Boulder County

Parks & Open Space

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BOULDER COUNTY PLANNING COMMISSION

Oct. 16, 2019 – 1:30 p.m.
Commissioners Hearing Room, Third Floor
Boulder County Courthouse

Study Session: E-bikes Pilot Study Research Results & Proposed Updates to Passive Recreation Definition in the Open Space Element of the Boulder County Comprehensive Plan

Information item only, public testimony will be taken

Staff presenter:

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Study Session Agenda

1. Staff presentation
2. Public Hearing
3. Planning Commission Discussion

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I. Introduction

Boulder County Commissioners approved a one-year pilot study to allow e-bikes on most county open space trails on the plains starting Jan. 1, 2019. During spring and summer, staff conducted studies on the visitor and trail impacts of e-bikes on county trails. The commissioners also directed staff to explore an update to the definition of passive recreation in the Open Space Element of the Comprehensive Plan as a means for allowing e-bikes on certain county trails. Planning Commission held a study session on this topic in December 2018 and a joint study session with the Board of County Commissioners in March 2019.

The three goals for the e-bike pilot study are based on input from the initial public outreach in 2018, review of e-bike research and other related literature, and direction from BOCC and the Planning Commission. Both the BOCC and Planning Commission highlighted the importance of sound survey design and sampling methods to achieve statistically valid results.

Goal 1: Study the visitor and trail impacts of e-bikes on trails
Goal 2: Work with Planning Commission to explore options for updating the passive recreation definition
Goal 3: Employ a robust public engagement process

The purpose of this study session is to provide an overview of the 2019 e-bike pilot study research results and present options for updating the passive recreation definition in the Open Space Element of the Boulder County Comprehensive Plan.

II. E-bike Pilot Research Results

During the pilot, staff endeavored to obtain answers to the following questions in relation to Goal 1:

- Are county residents' perceptions about e-bikes on certain county trails generally favorable or unfavorable? How many e-bikes are on county open space plains and regional trails? What proportion of open space visitors do e-bikes represent?
- How fast are bikes traveling on regional and plains trails, and can we determine if e-bikes speeds differ from speeds of regular bikes?
- What are visitors' perceptions of conflict on trails, can those perceptions be attributed to e-bikes? Are there differences in perceived conflict on regional trails compared to trails at open space parks?
- Do county residents avoid trails because of e-bike use?
- What safety concerns are associated with e-bikes?

In order to answer these questions, staff conducted research through several methods.

1. Literature review. The regulatory landscape is a fast-changing landscape, and many agencies are regulating and studying e-bikes—in Colorado, across the country, and other places in the world. The literature review gives a picture of potential positives and negatives associated with e-bikes and how other agencies are addressing them. In addition to e-bike research and regulations, the literature review investigates the broader topics of recreation conflict and emerging technology.

   Key results:
   - E-bikes increase recreation access for aging populations and those with mobility disabilities. They enable riders to go further and comfortably ride over hilly terrain. For younger

populations e-bikes tend to serve a utilitarian purpose, replacing car trips for commuting and errands. Given this substitutability of e-bikes, an increase in their transportation mode share could reduce carbon emissions.

- Safety, speed, crowding, and user conflict are common concerns related to bicycles generally, and these concerns are heightened for e-bikes. Recreation conflict literature suggests that most conflict follows an asymmetrical pattern, and research on e-bikes shows that experience informs perceptions. Several studies show that trail users who are unfamiliar with e-bikes express a preference to not share the trail with them, but the majority did not notice that they were sharing the trail with e-bikes. Similarly, once they were exposed to e-bikes, concerns about them decrease for many.
- All forms of recreation may have negative impacts to wildlife habitat, but there is little research to suggest that e-bikes have greater negative impacts on trails or wildlife than regular bikes and mountain bikes.
- Many Colorado jurisdictions have acted to allow some or all classes of e-bikes, including City of Boulder (certain multi-mode paths), Durango, Jefferson County, Eagle County, Summit County Rec Path, and the Rio Grande Trail. Many other local jurisdictions allow e-bikes by default under the August 2017 change in state law, including Lafayette, Louisville, Longmont, and Superior. Colorado Parks and Wildlife allows e-bikes wherever conventional bikes are allowed. In August 2019 the Department of the Interior issued an order directing all DOI lands to exempt e-bikes from the definition of motorized vehicles and to permit them wherever conventional bikes are allowed. In addition, the order gave agencies 30 days to develop proposals to guide implementation.

2. Countywide telephone survey. A statistically valid countywide telephone survey gives a snapshot of Boulder County voters' opinions and behaviors as contrasted with surveys of visitors. This tool is especially appropriate to measure e-bike perceptions in the general population, opinions about the importance of the various values and functions of open space, and potential displacement of users. Drake Research and Strategy called a random sample of Boulder County voters between Aug. 1 and Aug. 12, 2019. A total of 605 surveys were completed, 65% on cell phones. The results are statistically representative with a margin of error of +/-4%.

   Key results:
   - 24% have ridden an e-bike and just 2.3% own an e-bike. Of these e-bike owners, 54% do not know what class of e-bike they own.
   - 88% use their e-bike for errands around town, 63% for commuting, and 55% for recreation.
   - When asked if they support allowing e-bikes on Parks & Open Space properties, 43% support allowing them on regional trails and flat trails on the plains, while 29% opposed. Feelings about e-bikes on foothills trails is exactly the reverse: 43% opposed allowing e-bikes and 29% were in support.
   - 50% of Boulder County residents predicted that allowing e-bikes on a trail would have no effect on their use of that trail, 9% would be more likely to visit, and 32% would be less likely to visit.

3. Visitor intercept surveys at targeted trail locations: Boulder County Parks & Open Space has been collecting visitor use data at open space properties and regional trails every five years since 1995; these results provide a baseline for information about trail users' behaviors, experiences, and opinions. Intercept surveys were conducted from April through Sept. 2019 at regional trail and open

space park locations where e-bikes were allowed during the pilot. Survey shifts were randomized by day of week and time of day to capture a broad range of users. A total of 427 surveys were completed.

Key results:

- Only about 5% of respondents saw an e-bike on the day of survey. Four of the 427 respondents were riding an e-bike when they took the survey.
- Support for allowing e-bikes is very similar to the phone survey results: support is greatest for e-bikes on regional trails (41%) and flat trails in the plains (42%) with another third of respondents neutral or unsure for both trail types. Conversely, nearly half of respondents were opposed (49%) to allowing e-bikes on foothills trails (compared to 43% in the phone survey), with 26% in support and a quarter neutral or unsure.
- 96% of trail users did not experience conflict on the day they took the survey, which is consistent with data collected in the 5-year visitor surveys (in 2015, 5% of survey respondents reported experiencing conflict on that day, and conflict ratings were lowest on plains trails and regional trails). There were no reports of conflicts with e-bikes, which is not surprising given the low numbers of e-bikes currently on county trails. Of those who did experience conflict, the most frequently cited reasons are:
    - Off-leash dogs or dogs crowding the path
    - Other trail user was wearing headphones or blasting music and not able hear the individual approaching
    - Cyclists not announcing themselves when passing

4. Bike speed observation studies: While intercept studies capture visitors' opinions and impressions, observation studies measure real time behavior. Observation studies are effective for measuring speeds of conventional bikes versus e-bikes, as well as providing a snapshot of the mode share of e-bikes. Observers were trained in speed observation protocols and how to identify e-bikes. Observations were conducted in two-hour segments either preceding or following the intercept survey shift. In addition to the intercept survey locations, observations were recorded at Betasso Preserve, Ron Stewart Preserve at Rabbit Mountain, and the US36 bikeway. At each location, speeds of oncoming cyclists were taken 100 ft away from the observer. The type of bike was recorded (conventional/electric/recumbent) as well as slope of travel (uphill/downhill). Trail condition (wet/dry) and weather were also recorded.

   Key results:

   - 504 bikes were observed: 12 e-bikes and 492 conventional bikes.
   - Perhaps counterintuitively, the average e-bike speed was less (13.8 mph) than the average conventional bike speed (14.9 mph), which may reflect the demographics of e-bike riders (based on research, e-bike riders are older, and thus perhaps more cautious and aware of their speeds given that most e-bikes have a speedometer). Because of the small number of e-bikes observed, these observations may not be predictive of future trends.
   - Across survey locations, uphill e-bike speeds were faster than conventional bike speeds at 13.8 and 12.9 mph respectively. For average downhill speeds, conventional bikes traveled at 15 mph on average, while e-bikes traveled at a slower average speed of 13.5 mph. [n (electric uphill)=10, n (conventional uphill)=152, n (electric downhill)=2, n (conventional downhill)=339]
   - Comparing speed at different locations, the highest average e-bike speed was recorded on the Meadowlark Trail near Coalton Trailhead (16.0 mph), the lowest average e-bike speed was recorded at Carolyn Holmberg Preserve (11 mph). The highest average conventional bike

speed was recorded at Betasso Preserve (15.9 mph—speed at this location was measured in order to capture mountain bikes, and the highest individual speed observation—26 mph—was also recorded at Betasso Preserve). The lowest average conventional bike speeds were observed at Niwot Trails (13.2 mph).

5. Technical trail evaluation: While the majority of regional and open space plains trails are 8' or wider, some trail segments have vegetative encroachments at ground level or in the overstory, causing the trail to be narrower or have sight obstructions. In addition, some segments have limited sight distance due to slopes and/or curves. Trails staff is conducting a technical trail evaluation to provide data to inform decisions about management actions including maintenance, hazard signage and possible speed limits. As a result of this evaluation, staff will identify maintenance needs and possible locations for hazard signage. Discussions about the pros and cons of speed limits and whether they are appropriate for BCPOS trails are ongoing.

III. Staff Recommendation For E-bike Policy

The research did not generate any results that suggest changes to the e-bike recommendation staff proffered after initial public engagement in 2018. The research has served to solidify the rationale for allowing class 1 and class 2 e-bikes on plains trails:

- E-bikes are here and though they are a small portion of trail visitors today, their use will likely continue to increase as price points become more competitive combined with demographic trends of aging baby boomers. Acceptance of e-bikes is fairly high and will likely continue to grow.
- The accessibility and sustainability benefits provided by class 1 and class 2 e-bikes outweigh the negatives that may result from crowding, conflict, and safety concerns. These negatives are a result of increased recreational demand and use of all uses, not just e-bikes. One lesson from the pilot study research is that the county can be more proactive in its trail maintenance, hazard signage, and education and outreach efforts.

Thus, the staff recommendation remains: to allow class 1 and class 2 e-bikes on Boulder County trails on the plains where regular bikes are allowed, including regional trails and trails on open space parks, with the exception of three county trails requested to be off limits to e-bikes by the City of Boulder[1].

With this recommendation, the Parks & Open Space staff also proposes to increase education and outreach efforts on trails where e-bikes are allowed, including trailhead displays about sharing the trail with hikers, runners, bikers, equestrians, and trail users with dogs. In addition, the department will direct Boulder Mountain Bike Patrol and Volunteer Ranger Corps to properties where e-bikes are permitted and engage with parks visitors about proper trail etiquette. Staff will also address maintenance needs and add caution signs along trails in areas with hazards such as limited sight-distance.

IV. Options for Amending the BCCP Passive Recreation Definition

In order to implement the recommended e-bike policy it is necessary for it to be in alignment with the policy direction provided in the Boulder County Comprehensive Plan (BCCP). The definition of passive

[1] The City of Boulder requested e-bikes not be allowed on the Boulder Canyon Trail (due to prohibition of motorized uses on a conservation easement parcel owned by City of Boulder), and Coalton and Mayhoffer-Singletree Trails (because these two county trails lead to city-owned trails where e-bikes are not allowed, and there is no option to leave the trail).

recreation in the Open Space Element of the Boulder County Comprehensive Plan (BCCP) (www.bouldercounty.org/open-space-element) reads as follows:

> Passive Recreation, referred to in the *Open Space Element* policies, is defined as non-motorized outdoor recreation with minimal impact on the land, water, or other resources that creates opportunities to be close to nature, enjoy the open space features, and have a high degree of interaction with the natural environment. Further,
>
> - Passive recreation requires no rules of play or installation of equipment or facilities, except for trails and associated improvements.
> - Passive recreation includes activities such as hiking, snowshoeing, cross-country skiing, photography, bird-watching, or other nature observation or study.
> - If specifically designated, passive recreation may include bicycling, horseback riding, dog walking, boating, or fishing.

The BCCP was adopted in 1978 and this definition has not changed substantially in subsequent updates[2]. In 1978 and up until recently, the prohibition on motorized uses served as a clear shorthand for distinguishing between desired passive recreational uses and other recreational uses that were not desired, since motors meant loud, polluting, heavy, and fast machines such as dirt bikes.

The advent of e-bikes as a hybrid technology presents a challenge and opportunity to reconsider this definition. In 2017 the State Legislature passed HB17-1151 Electrical Assisted Bicycles Regulation Operation, changing Colorado's bike law such that e-bikes are now classified as bicycles and have the same rights of the road as conventional bicycles. Specifically, C.R.S. § 42-4-1412 allows class 1 and 2 electric assisted bicycles on multi-use trails unless explicitly prohibited by the managing land agency.

For purposes of study session discussion, staff offers three options to consider for updating the definition of passive recreation:

> **Option 1**. Add e-bikes to the list of activities allowed if specifically designated in the 3rd bullet (designation would be a policy action of the BOCC):
>
> - "If specifically designated, passive recreation may include bicycling, horseback riding, dog walking, boating, fishing, or e-bikes."
>
> **Option 2**. Remove the reference to non-motorized recreation and add a bullet that unpacks the characteristics that would be associated with motorized uses vs. non-motorized uses.
>
> Passive Recreation, referred to in the *Open Space Element* policies, is defined as ~~non-motorized~~ outdoor recreation with minimal impact on the land, water, or other resources that creates opportunities to be close to nature, enjoy the open space features, and have a high degree of interaction with the natural environment. Further,
>
> - Passive recreation requires no rules of play or installation of equipment or facilities, except for trails and associated improvements.
> - Passive recreation includes activities such as hiking, snowshoeing, cross-country skiing, photography, bird-watching, or other nature observation or study.

[2] The definition of passive recreation was updated in the most recent Open Space Element update in 2017 to include dog walking and boating if specifically designated. These common activities were addressed in the Parks & Open Space regulations but was not encompassed in the passive recreation definition before the 2017 update.

- If specifically designated, passive recreation may include bicycling, horseback riding, dog walking, boating, or fishing.
- Passive recreation is traditionally non-motorized. However, certain low-powered electrical-assist modes may be permitted if
    - Travel speeds are comparable to non-motorized modes or are dependent on the user's condition, skill, terrain, trail conditions, and weather
    - Noise is no greater than that generated by non-motorized modes or other uses
    - No pollution is emitted as a result of use
    - Potential trail damage is no greater than that caused by similar non-motorized modes, and can be mitigated through trail closures
    - Potential impacts to land, water and other resources are no greater than those caused by similar non-motorized modes

Option 3. Remove the reference to non-motorized recreation and add a bullet with language that provides guidance for evaluating the desirable characteristics associated with the new technology:

Passive Recreation, referred to in the *Open Space Element* policies, is defined as ~~non-motorized~~ outdoor recreation with minimal impact on the land, water, or other resources that creates opportunities to be close to nature, enjoy the open space features, and have a high degree of interaction with the natural environment. Further,

- Passive recreation requires no rules of play or installation of equipment or facilities, except for trails and associated improvements.
- Passive recreation includes activities such as hiking, snowshoeing, cross-country skiing, photography, bird-watching, or other nature observation or study.
- If specifically designated, passive recreation may include bicycling, horseback riding, dog walking, boating, or fishing.
- Passive recreation is traditionally non-motorized. However, certain low-powered electrical-assist modes may be permitted if they complement or enhance accessibility, sustainability, or the visitor's enjoyment without diminishing or damaging natural resource values.

Discussion

Option 1 is the simplest and most narrow way to update the passive recreation definition, and there is precedent for this approach with the addition of dog walking and boating in the most recent update of the Open Space Element of the BCCP. This list can be amended over time as needed when future technological advances are introduced. During initial discussions with the Planning Commission in 2018, and during the joint study session with the Board of Commissioners, one Commissioner and a couple Planning Commissioners expressed a preference to keep any changes to the passive recreation definition narrowly focused on e-bikes.

However, option 1 doesn't address the underlying reason for considering an update to the passive recreation definition: the emergence of low-power hybrid technology that doesn't present the negative qualities (loud, polluting, heavy, fast) of motorized uses such as the dirt bikes that were envisioned in the 1970s by the drafters of the definition.
Option 2 is an attempt to unpack the positive characteristics associated with non-motorized uses that are in direct contrast to motorized uses. Though interest in this approach was not strong during the initial Planning Commission discussion in 2018 or the March 2019 joint study session, staff feels that there is value in going through this exercise. Table 1 below presents a comparison of positive non-motorized

characteristics for bikes, e-bikes, and dirt bikes. E-bikes fit the measurable characteristics, highlighting the similarities between e-bikes and bicycles.

Table 1
Option 2: Unpacking Measurable Characteristics of "Motorized"

Characteristic of non-motorized use	Conventional bikes	e-bikes	Dirt bikes
Travel speeds are limited by terrain, weather, the rider's condition and skill	true	True for class 1 e-bikes Not true for class 2 if throttle engaged	False
Noise is minimal or no greater than that generated by non-motorized modes or other uses	True	True, though electric motors on older models may have slight noise	False
No pollution is emitted as a result of use	True	True	False
Potential trail damage is no greater than that caused by similar non-motorized modes, and can be mitigated through trail closure	Trail damage is a function of rider weight, bike weight, style of riding, and trail conditions.	True. The only study performed to date did not find significant difference in impacts caused by mountain bikes and eMTBs.	False. The same study found that dirt bikes cause significantly greater erosion and soil displacement than mountain bikes and eMTBs.
Potential impacts to land, water and other resources are no greater than those caused by similar non-motorized modes	Most recreation has a disruptive and potentially harmful impact on wildlife. BCPOS regulations require bikes to stay on trail.	Some evidence suggests that motorized recreation has a higher impact due to noise, which isn't a factor with e-bikes. Other research suggests that motorized uses cause less impact because they are more likely to stay on trail. This would not be a distinguishing quality because BCPOS regulations require all bicycles to stay on trail.	False

The criteria outlined above are measurable dimensions of user experience and trail/environmental impacts. However, research shows that many aspects of the visitor use experience aren't easily measured and are a result of perceptions influenced by exposure, experience, and social lenses. An example that may be instructive is the initial resistance to the introduction of snowboards by skiers. Part of the resistance had to do with the perception that snowboards were disruptive to the norms and traditions of skiing—in other words, low social acceptance of an upstart technology that was associated with rebellious youth. Snowboards were not allowed at a number of ski resorts in the early days, but they are now widely accepted.

Which brings us to option 3. Instead of enumerating the characteristics represented by "motorized" uses, option 3 attempts a more wholistic approach through a qualitative reference to county guiding values of inclusivity and sustainability.

