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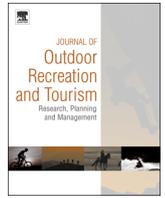


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The emergence of “fat bikes” in the USA: Trends, potential consequences and management implications

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ABSTRACT

In the USA, sales and use of “fat bikes” (bicycles with 75–120 mm-wide tires) have increased dramatically in the past five years. These bikes are designed to open new terrain to cyclists, including snow-covered trails and softer ground surfaces impossible to ride with a standard mountain bike. In this paper, we discuss the extent and possible trends of fat bike use, potential impacts, conflicts and land management approaches. Our preliminary information gathering suggests that fat bikes are used equally on footpaths and snow trails and that riders rarely stray from established trails. Because snow riding represents a new use for bikes we focus on that aspect. Fat biking on snow is likely to have limited environmental impacts due to use on typically frozen ground with the greatest ecological effects most likely to occur during ‘shoulder season’ use when riding may damage muddy trails. From a visitor experience perspective, conflicts among winter users appear to be common, with cyclists reporting issues with both cross country skiers and snowmobilers. One rapidly developing approach for mitigating these conflicts is the development of maintained winter trails specifically for fat bikes. In the USA, state managed lands are leading the way with trail designation and management while Federal lands remain more restrictive. With proper management, winter fat biking offers an opportunity to increase low-season use of public lands for a healthy pursuit with potentially low environmental impact and positive economic impacts.

MANAGEMENT IMPLICATIONS

- Fat bikes—specialty mountain bikes with very wide tires and other modifications—have gained substantially in popularity over the last five years. These bikes open new terrain for cyclists, particularly winter snow trails.
- As riders explore new terrain, or ride in areas maintained for other types of winter recreation, management concerns have emerged including ecological impacts, conflict with other recreationists, trail safety, and increased trail maintenance costs.
- Many areas in the USA are actively perusing solutions to the above issues. Although little data exist, spatial and/or temporal separation of riders and other uses appears to be a particularly effective solution for many issues.

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1. Introduction

Since a rapid rise in participation throughout the 1980s and 1990s, mountain biking has remained a popular activity in parks and protected areas worldwide. Recent assessments in the USA suggest that participant rates peaked in 2001, but have remained relatively constant since, at approximately 40 million annually

(Outdoor Foundation, 2014). Mountain bike use remains about half the participation of hiking use, but is second overall in popularity among all other trail-based activities. Participation occurs in a wide variety of locations including urban proximate parks and more remote multiple-use conservation areas (Pickering, Hill, Newsome, & Leung, 2010).

Since the 1980s mountain bike development has largely focused on making lighter, faster bikes with better suspension. Over approximately the last 10 years however, a new variant to mountain biking style and technology has arrived with the development of the “fat bike”. Fat bikes have wide frames that

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accommodate wide rims (40–100 mm) and tires (75–120 mm) (Carman, 2014). The wide tires allow these bikes to “float” over and maintain traction in soft surfaces such as snow, sand and mud that is difficult or impossible with standard mountain bikes, which typically have narrower tire widths (<60 mm). Since little research has been conducted on the potential issues with this emergent activity, we begin with a brief summary of what is known regarding traditional mountain bike impacts, issues and management. This related information forms the basis for our examination of fat bike issues.

Mountain biking is not a homogenous activity (e.g., Marion & Wimpey, 2007; Newsome & Davies, 2009; Pickering et al., 2010) and different riding styles such as cross country, down hill, dirt-jumping, and others are associated with differences in equipment, setting preferences, impacts and potential social and ecological management issues (Felton, 2004; Pickering et al., 2010). From an ecological perspective, mountain biking trails have similar impacts (e.g., soil loss) as hiking trails (Bjorkman, 1998; Marion & Wimpey, 2007). Impacts appear to be more of an issue when use extends beyond established and maintained trails and participants create new networks of informal trails and/or construct technical features (Newsome & Davies 2009). These conclusions are consistent with recreation ecology theory, which suggests that activities extending beyond established, spatially confined locations are likely to result in the most rapid ecological change (Hammitt, Cole, & Monz, 2015; Monz, Pickering, & Hadwen, 2013). Mountain bikers also typically have a wider spatial range than hikers (Pickering et al., 2010), which suggests a broader scale of possible ecological disturbance effects.

