depend on there being any difference between hikers and mountain bikers). And, of course, <u>wherever the number of visitors increases, there is pressure to build more trails, destroying even more habitat</u>. Once again, it would appear that this study was undertaken with the intent of excusing mountain biking.

Gary next cites a study of bald eagles by Robin Spahr (1990). "Spahr found that walkers caused the highest frequency of eagle flushing". However, this study is difficult to interpret. Eagles don't congregate in large numbers, like sheep, so it is hard to ensure that all treatments are equally balanced: it is hard to imagine that the conditions under different treatments (or even within treatments) were equal. Also, the bikers were apparently instructed to ride by without looking at the eagles, whereas some of the walkers were told to look and point at the eagles (the paper is vague on this point). In other words, the study was comparing apples with oranges. Thus, I don't know if this was really a controlled study. Spahr also found that "bicyclists caused eagles to flush at [the] greatest distances", which would tend to indicate that bicyclists have greater impacts. Distances are also notoriously difficult to measure accurately. We are given no information about the "rangefinder", in order to judge its accuracy. At best, these are mixed results. And, once again, the greater distances that bikers travel are ignored, as well as the greater visitor numbers that the bicycle enables. Therefore, the study cannot be said to

support any conclusion about how hiking compares with mountain biking, and certainly not Gary's statement: "Hikers have greater impact on eagles than cyclists". To Spahr's credit, she did not attempt to generalize beyond her data.

Gary concludes "Mountain biking, like other recreation activities, does impact the environment. On this point, there is little argument. But … a body of empirical, scientific studies now indicates [sic] that mountain biking is no more damaging than other forms of recreation, including hiking [Gary's emphasis]. Thus, managers who prohibit bicycle use (while allowing hiking or equestrian use) based on impacts to trails, soils, wildlife, or vegetation are acting without sound, scientific backing." *Au contraire*, as I have indicated, the very studies that Gary and IMBA cite as support for mountain biking actually show that mountain biking does much more harm to the environment than hiking! Gary goes on to fault "the wisdom of prohibiting [sic] particular user groups". However, as I explained earlier, mountain bikers are not prohibited from using any trails. Bicycles are occasionally prohibited. Mountain bikers are merely required to follow the same rules as everyone else, and walk.

At the bottom of the same web page is the notice: "IMBA wishes to obtain and incorporate into future revisions of this document any new or additional empirical science regarding the impacts of mountain biking. IMBA welcomes input [my emphasis]. To offer information, please contact the author at gary@imba.com". On April 25 I emailed Gary (and Pete Webber, pete@imba.com) the Wisdom et al study, which demonstrates that mountain bikers have a greater impact on elk than hikers. Not only hasn't this new research been incorporated into his paper, but I haven't even received a reply. It would appear that IMBA isn't really interested in achieving a scientific answer to this question.

In 2003, Jason Lathrop wrote an excellent "critical literature review" on the ecological impacts of mountain biking, raising some questions found nowhere else. He quotes the BLM: "An estimated 13.5 million mountain bicyclists visit public lands each year to enjoy the variety of trails. What was once a low use activity that was easy to manage has become more complex". He criticizes all of the studies for not using realistic representations of mountain biking. For example, on Thurston and Reader, he says "this study's treatment passes at best loosely approximate the forces exerted by actual mountain biking. On real trails, riders possess widely varying levels of skill, resulting in variant speeds, turning, and braking. This study does not address these variables." Lathrop also makes the excellent point that "Direct mortality [of animals] is virtually unstudied. I could find no references to it in the literature. Anecdotal evidence suggests, however, that small mammals are vulnerable to impact and are not uncommonly killed."

And: "Taylor (2001) concluded that short-term behavioral changes do not vary between bicyclists and hikers on a per-encounter basis. However, because bicyclists are capable of and, in most areas, typically do travel much farther than hikers, it is reasonable to conclude that they will create a somewhat higher total number of encounters and flushings."

Cessford (1995) did an oft-quoted review (which I am including only because it is so widely cited) that, like all others, uncritically accepts Wilson and Seney (1994) as proof that mountain biking impacts are no worse than those of hikers. His paper is mostly speculation, based on few actual research findings. He disparages negative information about mountain biking by such devices as claiming that problems are caused by a minority of mountain bikers, exhibiting "poor riding habits", that accidents involving hikers and bikers are "rare", that hikers' dislike for being around bikes in the woods, and feelings that bikes cause greater environmental harm than hiking, are mere "perceptions". He blames hikers for "misperceiving" mountain bikers, claiming that "the two groups are more similar than is generally perceived. … The bicyclists … are basically hikers who are using mountain bikes to gain quicker access to the wilderness boundary". He speculates, without any evidence, that "the degree of conflict with mountain biking may diminish over time as other users become more familiar with bike-encounters and riders themselves". A more likely interpretation is that hikers who dislike being around bikes simply stop using trails that are open to bikes, thereby lessening the conflict!

In 2004, Wisdom et al did a very well controlled study comparing the impacts of ATV riders, mountain bikers, and hikers on elk and mule deer. They say we have an "urgent need for timely management information to address the rapid growth in off-road recreation. … Mountain biking [is] … increasing rapidly". Recreationists were allowed to stop for less than a minute to look at the animals. All measurements were made electronically, using an Automated Telemetry System and GPS, allowing control measurements to be made "blind", with no humans present! "Use of the automated telemetry system to track animal movements, combined with the use of GPS units to track human movements, provided real-time, unbiased estimates of the distances between each ungulate and group of humans [the recreationists were in pairs]". He pointed out that direct measurements, *a la* Taylor and Knight, tend to be biased, because some animals can't be observed. The area was entirely fenced, allowing researchers to completely control human access.