A similar comparison for option 3 is presented in Table 2, illustrating that e-bikes meet the standard

Table 2
Option 3: Comparing more qualitative "Guiding Principles"

Characteristic	Conventional bikes	e-bikes	Dirt bikes
Complements or enhances accessibility	Access may be limited based on physical limitations due to certain lung, heart, muscle or joint conditions or due to aging. Access may also be affected by challenging terrain or distance.	True. Research shows that e-bikes enable people get out more frequently and for longer rides, contributing to both accessibility and positive health outcomes.	True, dirt bikes can enhance accessibility for individuals with some mobility constraints.
Complements or enhances sustainability	Ability for bikes to be a tool for sustainable travel may be limited by both the rider's physical condition and terrain.	True, e-bikes may enhance sustainability in the recreation arena especially if used to travel to a trail rather than drive.	Dirt bikes consume fossil fuels and emit pollution and not a tool for enhancing sustainable recreation
Does not diminish or damage natural resource values		True, no more damage than conventional bicycle, especially in the context of plains trails and regional trails	False

V. Electric scooters

Electric scooters, or e-scooters, are another emerging technology. Designed for "first mile" and "last mile" transportation, e-scooters have caused enormous disruption in the urban transportation space, and regulators have been struggling to catch up. On May 23, 2019, the Colorado Governor signed HB 19-122, updating the Colorado Revised Statutes that regulate the operation of e-scooters. Before this bill, electric scooters were classified as "toys" which meant they could be driven on sidewalks, but not on streets. Under the new amendments, electric scooters and low-powered scooters are excluded from the definition of "motor vehicles" (CRS § 42-1-102(58)) but are within the definition of "vehicles" (CRS § 42-1-102(112)). Similar to e-bikes, they do not need to be registered. Electric scooters are now generally permitted on roads except that local authorities can prohibit electric scooters from roads in situations where suitable bike paths, horseback trails, or other trails have been established on the right-of-way or parallel to it within four hundred fifty feet of the right-of-way of heavily traveled streets (CRS § 42-4-109(11)). Local jurisdictions would not be able to ban electric scooters from roads where there is no path that permits electric scooters.

The law allows local authorities to prohibit electric scooters on bike or pedestrian paths (CRS §§ 42-4-111(dd) and (ff)). However, CRS § 42-4-221(8.5) provides that "[a] local government may regulate the operation of an electric scooter in a manner that is no more restrictive than the manner in which the local government may regulate the operation of a class 1 electrical assisted bicycle."

Electric scooters are designed for urban transportation and not well suited to crusher fines or dirt trails such as those in Boulder County. While it is unlikely that they will be used on Boulder County trails both

because of their design and due to the location and surface of Boulder County trails, Boulder County cannot permit e-bikes on POS trails without also allowing e-scooters on the same trails.

Boulder County legislative staff is researching the intent of the bill and will propose amendments to the drafters in the coming legislative session to unlink the regulation of e-scooters and e-bikes. There has been no public discussion or staff analysis of whether to allow e-scooters on BCPOS trails and it is not clear that this would be problematic or desired.

VI. Discussion Questions

1. Do Planning Commissioners have questions about the e-bike pilot study research results?
2. Do Planning Commissioners have questions or a preference about the proposed options for amending the Comp Plan definition of passive recreation?
3. Do Planning Commissioners wish to consider electric scooters for inclusion in the passive recreation definition?
4. Any other questions or feedback?

VII. Public Engagement and Next Steps

The Boulder County Commissioners gave clear direction that the pilot period should include a robust public process to ensure that members of the public have a chance to weigh in on the merits of e-bikes on open space trails and potential changes to the definition of passive recreation.

2019 Public Engagement to date:

- Notices to public through all the usual channels including social media, list serves, press releases, etc.
- Public input form on department's e-bike webpage throughout the pilot period
- Three open houses in October (Longmont 10/2, Lafayette 10/3, and Boulder 10/6) to review research results and invite comment on the draft recommendation
- Courtesy updates to the Parks & Open Space Advisory Committee (POSAC)

Next Steps:

- Oct. 24 Public hearing at POSAC for recommendation to Board of County Commissioners
- Nov. 16 Public hearing for policy decision with Board of County Commissioners
- Dec. 18 Public hearing with Planning Commission for decision on passive recreation definition amendment

Attachments: All research documents and history of public engagement process are available on the county's e-bike page.

A. Final Draft Recreation Conflict Literature Review
B. 2019 E-bike Visitor Intercept Survey and Speed Observation Report
C. Boulder County Telephone Survey Results, Aug. 2019
D. Public Comments received through the county e-bike website, March-Sept. 2019

Attachment A

FINALE DRAFT

Literature Review of Recreation Conflict, and Bicycle and E-bike Research, Policies & Management

Prepared by Boulder County Parks & Open Space

October 7, 2019

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Executive Summary

As a rapidly evolving hybrid technology, e-bikes are challenging the notions of traditional passive non-motorized recreation. The goal of this literature review is to inform policy discussions and decisions for the quickly growing e-bike market in four of Colorado's northern Front Range open space programs: Boulder County Parks & Open Space, City of Boulder Open Space and Mountain Parks, Larimer County Natural Resources Department, and City of Fort Collins).

A 2018 nationwide study of nearly 1,800 new e-bike owners found that older adults and those with physical limitations use their e-bikes mostly for fitness and recreation, whereas younger adults tend to use their e-bikes more heavily for utilitarian purposes, such as replacing car trips for commuting, errands and hauling cargo. The electric-assist makes it possible for more people to ride a bicycle and generates more and longer trips. Many users feel safer riding an e-bike due to the increased confidence of getting through a wide intersection or navigating more challenging terrain.

E-bikes offer positive outcomes for accessibility and inclusion, and many agencies allow them as "other power-driven mobility devices" (OPDMDs) under Federal ADA guidelines. Several studies have established positive health benefits due to e-bikes, given that e-bike riders ride more frequently and longer. E-bikes are particularly attractive to aging baby boomers.

Safety, speed, crowding, and user conflict are common concerns related to bicycles generally, and these concerns are heightened for e-bikes. Recreation conflict literature suggests that most conflict follows an asymmetrical pattern, and research on e-bikes shows that experience informs perceptions. Several studies show that trail users who are unfamiliar with e-bikes express a preference to not share the trail with them, but the majority did not notice that they were sharing the trail with e-bikes. Similarly, once they were exposed to e-bikes, concerns about them decrease for many.

Another negative in the recreation arena is a concern about technical abilities and riders on e-bikes getting in over their experience levels or needing rescue. There is also a sense among some recreational mountain bikers that riders should "earn" their ride. There is not much research on the impacts of e-bikes to physical trail conditions. The only study to date found that soil displacement resulting from eMTBs was not significantly different from mountain bikes, and

both kinds of bikes cause significantly less damage compared to dirt bikes.

Ecologically, some evidence suggests that impacts due to e-bikes (erosion, noise pollution, effects on wildlife) are no different from conventional bikes, but e-bikes batteries may exacerbate problems associated with battery production and disposal. On the positive side, although they emit more CO2 than conventional bikes, the potential emissions reduction from e-bikes could be significant if widely adopted and used for utilitarian purposes.

Many Colorado jurisdictions have acted to allow some or all classes of e-bikes, including City of Boulder (certain multi-modal trails), Durango, Jefferson County, Eagle County, Summit County Rec Path, Rio Grande Trail. Many other local jurisdictions allow e-bikes by default under the August 2017 change in state law. Colorado Parks and Wildlife allow e-bikes wherever conventional bikes are allowed. In August 2019 the Department of the Interior issued an order directing all DOI lands (National Park Service, National Wildlife Refuge, Bureau of Land Management, and Bureau of Reclamation) to exempt e-bikes from the definition of motorized vehicles and allow e-bikes on all paths where conventional bikes are allowed, and provided agencies 30 days to develop proposals guiding implementation.

Chapter 1 - Introduction

Technology has the potential to act both within and outside the wilderness and outdoor recreation arenas. It not only has the ability to shape our preferences with natural world, but also our expectations of how wilderness and recreation areas should be managed. As technology becomes more mainstream in outdoor spaces, general concerns over its integration fall into three categories. 1) the accelerating rate of technological innovations affecting outdoor recreation and its incorporation into the mass market; 2) the increasing amount of social impacts (conflict, crowding, and displacement) and environmental impacts (increased erosion and wildlife disturbance); and 3) the structure and cultural roles of parks and nature.

One realm of innovation that is changing outdoor recreation preferences are electric-assisted recreation modes, including e-bikes, e-scooters, and e-skateboards. Electric-assist bicycles are a small but rapidly growing segment of the U.S. bicycle market, not just in the realm of active transportation but as a substantial contributor to outdoor recreation preferences. The regulatory landscape for e-bikes is also evolving as land management agencies at all levels of government, from federal agencies to state and local jurisdictions and special districts, are working to develop policies to address this emerging hybrid technology. In August 2017 a Colorado bill was enacted that updated the law that regulates the operation of bicycles in the state. Under the new law, e-bikes are no longer classified as motorized vehicles, and the definition is expanded to three classes. Class 1 and 2 e-bikes are allowed on bike or pedestrian paths where bikes are allowed unless local governments take action to prohibit them. Class 3 e-bikes are not permitted on bike or pedestrian trails unless local authorities take explicit action to allow them.

Definitions

E-bikes, also known as electric bicycles, powerbikes, pedelecs, or booster bikes, are bicycles with an integrated electric motor that does not exceed 750 watts of power.

- Class 1: Low-speed pedal-assisted electric bicycle equipped with a motor that provides assistance only when the rider is pedaling, and that ceases to provide assistance when the e-bike reaches 20 mph.

- Class 2: Low-speed throttle-assisted electric bicycle equipped with a throttle-actuated motor, that ceases to provide assistance when the e-bike reaches 20 mph.
- Class 3: Pedal-assisted electric bicycle equipped with a motor that provides assistance only when the rider is pedaling, and that ceases to provide assistance when the e-bike reaches 28 mph. Note: class 3 e-bikes are prohibited on all open space trails.

Funding and Scope

This literature review was funded by four land management agencies in the north Front Range of Colorado. Three of these agencies are in the process of evaluating policies regarding e-bike use on their trails in the wake of the changed Colorado State law, and the fourth will take up the issue in the near future:

- Boulder County Parks & Open Space (BCPOS) began a one-year pilot on Jan. 1, 2019 allowing e-bikes on certain open space and regional trails located in the plains of the county. Research conducted during the pilot period will inform a policy recommendation for electric-assist bicycle use on Boulder County open space and regional trails.
- Larimer County Department of Natural Resources (LCDNR) took the opportunity to consider appropriate regulations associated with e-bikes as part of its update to departmental regulations in 2018. The decision was made by LCDNR to allow Class 1 and 2 e-bikes on paved trails (which includes River Bluffs, Lions Park, and Long View open spaces). LCDNR does not currently allow motorized use on park and open space natural surface trails. LCDNR is in the process of collecting information on e-bikes via public outreach to include an online LCDNR survey, informal stakeholder meetings, and discussions with the department's two advisory boards to evaluate whether or not these policies should change.
- City of Fort Collins City Council started a one-year pilot program in May 2019 to allow Class 1 and Class 2 e-bikes on **paved** trails (currently prohibited except for users with a temporary or permanent disability). Prior to and during the pilot program, Fort Collins will conduct extensive education and evaluation to help inform future e-bike regulations.
- While the City of Boulder has allowed e-bikes on its multi-use paths since 2013 following a pilot study, e-bikes are not allowed on the city's open space and mountain

park trails. The city plans to take up a review of this policy in the near future.

The purpose of the literature review is to gain a better understanding of the demographics and use patterns of e-bike riders in the recreation sphere and to learn about positive and negative issues surrounding their use, from a visitor use perspective as well as impacts to trails and natural resources. Another goal is to discover how other jurisdictions are addressing these issues.

Because e-bikes are a relatively new technology with limited research results to draw from, the scope of this literature review includes research on recreation conflict more broadly, to uncover how this research might inform discussion about e-bike policies.

The scope of this research was confined to publicly available, peer-reviewed documents with the exceptions of articles within the Journal of Leisure Research the CU Boulder Norlin Library. This review drew upon literature from multiple research disciplines and numerous countries and regions, including China, Australia, Europe, Canada, and the United States.

Chapter 2 - Theoretical Frameworks for Recreation Conflict

This chapter explores the concept of recreation conflict, how conflict arises in outdoor experiences, and the user types associated with specific conflicts. Anecdotal findings often confuse the symptoms of conflict, such as vandalism and arguments, as the cause of conflict; yet the studies in this chapter found that conflict is as complex and diverse as recreation activity itself. Conflict can occur as goal interference (interpersonal conflict) or because of differences in social values and norms (social values conflict). In general, conflict originates through four interactions: activity style, resource specificity, mode of experience, and tolerance for diverse activities. Through an investigation of these interactions, this literature review will provide insight for identifying outdoor recreation management strategies related to emerging technology, specifically e-bikes, in Boulder County.

a. Evolution of Recreation Conflict Research

Recreation conflict has been a challenging topic for recreation managers since the 1970s. Early research defined conflict using the *discrepancy theory*, which states that dissatisfaction results from a difference between actualized and desired goals. In other words, conflict is an individual's dissatisfaction caused by the interaction of another individual's behavior [i]. In the 1980s, researchers measured conflict using the *goal interference model*, which states that conflict originates from the interference or interruption of goals among different types of users and assumes that users recreate to achieve specific goals or outcomes [ii]. By the 1990s, however, the *social values conflict* model became the preferred method for understanding conflict, stating that conflict arises among user groups who do not share similar norms or values. As a result, contemporary research explores the relationship between goal interference and social values conflict as direct contributors to recreation conflict [iii].

Because of its abstract nature, recreation conflict is viewed through two lenses: asymmetrical, in which conflict is felt by one user but not the other; and symmetrical, where both users experience conflict from the presence of each other. Studies identified in this chapter focus on both types of conflict and are primarily based on multi-use trail users, including hikers,

equestrians, mountain bikers, commuting cyclists, e-bike riders, 4-wheel drive users, all-terrain vehicle users, and snowmobilers.

The term "multi-use trail" is defined as any trail that can accommodate multiple users; however, single-use trails are considered as well, as they accommodate several types of activities. Other types of recreation are mentioned in this chapter to discuss the conflict that can arise between motorized and non-motorized recreation activities such as anglers, oar-powered boaters, river rafters, and motorboaters. Table 3.1 provides a list of research associated with recreation conflict.

Table 3.1 Studies on Recreation Conflict

Author	Topic
Discrepancy Theory	
Knopp & Tyger, 1973	Cross-country skiers & snowmobilers
Stankey, 1973	Backpackers & horse packers
Fishbein & Ajzen, 1975	Belief, attitude, intention & behavior
Lime, 1975	Paddling canoeists & motorboats
McCay & Moeller, 1976	Compatibility of Ohio trail users
Nielsen & Shelby, 1977	River-running in the Grand Canyon
Schreyer & Nielsen, 1978	Whitewater river recreation
Goal Interference Theory	
Jacob & Schreyer, 1980	Goal Interference Theory
Shelby, 1980	Motors and oars in the Grand Canyon
Gramann & Burdge, 1981	Effect of recreational goal on conflict perceptions
Adelman, Heberlein, & Bonnicksen, 1982	Paddling canoeists & motorboats
Jackson & Wong, 1982	Cross-country skiers & snowmobilers
Social Values Conflict	
Whittaker, Anderson, & Mosby, 1990	Oar-powered & motor-powered whitewater rafters
Kuss, Graefe, & Vaske, 1990	Visitor impact management
Watson et al., 1991	Hikers & mountain bikers
Watson et al., 1994	Hikers & stock users
Vaske et al., 1995	Interpersonal versus social values conflict
Ramthun, 1995	Hikers & mountain bikers
Vaske et al., 2000	Recreation conflict among skiers and snowboarders

b. Origins of conflict

Interpersonal (Goal Interference) Conflict

Interpersonal conflict is defined as the interference of goals based on the behavior of two or more user groups. For a conflict to arise, the two groups involved must have direct or indirect social interaction. For example, a hiker may experience interpersonal conflict if a fast-moving

mountain biker is attempting to pass [iv]. This type of conflict is often asymmetrical, such that the hiker may experience conflict with the mountain biker, but the reverse is not the case. This one-way pattern has been described in studies on water recreation activities as well. Paddling canoeists in the Boundary Waters Canoe Area in Minnesota disliked seeing motorboat users; however, the people using a motorboat enjoyed seeing and interacting with the canoeists [v].

Interpersonal conflict has also been observed in other forms of outdoor recreation, including hikers and equestrians [vi], oar-powered rafters, and motor-powered rafters [vii], as well as cross-country skiers and snowmobilers [viii]. In general, these studies have shown that recreationists who say they have experienced a negative interaction, either from a disruption in their intended activity or negative behavior from other user groups, tend to dislike the opposing activity or recreationists. Although the interpersonal concept is highly generalizable across recreation activities, it does not explain how conflict originates in the absence of contact among user groups.

Social Values Conflict

Conflicts are known to occur among different trail users and users within the same group, yet they can also occur as a result of factors unrelated to user activities altogether. Behavior and attitudes toward other forms of recreation present a source of conflict associated with differing norms or values often referred to as social values conflict [ix]. A study of interactions between llama packers and backcountry hikers in Yellowstone National Park, for example, found that despite low interaction numbers (fewer than 30% user encounters), 56% of backpackers expressed disagreement with the appropriateness of allowing llamas in the area [x]. Similar conclusions were found in a study between hikers and mountain bikers in the Rattle Snake National Recreation Area near Missoula, Montana. Roughly two-thirds of the hikers surveyed had not encountered a mountain biker but objected to their presence on the trail [xi]. In both of these situations, a difference in social values resulted in conflict even though the groups had little to no interaction. Unlike the interpersonal conflict theory, social values conflict focuses on an individual's perception of a situation, thus creating a conflict in the absence of direct interaction between users.

Although these studies consistently confirm the presence of interpersonal and social

values conflict, the procedures used to operationalize and manage social values conflicts are not conceptually explicit. In their study, Vaske et al. operationalize the social values conflict in two ways: 1) people who do not witness a behavior but believe it to be a problem, and 2) assessing the responses of people who express an interpersonal conflict with just knowing that other user groups are in the area. With the first method, problems arise because it is unclear whether people have a problem with a specific behavior or merely a difference in social values. A hiker, for instance, may avoid a particular area because he/she knows that mountain bikers are allowed to ride there. This response could have been received through second-hand knowledge or from direct interaction with a mountain biker at an earlier date. In this case, there is no guarantee that the reported problem represents a social values conflict, as it may be a result of something the respondents have heard, rather than firsthand knowledge. The issue with the second operationalization method is that it is difficult to measure social values on different subgroups. Some groups are classified based on observations or evaluations of behaviors, while others base their responses on previously learned information.

Merging Expectancy and Discrepancy Theory

Initial theoretical models for understanding recreation conflict focus on the origins of why conflict arises among user groups and how trail managers can resolve these issues [xii]. In this model and previously in the chapter, conflict is defined as the interference of goals as related to another's behavior. This definition is primarily based on both the expectancy theory, in which behavior is seen as goal-orientated and the discrepancy theory, where satisfaction is determined by the level of desired and achieved goals. Within this context, conflict is seen as a unique attribute of the discrepancy theory, where dissatisfaction is caused by the interaction or perception of two or more opposing goals.