From a visitor experience perspective, conflicts between bikers and other trail users and perceptions of bikes as a safety hazard are primary issues that have been investigated (Cessford, 2003). To a large degree, conflict in outdoor recreation can be explained by the behaviors of one group interfering with the goals of another group and by perceived intergroup differences in values, lifestyles, environmental attitudes, and motives (Watson, Williams, & Daigle, 1991; Carothers, Vaske, & Donnelly, 2001; Manning, 2011). Investigations of conflict between hikers and mountain bikers suggest that hikers perceive bikers to have different attitudes and motives, but often these attributes are more similar than perceived (Watson et al., 1991; Manning, 2011; Watson et al., 1991). In settings where hiker and mountain biker interaction was commonplace, differences between groups were less distinct (Watson, Asp, Walsh, & Kulla, 1997). Alternatively, both perceived and actual safety concerns have been identified when bikers ride too fast for multiple use trails or when they surprise hikers on blind corners. There is some indication that the perception of safety hazards

exceeds the actuality, but regardless managers typically recognize this as a valid issue (Cessford, 2003). These findings suggest that both direct and indirect management strategies can be successful at reducing conflict. Direct strategies could consist of spatial and temporal separation of uses, such as developing separate trails, where possible, for each activity type. Indirect strategies could employ educational approaches to educate bikers as to behaviors considered to be unacceptable by others and educating hikers as to the similarities between the two groups.

In this paper, we examine fat biking as an emergent variant of mountain biking and provide a discussion of current trends, potential ecological and visitor experience issues and management implications. Since currently there is no peer-reviewed literature on this topic, our discussion relies on inferences from the appropriate recreation ecology and aforementioned mountain bike literature, popular and industry sources of information, and the authors' experience with this activity, to provide a framework to examine current issues and suggest future research and management strategies.

2. Historical perspectives and current trends

Custom-made bikes with very wide tires date to at least 1924 (Fig. 1; Anonymous, 1924) but the 1987 Iditarod race along the Iditarod Trail in Alaska is widely credited as starting modern fat biking. Riders in this race quickly realized they needed wider tires to function on snow, which led to the development of custom-made double and triple wide rims and special frames to accommodate those wide rims. Interestingly, some of the first commercially produced wide rims (80 mm) were made in New Mexico where a local rider was developing bikes for riding on loose sand in 1999. Similar wide rims came out shortly thereafter from shops in Alaska. During this time period, the use of these wide rims remained limited because both bikes and tires typically had to be customized and were not commercially available.

In 2005 the first widely available fat bike, the Pugsley, was released by Surly bikes (Fig. 1). This bike had 65 mm rims and 94 mm wide tires. This and related fat bikes quickly found a market and the Surly and Salsa bike brands realized annual median sales increases of 65% for the period between 2006 and 2014 (Sjoquist, 2015). By 2013 major manufacturers Trek and Specialized began selling fat bikes and sales reached 36,865 units and \$30 million (Wiebe, 2015). This was a dramatic increase above the 10,000 units estimated to exist in 2012 (Sjoquist, 2015). By 2013, 92 of 227 bicycle retailers surveyed were selling fat bikes (Bicycle Retailer & Industry News, 2015).

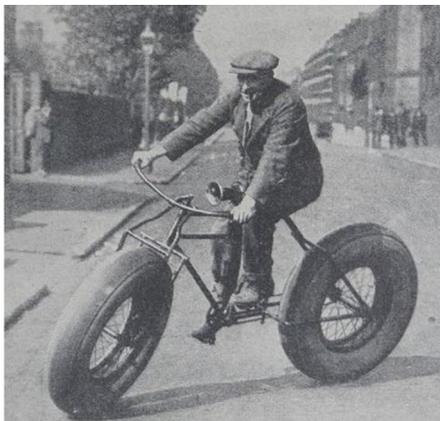


Fig. 1. Custom fat bikes have been used least since 1924 but today's modern fat bikes became commercially available with the Surly Pugsley in 2005. Today fat bikes are available from over 100 manufacturers including major bike manufacturers (images courtesy of Surly Bikes).