They found: "Movement rates of elk were substantially higher during all four off-road activities as compared to periods of no human activity. … For the morning pass, movement rates of elk were highest during ATV activity, second-highest during mountain bike riding, and lowest during hiking and horseback riding. … Peak movement rates of elk during the morning pass were highest for ATV riding (21 yards/minute), followed by mountain bike riding (17 yards/minute) and horseback riding and hiking (both about 15 yards/minute). … By contrast, peak movement rates of elk during the control periods did not exceed 9 yards/minute during daylight hours of 0800-1500, the comparable period of each day when off-road treatments were implemented. Interestingly, movement rates of elk were also higher than control periods at times encompassing sunrise and sunset for the days in which an off-road activity occurred, even though humans were not present at these times of the day. These higher movement rates near sunrise and sunset suggest that elk were displaced from preferred security and foraging areas as a result of flight behavior during the daytime off-road activities. In particular, movement rates of elk at or near sunrise and sunset were higher during the 5-day treatments of mountain bike and ATV activity".

"Higher probabilities of flight response occurred during ATV and mountain bike activity, in contrast to lower probabilities observed during hiking and horseback riding. Probability of a flight response declined most rapidly during hiking, with little effect when hikers were beyond 550 yards from an elk. By contrast, higher probabilities of elk flight continued beyond 820 yards from horseback riders, and 1,640 yards from mountain bike and ATV riders. In contrast to elk, mule deer showed less change in movement rates during the four off-road activities compared to the control periods". (Perhaps they seek cover, rather than running away.)

"The energetic costs associated with these treatments deserve further analysis to assess potential effects on elk survival. For example, if the additional energy required to flee from an off-road activity reduces the percent body fat below 9 percent as animals enter the winter period, the probability of surviving the winter is extremely low. Animal energy budgets also may be adversely affected by the loss of foraging opportunities while responding to off-road activities, both from increased movements, and from displacement from foraging habitat. … Our results from 2002 also show clear differences in elk responses to the four off-road activities. Elk reactions were more pronounced during ATV and mountain bike riding, and less so during horseback riding and hiking. Both movement rates and probabilities of flight responses were higher for ATV and mountain bike riding than for horseback riding and hiking."

It is also instructive to note that only one pair of ATV users were needed to cover the 20-mile study area, but two pairs of mountain bikers and three pairs of hikers were needed, to cover the distance in the time allotted, underscoring the different relative distances that the three groups are capable of covering.

Davis et al studied the impacts of mountain biking on birds: "We evaluated foraging and nesting behavior, territory size, and nest success of Golden-cheeked Warblers …, a federally endangered songbird, relative to mountain biking trail use. … Territories of male[s] … in biking sites (2.2 ha) were 1.5 times as large as those in non-biking sites (1.4 ha). Mayfield nest success in biking sites (n = 33) was 35% compared to 70% in non-biking sites (n = 22). Nest abandonment was three times greater in biking areas (15%) than in non-biking areas (5%). Seven nests were depredated in biking sites, but only two nests were depredated in non-biking sites. … [F]ragmentation and alteration of habitat by mountain biking trails may reduce quality of nesting habitat for Golden-cheeked Warblers." (p.465) "Our results suggest mountain biking trail use negatively impacted Golden-cheeked Warblers during the breeding season." (p.470) "[O]ur direct observations of Golden-cheeked Warbler encounters with mountain bikers did show the birds were disturbed by the bikers. During three of the four observed encounters with bikers, the bird flushed >= 20 m in response to the passing biker." (p.471) "Conservation efforts that curtail construction of new mountain biking trails in Golden-cheeked Warbler habitat and reduce the amount of forest open edge habitat created by existing mountain biking trails should promote recovery objectives." (p.472)

In spite of these significant impacts, the authors conclude "The cumulative effect of disturbance from mountain biking trail use on Golden-

cheeked Warbler foraging and nesting behavior appears to be minimal"! In addition, like all other studies, they ignore the physical extent of mountain biking riding and trail-building, thereby underestimating those impacts. Such "fig leaf" statements allow land managers to ignore the actual results of the study, and continue "business as usual" in regards to permitting mountain biking in the birds' habitat, while pretending to be following the science.

Summary:

Mountain bikers have turned to scientific research to try to make mountain biking seem less harmful, and in particular, to studies comparing it with hiking. Although they have interpreted this data as indicating that mountain biking impacts are no greater than those of hiking, a more careful look at these studies leads to the conclusion that mountain biking impacts are actually several times greater than those of hikers.

Some of the important characteristics of mountain biking that have been ignored are: speed; distance traveled; the increase in number of visitors that bikes allow; increased trail-building, with its attendant habitat destruction; the displacement of soil (other than downhill); the killing of roots and soil organisms and ecosystems; most effects on wildlife; manner of riding (skidding, braking, acceleration, turning, and representativeness); tire tread; and noise (bikes are relatively quiet, but a rattling chain may be perceived as "alien" to natural surroundings).

In addition, measuring techniques need to be described in more detail, "blind" measurements should be considered (where the measurers don't know what treatment they are measuring), controls need to be added, and "intangibles" (e.g. loss of feelings of safety and loss of the primitive feel of natural settings) need to be taken more seriously. The direct killing of small animals deserves attention.

On the other hand, why do we need research to prove what is obvious? We don't need any research to know that we shouldn’t step in front of a speeding truck. Or mountain bike.

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