Jacob and Schreyer suggest that conflict is linked to four significant factors:

1. *Activity style*: the personal meaning associated with a recreation activity, which may include the intensity of participation, equipment status, range of experience, and definition of quality.
2. *Resource specificity*: the significance accredited to the type and quality of resources used

in the activity. For many users, this difference may invoke a sense of possession and status based on the knowledge and expertise of the resource used.

3. *Mode of experience*: the varying expectations placed on how users should perceive and interact in the environment.
4. *Tolerance of diverse activities*: whether a user will accept or reject a lifestyle different from his/her own, which may result from differences in technology, attitudes, perceptions about the environment, resource consumption types, and social prejudices.

From these four factors, Jacob and Schreyer generated a list of ten propositions that suggest the conditions most likely to cause recreational conflict (Table 3.2). According to their findings, conflict is not purely objective but rather an interpretation of the experience, beliefs, and attitudes of a particular activity, whether or not physical interaction has taken place.

Table 3.2 Propositions of Conflict [xiii]
1. The more intense the activity style, the higher the likelihood of social interaction with less intense participants will result in conflict.
2. When the private activity style confronts the status-conscious activity style, conflict results because the private activity style's disregard for status symbols negates the relevance of the other participant's status hierarchy.
3. Status-based interactivity conflict occurs when a participant desiring high status must interact with another viewed as lower status.
4. Conflict occurs between participants who do not share the same status hierarchies.
5. The more specific the expectations of what constitutes a quality experience, the higher the potential for conflict.
6. When a person who views the place's qualities as unequaled confronts behaviors indicating a low evaluation, conflict results.
7. Conflict results when users with a possessive attitude toward the resource confront users perceived as disrupting traditional uses and behavioral norms.
8. Conflict occurs for high-status users when they must interact with the lower states users who symbolize devaluation of a heretofore exclusive, intimate relationship with the place.
9. When a person in the focused mode interacts with a person in the unfocused mode, conflict results.
10. If group differences are evaluated as undesirable or a potential threat to recreation goals, conflict results when members of these two groups confront one another.

c. Experience, Specialization, and Recreational Conflict

The propositions of conflict listed above (Table 3.2) and the discussion of social values and discrepancy theory as origins of conflict highlight interactions between users with different, motivations, values, and goals. The following section will further explore differences between users by examining the impacts of experience and specialization on recreational conflict.

Definitions and Measurements of Experience

Under its most basic definition, recreation experience is the amount of time or frequency of participation that an individual spends doing a specific recreation activity. Commensurate with higher degrees of participation, the experience is divided into three levels of expertise (novice, experienced, and expert) determined by the amount of knowledge an individual maintains about an activity [xiv]. These categories exist along a spectrum and are inherently subjective, highlighting the rationale used by many researchers for attempting to give standardized values to different levels of experience.

Some studies measured experience only, for example, asking respondents to estimate their frequency of participation for a specific activity [xv], while others have measured experience as a potential determinant of "recreation-related attitudes, preferences, and behavior" [xvi] by employing multi-dimensional indices of experience [xvii]. Such research led to a generally acknowledged belief that levels of experience and their associated differences in knowledge may determine the attitudes, behaviors, and preferences of individuals [xviii], thereby indicating significant discrepancies among participants of the same activity. These discrepancies and their effects will be discussed in the following section.

Dimensions of Experience

Empirical research relating specialization and experience have primarily included studies of water-based recreation, such as river-floating and non-motorized boating. This research found that experience dictates whether an individual chooses to participate in private vs. commercial recreation opportunities: i.e., more experienced individuals were less likely to be on a

commercial trip than a novice [xix]. This finding suggests that those with lower levels of experience may not have the equipment or knowledge-base to engage in the activity without professional assistance. A study of backpacker motivations in the Great Smoky Mountains National Park found that more experienced users rated their motivation for seeking solitude as higher than non-experienced users [xx]. More experienced users also expressed greater awareness of ecological disturbances and support for management than non-experienced users [xxi].

While several studies confirm that experience influences an individual's attitude, a laboratory study examining the relationship between experience and wilderness preferences found that both high-level and low-level experience respondents had similar attitudes about wilderness areas. The study also found that higher levels of experience corresponded with a "cognitive distinction among wilderness attributes" and a broader judgment about the acceptable state of place settings [xxii]. In other words, this study contradicts the previous findings by stating that experience has a marginal influence on place attachment. Such contrasting results highlight the complexity of measuring and interpreting the effects of recreation experience. In light of this complexity, other research has emerged that seeks to categorize specialization and the behavioral aspects of the experience.

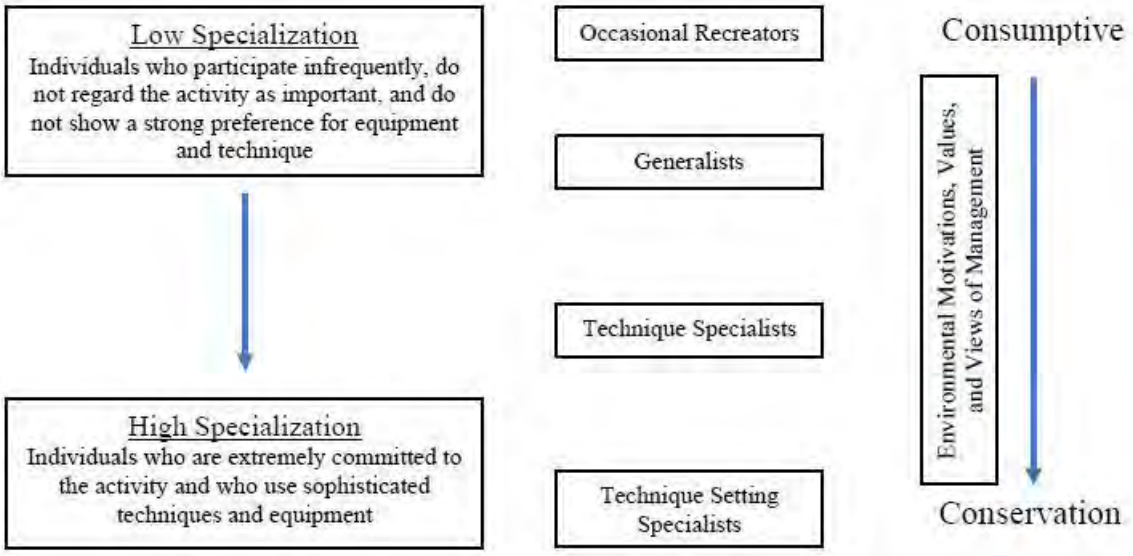
Specialization: Origins of the concept

Specialization research began with the work of Bryan (1977), whose primary goal was to provide "a concept for understanding and investigating diversity among outdoor recreationists engaged in the same activity." Specialization is not just a measure of involvement intensity, but a developmental process in which participants progress to higher stages of involvement as their length of activity participation increases. Several other researchers acknowledged and supported this belief in their research [xxiii], finding that specialization is associated with performing the activity itself rather than obtaining a goal.

Bryan expanded on this definition, stating that recreational specialization is "a continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport, and activity setting preferences" [xxiv] (see Figure 3.1). With each progressive stage, an individual's motivations, values, views of management (from consumptive to conservation-focused), and setting preferences are subject to change. In this way, specialization is a product of behavior

(length and degree of involvement), and attitudes and values (i.e., centrality to one's identity) and can be measured as such [xxv].

Figure 3.1: Continuum of Specialization Behavior (Bryan 1977, p. 323)



Specialization as a Progression

Scott and Shafer (2001) define specialization as a progression in three steps:

1. Focusing behavior: an individual will focus on one activity at the expense of other activities because of time and economic constraints.
2. Acquiring skills and knowledge: increased participation equates to decreased dependence on equipment.
3. A tendency to become committed to the activity, such that it becomes a central life interest: an individual will develop a strong behavioral and personal commitment to an activity, so much so that the activity becomes a central life activity, thereby defining his/her lifestyle, personal identity, and social networks.

Once the activity becomes a central life interest, it can further dictate familial and career decisions, allowing the individual to spend the maximum amount of time involved in the activity, either through proximity to recreation access, schedule flexibility, or on-the-job skill-building.

Personal investment can also include monetary expenditures, most often through the purchasing of activity-specific equipment [xxvi]. Scott and Shafer also note that progressing to high levels of specialization may induce social, physical, or temporal sacrifices [xxvii]. They propose this specialization is why many people choose to be generalists and participate in a wide range of recreation activities, thereby straddling multiple social and physical demands but presumably, enjoying the benefits of each.

The notion that increased specialization develops into a central life activity raised the question of how this progression affects costs or benefits. A study of bird watching and specialization found that the benefits of specialization outweigh the costs, especially in regards to the presence of "enduring benefits" or the social, physical, and emotional benefits experienced independently of time spent recreating [xxviii]. Furthermore, individuals who display a behavioral and personal commitment to an activity, but do not have high levels of skill or knowledge, still experience the same enduring benefits of the activity, which explains why individuals self-segregate based on their recreation interests and specialization. As individuals become more specialized over time, they experience the benefits of their activity, even if they never reach the elite levels that their peers do, likely reinforcing the tendency for their sport to become a central life activity.

The finding that specialization is proportional to the participation and commitment was corroborated by a study of anglers [xxix]. Findings suggest that high specialization anglers attached less importance to activity-specific experiences and more to non- activity-specific. Activity-specific experiences are associated with the mechanics of the activity itself, while non-activity-specific experiences describe attributes that surround the activity, usually in relation to the place setting. For example, as anglers become more specialized, they become less focused on the catch itself (activity-specific) and more focused on their experience on the water (non-activity-specific). In other words, building more confidence and specialization in a particular activity may alter the motivation for doing said activity.

This activity preference was also found to be associated with place attachments. Another study of anglers found that over time, highly dedicated or skilled anglers who are satisfied with the activity-specific elements are more likely to seek non-activity specific outcomes and acquire a secure connection to a place. Explicitly, in terms of place identity, over time (and with an increase in specialization) an angler equates a fishing site to a significant place in his/her life [xxx].

This research suggests that experience within an activity and access to the recreation activity significantly influence feelings of respect and adoration for specific place settings. The implications of this finding and others are discussed in the following section.

Implications for recreational management

From a management perspective, the relationship between specialization and place attachment is particularly compelling, especially when considering conservation practices. Using a comparison of willingness to pay (WTP), recreation specialization, and management support, Oh and Ditton found WTP positively affects recreation specialization and correlates to the "management support construct" (catch-related and general fishing regulations). The study also found consumptive orientation (the drive to fish with the motivation of catching and keeping fish) to be negatively correlated with WTP. Since WTP was used as a measure of awareness of environmental issues, the authors theorized that those with higher levels of specialization are more willing to support conservation efforts, while those with more consumptive orientations were less likely to support management they perceived to be "micromanaging." Given that this finding came from a study of anglers, its carryover to non-consumptive forms of recreation such as hiking, biking, and viewing wildlife is not necessarily clear-cut. However, the connection between high levels of specialization and high levels of management does suggest that management planning for high-use areas should consider the specialization of its visitors.

Given that specialization is seen as a progression of skills and knowledge, personal and behavioral commitments, and increased place attachment and conservation support, the question remains whether users across the spectrum of specialization create specific challenges for recreation management. A study of mountain bikers in North Carolina found that level of specialization was significantly related to trail attributes and that as specialization increased, the desire for more challenging and varied terrain increases. The study also found that mountain bikers across the specialization spectrum prefer to bike in natural/remote settings [xxxi], highlighting the importance of trail design and accessibility for recreationists across the specialization spectrum.

d. Specialization and Conflict: Anecdotal Findings

This chapter would not be complete without exploring how advances in recreation technology have impacted specialization, experience, and outdoor conflict. Innovations in material, function, and design have undoubtedly changed how people use recreation equipment and access the wilderness landscape. Although these advances might inspire some people to explore the outdoors, technology has also prompted conflict between users for various reasons.

A study of reservoir visitors in Oregon, for instance, found that motorized and non-motorized use prompted a symmetrical conflict, meaning that each party disliked the presence of the other. Distinct clustering between the user types and specialization was also noted, whereas both groups (motorized and non-motorized with both skilled and novice users) were adamant about floating near similar users and skill types. This study suggests a within-cluster similarity to the extent that recreationalists seemed desensitized to the obtrusiveness of individuals within their cluster [xxxii]. In other words, technology creates both an internal division within recreation groups and an external division between user types. (This section is abbreviated to include articles relevant to recreation conflict. To read more about technology and its impact on recreation, consult Chapter 5: Emerging Technology and Outdoor Recreation).

Anecdotally, online and intercept surveys conducted during Boulder County's pilot study revealed that cyclists with high levels of experience (i.e., pro-cyclist) are opposed to sharing the trail with e-bikes. The most common dispute is that e-bikes provide an unfair advantage for less-experienced riders who have not "earned their stripes" in the cycling world. Many online survey respondents significantly disliked e-bike use on trails because they believed less skilled riders would ride too fast and cause accidents. One respondent, in particular, sums up the general negative disposition toward e-bike users.

> *"During my commute to work, I am frequently passed on uphill by bikes going insanely fast. As in class 3 speeds. On flats, same deal. I can easily go 20-23 mph on flats, and these bikes pass me like I'm almost standing still…An accident caused by the faster moving and inevitably less skilled 20 something e-bike riders would be unavoidable. It is always the young 20-30 something riding the e-bike like a maniac." - Dawne Dem, 6/26/2019, Broomfield*

Overall, findings throughout this section suggest that experience and specialization can significantly impact an individual's attitude and preference toward other users and how

recreation spaces should be managed. Individuals with high levels of experience attach greater importance to activity-specific experiences, thus creating strong place-attachment characteristics.

e. Conclusion

Throughout this chapter, many variations on the origins of recreation conflict have been discussed, including interpersonal versus social values, asymmetrical versus symmetrical, and experience versus specialization. Interpersonal conflict occurs when an individual's activity interferes with the goals of another. A social values conflict arises out of a difference in norms or values between two parties, such as feelings toward environmental stewardship. Both types of conflict can have a symmetrical relationship, where each party feels equally put off by the other; however, most studies suggest that conflict follows an asymmetrical pattern. This pattern is also evident in studies on experience and specialization, where varying levels of expertise result in an asymmetrical pattern of conflict. Individuals with less experience in one activity showed more significant levels of aversion toward individuals in another activity, such as novice hikers and mountain bikers. Social values theory suggests that inexperience equates to reduced levels of self-identification with the activity, whereas novice individuals feel less comfortable interacting with other users. On the other side of the spectrum, a conflict between "expert" users tends to follow a symmetrical pattern, where highly skilled individuals believe their activity or social values outweigh other users or activities. From a management perspective, the connection between a high level of specialization and conflict suggests that managers should consider the specialization of its users when planning outdoor recreation areas. Higher skilled users require more specialized recreation features, such as technical mountain bike trail designs or white-water rafting areas, and should be separated from lower-skilled areas to accommodate all levels of experience.

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Chapter 3: Cultural Influences on Recreation

The "not in my backyard" or NIMBY phenomenon is an influential grassroots social force organized in response to proposed changes such as new developments or management shifts in the outdoor recreation space. In this chapter, the connection between NIMBYism, place attachment, and recreation are explored in an attempt to understand further the best practices for land managers seeking to alter lands under their jurisdiction. In addition, the well-developed mobility culture of several countries and regions is examined as means to explore the proliferation of e-bikes. Each of these cultural influences suggests that both the commuting and recreation landscape of a country or region is a direct reflection of its culture and underlying values. To further this finding, we suggest continued research examining the market share and use of e-bikes for recreation across demographics and regions in the U.S.

a. Place attachment and NIMBYism

The term "not in my backyard" (NIMBY) describes negative attitudes towards proposed development or change [i]. Stemming from an attachment to a place, these attitudes are often in response to a proposed development. The range of responses to such proposals can include public displays of discontentment such as sit-ins, protests, and organized protests. Such reactions have occurred in response to proposed additions and/or changes to a wide variety of proposed development that could pose environmental, social, or health impacts [ii].

In practice, NIMBYism is a powerful social force that can determine the success of a proposed development or management change. Part of this power derives from social-environmental phenomenon associated with the NIMBY mentality including place attachment, identity, and disruption;

- Place attachment is defined as both the process of attaching oneself to a place and the product of this attachment [iii].
- Place identity refers to the ways in which the physical and symbolic attributes of specific locations contribute to an individual's sense of self or identity [iv].

- Place disruption can be perceived as a threat or potential disruption to place identity or attachment. Such change can result in emotional loss or psychological trauma as these disruptions affect both the physical places themselves and the social networks that communities rely on [v].

Place attachment can predict recreation experience preferences which imply that an individual's attachment to a setting may influence their motivations of visitation and use. Furthermore, significant places can be a landscape in which social relationships are nurtured, affecting users to be more knowledgeable about the area, and seek solitude or personal growth [vi].

NIMBYism opposition is either a product of proximity, principle, or ignorance [vii]. For instance, an individual may support the development of wind farms as an effort to reduce carbon emissions but be opposed to having them visible from their house. This is a form of spatial discrimination and opposition determined by proximity. Examples of principle as determinant of opposition include individuals who hold a "not in anyone's backyard mentality." NIMBYism has also been conceived as a product of self-interest or ignorance and the so-called "information deficit" [viii] in which the public is perceived to be ignorant of environmental science and irrational in their response to perceived risks. Subsequent education and engagement are often deemed necessary to convert the public to a more "objective view." However, this view ignores the fact that many opponents of proposed projects or changes are highly educated and well-informed [ix].

NIMBY research often focuses on public perceptions of renewable energy developments. In a study of a proposed hydro development, place attachment was shown to explain differences in attitudes more than social demographics, finding a negative relationship between attachment and support of the project x. Research also shows that the type of attachment (social vs. physical) matters, with those who believe a place to be of social importance are less likely to oppose development than those whose attachment is based on the physical properties of a specific environment xi. According to this research, the most effective public engagement strategy should include a discourse that considers social psychology instead of discounting the emotional response of opponents. This engagement should be "mindful of the symbolic, emotional, and evaluative aspects of place attachments and place identities" [xii] (p. 437).

In many cases, however, public engagement does not always exclusively include the residents of a community, as there are often visitors to the area. Hence, this issue becomes more

complicated when the effects of tourism are factored in. NIMBYism can increase with an associated increase in the actual or perceived amount of tourism. This effect rests upon the amount of interaction that the residents of host communities have with tourists and the perceived difference between benefits and costs of tourism, including economic benefits countered by crowding and environmental impacts [xiii].

Neighborhood open space areas are a conduit for place attachment and NIMBYism. Such spaces can provide residents with recreational and aesthetic values and a variety of deeper nature-based psychophysiological and spiritual values [xiv]. A study comparing local greenway trails in Chicago to regional trails on the fringe of the city found local greenway trails to be used by those living less than a mile from the location and often under their own power. These users were more likely to be loyal to the trail, and not view other trails as substitutes for their experience. They were also more likely to use the trails for commuting (if possible).