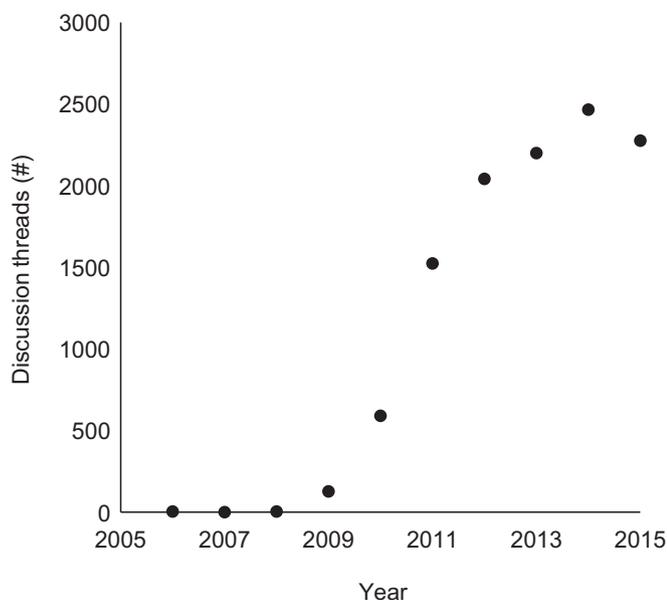


Fig. 2. Number of discussion threads about fat bikes on MTBR.com by year.

Several additional lines of evidence indicate a rapidly increasing use of fat bikes. The numbers of discussion threads about fat bikes on MTBR.com, a major mountain bike review and discussion website, shows a dramatic increase in interest in fat bikes starting around 2010 (Fig. 2). This increase in fat bike use has led to a quick rise in both maintained and unmaintained snow biking trails across the northern US. In the following sections we discuss where fat bikers are riding, what they are looking for in trails, potential conflicts with other users and management approaches.

3. Trail characteristics

3.1. Trail and terrain preferences

Several surveys have revealed some consistent trail and terrain preferences among fat bike riders. A 2014 survey on singletracks.com received over 975 responses from dozens of countries and 49 states in the US and revealed that respondents were looking for (in order) 1) packed snow, 2) moderate climbs, 3) groomed snow and 4) narrow trails. Fat bike owners averaged 76 riding days a year and 64% of respondents would pay to ride on groomed trails (Singletracks.com, 2015).

A 2014 survey performed by the Vermont Mountain Bike Association (VMBA) found that 44% of 264 respondents ride their fat bikes year round (T. Stussey, personal communication, May 29,

Table 1

Open-ended questions posted by the authors on MTBR.com as part of the information gathering for this paper.

- 1) In what state (country) do you live?
- 2) How do you use your fat bike? Please indicate the conditions you fat bike as a percent of your fat bike riding time on groomed snow, ungroomed snow, dirt trails, dirt off trails, public land and private land.
- 3) Have you encountered conflicts with other trail users? With whom and do conflicts seem to be increasing or decreasing over the past few years?
- 4) What percent of your time on a bike each year is on a fat bike?
- 5) How has the time you spend fat biking changed between 2010 and 2015?
- 6) How is fatbiking changing near you (e.g., new trails, commercial trails, policy changes by land managers)?

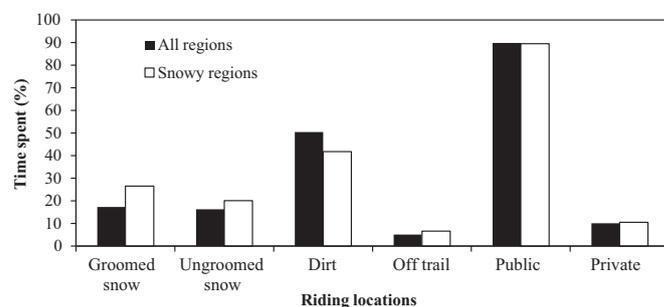


Fig. 3. Proportion of riding time by trail type and use location reported in a survey posted to MTBR.com's "fat bike" forum. Refer to Table 1 for survey questions.

2015). That survey was posted on the VMBA Facebook page on 20 August, 2014 and remained open through 30 August, 2014. Most (71%) respondents were willing to pay to ride groomed trails and most riders were willing to share trails with cross country skiers (87%), snowshoers (91%), dogs (79%), snow machines (51%) and hikers (77%). Over 80% of respondents indicated they do not ride their fat bikes when trails are muddy and sensitive to damage. Most respondents (69%) reported riding two or more times a week. Most respondents (81%) also indicated they would be willing to help with trail maintenance.