Regarding regional greenway trails, users often drove to the trailhead, took longer trips, and were more likely to be first time users. The implications of this study are threefold;

- First, this study highlights the importance of developing trails in close proximity to neighborhoods in order to accommodate the recreation and commuting needs of its most frequent users.
- Secondly, regional trails in close proximity to diverse neighborhoods provide access to people across demographics [xv].
- Finally, each of these findings also suggests such an intense feeling of place attachment may impart NIMBY reactions if neighborhood communities feel that their beloved spaces are threatened by change or development.

NIMBYism Implications for Recreation

As discussed earlier, place attachment can impact the motivations of use and visitation [xvi]. This suggests that the physical or social characteristics of the trail are a determinant of its use. In addition, since place attachment and NIMBYism are closely related, it can be inferred that physical and social characteristics of a place may inform the degree to which an individual feels feel compelled to their cherished values and resist change [xvii]. In many land-use cases, the primary opponents are local landowners who oppose the development for various reasons. In the

case of less tangible changes, such as regulations for land use areas, the opponents of the issue are often trail users themselves. On one side, users may be wary of changes to their prized recreation area, while on the other side, people are ready to support changes in accordance with shifting needs and demands. This connection should be further explored as land managers attempt to answer whether specific trails with designated characteristics determine local opposition to change. With such knowledge, land managers could better plan for local opposition to change in areas under their jurisdiction.

In this section, the concept of NIMBYism and its role in curtailing or altering management decisions in recreation were explored. The next section will explore another cultural force by examining the mobility culture in the United States, Europe, and China as they relate to shifting transportation and recreation trends.

b. Cultural Influence on Mobility Culture in Europe, China, and the United States

Mobility Culture in Europe

The differences in mobility cultures amongst western nations have deep roots. Though the prominence of cycling culture differs among European countries, taken as a unit, their use is more widespread than in the U.S. Canada, Australia, and Britain [xviii]. Nordic countries lead the pack when comparing a city's mobility share (or the percentage of bicyclists out of the entire transportation sector) with the cities of Copenhagen and Amsterdam exhibiting 35% and 32 % cycling modal share in 2010 and 2012 respectively [xix]. The Dutch and the Danish are at least partially responsible for the so-called democratization of cycling. During the 1920s the bicycle became a national symbol of the Netherlands. This was due in part to the agreeable geographical conditions of the country. The country has little elevation change and relatively undeveloped cities and has promoted the egalitarian identity of the sport within the national imagination. This adoption was a result of a concerted effort by several Dutch cycling organizations and by government policies. This identity was strengthened in the WWII era, and while there was a brief re-emergence of car-dependence in the 1970s, modern-day Denmark and the Netherlands more closely resemble the culture of the 20th century. The result is a robust multi-modal mobility

culture that prioritizes and enables safe cycling through a diverse set of policies and cultural norms [xx].

A study by US transportation experts documented the conditions that support such a robust mobility culture [xxi]. The countries visited—Denmark, Sweden, Germany, The United Kingdom, and Switzerland—each exhibited numerous factors that contribute to higher rates of pedestrian and cycling safety, including:

- Integration of transportation and land-use policy
- Transportation planning and design policies that are mode neutral or give preference to vulnerable road users (bicyclists and pedestrians)
- Political support at all levels: elected officials, government staff, and the public
- High costs of owning a vehicle (sales tax, annual registration fees, gas, parking, and other fines)
- A comprehensive, continuous, integrated approach to promote higher levels of walking and bicycling

This integrated approach to cycling includes the widespread availability of public transportation, highly connected and accessible on and off-street bicycling networks, traffic safety education for school children that includes both knowledge and skill-based learning, routine photo enforcement to mitigate speed and traffic signal risks, and the prohibition of preferential treatment for cars such as no right-turn-on-red intersections [xxii]. The study also found many of the foreign hosts to have an established "urban street user hierarchy" giving preference to walking, biking, and public transit. This hierarchy supports several public policy goals, including livability, public health, sustainability, climate change mitigation, congestion reduction. The hierarchy also dictates the course of transportation planning, design, operations, and maintenance. Street designs under this planning process consider the needs of pedestrians and cyclists over the need of drivers. At the core of the planning mentality is the notion ‘of safety in numbers’ or the idea that when pedestrians are the most common urban-street user, motorists will take precautions and drive with prudence due to pedestrians guaranteed presence. This reduces conflict points and improves safety for all road users, thereby instituting a culture that promotes multi-modal transportation [xxiii].

Mobility Culture in the United States

While cycling in Europe has thrived since the industrial revolution, in the U.S. cycling did not take root until the 1950s during the post-war era [xxiv]. During this time, cycling increased in popularity with help from tourist bicycle organizations that transitioned the sport from its competitive nature into the broader community-driven realm of outdoor recreation [xxv]. Jensen's theoretical framework for studying different mobility practices suggests that these differences reflect different cultures, arguing that such cultures are more than just the result of planning and infrastructure but from the inner workings of culture and experience within a city. Jensen's model suggests that the bike as a recreation rather than commuting tool is a reflection of American culture [xxvi].

In contrast to the Netherlands and Denmark, in the United States (and in other western nations) the private car dominates the political, social, and infrastructure landscape. In effect, due to their sheer number and overwhelming comparative speed, cars have forced cyclists off the road [xxvii]. According to the 2017 American Community Survey, 76.4% of the 148 million Americans age 16 or older drove to work alone while only 2.7% walked and 1.8% traveled by other means [xxviii]. Politically, bicycle-friendly policies, if they exist at all, are not broadly supported and fail to incentivize individuals who might otherwise be willing to cycle instead of drive. In terms of infrastructure, reported travel time and type of infrastructure are the most critical factors in determining route choice. Specifically, bicycling facilities segregated from traffic are favored by cyclists [xxix]. Socially, cycling is still largely pigeon-holed into the realm of outdoor recreation and exercise. It is more closely associated with a childhood pastime, younger men, yuppie culture, or conversely with poverty and or low social status. In the U.S. there is a relatively small contingent of dedicated cyclists each of whom is intimately familiar with the prevalence of adverse bicycling conditions, and often adhere to an alternative lifestyle categorized by a rebellion against the dominant-SOV/economic culture [xxx].

In comparison to the U.S., cycling is more prevalent in Canadian cities. Even when controlling for population differences, the share of cycling is about three times higher in Canadian than American metropolitan areas. This may sound counterintuitive given the significant difference in climate between Canada and the U.S.; however, this result is caused by several convergent factors. Canada maintains higher urban densities and mixed-use development,

shorter trip distances, lower incomes, higher costs of owning, driving and parking a car, safer cycling conditions, and more extensive cycling infrastructure and training programs [xxxi]. These differences are a result of different land-use and transportation planning policies between the two nations and not from "intrinsic differences in history, culture or resource availability" (p. 265) as is likely the cause between Europe and the United States.

The result of this mobility culture is evident in nearly every major U.S. city. The car dominates while the bicycle and pedestrian are left fighting for space. The next section will explore the effects of this infrastructural and cultural landscape concerning e-bikes.

E-biking in Europe and the United States

Taking advantage of the existing physical and cultural infrastructure for conventional cycling, e-biking popularity is soaring in Europe. According to a Bosch market study conducted in 2016, there were 1.6 million e-bike sales across Europe, an increase of more than 22% from 2015 [xxxii]. The momentum for this market continues to increase as e-bikes continue to account for more significant percentages of market share with each reporting quarter. Table 3.1 illustrates this market share growth.

Table 3.1 2018 E-bike Market Share in Several European Countries [xxxiii]

Country	E-bike Market Share (%)
Austria	33
Belgium	50
Denmark	10
France	40
Germany	25
Netherlands	>50
Spain	11

There were early signs for this boom in popularity. A 2015 survey conducted in Norway found that when given access to an e-bike in exchange for their car, a so-called bike for keys swap, people increased their average number of biking trips and average distance per day when compared to a control group. In addition, biking as a share of total transport increased locally

from 28% to 48%. In comparison, the control group of conventional cyclists did not see an increase in the amount of cycling frequency, distance, or transport share. Finally, e-bike usage increased with time, especially for women [xxxiv]. This finding was echoed by a study of university students in the Netherlands that found a high-potential for e-bikes to be used by younger generations and as a substitute for public transportation use. However, the study also found the high price of e-bikes to be a limiting factor, as the price tag diminishes their competitiveness in comparison to conventional cycling and public transportation [xxxv].

E-MTBs in Europe and the United States

The acceptance of e-bikes extends into the European electric mountain bike (eMTB) community as well. The differences between the United States and Europe regarding eMTB acceptance start with different recreation expectations stemming from higher development density in Europe and less of the 'rugged individualism' found in the American West. This breeds a different outdoor ethic in which there is a greater emphasis on participation and recreation as opposed to a non-motorized, solitude-oriented ethos. Reportedly, e-bike interactions involve less of a pejorative 'you're cheating' attitudes and more of a 'good for you for being out here and riding' perspective. The omnipresent tourism infrastructure of Europe also allows for more investment in outdoor participation in general, but specifically in e-bikes as the newest avenue for revenue generation.

Tourism companies in the Alps are more inclined to accept e-bikes into their establishments since their trails are characteristically steeper and more technical than those in North America, and thus the allowance of e-bikes opens the door to more riders [xxxvi]. In addition, eMTB riders and regular MTB riders do not differ in their motivations to cycle, suggesting that the sport attracts similarly minded individuals [xxxvii]. In effect, MTB tourist destinations are merely expanding their infrastructure by providing charging stations for e-bikes on the trail, creating e-bike specific routes that cater to different experience levels, and hosting eMTB races. It is important to note that these destinations are not trying to dissuade or heavily regulate eMTB's; instead their goal is to attract these visitors in order to tap into this rapidly expanding market. This is in contrast to a land manager who is interested in providing the best recreation experience for all their users [xxxviii].

E-biking in China

Similar to the explosive growth of Europe, the Peoples Republic of China saw a boom of e-bike sales beginning in the late ’90s that has lasted well into the current era. Annual sales in 1990 totaled around 40,000 and grew to 10 million in 2005. As of 2013, this number had increased to 150 million [xxxix]. This rapid increase in popularity occurred well before other international growth. This was due in part because of their status as a low-cost and convenient means of private transportation for the average consumer, coupled with the promotion of e-bikes by local and national governments due to their low emissions, a vital consideration in the highly congested and polluted urban areas within the country [xl]. Despite e-bikes' popularity, however, the rise of the private vehicle has countered the dominance of the e-bike. The increase in car ownership is primarily concentrated in 20 large cities across China. These cities are centers of purchasing power and sustain the infrastructure and services necessary for private car ownership [xli]. Interestingly, both the increase of e-bikes and private cars derive from rising Chinese income levels, though the e-bike remains the most cost-effective of all personal motorized transportation options when considering maintenance, fuel, vehicle cost, and battery replacement [xlii].

Several other factors have contributed to these two transportation trends. The rise of the automobile has resulted in crippling congestion throughout many of China’s significant cities [xliii] pushing more people towards public transportation, bikes, and e-bikes. However, both public transit and biking face crowding in the form of long lines and hectic bike infrastructure [xliv]. In addition to private e-bike ownership, China is enjoying the proliferation of e-bike shares across the country. After a failed initial launch during the 2008 Beijing Olympics, Chinese cities have adopted both docked and dock-less e-bike-share systems in various cities across the county, giving rise to their popularity and use in crowded yet sprawling urban areas [xlv].

Increases of e-bikes have not occurred without significant issues. The main concerns articulated across the country involve: congestion, etiquette, speed, safety, and environmental impacts of lead in e-bike batteries [xlvi]. In many ways, these concerns mirror those present in the and will be further discussed in Chapter 5.

It is important to note that these issues primarily involve the use of e-bikes for commuting instead of recreation. In addition, many of these concerns arise from the literature on e-bike usage within bike shares across China. There is significant research on e-bike shares in

China and Europe, and while that research body is not the focus of this literature review, the discussion of them may be applicable to land managers who are considering e-bike usage close to urban centers where e-bike shares exist.

c. Discussion: Effects of Mobility Cultures on E-bikes and Recreation

It is not altogether surprising that the e-bike has gained quicker and more widespread acceptance as a commuting and recreation tool in Europe than in the United States given their differences in mobility culture. The history and egalitarian cycling culture in Europe predispose the region towards accepting new technology that makes cycling more comfortable and more accessible for recreation and commuting. While in the U.S. the car-dominant culture hinders widespread adoption. Likewise, on public lands there is a divide between areas open to motorized use and those exclusively reserved for non-motorized. Perhaps it is precisely because of these two factors, the dominance of the car and the limited areas in which bikes can purely be used for recreation that makes the acceptance of e-bikes into that recreation sphere so rife with conflict.

When considering this divide from a land manager's perspective, both in the forms of cultural resistance and infrastructure limitations, several questions come to the forefront.

- How can land managers balance the desires of those who do not want their recreation environment to change (NIMBYist) against a group of cyclists (e-bikers) from utilizing and enjoying off-road infrastructure?
- Can change the underlying restrictions governing motorized use on U.S. lands disassembles the dominance of the SOV?
- Is opposition to updating motorized use regulations a philosophical issue and do opponents maintain a “not in anyone’s backyard mentality?
- Is opposition to updating motorized use regulations a localized strain of NIMBYism induced by place attachment of neighborhood non-motorized areas?
- Does support either for or against change creates friction among trail users with the potential to increase recreational conflict?
- Can a prescriptive public engagement process surrounding e-bike use successfully change the minds of local opponents and decision-makers?

Unfortunately, there is little empirical research to provide answers. However, the response from major regulatory and public land agencies to updating motorized-use regulations will be explored in greater detail in Chapter 7.

As an interesting comparison to the unanswered questions on the domestic scale, China experienced the rapid proliferation of e-bikes primarily from government support. This top-down approach is unique within the global e-bike market since in Europe, Canada, and the United States e-bike proliferation has been primarily industry and consumer-driven. However, such growth occurred for commuting purposes in extensive urban areas rather than recreation on public lands. This result offers an exciting insight into how effective government programs can be in altering transportation in a county. Taken together, through the examination of each mobility culture it can be inferred that mobility has direct ties to recreation culture. However, more research is necessary to determine the exact extent of this relationship in each of the markets discussed above.

d. Lessons from Cultural Factors

The previous discussions about NIMBYism, mobility cultures, and e-bike popularity across the world highlight several key takeaways about the future of transportation and recreation.

- NIMBYism is a robust social force that is deepened by place attachment. Both forces can create significant resistance to change and give rise to barriers for recreation management regulation changes. Whether NIMBYism also affects the motorized vs. non-motorized debate, perhaps hindering changes to e-bike allowance in recreation areas, has yet to be fully explored.
- For cycling to flourish in the U.S., be it by conventional bicycles or e-bikes and for both commuting and recreation purposes, requires both cultural and infrastructure changes.
- There remains a different ethos surrounding recreational biking in much of Europe that fosters a more accepting market for e-bikes to enter.
- The sheer size of the Chinese economy, coupled with top-down support for the adoption of e-bikes led to the technology's proliferation.
- The Chinese market is not comparable when examining the recreation of e-bikes, given their primary commuting purpose.

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Chapter 4 - Emerging Technology and Redefining Outdoor Recreation

Advances in technology have always been accompanied by a familiar dissonance in opinion; those who embrace technology (early adopters) and those who resist or oppose change (Luddite). The term Luddite harkens back to the early 19th century in which English textile workers destroyed weaving machinery as a way of protesting job insecurity [i]. In its modern conception, a "neo-Luddite" represents a resistance toward a world where digital technology is inseparable from the daily human experience. Neo-Luddites do not employ the same destructive methods as their predecessors, but they still resist electronic, communication, data visualization, and media sharing devices. This resistance is also prevalent in the outdoor recreation field, particularly regarding electric-assisted bicycles, augmented reality, drones, and social media, and their appropriateness in wilderness areas.

This chapter explores the complicated relationship between outdoor recreation, emerging digital technology, and electric mobility modes (e-bikes, e-scooters, e-skateboards), illustrating both the resistance and acceptance to change. Comparisons are also made on the role of social media and its influence on perceptions and behaviors for both visitors and managers. The chapter concludes with a discussion on the implications of technology and its effect on specialization and level of experience in the field of outdoor recreation.

a. Virtual Reality & Augmented Reality in Outdoor Recreation

Virtual reality (VR) uses computer technology to create a simulated environment by incorporating sight, sound, touch, and smell that immerses the user into a deeper level of interaction than a traditional computer game. Currently, there are two kinds of VR technology on the market: virtual and augmented reality (AR). Aside from its gaming capabilities, VR has set the stage for inclusivity in other realms of life, mainly outdoor recreation [ii]. In a report by NPR, a man with muscular dystrophy was able to experience the sensation of surfing standing up. The technology provided the experience by using film from professional surfers and creating an immersive cinematic experience that convinced the man he was surfing [iii]. Outdoor brands like Moosejaw Mountaineering, The North Face, and Mammut are using the technology to make an emotional connection with their consumers. Like VR, augmented reality (AR) is rapidly

becoming a crucial means for people to experience outdoor spaces. Instead of completely immersing the user in a fabricated world, AR technology overlays virtual elements with real-life events, such as a virtual map of a city with interactive elements or activities.

b. Pokémon Go

Today, one of the most popular AR systems is Pokémon Go. During the first two months of its launch in 2016, downloads reportedly exceeded 500 million with users walking over 8.6 billion kilometers (The Pokémon Go Team, 2019). The popularity of Pokémon Go stems from its ability to facilitate physical activity through social interaction. In one preliminary study using location and sensor data, Althoff et al. (2016) found that Pokémon Go users had significantly increased their levels of physical activity after using the game. Similarly, a number of studies found that the game had motivated players to spend time outdoors, socialize with friends, bond with family, and make new connections [iv].

On the other hand, the game has been linked to several negative consequences such as traffic accidents, physical injuries, addictive and obsessive behaviors, and child safety issues [v]. A report out of Indiana found that within the first six months of its release, Pokémon Go contributed to roughly 145,000 vehicular crashes and 256 fatalities with an implied economic cost between $2 and $7 billion [vi].

Overall, these studies suggest that AR developers need to keep a close eye when it comes to the safety and welfare of their users; yet comparisons can be drawn about technology specific to outdoor recreation activities. Advances in micro-mobility modes can provide people with access to places they might not otherwise visit. Similar to the safety concerns surrounding AR technology, e-bike riders could potentially get themselves into risky situations (i.e., restricted areas, wild animal habitats, treacherous terrain) more so than conventional bikes because of their speed and power (e-bikes will be discussed further in section g. below).

c. Drones

Remotely piloted aircraft (RPA), also known as drones, are a broad category of small electronically controlled aerial vehicles. Advancement in drone technology was predominantly

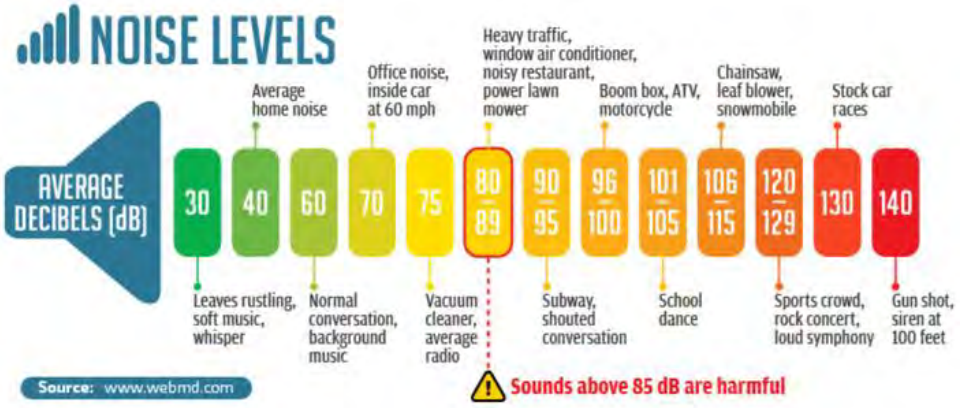
driven by the military, government, and industrial applications. In the past two decades, however, the rapid development of high-speed controllers and battery technology has led to smaller, more affordable drones that have considerably expanded that market for public use [vii]. Publicly available drones are significantly smaller than commercial drones but still require Unmanned Aircraft Systems (UAS) remote pilot certificate to operate [viii]. Despite their growth in popularity, the debate continues over the use and appropriateness of drones in wilderness areas with regards to wildlife and recreation conflicts, privacy, and safety.

Drones have been used for a range of applications in both scientific and commercial settings, which benefit from their affordability, versatility, transportability, and ease of use compared to piloted aircraft survey instruments. Drones also benefit wildlife and conservation managers, adding an essential capability to their observational methods and ecological data research. The absence of a human pilot allows flight operations into environments that might otherwise be too difficult, dangerous, or inaccessible [ix].

The appropriateness of drones in wildlife areas is also an essential topic for recreation managers in the United States. According to a survey of park and recreation personnel xv, 37% of respondents agreed that drones should not be allowed in outdoor recreation areas, citing noise, impact to privacy and the recreational experience. Those who agreed with drone use (42%) commented that drones could be a helpful management tool (i.e., security, data collection, disaster recovery). In fact, only 61% of respondents knew that parks and recreation agencies use drones for work-related purposes. Regarding drone policies, more than 50% of respondents said their community either prohibited drones or permitted them with limitations.

Although some commentary suggests that drone use in conservation management may reduce disturbance effects presented by human interaction, other research argues that drone interactions have adverse impacts, including those described in studies on black bears [x], Adelie penguins [xi], and seagulls and raptors [xii]. In these cases, a disturbance occurred at low altitudes when noise and visibility were high. According to a study measuring drone noise disturbances, both fixed-wing and rotary-wing drones produce an average outdoor ambient sound between 33-40 decibels [xiii]. The study also measured the sound generated from a large bee hive and found that they produced similar noise levels compared a single drone. On a decibel scale, these levels are comparable to noises generated inside a busy restaurant or moderate rainfall (see figure 4.1).

Figure 4.1: Decibel Scale



Currently, there are no studies measuring the decibels generated from electric bicycle motors or components, however, one study investigated how wind noise exposure can affect hearing for cyclists. The study found wind noise levels are proportionate to the speed and directionality of the wind current, from 84 decibels at 10 mph to a maximum 115 decibels at 60 mph. Given that it is rare for an average cyclist to reach speeds of 60mph or above, except possibly on long downhill sections with little wind resistance, it is unlikely that prolonged high decibel exposure would occur [xvi]. Additionally, the fastest commercially-made e-bike on the market (class 3) has a cut-off speed of 28 mph, which according to the study, could produce wind noises up to 100 decibels.

d. Social Media

In past generations, outdoor recreationists have enjoyed the tranquility away from technology; however, in recent years, this motivation has shifted to a culture focused on technology and social media. In a study of National Park attendance, researchers found that younger generations were apprehensive about exploring places without access to Wi-Fi or mobile data. With so much of modern life being inundated with wireless technology, many National Park managers have considered building infrastructure to support the demand. (The estimated number of U.S. wireless subscribers grew from 28.1 million in 1995 to 400.2 million in 2017 [xvii].) In 2013, the National Park Service (NPS) introduced a pilot program to test if visitor numbers would increase if they provided access to cell reception and internet services. In

conjunction with their mission statement--which is to provide high-quality opportunities and maintain an inviting atmosphere for all visitors--, the NPS believed that this addition would attract younger populations [xviii]. The pilot was introduced through a series of reception towers and mobile apps, which included amenities like trail map systems, wildlife identification, and emergency response support. Mobile apps, like the GPS Ranger in Cedar Brooks National Monument, were very popular with new visitors. Overall findings suggest that visitors enjoyed using the GPS ranger to navigate the park and learn about geology, wildlife, and plants more so than interactive signage or brochures. One reason for this response, according to the study, is that typical visitors arrive with only general expectations of the site, while GPS users tended to be more curious about their surroundings and used the GPS ranger to find information [xix].

Although support for the added technology was abundant, many visitors expressed opposition to the idea, stating that national parks should be a respite from the technology chatter. Several visitors believed that cell towers and internet services would diminish the natural beauty of the park. Others suggested that an increase in technology would attract people with less knowledge or skill level into the park, further diminishing the capabilities of rescue operations [xx].

> *"One of the worst trends we have seen in the past 20 years is the proliferation of cell phones and technology in the backcountry … It gives people a false sense of security. It is the idea that - who cares how bad of a jam I get myself into because if there is cell coverage, I'll just call and someone will come get me."* [xxi] - Tim Smith, an instructor at Jack Mountain Bushcraft School in Maine.

e. Strava, FitBit, and other Fitness Tracking Devices

Much like the controversy over social media platforms and their influence on outdoor recreation, one of the newest trends sparking debates in the last two decades is fitness tracking apps and devices. Using GPS, heart rate monitors, and a plethora of other tracking technologies, fitness trackers enable people to keep tabs on their personal fitness goals as well as the fitness goals of their friends [xxii]. Apps like Strava, Fitbit, My Fitness, and Google Fit and many others not only encourage users to push their physical and mental limitations, they can also provide a wealth of data for recreation administrators attempting to catalog and manager outdoor spaces [xxiii]. The growth of these apps (combined with the introduction of electrically assisted modes) however, has led to more people fabricating their fitness achievements.

A recent news article in the Wall Street Journal found that several Strava users were "cheating" on their fitness times (i.e., using an e-bike while recording their activity on a conventional bike). The app does allow users the opportunity to switch their mode of use via a drop-down menu, yet the problem lies with the overall scoring system. "The cycling segment leaderboards are for conventional bicycles," stated a representative from Strava, "and should only reflect human-powered achievement rather than unattainable, motor-assisted times." [xxiv] Despite these restrictions, much of the backlash against e-bike riders come from the purist cyclists who do not like having their king of the mountain scores defeated by an e-bike.

f. E-bikes, E-scooters, and E-skateboards

Electric-powered recreation modes (e-bikes, e-scooters, and e-skateboards) represent a unique and challenging problem for recreation managers and urban planners for several reasons. The first is a safety concern: because of their potential to reach higher speeds than conventional modes, e-powered modes may cause more collisions. Unlike traditional trail uses, electric-assist modes allow users to attain higher speeds, travel farther distances, and carry more gear/equipment. These characteristics can present safety problems for hikers, conventional bicycle riders, and horse or stock animal users who generally travel slower, shorter distances and carry less equipment [xxv]. Considering the speed and increased accessibility to natural surface trails, the impact of e-bikes on natural areas is similar to that of traditional bikes. A study by the International Mountain Bicycling Association (IMBA) compared the impact of a mountain bike with a pedal-assisted electric mountain bike (e-MTB) and a gas-powered dirt bike. Researchers concluded that the conventional and e-MTB had similar impacts while the dirt bike significantly displaced more soil [xxvi].

The second concern relates to the increased ability for riders to venture into more remote areas and their potential for trespassing in undesignated areas. Advances in electric motor technology have made it possible to travel longer distances while decreasing the overall weight and size of most electric modes. This aspect presents a problem for recreation managers as it could create more search and rescue operations for inexperienced riders as well as increased conflict with private landowners [xxvii].

The third concern is the potential increase in trail maintenance. Trail impact studies

reveal that bikes can decrease trail longevity (over a long period of time) and may degrade specific areas prone to erosion if managed improperly [xxviii]. Mountain bikes on natural surface trails, in particular, have been shown to cause environmental damages such as trail erosion, reduction in water quality and increased runoff, as well as disruption of wildlife and vegetation [xxix]. This disruption was also documented by Larson et al. (2016) in a global literature review of 274 articles on the effects of non-consumptive recreation on animals. Overall, the study found that 93% of the articles documented at least one effect of recreation on animals with the majority (59%) being classified as a negative impact.

Contrary to public perception, this review found that summer-based non-motorized activities were 1.2 times more likely to negatively impact wildlife than motorized activities. For snow-based recreation, non-motorized activities were 1.3 times more likely to disrupt wildlife areas than motorized. One explanation for this discrepancy could be that motorized trails tend to be more prominent and placed outside wildlife areas, creating a corridor of displacement that animals know to avoid. Non-motorized users, on the other hand, can travel off the beaten path more frequently, resulting in a less predictable travel pattern.

For an in-depth discussion on the ecological impacts of e-bikes and other motorized recreation modes, see Chapter 6: Costs and Benefits section f. E-bikes and Potential Ecological Impacts.

g. Implications of Technology in Outdoor Recreation

Although park and recreation managers have to deal with the influx of technology, the concerns over its integration into outdoor spaces fall into three categories. 1) the accelerating rate of technological innovations affecting outdoor recreation and its incorporation into the mass market; 2) the increasing amount of social impacts (conflict, crowding, and displacement) and environmental impacts (increased erosion and wildlife disturbance); and 3) the structure and cultural roles of parks and nature. One of the overarching themes within these categories is the increased pressure placed on park staff and recreation managers. Advances in recreation technology create more opportunities for people who might not otherwise venture into outdoor spaces. This influx of new, less experienced users can, and does, create conflict for individuals at a higher skill level as well as search and rescue operations. These findings correlate with the

theoretical framework of experience and conflict presented in Chapter 3: Recreational Conflict, which shows that experience dictates the level of voluntary risk. Visitors with experience in one activity, such as conventional biking, might be inclined to try e-biking without further educating themselves on the specific features because it seems familiar to them.

Technology also forces recreation managers to deal with diverse demands of specialized user groups, as each new technology-based activity creates clientele with distinct values, motivations, and attitudes. This increased level of management is what Weil and Rosen (1997) describe as "technoStress," which is the individual and societal costs of dealing with the consequences of technology. The impacts of technoStress affect outdoor recreationists and park managers in unique ways. Fifty years ago, for example, hiking on a backcountry trail required a physical map, a printed guidebook, a compass, and the expertise to operate and navigate these tools. Today, most people can explore remote areas via a GPS or other mobile application without having to read a physical map. For recreationists, these advances have been particularly revolutionary in terms of making outdoor spaces more inclusive and accessible. For park managers, these advances equate to higher visitor numbers in backcountry areas, which, if coupled with inexperience, can mean increased burden on search and rescue operations [xxx]. On the other hand, GPS technology has made it much easier for park managers to locate visitors in rescue situations.

h. Conclusion

Modern innovations have proven to be a double-edged sword for both recreation managers and users alike. Technological advances have significantly changed how people access wilderness areas through improved transportation, safety, comfort, and information; yet advances in recreation technology create more opportunities for people who might not otherwise venture in outdoor spaces. This influx of new, less experienced users can, and does, create conflict for individuals at a higher skill level as well as search and rescue operations. As a result, park managers have adapted their social, environmental, and cultural practices to accommodate this emerging brand of users. From the user's perspective, technology has significantly shifted how individuals perceive nature and pursue outdoor recreation opportunities. Modern technology allows us to venture farther into remote areas; yet will this traffic eventually alter the outdoor

recreation experience? Database and memory technology, combined with a higher level of public access, might take away the "unknown" aspects of recreating in nature so commonly associated with discovery and mystery. Instead of developing local knowledge from direct interactions, more decisions and expectations could be based on media-driven experiences.

Regarding the threat of increased noise pollution caused by e-bikes, there has been little research indicating that bicycles produce a substantial amount of noise compared to other transportation and recreation modes, although research on wind noise suggests that noise levels can be significant for cyclists depending on travel speed, and wind speed and directionality.

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Chapter 5 – Costs and Benefits of E-bikes

In this chapter, the positive and negative dimensions of e-bikes are examined. This research has occurred in response to the relatively recent market penetration of e-bikes and the associated concerns and potential benefits voiced by land managers, trail users, and transportation professionals. Concerns exist over e-bike speed and safety on roads and trails, as well as the potential ecological impacts. The potential benefits of e-bikes include increased accessibility for a diverse range of trail users, health and wellness effects, and congestion/emissions reduction.

a. Active Recreation and Health

Despite warnings about the negative health consequences associated with a sedentary lifestyle, a substantial portion of the population in the United States, Europe, and Asia remains physically inactive [i]. Regular participation in a moderately intense physical activity, such as walking, biking, or swimming, can provide essential health benefits. In 2007, the American College of Sports Medicine (ACSM) and the Centers for Disease Control and Prevention (CDC) updated national physical activity recommendations, which list the types and amounts of physical activity needed by healthy adults to improve and maintain health. Recommendations include new data relating physical activity to the sedentary lifestyle health concerns, such as an increased risk of cancer, anxiety or depression, cardiovascular diseases, overweight or obesity, decreased skeletal muscle mass, as well as elevated blood pressure and cholesterol levels [ii].

To promote and maintain health, the ACSM and CDC recommend all healthy adults, ages 18 to 65, need at least 30 minutes of moderate-intensity endurance physical activity five days each week (e.g., brisk walking) or 20 minutes of vigorous-intensity physical activity (e.g., jogging) three days each week. The updated recommendation states that individuals should strive to combine moderate- and vigorous-intensity activities into their daily lives [iii]. According to a 2017 report by the CDC on physical activity, fewer than 20% of American adults met the recommended amount of moderate-intensity activity recommendations, with 26% of adults stating they do not participate in any physical activity [iv].

While these recommendations may improve the well-being of the average adult, they do not take into consideration the roughly 43 million (13%) Americans living with a mobility disability [v]. Because most outdoor activities require some physical aptitude, the experience level for someone with limited mobility would be far less achievable than the average adult, yet recent advances in virtual (VR) and augmented reality (AR) seek to change this outcome. For a detailed discussion on VR/AR technology and its role in changing outdoor recreation experiences, see Chapter 4: Emerging Technology and Redefining Outdoor Recreation.

Health Benefits of E-bikes

Bicycling, both for commuting and recreation purposes, has been shown to improve physical performance [vi], health [vii], and prevent diseases associated with overweight or obesity [viii]. Several studies have looked at the health impacts of e-bikes by comparing physiological performance factors with traditional bike riding.

In the Netherlands, a study measured 12 physically active individuals while riding the same distance on an e-bike using three power settings: no power assistance, eco-mode, and maximum assistance. Measuring the heart rate, oxygen consumption, and power exertion of each rider, researchers concluded that all three power settings contributed to the riders' meeting the minimum physical activity requirements. Even with the maximum assistance, riders achieved the recommended physical activity intensity, which reduces the chances of sedentary lifestyle diseases. Not surprisingly, riders using the most assistance achieved higher average speeds and traveled a farther distance in a shorter amount of time [ix]. Although reducing the overall riding time can limit the amount of exertion, research suggests that those riding an e-bike tend to spend more time on their bikes than if they were using a traditional bicycle [x].

The results were mirrored by a study in Switzerland that sought to determine whether e-bikes could provide enough physical activity for users to gain health benefits [xi]. The study compared the metabolic effort of walking, biking, and e-biking in high and standard power-settings up a hill. The walking and e-bike trip with the high-power setting resulted in a metabolic effort of 6.5 and 6.1, respectively. The e-bike with the standard power setting and the conventional bike resulted in a metabolic effort of 7.3 and 8.2, respectively. Results show that e-bikes are effective in enhancing overall health through physical activity.

Similarly, a U.S.-based study measured rates of physical exertion on 19 users as they walked, rode a bicycle and an e-bike from the University of Tennessee bike-share system [xii]. Using a combination of laboratory, GPS, and onboard power meters, the research found that e-bikes require 21% less energy than a regular bike and 62% less energy than walking when considering overall trip characteristics, including distance traveled.

Another U.S. study from CU Boulder quantified the health benefits of replacing sedentary commuting (cars) with a class 1 e-bike. The study found that over a month, compared to driving a car, commuting via e-bike helped participants reach their physical activity recommendations, increased essential cardiovascular endurance, and improved blood sugar control [xiii].

Finally, a study in Germany measured the physical exertion rates for eight sedentary females who were instructed to ride an e-bike and a conventional bike along a 9.5 km route [xiv]. Significant findings of the study included that 1) e-bikes required less muscle activation in lower limbs, 2) reduced overall cardiovascular effort, 3) increased fat metabolism, and 4) reduced perceived exertion but increased enjoyment. Despite the lower levels of exertion required to pedal an e-bike, the total amount of energy used can improve health outcomes for most riders.

Overall, the research shows that e-bikes have a positive effect on physical activity and health. Trips using an e-bike contribute to improved health outcomes. Given that e-bike riders tend to ride more often and on longer trips than regular bike riders, e-bikes could contribute to improving physical activity levels for most users. E-bikes may start replacing other forms of transportation, yet they are not a complete substitute for meeting daily physical activity recommendations unless the total trip time and distance are increased.

b. Speed and Safety

Although much has been discussed regarding e-bikes and the health benefits they can provide to counteract sedentary lifestyle diseases, many studies have examined how their increased speed and distance affect user behavior, mainly as related to safety. As a reaction to these concerns, much of the worldwide regulation on e-bike use, designations, and purchases are focused on safety concerns. These concerns exist in both recreation and transportation literature, especially regarding the speed and safety of e-bikes when interacting with others. However, the

current literature provides insight into these concerns only in the transportation context.

Although e-bikes are an emerging form of transportation in the United States, several concerns are related to user behaviors rather than the technology itself. In New York City, for instance, until April 2019 riding an e-bike was illegal because it was considered riskier than a conventional bicycle. If caught riding an e-bike, the cyclist could be charged a $500 fine. Mayor de Blasio, who instituted the ban in October 2017, justified the decisions, citing that e-bike riders are more reckless and dangerous than other users on the road, despite motor vehicle data that suggested only 0.7% of vehicle collisions were caused by e-bikes in 2018 [xv].

In April 2019, however, after considerable backlash from voters and e-bike advocates, New York amended the ban on electrically assisted devices. In the State Bill S5294, legislators both redefined e-bike categories specific to New York City and how they should be operated, stating that all electrically assisted devices shall be treated alike, and abide by, all traffic laws applying to other human-powered devices. "Every person riding an electric device upon a roadway shall be granted all the rights and shall be subject to all of the duties applicable to the driver of a vehicle."