We (the authors) also performed a web-based survey of fat bike users at MTBR.com (Table 1) that produced similar results. The survey was posted 7 through 29 May, 2015. MTBR.com is a mountain bike reviews web site that has the highest internet traffic score as assessed by Alexa Internet for mountain biking in North America with 3.6 million monthly visits (© 2015, Alexa Internet; www.alexa.com). Reflecting the rapid rise in fat bike use, only three of 24 respondents owned a fat bike prior to 2010. Most respondents (18 of 24) purchased their fat bike between 2013 and 2015. Across all respondents, riders estimated that 50% of their riding was on dirt trails (Fig. 3). Even for respondents who self-identified as living in snowy areas, only 46% of riding was reportedly done on snow. This riding was split fairly evenly between maintained (groomed) trails (27%) and unmaintained trails (20%). These results help place fat bike sales numbers in a management context as roughly only half of fat bike use occurs under new conditions for trail riding, for example, the use of bikes on snow trails. With the exception of three respondents who ride extensively on beaches, riders reported very little off-trail riding (5%). Almost all riding (90%) was reportedly done on public lands.

Five of 17 riders who reported riding in snow noted conflicts with other users and four of the five conflicts were with cross-country skiers. In snowy areas 12 of 15 respondents indicated that trail use conditions were changing and in every case the change was an increase in riders and trails.

Results from these three surveys were informal and performed from a self-selected group of mountain bike riders but provide a basis for more rigorous assessments in the future. While variables such as "off trail" or "muddy-trail" use should be confirmed independently, these uses do not appear likely to present a significant novel use. Other variables such as the rapid rise in use was consistent from sales numbers, interest from users and the timing of bike purchase, suggesting these results are robust.

3.2. Where are fat bikers riding?

3.2.1. State managed lands

Our survey indicated that 90% of riding is done on public lands. State Parks have been leading the way with fat bike trail development. Managers we contacted in northern US States (Michigan, New Hampshire, Wisconsin and Vermont) noted that fat bikes are

allowed in some areas and that state lands have seen increased use over the past several years. Some State Parks in Washington, Wyoming, Idaho, Wisconsin, Michigan and Minnesota now provide groomed trails for fat bikes. In Minnesota, eight State Parks provide trails for winter fat biking, however fat bikers are discouraged from riding on snowmobile or cross-country ski trails due to safety and grooming cost concerns.

Doug Rich of the Michigan Department of Recreation provided a summary of fat bike policy that was representative of many state land managers (D. Rich, personal communication, May 28, 2015). He noted that bikes on State Lands are only allowed on designated trails and trail designations are determined on an individual park basis. Proposals should demonstrate that the activity is acceptable within the management of the park, provide clear ingress/egress to avoid trespass and informal trail formation and avoids high use or sensitive areas such as nesting bird habitat. As with other managers, Rich noted an increase in fat bike use and conflict with snowmobilers and cross-country skiers on groomed trails. The Michigan policy has resulted in several maintained trail systems on state lands (e.g., the Noquemanon Trail Network, Fort Custer State Park, and Vasa Pathway). Some of the systems such as the Noquemanon and Vasa trail systems limit fat bike use to particular days or times within days to limit conflict with other users. Increasing demand has also resulted in additional trails being developed on Military land (Hanson Hills), private land (Crystal Mountain and Cannonsburg ski areas) and city land (Indian Trail Golf Course) in Michigan.

3.2.2. Federal lands

Federal land managers, in general, have adhered to a policy that restricts bikes to trails that have previously been established as open to mountain bike use. Federal land managers have been slower to designate trails for winter fat bike use. For example, two popular National Parks for winter recreation, Teton and Yellowstone National Parks only allow non-wheeled forms of winter travel; snowmobiles, snow coaches, skiing and snowshoeing. The Global Fat Bike Summit, meetings held to promote winter fat biking, were started in large part to lobby to allow fat biking in National Parks and have resulted in the current policy being under review by the National Park Service ([Global Fat Bike Summit, 2015](#)). On USDA-Forest Service lands the policy is that "Bicycling shall be allowed only on National Forest System trails that are designated for that use. Forest System Roads (Class I–V) shall be open to bicycling unless posted closed". Many forest roads are groomed for snowmobile use in winter and current policy appears to allow fat biking as use is common on these trails in Utah, Idaho and Montana.