Although the ban on e-bikes in New York is an extreme example, the issue of user behavior continues to be a significant safety concern for many state transportation and recreation regulators. However, given the evolving status of e-bikes, most research to date on e-bike user-behavior is concerned with transportation instead of recreation. When faced with e-bike legislation, many legislators and stakeholders question the safety, speed, and allowed locations for an e-bike. This attitude holds for public opinion, too. As a part of an e-bike survey conducted in 2015 by the League of American Bicyclists, 72% of Americans stated their top concern was safety. Mirroring this concern, the State of California requires all e-bike riders to use a helmet but does not require helmets for regular bicycle riders. In addition to California, seven other states have helmet requirements, including Arkansas, Colorado, Connecticut, Michigan, Tennessee, and Utah. As another safety precaution, ten states restrict the operation of e-bikes to individuals over the age of 16 [xvi].

Perceived Safety and Behavior with E-bikes

One of the most common adverse reactions to e-bikes is that their potentially increased speed makes other trails or street users feel unsafe, yet evidence suggests that e-bikes can change riders' perception of safety compared to traditional bikes. In a North American survey, 60% of e-bike owners said they felt safer riding their e-bike, while another 42% said their e-bike helped

them avoid crashes. In both scenarios, reasons ranged from having enough acceleration to clear an intersection, keeping pace with traffic, and improving self-balance at higher speeds [xvii]. Similar results were found in China. In one study, women who rode an e-bike felt more confident about traversing an intersection than with a regular bike [xviii]. In another study, roughly half of e-bike riders thought it was safer than a regular bike [xix] (Lin et al. (2008). These findings were mirrored in Boulder County's 2019 pilot study in both the online survey comments and intercept survey. In both surveys, several respondents acknowledged that e-bikes would significantly improve their capabilities and confidence as a biker. Others recognized that e-bikes could be beneficial to aging populations and those with mobility limitations, while a few mentioned that an e-bike had replaced much of their car trips as observed by the following comments. (See results of the intercept and online survey for a more detailed description.)

> *"The electric-assist gives me the confidence to take longer jaunts to pearl street in Boulder (17 miles from home) or even to Lyons. The throttle is the thing that has surprised me the most. If I were to have to stop at a light or stop sign even on a weak incline, I might have difficulty getting started."*
>
> *"As a senior with a disability, being able to use my e-bike is allowing me to go outside, exercise, use my car less, and enjoy life!"*
>
> *"I have been replacing at least 50% of my car trips. I run errands, go out to dinner, go grocery shopping, and visit friends and family on my bike when I used to take my car."*

Like China, studies in the United States found that e-bike owners generally felt safer and tended to obey traffic rules (stopping at stop signs, hand signaling, alerting presence) compared to traditional riders [xx]. Many participants noted that e-bikes boosted their confidence on portions of the route that interacted with traffic. Several riders expressed that the throttle made it easier to stop at stop signs because they did not have to worry about making drivers impatient. Other participants felt very comfortable riding an e-bike simply because of its flexibility to operate as a conventional bike, as illustrated by this comment:

> *"I like the flexibility of it. I have a boost if I need to get through an intersection, but I can also slow down and mingle with pedestrian traffic on the sidewalk". - male, 51 comments (Popovich et al. 2014)*

However, some research demonstrates that an e-biker's increased perception of safety does not improve his/her on-road behavior. One study found that e-bike and bicycle riders behave very similarly in traffic control settings [xxi]. For both bicycle types, more than 40% of riders traveled the wrong way on directional roadway segments. For intersections with stop signs and traffic signals, the violation rates for both riders followed a similar trend, with a high violation rate at low speeds. Roughly 80% of riders did a rolling stop at speeds less than 3 mph, with 30% riding through at high speeds (above 8 mph). These high rates of violations for both conventional bicycles and e-bikes suggest the need for better bike-safety education, regardless of the presence of a motor.

c. Accessibility

Efforts by municipalities and advocacy groups to encourage biking for transportation and recreation have been associated with improvements in emissions reductions, economic development, public health, and social equity [xxii]. However, increasing the availability of bike infrastructure is not enough to single-handedly increase ridership [xxiii]. Several other barriers to cycling exist, including the expense of owning, maintaining, and storing a bicycle, as well as safety concerns based on motor traffic [xxiv]. It is likely that these barriers exist for recreational cyclists as well; however, most of the accessibility research has focused on using bikes for transportation. As a result, that body of research is reported here.

Despite municipal and advocacy efforts and, as mentioned in Chapter 4, across the United States, the single occupancy vehicle is the dominant mode of commuting to work. In 2013, 86 percent of American workers drove to work, and three out of four of these commuters drove alone. The percentage of pedestrian and bicycle commuters is paltry in comparison, as 2.1 percent of individuals walk and only 0.6 percent bike to work [xxv]. This disparity occurs despite the well-established economic, ecological, and social benefits of increasing rates of bicycle use for transportation purposes. Economically, individuals are more likely to stop and patronize a business from a bicycle than a car, and a bicycle does far less damage to roads than cars do [xxvi].

Ecologically, the bicycle provides a transportation option that contributes no noise or air pollution, both of which have negative health consequences for city residents [xxviii]. Finally, bicycle use encourages physical activity, thereby improving public health [xxix]. Given all these

benefits, one would expect city planning departments to invest in bike infrastructure projects to encourage bicycle use. However, such investments must be carefully considered, and it is difficult to discern how exactly to change people's modal choice for commuting. One of the most effective strategies done across the United States is to identify the primary barriers to biking among commuters. A study in Portland, Ore., identified the significant barriers to bicycle use to be safety concerns about motor traffic and the cost, expertise, and space required to purchase, maintain, and store a single bicycle [xxx]. Other studies have pointed to topography, the duration of the planned trip, and space limitations in terms of cargo and passengers [xxxi]. These barriers may affect individuals all at once, at different times in their life, or simply on individual days.

To overcome these barriers, numerous strategies have emerged through the work of municipal governments and community organizations. Figure 5.2 is a conceptual diagram that illustrates significant barriers to cycling and the strategies that seek to address them. This includes color-coded connecting lines that illustrate the connection of barriers to strategies.

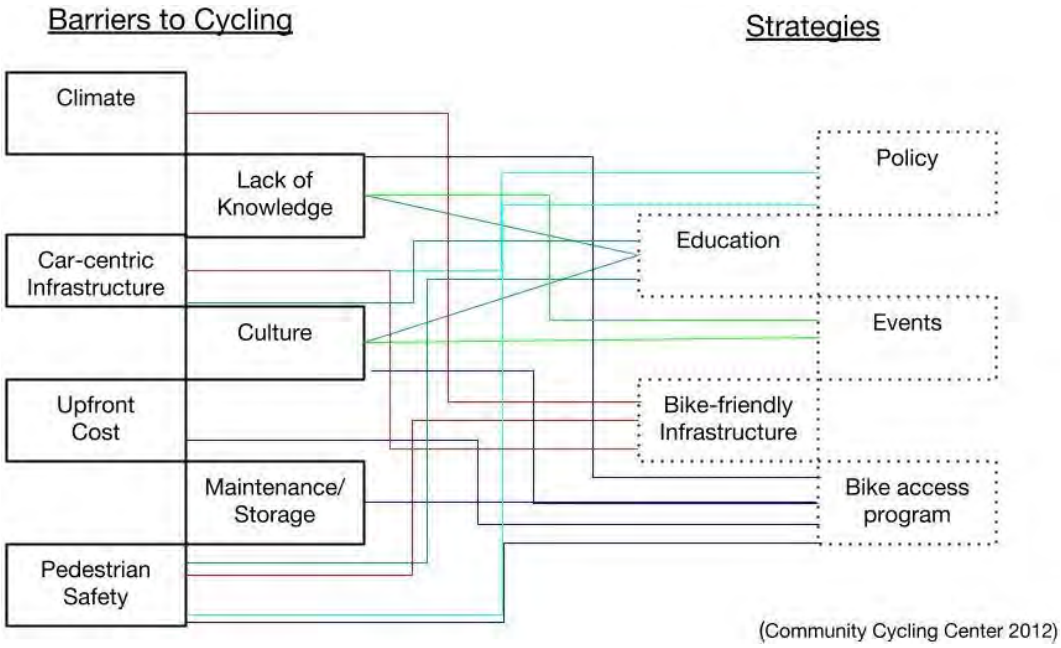

Figure 5-1. Barriers to cycling and strategies employed to address them. (Created by Sadie Mae Palmatier)

As illustrated by the overlapping and intersecting lines in Figure 6-1, multiple strategies can be employed to address the same barrier; and in the same vein, multiple barriers can be addressed by the same strategy. This nuance is especially crucial, given that it highlights the

interdependence of these strategies. For instance, public policies that aim to institute bike safety programs in local schools can create and further the goals of the "education" strategy while addressing the barriers of lack of (bike) knowledge and culture. Similarly, if policies address pedestrian and "bike-friendly infrastructure," the dominance of "car-centric infrastructure" and the concerns of "pedestrian safety" could be addressed. Although it is essential to highlight the mutually reinforcing nature of these strategies, it is perhaps equally important to recognize that there is no necessary order of implementation for these strategies to be effective. For example, the implementation of bike-friendly infrastructure and the hosting of bike-related events, such as a community ride, can happen simultaneously or chronologically. Although the results of the two-timing scenarios may differ from each other slightly, the overall effect will likely be the same in that there is an increase in knowledge about biking and perhaps a small reduction in car-dominance culture.

Research has found the same barriers to exist for e-biking as well. However, current research is still attempting to fully grasp how these barriers are affecting consumers rather than discerning the best methods to overcome them. As with conventional bikes, the associated cost of owning an e-bike can dissuade an individual from purchasing one. The most current averages, from January through June 2019, relate the average cost of an e-bike at $2,314, up 2.4% from the same period last year. On the low end, e-bikes can sell for around $500 from mass retailers and can exceed $10,000 for high-end road bikes or full-suspension electric mountain bikes [xxxii].

Moreover, the maintenance of an e-bike includes that of its motor, an added cost not found in conventional bicycles. Like cost, a barrier for potential e-bike users includes the fear of theft [xxxiii]. Since e-bikes are relatively expensive and the battery can be removed from the frame in standard models, theft is a concern. Some e-bike manufacturers have attempted to circumvent this issue by adding a locking function, thereby securing the battery to the frame [xxxiv] and lowering the possibility of theft.

In addition to cost, market penetration is hindered by the current state of technology: battery range/life-cycle, and weight of the bike. Depending on the type of e-bike purchased, batteries can have minimal ranges and lifespans. Associated with technology, the total weight of e-bikes is a barrier for many potential users, especially women and older riders who have difficulty lifting or maneuvering e-bikes (such as going upstairs or over curbs) when they are turned off or not being ridden, and therefore not using the pedal-assist function [xxxv].

E-bikes face the same infrastructure barriers as bicycles. The lack of sufficient bike lanes and perceptions of safety while on the road are both significant barriers to e-biking [xxxvi, xxxvii]. A study of e-bikes in Portugal found the absence of segregated cycle infrastructure and the absence of cycle lanes within the road infrastructure to be the first and second most significant barriers to cycling. This concern implies that bike infrastructure is at the core of the decision to bike or not to bike for e-bikes too.

However, a 2015 study from Zurich Switzerland, suggests that the presence and absence of bike infrastructure affect bicyclists and e-bicyclists differently. Using GPS tracking data, this study found that conventional cyclists were more likely than e-bikers to choose bike routes that included physically separated bike lanes, a street with low or banned traffic, and in areas that included cycling facilities. Conversely, e-bikers were more likely to ride in areas with increased vehicular traffic and listed "low traffic volume" as less essential criteria when deciding upon transit routes. Finally, although both e-bikes and conventional cyclists cited route choice that included "minimal distances" as a high priority, the perception of effort (primarily in uphill sections) from e-bikers was less than that for conventional cyclists [xxxviii]. Another unique infrastructure difference between e-bike and conventional bikes includes the presence of charging stations along popular bike routes. Based upon an individual's desired commute or transit route, the e-bike may need to be stopped and recharged, a severely limiting factor in the decision of using an e-bike as a commuting tool [xxxix] (Shao et al., 2012).

Similarly, E-Bikes also face policy barriers that limit their use to specific bike paths, designated greenways, or road access only. For instance, in Toronto, Ontario, e-bikes face the barrier of murky legal distinctions. In Ontario, e-bikes are grouped into the same class as e-scooters. This affects public acceptance and outreach and education efforts, thereby restricting their functionality as a practical transportation tool [xl]. Chapter 7 covers the status of other restrictions on public lands throughout the United States.

Although e-bikes face many of the same barriers as conventional bicycles, research has found several barriers not to apply or to apply to a lesser degree, such as weather, physical ability, and topography. A study of e-bike participants in and around Davis, Calif., did not cite weather as a limiting factor to using e-bikes as a commuting tool, but referenced their ability to bike on hot and windy days. In regards to physical ability, e-bikes have been cited as an "equalizer" for aging populations, those with physical limitations, and for those who may benefit

from extra assistance (Edge & Goodfield, 2017; Shao et al., 2012). E-bikes can also increase the distance traveled and the type of terrain ridden, making climbs seem less formidable [xli]. A reduction or elimination of these barriers opens opportunities for different types of riders, the results of which will be explored in the following section.

Who is Using E-bikes and How?

Given the dichotomy between the barriers present for e-bikes and those barriers that e-bikes eliminate, research is attempting to understand who is using e-bikes and for what purpose. Several demographic groups have been identified as those most likely to benefit from e-bike ownership [xlii]. These three potential beneficiaries of increased e-bike access and infrastructure include commuters, rural residents, and students.

- Commuters benefit from increased physical health, mental wellbeing, and affordability of transportation. They experience barriers to facilities, comfort, and ease.
- Rural residents can travel longer distances, connect to other transportation options, and have flexible ad affordable transportation. However, they also experience the barriers of distance and inadequate facilities.
- Students experience boosts to their independence, health, and cycling habit-forming, while affordability and image (e-bikes can sometimes be considered "an old-person's bike") plague their use [xliii].

One area of research that has not been thoroughly explored and could not be covered in this review is how e-bikes are expanding options for individuals with mobility disabilities. In many areas along the front range of Colorado, municipalities allow individuals to use e-bikes as other power-driven mobility devices (OPDMDs) on their open space and parks trails based on federal ADA regulations (as mentioned in Chapter 7). However, to date no empirical research exists to suggest the extent of which e-bikes are being used to this end in Colorado or elsewhere in the county.

d. Congestion Reduction and Potential Substitutability of E-bikes

E-bikes are like conventional bicycles in terms of function, yet their ability to maintain travel speeds and extend trip durations make them a reasonable replacement for other forms of transportation. E-bikes have the potential to overcome barriers associated with riding a

conventional bike, such as hilly topography, temperature and humidity, distance, and time spent riding between destinations [xliv]. One of the most frequent motivations for purchasing an e-bike is the ability to travel longer distances at a comfortable and efficient speed [xlv]. An online survey conducted in North America found that 65% of e-bike owners purchased an e-bike to reduce car trips. Within this group, 55% rode weekly or daily before owning an e-bike, versus 93% after buying an e-bike. Researchers also found that nearly 21% reported having a medical condition that limited their ability to use a conventional bike, and 60% of owners lived in a hilly area and wanted to ride with less effort [xlvi]. Similar results were found in Australia, with 42.6% of respondents buying an e-bike to replace a car trip [xlvii]. Most respondents, roughly 80%, rode their e-bike weekly, while 34% took daily trips.

Another study in China found a similar trend in e-bike purchases; yet the mode choices differed based on the respondent's original travel mode, sheltered (bus, subway, vehicle, or taxi) and unsheltered (walk, bike, motorcycle). Only 28% of travelers accustomed to sheltered modes were willing to use a conventional bike compared to 72% of unsheltered travelers. When given an e-bike, however, 47% of sheltered travelers and 53% of unsheltered travelers were willing to change modes. These results show that a behavior change could encourage a shift in mode choice. If travelers who usually take the bus, subway, or drive alone view e-bikes as an alternative and efficient mode, they might be willing to switch their daily trip patterns altogether.

As studies in China illustrate, e-bikes are becoming a dominant replacement for other motorized travel. In Kunming, for instance, 25% of all riders use e-bikes to substitute their car trips, and another 60% use them to replace public bus trips [xlviii]. This finding is replicated in other cities with high-quality transit systems, including Shijiazhuang [xlix] and Shanghai [l]. In both studies, researchers suggest that e-bikes replace short public transport trips more often than they replace automobile ownership. As described in these studies, most e-bike purchases are made by those living in areas underserved by public transit [li].

While e-bike market penetration has been slow in North American cities, there is evidence that they are replacing car trips. A survey of e-bike owners by the NITC found that roughly 75% of all respondents would ride an e-bike to replace a car trip, while 67% said that reducing the number of car trips was essential to them [lii].

e. Climate change mitigation

As described above, in the early stages of e-bike market penetration, some evidence suggests that e-bikes are replacing car trips. As a significant source of air pollution and greenhouse gas emissions, moving away from cars could be a significant shift [liii]. Estimates of the role of e-bikes in potential climate change mitigation via carbon dioxide (CO2) emission reductions are based on a modal share of e-bikes in the transportation sector. Currently, e-bike users fill a niche of green enthusiasts and early adopters of the technology. This fact is despite the potential for e-bikes to represent a more significant percentage of the modal share usurping the dominance of cars. The difficulty with achieving this reality is rooted in the fact that modal share and travel behavior are habitual; thus, getting more people out of cars and on e-bikes means breaking entrenched habits. A 2017 study performed a longitudinal assessment following participants of a two-week "keys for e-bike" demo period in Switzerland. This study found that after a year, habitual association with car transport had weakened substantially among study participants who purchased an e-bike and those who did not [liv]. This study suggests that prolonged exposure to alternative forms of transportation can decrease the habitual nature of relying on cars for transport.

This potential modal shift toward e-bikes is encouraging, as the reductions in CO2 can be significant. A 2019 white paper assessed these potential impacts. The study employed a CO2 reduction model based on transport modal share in the Portland, Oregon metro area, hypothesizing that a 5% modal share of e-bikes in the city would reduce CO2 by 307 tons/day and 112,049 tons/year. With a 15% modal share of e-bikes, these numbers would increase to 921 tons/day and 336,147 tons of CO2/year. At the 15% level, there would be an 11% decrease in CO2 emissions from transportation per day. When looking at an individual level, the study found cars to emit 274 g of CO2 per person mile, 140 g CO2/person mile for public transit and only 4.9 g CO2/person mile for e-bikes. As more utilities switch to renewables or electricity generation, the associated CO2 emissions from e-bike charging (and the charging of other EV's) may decrease [lv].

In Boulder County, transportation accounts for 30% of county-wide emissions [lvi]. In 2017, Boulder County residents drove 15.2 miles/day/person [lvii]. If e-bikes were to increase in modal share and the miles are driven per person per day were to decrease; the emissions

reductions and associated public health benefits could be significant.