3.2.3. Private and privately managed lands

Private cross-country ski areas typically prohibit fat bikes on trails groomed for cross country skiing due to their potential to damage groomed trails by creating deep ruts that can freeze into place. Some areas, however, have opened some existing trails or developed new trails to fat bikes as an opportunity to increase visitation (e.g., Kingdom Trails in Vermont, Durango Nordic Center in Colorado, Howelsen Hill Nordic Center in Colorado, Flagstaff Nordic Center in Arizona, Waterville Valley in New Hampshire and others). Alpine skiing areas have also begun developing trails and renting fat bikes (e.g., Royal Gorge in California, Crystal Mountain in Michigan, Waterville Valley in New Hampshire, Grand Targhee, Wyoming and others).

3.3. Trail use issues and potential conflicts

In areas with a low frequency of use, riders tend to use trails maintained by other winter users like skiers, snowshoers, hikers

and snowmobilers. Although permissible in many multiple-use situations, the addition of bikes to trail systems maintained for other uses raises numerous issues, particularly in situations where the funding or labor for trail maintenance originates with a particular user group (i.e., nordic skiers or snowmobilers). In limited, favorable conditions, fat bikes leave little evidence of their passage but in most snow conditions fat bikes can leave ruts in trails. These ruts can freeze into place and be difficult to ski over or repair with standard trail grooming equipment. Further, it can be difficult to predict when trails will be sensitive to fat bike use and conditions can vary widely across a trail system on a given day.

Conflicts with skiers center around trail damage and perceptions of "legitimate" uses of trails prepared for skiing. Several options are available to mitigate these potential conflicts. Most managers find it best to spatially separate skiers and fat bikers by either establishing new snow trails or designating bike lanes on existing trails. Regardless, both approaches often result in increased costs either as a result of maintaining an additional trail system, or more frequent maintenance of the existing trails. On multi-use trails, rider education is an important approach for limiting trail damage. Many multi-use trails used for fat biking post signs that indicate fat-bike trail etiquette (see [Section 4.4](#)). Principle among fat bike etiquette is to ride wide tires (95+ mm) at low pressures (2–10 psi – 0.2–0.7 atm) and to only ride multi-use trails when tires sink less than 1–2 cm into the snow.

Our survey, experience and discussions with land managers suggest that conflicts with snowmobilers typically are focused on safety and legitimacy of use concerns. Snowmobilers have noted that fat bikers riding slowly, in the dark with little to no lighting and wearing headphones present a perceived safety hazard but to date we are unaware of any actual accidents. Land managers in Vermont, Michigan, Minnesota and Wisconsin noted conflicts between fat bikes and snowmobiles. As with skiing, another concern is that fat bikers increase use on snowmobile trails resulting in increased snow trail maintenance costs. Finally, particularly in areas where trails systems have been developed on private land, snowmobile clubs have secured access from numerous landowners for snowmobile trails and renegotiating use for fat bikers is not a priority. This was reported by land managers in Wisconsin (B.E. Brown, personal communication, May 15, 2015) and Vermont (T. Stussey, May 29, 2015). In our personal experiences, however, we have had generally positive interactions with snowmobilers on multi-use trails in Utah, Idaho, Montana and Alaska.

4. Management approaches

4.1. Minimizing visitor conflict

As discussed above, conflicts with other visitor groups are a primary concern, particularly in locations where prior uses are well established on designated trails. Conflicts can arise in situations where varied outdoor recreation activities occupy the same location at the same time, and thus finding opportunities to designate and maintain separate trail systems is always desirable. In cases where this is not possible, trail users and land managers must seek solutions to accommodate all appropriate activity types in an equitable manner, with the recognition that not all activities can be accommodated in every location.