These numbers reinforce previous research that concluded that significant emissions savings result from an individual changing his/her primary mode of transportation from a car to public transportation or e-biking [lviii]. It is important to note, however, that these potential climate change benefits would be a result of using e-bikes for commuting. Although this review intends to highlight that transportation possibility, it must be noted that using an e-bike for purely recreation or exercise purposes instead of commuting may introduce more carbon into the system. An exception is if an eMTB rider were to e-bike to the trailhead instead of using their car for transport. When an e-bike is used solely for transportation, the result is carbon-neutral [lix].

Although e-bikes have a relatively low carbon footprint, 4.9 g of CO2 /person mile, conventional bikes have a footprint of 0 g CO2 /person mile [lx]. In effect, when e-bikes are used recreationally, either as a potential substitute for a conventional bike or as a standalone purchase, they are introducing CO2. Although it is not a significant amount, it is essential to consider this effect and be aware of the full picture of e-bike impacts. To this end, the potential ecological effects of e-bikes are explored in the following section.

f. E-bikes and Potential Ecological Impacts

The previous section on climate change mitigation from e-bikes primarily focused on their urban use. However, e-bikes, including electric mountain bikes (eMTBs), may have associated environmental impacts as a result of both their production and use. Looking to the Chinese market, current figures estimate that 95 percent of e-bikes (of which many are possible "e-scooters") use lead-acid batteries. These batteries are primarily responsible for the demand of lead-mining in recent years throughout the country [lxi], and the subsequent disposal or recycling of said batteries are believed to be a significant source of environmental pollution and pose significant human health risks [lxii]. Given the environmental and health impacts associated with lead batteries, lithium-ion or li-on batteries have emerged as a vehicle-enhancing and healthier choice for e-bikes [lxiii]. E-bike manufacturers in Europe already employ these batteries almost exclusively [lxiv], and other emerging or transitioning e-bike markets (the United States and China respectively) are expected to follow suit lxv. Such a shift may bear its own environmental impacts; however, unlike the electric vehicle market, the link between demand and production of

e-bikes using li-on has not been empirically connected to adverse environmental impacts.

As with all batteries, lithium-ion batteries have a limited life-span. Although estimates differ, as reported by battery manufacturers, and can be increased or decreased depending upon the charging behavior of the rider, most e-bike batteries are expected to last around three years or 1,000 charge cycles [lxvi]. The life-cycle and production of e-bike batteries should be considered when assessing their role in broader sustainability goals.

eMTBs on trails

For land managers, research surrounding the effects of e-bikes on natural surface trails is of particular interest. Since e-bikes are classified by some as motorized vehicles, research on motorized and non-motorized effects is salient. This research comes from the field of recreation ecology or "the study of the environmental consequences of outdoor recreation activities and their effective management" [lxvii] (p. 1). Included in this research are the effects of trampling and visitor use on vegetation, soil, aquatic environments, and wildlife. Each of these uses is affected by the amount and type of use, timing and seasonality, environmental conditions, and spatial aspects [lxviii].

In a systematic literature review of recreational ecology research, Larson et al. (2016) found most reviewed studies (59%) asserting the negative impacts of recreation on wildlife. Recreation disturbances can have the following negative impacts on wildlife: decreased species richness or diversity; decreased occurrence, survival, or reproduction; decreased foraging, increased vigilance, and other behaviors thought to be a negative reflection of anthropogenic disturbances; and physiological conditions believed to be associated with disturbance effects, i.e., decreased weight and increased stress. Other responses can be labeled as positive or unclear. However, positive responses do not necessarily imply beneficial outcomes. For example, an observed increase in species richness could be a result of the proliferation of invasive species. Responses could be observed at the community, landscape, and individual level [lxix].

When analyzing the literature for the type of recreation practiced, Larson's study found that non-motorized recreation had more evidence of adverse effects than motorized. This result is likely caused by motorized travel is more predicable travel patterns, to which animals can more easily adapt. This study contradicts previous research that suggests more significant potential for

ecological impacts from motorized use because of the ability to travel greater distances, tackle more terrain at higher speeds, and add noise pollution in the area [lxx]. A 2004 study compared the disturbance levels of hiking, horse riding, mountain biking, and ATV use on deer and elk populations in Oregon. Measuring the furthest distance from each animal, researchers found that ATVs disturbed both deer and elk from over 1350 meters away, while mountain bikes, horse riders, and hikers were observed at 750, 550, and 400 meters, respectively. Overall, this study suggests that motorized recreation uses have greater impacts of wildlife. Given than e-bikes very similar to conventional bikes in terms of noise, trail impact, and speed, it is fair to say that their impact to wildlife habitats would be similar to other non-motorized bicycles [lxxi].

This study considered only the effects of motorized-vs-non-motorized recreation on wildlife. The study did not explore the effects of soil compaction, vegetation loss, or other trail degradation by recreation type. Previous research has found motorized uses to have negative impacts when compared to similar non-motorized activities. However, "motorized uses" in this research mainly considered ATV's, dirt bikes, and other large off-roading vehicles [lxxii]. Notably, these motorized uses do not consider e-bikes. To date, there has been only one study that documented the differences in trail impacts from conventional mountain bikes and electric mountain bikes (eMTBs). The study explicitly states that its scope was limited, being a small-scale field study; and, therefore, no broad conclusions should be drawn from the interpretation of the data. That said, the study did find that all trail users affect the surrounding environment, especially when the trails are poorly constructed. Some differences were observed at grade changes and turn between class 1 eMTB and mountain bikes. However, the study found that soil displacement from eMTB and mountain bikes was not significantly different between the two but was significantly different from motorcycles. These differences were expected because of eMTBs increased ability to accelerate and use speed through turns. The motorcycle's differences persist because of their relatively higher mass and throttle function, which allows for much greater acceleration and speed [lxxiii].

Despite these findings, public concerns about potential trail degradation caused by eMTBs persist. A 2017 study conducted in Fruita, Colo., found crowding, potential user conflict, and trail damage as participants' top concerns following the potential opening of popular mountain biking areas to eMTBs. In the same study, however, trail users who participated in the study's demo addressed another top environmental concern of e-bike allowance: noise pollution.

These trail users acknowledged how quiet the e-bikes were when demoed and saw similar trail impacts as created by conventional mountain bikes [lxxiv]. This fact suggests that public perception surrounding e-bikes' environmental impact may be at odds with observed effects. Given the limitations of the 2015 Oregon study and the conflicting findings of the 2017 Fruita study, more research is needed to evaluate both the social and physical impacts of eMTBs on trails.

g. Conclusion

The associated costs and benefits of e-bikes include numerous social, economic, and ecological factors in both the transportation and recreation space. The main takeaways from this chapter are:

- When disaggregated by trip type, age, gender, and physical ability, e-bike use varies substantially. Most notably, older riders or those with physical limitations are more likely to use an e-bike for recreational purposes. Younger riders, on the other hand, tend to use e-bikes for commuting purposes. This observation suggests that younger riders are using e-bikes to replace regular trips, while older riders may find more value in their recreational abilities on an e-bike.
- Research to date on the impact of e-bikes on cycling and car use suggests that e-bikes may facilitate more frequent cycling and trips of greater distance. In North America, Australia, and China, e-bikes are used as a replacement for some car trips or to increase/prolong recreation opportunities despite age or mobility disabilities.
- Owning an e-bike can reduce other barriers to cycling, including challenging topography and weather, while still being limited by the comparatively high cost of ownership, maintenance, and storage, heaviness, and fear of theft.
- E-bikes make riders feel safer and more confident navigating urban spaces, though riders display the same risky biking behavior as conventional cyclists. In addition, on trails e-bikes can more easily surpass other cyclists, hikers, or equestrians, raising concerns about their safety and trail etiquette.
- Ecologically, some evidence suggests that their trail impacts (erosion, noise pollution, effects on wildlife) are no different from conventional bikes, but e-bike batteries may exacerbate problems associated with battery production and disposal. In addition,

although they emit more CO^2 than conventional bicycles, the potential emissions reductions from e-bikes could be significant if widely adopted.

- Concerns about e-bikes mirror concerns about conventional bikes.

In summary, e-bikes allow more riders to pursue cycling for recreation or commuting with relatively few observed impacts. Despite this fact, public perceptions of e-bikes remain well aligned with decade-old concerns of conventional bicycles, including speed and safety and noise disturbance. More research is needed on both fronts, including trail-impact studies in a variety of conditions, life-cycle analyses of e-bike batteries, speed, and associated safety impacts, and the potential for expanded opportunities for people living with disabilities.

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Chapter 6: Recreation Management

Perhaps one of the most essential and challenging responsibilities of a land manager is achieving the elusive and precarious balance between optimizing visitor use experiences while protecting intrinsic ecological values. One must foster an environment that sits between a free-for-all and a "police state wilderness," between absolute autonomy and the enforcement of mandatory permits and visitor use regulations [i]. Implicit in this struggle is blending education and information efforts with use allocation and rationing [ii]. With the emergence of e-bikes, managing public lands has become even more complicated. This chapter will explore the numerous ways land managers have grappled with these issues, and the prescriptions empirical research can offer.

a. Management classifications

In recreation management literature, there are two significant classifications of management strategies [iii]. The first classification considers recreation opportunities/spaces and visitors as either a fixed or dynamic supply. For instance, when considering a fixed supply of recreation opportunities, a land manager may limit demand through restrictions that aim to reduce the number of visitors. In converse, a land manager may assume that the same number of visitors will come each year (a fixed demand) and thus attempt to modify the resource base (by creating more trails, etc.) in order to reduce adverse impacts and increase the durability of the landscape [iv].

A second classification schema categorizes actual management practices, including direct and indirect management [v]. Direct practices directly influence visitor behavior. An example of direct management includes restricting off-trail hiking through ranger enforcement and fee/fine systems. By contrast, indirect management practices "attempt to influence the decision factors upon which visitors base their behavior" (p. 275). An indirect approach could include an educational campaign about the fragility of alpine or riparian ecosystems and the individual visitors' direct role in their long-term health. Some studies point to indirect management as the most effective due to its low associated costs of enforcement and visitor preference [vi]. Others tout direct management prescriptions as the most effective since they regulate those users who

may ignore indirect management tactics [vii]. Finally, a contingent of researchers claim to manage along a spectrum of indirect to direct may be the most effective scheme, [viii] and a combination of the two—indirect and direct management—may complement each other.

These two management classifications include attempts to mitigate recreation conflict. Considering the supply and demand of visitation and recreation opportunities, a land manager can attempt to reduce crowding and thereby reduce potential conflict. Direct or indirect management practices attempt to influence user behavior and therefore create a more hospitable recreation space for all users. Both of these classification types are helpful frameworks from which to analyze and make decisions regarding used management tools: information and education and use allocation and rationing [ix]. Each of these tools will be discussed in further detail in the following sections.

b. Information and Education

Information and education are seen as an indirect management approach designed to "persuade visitors to adopt behaviors that are compatible with recreation management objectives, usually to reduce the ecological and experiential impacts of outdoor recreation." Large-scale examples of these approaches include the Leave No Trace (LNT) campaign and the Global Code of Ethics for Tourism. The research within information and education management has mainly examined four main categories

1. Influencing recreation patterns
2. Enhancing visitor knowledge
3. Influencing attitudes towards management policies
4. Addressing depreciative behavior (littering and vandalism)

Examples of practical information and education tactics include interpretive programs regarding guidelines and regulations given today's users, education campaigns using compelling programs within a designated area, bulletin boards at trailheads, and workshops or special programs for recreation groups [x] . Such tactics have to influence behavioral change in regards to on-trail behavior, knowledge of the area, attitudes towards management policies, and depreciative behaviors [xi].

c. Use Allocation and Rationing

Since its inception in the 1960s, use rationing and allocation has been viewed as a controversial tool as its prescription counters, the primary objective of public lands, which is to secure access for all people. Most commonly, use allocation and rationing are grouped into five management practices—reservation systems, lotteries, first-come-first-serve, merit, and pricing. These tactics were historically used in urban fringe areas and are currently employed in some aspects of the National Park and USFS system where outdoor recreation conflict intensity is most significant because of limited space, dense populations and a greater diversity of outdoor recreation [xii].

To effectively and fairly administer rationing and allocation, recommendations include emphasizing the social and environmental impacts of use instead of the amount of use since some activities may be more resource-intensive or damaging than others [xiii]. It is also recommended that use rationing and allocation methods be the last resort for land managers and that the decision to implement any such regulations be grounded in well-sourced and accurate information. This is especially important as new regulations could impact users and the landscape in unintended ways. A final recommendation includes implementing a combination of use-allocation so that the needs and restraints (both monetary and temporal) of multiple users are being considered. This last consideration suggests the importance of fairness in all decision-making within public land agencies. Actions must be perceived as efficient and equitable to calm public discontentment and build support.

Such support can be garnered through adherence to "distributive justice" or the "ideal whereby individuals obtain what they ought to have based on criteria of fairness" [xiv] (p. 296). This concept of distributive justice is understood within four dimensions: equality, equity, need, and efficiency [xv]

- Equality affirms that every person has equal rights to access.
- Equity, in its early definition, describes the equal distribution of benefits to those who have earned them through various investments (time, money, effort, etc.) — in the modern conception, achieving equity guarantees that access is not determined by forms of discrimination and oppression including race, class, culture, and gender [xvi].

- Need suggests that these benefits be distributed to individuals based on unmet needs or competitive advantage.
- Efficiency considers that benefits should be given to those who place the highest value (social or environmental) on them [xvii]

Another series of studies identifies eight potential dimensions of equity and applies them to a broad spectrum of outdoor recreation services/activities. These dimensions are categorized into compensatory, equality, demand, and market reasons for allocating benefits [xviii]. Either conceptualization of distributive justice can be a helpful theoretical tool when using demographic information to determine use allocation and rationing.

Carrying Capacity and Recreation Management

Most research on use limits and the subsequent applications of use allocation and rationing has been concerned with crowding in wilderness areas. This topic has long been of particular concern for land managers since over-crowding can have significant social and ecological impacts. The rationale for limiting use is based upon two principles: protecting the biophysical resources and protecting the visitor experience. As an attempt to enumerate the absolute limit of visitors that an ecosystem can sustain [xix], the notion of carrying capacity was adopted from the ecological sciences into recreation management. This application of carrying capacity falls within human dimensions research and examines how many visitors an area can accommodate without degradation to the physical environment and while maintaining a high level of satisfaction for visitors [xx].

As the questions of carrying capacity and use rationing and allocation relate to tourism, many researchers see carrying capacity as a flawed concept and predicated on unethical and self-validating beliefs [xxi]. Carrying capacity is tricky to define, and quite challenging to quantify.

Coupled with the fact that the relationship between impacts and use level is not predictable, attempting to make management decisions premised on these two observed factors alone will yield insufficient and largely inaccurate results.

In the words of the authors:

> *"Ultimately, the notion of carrying capacity implicitly assumes that human-environmental systems are stable – how else could a number that can be sustained over time be developed? Instead, such systems are highly dynamic – even non-linearly dynamic, and capacities would vary under different environmental and social conditions. Thus, designating a carrying capacity could only occur under the assumption that systems are static. If systems are dynamic, then multiple capacities over time would have to be estimated, as well as the state of the system predicted" (McCool and Lime, 2001 p. 383).*

For these reasons, researchers recommend that land managers identify acceptable outputs from tourism development—including desirable social and biophysical conditions—and then develop management plans that commit to establishing and maintaining strict standards of quality. This will be more effective and efficient than relying on the numeric estimates of carrying capacity. However, this type of regulation does nothing to quell potential public perception of overcrowding, even when managers are adhering to their guidelines. Changing such opinions would be better accomplished following information and education tactics [xxii]. A related field of management tools—spatial and temporal strategies—will be described in the following section.

Spatial and Temporal Strategies of Management

According to the recreation activity space consumption sphere, activities can be concerning each other in three ways, dependent upon the resource use they demand; compatible, partially compatible, and incompatible. Compatible activities include fly-fishing and nature-watching, partially compatible involve non-motorized boats and fishermen, while hiking and mountain biking are often considered incompatible activities. Incompatible activities require single-use resource allocations which in effect, detract from user experience when the resource is shared [xxiii]. Through direct regulation of where visitors may go, how long they may stay and when they may enter the area, management can attain the desired intensity of use for a particular site. Implicit in these techniques is a trade-off between the loss in the recreationists' freedom of choice and the gain inability of the site to more nearly meet visitor needs and objectives [xxiv].

Similar to the intent of reducing the number of people within a specific area of use at the core of use-allocation and rationing and carrying capacity designations, spatial strategies attempt to contain visitor impacts within acceptable limits both on their environment and with interaction with each other, often heeding the compatibility of activities. Four main strategies exist within the recreation literature, each of which is enumerated below [xxv].

1. Spatial segregation: a strategy that shields sensitive environments from any human contact or from conflicting forms of recreation from each other
    a. Zoning: the designation of users (within the same group or multiple groups) within a particular space
    b. Closure: a zero-tolerance policy that completely eliminates visitor usage of the area.
2. Spatial containment: a strategy that funnels all visitors into an established or designated area with the intention of minimizing the aggregate impact on the landscape.
3. Spatial dispersal: attempts to minimize permanent resource impacts or visitor conflict by reducing the frequency and intensity of use via spreading visitors across a landscape.
4. Spatial configuration: a strategy that creates spatially distinct facilities to reduce negative impacts of visitor behavior and use patterns

Examples of these strategies in practice include designated bike, hiking, or equestrian trails and trail-closures, national recreation areas within a wilderness area, multiple entrance points for a trail system or a rotation of trail closures, and spreading facilities for recreation across a municipality, respectively. Taken together or separately, these strategies can be useful in a concentrated setting, but also spatially distinct areas [xxvi]

Across the Front Range of Colorado, spatial segregation has been a tool used by land managers to limit the amount of interface, and hopefully, a conflict between user groups with competing goals and motivations, such as hikers and mountain-bikers. Such actions have been empirically cataloged in other parts of the country as direct responses to overcrowding and the observed displacement of sensitive visitors [xxvii]. For more information on federal and state regulations, please see the appendix. One study suggested that residents living in or around a park (in this instance, Acadia National Park) or another recreation area may display more displacement coping mechanisms than other tourists given their tendencies for place attachment and local knowledge of the area. As discussed in Chapter 3, this place attachment may give rise to NIMBY reactions if the local trail users feel their trails are being altered in some way. Given this knowledge of coping as a result of perceived crowding or conflict a thorough and community-engaged planning process is recommended. Specifically, one that incorporates public

participation geographic information systems (PPGIS) considered a best practice for creating and managing the best park experiences [xxviii]. In this process, spatial strategies can be used to ameliorate perceptions of crowding, conflict between visitors, and environmental impacts while reducing displacement of local residents or frequent visitors.