Experiences in the Winthrop, Washington area provide what appeared to the authors to be an archetypical example of fat bike management. Methow Trails in Winthrop, Washington maintains one of the largest Nordic trail systems in the US with 200 km of groomed trails. Methow Trails began allowing fat bikes on 40 km of multi-use trails (i.e., skiing, ski-joring, walking) during the 2012–2013 season. To assuage concerns of cross-country skiers in

Winthrop the local bike shop has offered several free fat bike rentals to skiers. Fat bikers, however, remain a very small fraction of use on this system estimated at 100 of 50,000 user days in the Methow Trail system (P. Christen, personal communication, May 20, 2015). This limited use reflects in part the development of dedicated fat bike trails in the town under a partnership between the local bike rental shop, the Washington Department of Fish and Wildlife and the Washington State Parks who share fuel, equipment and grooming costs. In 2013 this coalition groomed 15 km of trail and increased the total to 27 km over two seasons. The local bike shop has seen an increase in total winter season fat bike rentals from 157 in 2013 to 485 in 2015. One unexpected consequence of the expanded trail system, is that the presence of trails groomed for fat bikers on Department of Fish and Wildlife and State Parks lands has encouraged their use by snowshoers and hikers (i.e., increased overall winter use). To reduce conflict among users this coalition plans on adding hiking and snowshoeing loops to the fat bike trail system for the 2015–2016 season.

4.2. Minimizing ecological disturbance

Our experience, the above discussion and general recreation ecology knowledge suggests that fat biking can potentially result in little ecological disturbance to soils and vegetation if managed properly. In snow-free situations, fat bike disturbance will likely be similar to a standard mountain bike, provided riding occurs on designated trail systems and routes. A greater potential for disturbance occurs when riders venture off trails and off durable surfaces such as exposed rock and sand. Any off trail use needs to be evaluated for potential impacts. The only ecological concern noted to us by state land managers was for dune erosion and the development of new access trails to beaches in the Great Lakes (D. Rich, personal communication, May 28, 2015).

In snow environments, the potential for soil and vegetation disturbance are minimized due to the ground surface being frozen and the protective nature of the snow layer. However, compaction of the snow caused by riding and snow-grooming equipment has the potential to result in several ecological effects. To date, little information is available about these effects for limited spatial scale situations like trails, but some likely effects can be inferred from the available literature. For example, in some mountain ecosystems large scale maintenance of ski pistes results in compaction of snow and reductions in the habitability of the subnivean space (space between snow surface and the ground) critical to the overwintering of small mammals (Sanecki, Green, Wood, & Lindenmayer, 2006; Negro, Isaia, Palestrini & Rolando, 2009; Sato, Wood, & Lindenmayer, 2013). Snow compacted attract animals with high footloads (body mass per foot surface area) due to ease of travel, but it is unclear if this influences habitat selection and dispersal (Whiteman & Buskirk, 2013). Further, snow compaction may contribute to trail widening over time if spring trail users avoid the persistent snow and travel on trailside areas. These effects suggest that the issues associated with snow compaction are an important consideration in the development of new fat bike areas, and trail designs should minimize the overall area of impact and associated degree of important ecologic concerns such as habitat fragmentation.

An overall concern in all seasons is the effect on wildlife—particularly as new trails are established or winter use increases in areas with little or no use. Riders travel at greater speed and for longer distances than most other non-motorized recreationists, and so the potential to expand use into key habitat and disturb wildlife should be evaluated carefully.

4.3. Developing and maintaining winter fat bike trails

Trails designed for snow biking differ from both mountain bike trails and Nordic ski trails. Snow bikers typically prefer single-track trails that are less curvy and steep than many mountain bike trails. Tight turns and side-slopes can be difficult in snow to both ride and maintain. Steep climbs are difficult on a snow bike though steep drops are enjoyable and soil erosion on fall-line trails does not appear to be a concern for snow-only trails unlike mountain bike trails. In many cases local riding groups or businesses that are renting fat bikes are generally willing to contribute to trail design and maintenance.

Snow biking speeds are slower than mountain biking speeds so fewer trails are needed for a satisfactory ride. Our personal experience is that snow biking speeds are about 30% slower than mountain biking speeds and about 10% faster than Nordic skate skiing speeds, though this varies with the user and snow conditions. Most maintained snow bike trail systems are currently providing about 15–30 km of groomed trail that provides about 2–4 h of riding. While dozens of maintained trail systems can now be found across the USA, some notable trail systems can be found in Cache Creek, Wyoming (16 km); Camba system, Wisconsin (64 km); Cuyuna Lakes, Minnesota (40 km); Grand Targhee, Wyoming (64 km); Jug Mtn. Ranch, Idaho (24 km); Kincaid Park, Alaska (25 km); Kingdom Trails, Vermont (30 km); Levis Mound, Wisconsin (15 km); Marquette Snow Bike Route, Wisconsin (24 km); Snow Mtn. Ranch, Colorado (10 km); Sunny Vale, Wisconsin (11 km); and Winthrop, Washington (27 km + 40 km on ski trails).

Trails are often maintained when a site receives more than about 10 cm of snow, and trail widths of 0.5–1.0 m are generally considered appropriate (T. Stussey, May 29, 2015). Trails are often prepared by snowshoeing or by pulling a grooming device such as a weighted sled to help cover tracks and compact snow. These labor-intensive approaches are more typical where snowshoers or volunteers are common and/or machines are prohibited. Machine grooming is faster and less labor intensive but more expensive and prohibited in some areas. The most common approach is to have a snowmobile pull an implement that both tills compacts snow similar to approaches used for cross country skiing. Compaction is one component of trail preparation the other being the mixing of snow to break snow crystals to increase bonding and surface firmness. Mixing snow will also help patch holes caused by walkers or animals. Finally, another approach is to use a motorbike with wide (e.g., 20 cm) wheels. This approach requires several passes as 20 cm wide tracks are difficult to ride. Some practitioners have suggested using the Rokon motorbike, which has two-wheel drive, large wheels and the ability to haul track-setting equipment (Haamer, 2015).

4.4. Other considerations and rider etiquette

When considering starting a maintained trail system, it is recommended to start with volunteer-supported grooming on a small (e.g., 5–10 km) trail. Starting with volunteer help will engage the user community and provide time to understand needs such as parking, plowing, restrooms, trash removal and grooming frequency. Mechanical grooming and trail expansion can occur as demand requires. Packed and groomed snow conditions are a primary interest for fat bikers. A consistent grooming schedule and communication of grooming conditions on a hotline or webpage will improve fat biker user experiences. This will be particularly important on multi-use trails where fat bikes may not be allowed under some (i.e., soft) trail conditions or at certain times. Similarly, if a grooming schedule is reported, bikers should adhere to the schedule.

Rider education is an important approach for reducing conflict with other winter trail users. Many fat biking trailheads have been outfitted with "fat bike etiquette" guidelines such as the following:

Do not ride on trails if:

- a. You are leaving a tire rut deeper than 1–2 cm.
- b. You are having a hard time riding a straight line.
- c. Your bike tires are < 3.7".
- d. Your tire pressure is > 10 psi.

- Bikes should yield to other users and ride only on designated trails.
- Ride on firmest section of trail.
- Do NOT ride in classic ski tracks.
- Stay to right around corners.
- Allow snow time to set-up after grooming (overnight).
- Use fat bikes only.

Other guidelines to consider include:

- Clean muddy tires before riding on snow trails.
- Don't wear headphones or limit to use to one ear.
- Use bright lights and reflective clothing.

5. Conclusions

As with any rapidly growing, emergent outdoor recreation activity, a proactive approach that is collaborative between land management and participant groups is vital to minimizing ecological change, mitigating recreationist conflicts and assuring satisfying participant experiences. Fat bikes represent a technological advance in mountain bike design that has allowed bike enthusiasts to expand their activities to new terrain particularly in the winter months on snowy trails. While many questions remain to be explored with both on site surveys and ecological assessments common in recreation research, this paper presents an initial summary on what is known about this activity at present.

Our analysis and experience suggest that ecological impacts in winter on soils and vegetation are largely mitigated by snow cover and frozen soil conditions, though effects of snow compaction, particularly the effects on wildlife remain to be determined. Wildlife impacts are always a concern as recreation activities expand both geographically and seasonally, and should be considered carefully in the designation and use of trail systems. Management costs and benefits have to be examined locally and will vary with climate, but our review suggests potential for significant low-impact winter use, added recreational benefits of public lands, collaboration among user groups, and a willingness to pay for groomed trail systems.

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