Temporal management has been used as a recreation management tool to reduce the skew of visitors to an area over time. These peaks of visitation can happen yearly (such as on holidays) or on a daily scale (lunch-time or after work). Peak visitations are also more likely to happen in areas closer to high-density urban areas regularly throughout the year, while alpine recreation areas tend to experience peak visitation during the summer months [xxix]. The management demands of this peaking phenomenon include providing facilities that can accommodate peak demand, and regulating crowding so as not to diminish visitor experience and prevent damage to flora and fauna of the area [xxx]. Examples of temporal management in practice include closing trails entirely on specific days or closures only towards particular groups on specific days. For instance, Betasso Preserve within the Boulder County Parks and Open Space System has hiker-only days. This system enables both users of the areas, hikers and mountain bikers, to have days when there is a lower chance of experiencing crowding. This version of temporal management is an attempt to reduce the documented phenomena associated with crowding, including displacement of individuals, conflict, and environmental impacts [xxxi]. As another example, Boulder County Parks and Open Space closes its properties from sunrise to sunset. This strategy reduces the responsibilities of park rangers and temporal opportunities for conflict.

d. Relating Research and Management

Sustainable Trails

Each of the strategies described above references the intent to instate management prescriptions that give the best possible opportunities for trails that both allow public access and concentrate impacts into a specific corridor. According to *The eMTB Land Manager Handbook,* this desire is synonymous with creating sustainable trails or a trail that "allows users to enjoy an area with minimal impact to the natural and cultural resources and requires only modest maintenance [xxxii]. Trail sustainability is usually conceived as having three dimensions: environmental, social, and economical.

- Environmental sustainability includes creating trails that enable minimal impacts such as erosion, soil compaction, etc.
- Social sustainability aims to balance the number of people who can access the trail by providing an exceptional trial experience. To do so, land managers can create three distinct types of trails, single-use, multi-use, and preferred-use.
    - Single-use trails only allow a single user type which can create targeted user experiences (such as technical single-track) and disperse traffic.
    - Multi-use trails allow two or more user-groups trail access. This trail type has the potential to accommodate the broadest array of users, build trail communities, support most visitors, and be the most cost-and resource-efficient.
    - Preferred-use trails allow two or more user-types access but are specifically designed to primarily accommodate only one of them. For example, a trail may entertain both cyclists and trail-runners but can be designed with cyclist specific elements such as technical descents or flowy single-track.
- Economic sustainability depends upon, and assurance of funding for trail maintenance and improvements over the trails expected lifetime [xxxiii].

Sustainable Trails and E-bikes

Given the potentially higher travel speeds of e-bikes as compared with conventional bikes, especially on uphill sections, People for Bikes recommends designating descending-direction trails as a way to mitigate use conflicts. Directional travel only reduces user interactions, reducing the speed differential, and mitigating adverse effects [xxxiv]. If this trail design is done in conjunction with other facets of sustainable trails, this design may work to increase the social sustainability of the area given the reduction of trail conflicts.

e. Conclusion

In this chapter, indirect and direct; information and education; use-allocation and rationing; and spatial management strategies were discussed. This chapter sought to give an overview of how researchers and land management agencies have navigated the management questions surrounding this emerging technology. The main take-aways from this research relating to e-bike management area:

- Crowding is a concern on public lands across the U.S. Spatial and temporal management strategies may be an effective means to alter visitor recreation patterns and thereby disperse visitor use, alleviate recreation conflict, and minimize environmental impacts.
- Local allowance of e-bikes differs at the state and local levels across the country. Several land management agencies have conducted pilot studies to analyze the potential effects of
- e-bikes within their jurisdiction. With such pilot studies, reports show community engagement to be a vital part of the process.
- Recommendations for e-bike management on trails range from descending direction trails to speed limits to restrictions on trail-width for e-bike use. Each of the regulations may increase trail sustainability and minimize conflict.
- Information and education management strategies may be useful when implementing e-bike regulations and for improving on-trail etiquette for all trail users.
- Public participation geographic information systems (PPGIS), maybe another helpful tool when determining how e-bikes are affecting a recreation area since they allow for public input on changes in conflict, displacement, and environmental impacts.
- Given the recent introduction of e-bikes into the outdoor recreation space, there is a paucity of research on e-bike management prescriptions. To further research in this field, we suggest follow-up studies from management agencies who have already decided upon the e-bike question in conjunction with empirical research that explores the efficacy of traditional management practices on e-bikes

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Chapter 7: E-Bike Regulations on Federal, State, and Local Lands

This chapter will provide a brief overview of e-bike classification and regulation at the federal, state, and local levels on public lands, roadways, and bike paths. For further reference to any jurisdiction discussed below, please see the Appendix.

a. Federal Regulations of E-bikes

Low-Speed Electric Bicycles

Federal regulations governing e-bikes were set in 2002 by HB 727 which designated a low-speed electric bicycle as "A two- or three-wheeled vehicle with fully operable pedals and an electric motor of fewer than 750 watts (1 h.p.), whose maximum speed on a paved level surface, when powered solely by such a motor while ridden by an operator who weighs 170 pounds, is less than 20 mph."[i] The designation of the 20 mph speed limit for e-bikes distinguishes them from motorcycles, mopeds, or other motor vehicles and as such, under the Consumer Product Safety Commission, e-bikes must meet the same safety standards as required for conventional bicycles. This law allows for e-bikes to be both pedal-assist (class 1) and throttle assist (class 2), however, it explicitly states that both e-bikes styles must travel under 20 mph when propelled by the motor alone. An e-bike may travel above these speeds but only from a combination of human and motor power.

This standard and the subsequent regulations affect only the manufacturing and sale of the e-bike at the federal level. The designation of where e-bikes are allowed however falls under the state domain. This gives local jurisdictions the right to restrict or allow e-bikes on streets and bikeways [ii].

Other Power-Driven Mobility Devices (OPDMD)

Under an interpretation of the Americans with Disabilities Act (ADA), e-bikes may be used as an OPDMD on certain public lands, along with electric wheelchairs, golf carts and other devices that provide mobility assistance. This use allows people living with mobility challenges the right to access the same lands as every other person unless the area has been specifically

designated as unsuitable for OPDMD use. However, this interpretation of the ADA is not uniform across U.S. land agencies (as discussed below) and therefore the list of accepted devices for use as an OPDMD may differ dependent on the trail or path location [iii].

Regulation by the Department of the Interior (DOI)

A recent order by the Trump Administration will change all regulations currently in place on land regulated by the Department of the Interior (DOI). Secretary Order 3376 was signed on August 29 by U.S. Secretary of the Interior David Bernhardt, directing all DOI lands to maintain a consistent regulation of e-bikes and increase recreation opportunities for all people by exempting e-bikes from the definition of motorized vehicles [iv]. Under the new proposed policy, class 1, 2, and 3 e-bikes are allowed everywhere conventional bikes can go on all National Park Service, National Wildlife Refuge, Bureau of Land Management, and Bureau of Reclamation lands. Each agency has 30 days from August 30, 2019, to develop a public proposal guiding implementation [v].

A summary of prior and current e-bikes regulations for each of the agencies under the Department of the Interior is outlined below.

National Parks Service (NPS)

The August 2019 e-bike policy will allow e-bikes on all park roads, paved or hardened trails, motorized-use areas, and administrative roads where conventional bikes are currently allowed. However, the order mandates that the e-bike rider must be pedaling to use the electric-assist function except in areas where there is public motor vehicle traffic. In other words, class 2 e-bikes may only use the throttle function while in traffic, and not on bike trails or paths.

This policy followed a trio of decisions by Acadia, Arches, and Canyonlands National Parks (in Maine and Utah respectively) to restrict e-bikes from areas currently open to bicycle traffic. It is not currently clear whether these three National Parks will be able to maintain these prohibitions or if they will have to reverse their decisions following Order 3376[vi]. The order has been met with pushback from regulators and the public who are frustrated with the lack of public process before the decision. In addition, this change may reinvigorate a fear held by a subset of the mountain biking community who worry that eMTB introduction on public lands and an

associated increase in demands on federal agencies will roll back hard-won mountain-bike access in similar areas [vii].

E-bikes are currently allowed on paved roads within U.S. National Parks and have grown in popularity, particularly within urban parks. E-bikes as a commuting tool are also encouraged for NPS staff in and around the park. This current use complies with NPS policy that regulates e-bikes as motorized vehicles, restricting them to roads where conventional bicycles and other cars are allowed. Per federally established rules, e-bikes are classified as such since they have an engine and are not exclusively human-powered. For this regulation to change in any park location, the superintendent of the park would be required to undergo a thorough cost-benefit review process that considers NPS criteria of "appropriate use" for the vehicle in the designated space. These criteria include:

- Consistency with applicable laws, regulations, and policies
- Consistency with existing park plans for public use and resource management
- The actual and potential effects on park resources and values
- The total costs to the Park Service
- Whether the public interest will be served [viii]

In regards to accessibility within the park system, NPS defines assistive devices as mobility aids that can be used both indoors and outdoors. This designation allows electric wheelchairs on all trails but does not permit e-bikes since the latter is only acceptable for outdoor use.

In the 2018 NPS Active Transportation Guidebook, NPS acknowledges the increased access of land and for people, utility, and emission reduction benefits of e-bikes. The handbook suggests that land managers for specific parks determine e-bike use on a trail by trail basis by considering surrounding resource characteristics, trail use-volume, trail type and width, speed and safety, and soil conditions [ix].

<u>Bureau of Land Management (BLM)</u>

Following the August 2019 Secretary Order 3376, e-bikes are no longer classified as

motorized vehicles and will be allowed on all BLM trails where conventional bikes are currently allowed x.

Prior to Order 3376, the BLM considered e-bikes as motorized vehicles under CFR 8340.5. They were prohibited on non-motorized trails, and thus only allowed on roads that permit cars, dirt bikes, and ATVs [xi]. However, now, e-bikes are allowed wherever conventional bikes are allowed [xii].

National Wilderness Preservation System

Wilderness areas are closed off to conventional bikes, as areas must be considered "untrammeled" to received wilderness protections under the Wilderness Act. As such, e-bikes are not allowed in wilderness areas [xiii].

Regulation by the Department of Agriculture

United States Forest Service (USFS)

Under the Travel Management Rule (TMR), the USFS defines motor vehicles as "any vehicle which is self-propelled, other than: (1) a vehicle operated on rails; and (2) any wheelchair or mobility device, including one that is battery-powered, that is designed solely for use by a mobility-impaired person for locomotion, and that is suitable for use in an indoor pedestrian area." 36 CFR 212.1[xiv]. Under this classification schema, e-bikes do not qualify as an Other Power-Driven Mobility Device (OPDMD) given that they are self-powered, not solely designed for use by a person with a mobility impairment and are not suitable for indoor use as a mobility tool. As such, under the TMR, e-bikes are regulated as motor vehicles and are subsequently only allowed on roads, trails, and other lands that have been recognized for motorized use.

Administrative units and ranger districts may introduce new opportunities for riding e-bikes as they update their motor vehicle use map (MVUM). However, any changes to management require environmental analysis and public participation prior to changes [xv].

Special Permits – Ski Areas

E-bikes are currently allowed on the summer trail-systems in multiple ski areas across the country. Such allowance is due to the ski area's special use permit with the USFS in which the leased land can allow e-bikes despite being on USFS lands. These trails often include lift-serviced downhill mountain bike parks as well as other trail networks for a diverse set of riders. Ski areas that currently allow e-bikes include Mammoth Mountain, CA; Steamboat Springs; and Purgatory Resort, Copper Mountain, Breckenridge, Keystone, CO [xvi].

b. State Regulations of E-bikes

At the state level, e-bike laws are variable. About 2/3 of states have "model" or "acceptable" legislation (as designated by the Bicycle Product Suppliers Association and People for Bikes) on the books. "Model" legislation regulates e-bikes within the three-class tier system, whereas "acceptable" regulates e-bikes as a bicycle. The final 1/3 have no working legal classification or regulation surrounding e-bikes and their use. Such legislation mainly includes regulation of e-bikes on roadways and segregated pedestrian paths or greenways. Concerning e-bikes on trails and public lands, e-bikes are allowed in state parks across Colorado, Delaware, Florida, Louisiana, Missouri, Minnesota, North Dakota, New Mexico, and Utah in areas where bicycles are allowed [xvii]. In California, class 1 and 2 e-bikes are allowed everywhere where conventional bikes are so long as they have not been explicitly prohibited.

Similarly, Pennsylvania recently revised its guidelines, allowing for class 1 e-bike allowance on State Forest trails anywhere that a conventional bike is allowed. Wyoming State Parks is considering a similar policy and planning a pilot program to evaluate the effects of allowing class 2 e-bikes as well. Similar to Colorado, several of these states have also allowed for local jurisdictions the right to restrict e-bike use within cities and counties [xviii]. For more detailed information on other U.S. states, please see the appendix.

c. Colorado State Regulations of E-bikes

In Colorado, e-bikes are considered bicycles so long as they have two or three wheels, fully operable pedals, and an electric motor that does not exceed 750 watts. E-bikes are exempt from motor vehicle requirements, including license and registration. E-bikes must conform to the three-tier classification system and be labeled as such with the top assisted speed and motor wattage. Any updates or alterations to the original e-bike must be met with an updated label.

Class 1 and 2 e-bikes are allowed on the same pedestrian paths as conventional bicycles. Class 3 e-bikes can only be ridden on pedestrian paths if it is within a street or highway or permitted by the local jurisdiction. However, local jurisdictions have the authority to prohibit any and all e-bike use on bicycle or pedestrian paths at their discretion [xix]. These alterations are summarized in Table 7.1 below

Table 7.1 E-bike allowance by trail type in several jurisdictions within Colorado.

Jurisdiction		Type of Trail/Area Where E-bikes are Allowed		
	Natural Surface[1]	Improved Surface[2]	Paved	Motorized Use
U.S. Forest Service				I, II, III
U.S. Forest Service Special Use Permit	I, II			
Bureau of Land Management	I, II, III			I, II, III
National Park Service	I, II, III		I, II	I, II, III
Colorado Department of Transportation			I, II, III	
Colorado Parks and Wildlife	I, II		I, II	I, II
Boulder County Parks and Open Space*		I, II,		
City of Boulder Open Space and Mountain Parks				I, II
City of Boulder Multi-use Paths*			I, II	
Larimer County Department of Natural Resources			I, II	
Fort Collins Natural Areas Department*			I, II	
Fort Collins Moves*			I, II	
Roaring Fork Transportation Authority			I	
Summit County Open Space & Trails			I	
Jefferson County Open Space*	I		I, II	
Eagle County Trails			I, II	
City of Durango Parks & Recreation *			I, II	
Village of Snowmass Transportation			I	
Town of Aspen Transportation			I, II, III	
City of Grand Junction*			I, II	

I = Class 1 e-bike II =Class 2 e-bike III = Class 3 e-bike

* Designates pilot study conducted prior to management decision

1. Natural Surface = Dirt trails with ongoing management
2. Improved Surface = Crush or fine gravel trail additions with ongoing management

Colorado Department of Transportation (CDOT)

CDOT has not adopted a formal policy following the 2017 state law change. CDOT has followed the prescription that e-bikes are allowed everywhere bicycles are allowed and haven't specified regions in which they are not. In the case of the US 36 bikeway, the path crosses 5 different local jurisdictions, each of which is responsible for setting their own policy and maintenance. To date, no involved jurisdiction has banned e-bike use on their section of the bikeway [xx].

Colorado Parks and Wildlife (CPW)[xxi]

- E-bikes use on CPW lands
  - Class 1 and 2 e-bikes are allowed the same access as road bikes and mountain bikes, while class 3 e-bikes are only to be allowed on roadways and in designated bike lanes.
- E-bikes use on State Park Lands
  - Class 1 and 3 e-bikes are allowed on roadways, designated bikes lanes, multi-use trails, and other areas (e.g., campgrounds) that are open to non-motorized biking.
  - Class 3 e-bikes are only allowed on roadways and designated bikes lanes
- E-bikes Use on State Wildlife Areas
  - E-bikes are allowed on designated roads and within designated camping areas where motorized vehicles are allowed. They are prohibited in all other areas.
- E-bike use on State Trust Lands
  - E-bikes are only allowed for use on designated roads and when being used for hunting, fishing, and wildlife viewing.

d. Colorado Local Regulations of E-bikes

Following the state law change in 2017, local jurisdictions across Colorado have grappled with how to regulate e-bikes on their lands. Several communities have held pilot periods or community meetings, allowing for public comment and opinions. These public comment periods have been productive since each jurisdiction faces different constituents, land management ideologies, and trail systems. These confounding factors alter the way in which e-bikes fit into their broader recreation and community ideals. These effects are described below in several notable counties and communities across Colorado. Also included below are basic demographics of the funding partners of this literature review summarized in Table 7.2.

Table 7.2: Landscape overview of trail demographics for Boulder County 2019 e-bike pilot project funding partners

Jurisdiction	Annual Visitation (Millions)	Conserved Acres	Public Access Acres	Total Trail Miles	Improved Surface & Crush-or-Fine Trails (Miles)	Paved Trails (Miles)	Natural Surface Trails (Miles)	Defintions of Passive Recreation (Y/N)	E-bike Pilot Study/Public Engagement Method
Boulder County POS	1.65	104,911	40,377	116	48.5	N/A	67.6	Y[1]	2019 Pilot Study w/ surveys, lit. review
City of Boulder OSMP	6.3	46,364	33,485	158	N/A	N/A	158	N[2]	2020 Proposed Review
Larimer County DNR	1.7	51,000	30,600	99	N/A	5-6	90+	N	Online Survey
City of Fort Collins NAD	unknown	36,650	35,644	124.6	N/A	20.6	104	N[3]	Pilot Study w/ Surveys, Education & Outreach

1. Boulder County POS: as referred to in the *Open Space Element,* passive recreation is non-motorized outdoor recreation with minimal impact on the land, water, or other resources that create opportunities to be close to nature, enjoy the open space features, and have a high degree of interaction with the natural environment. Further, • Passive recreation requires no rules of play or installation of equipment or facilities, except for trails and associated improvements. • Passive recreation includes activities such as hiking, snowshoeing, cross-country skiing, photography, bird-watching, or other nature observation or study. • If specifically, designated, passive recreation may include bicycling, horseback riding, dog walking, boating, or fishing.
2. City of Boulder OSMP: Passive recreation is identified as a purpose of OSMP, among other things, in the Boulder City Charter. Although the City Charter never precisely defines passives recreation, it does mention several "passive" recreational activities, including hiking, nature study, and photography. Three other recreational activities are listed in the City Charter as appropriate passive recreation under certain conditions- bicycling, fishing, and horseback riding.
3. City of Fort Collins NAD: NAD does not have a formal definition of "passive recreation." However, it is traditionally interpreted as activities including hiking, bird watching, photography and the like

Boulder County Parks and Open Space (BCPOS). In December 2018, Boulder County Commissioners approved a one-year pilot study to allow e-bikes on specific county open space trails on the plains starting January 1st, 2019. During the pilot period, staff studied visitor and trail impacts of e-bikes on county trails through an intercept survey, speed observation study, phone survey, trail evaluation, and this literature review. The goals of this pilot study are to investigate demographics, use patterns, visitor use impacts, and trail impacts related to e-bikes. This information will inform policy decisions regarding e-bikes on trails in Boulder County.

City of Boulder Open Space and Mountain Parks (OSMP). In 2014, the City of Boulder passed an ordinance allowing e-bikes on paved, multi-use paths within the city. The ordinance does not allow for e-bike use on Open Space and Mountain Parks (OSMP) trails per the City Charter which limits trail-use to non-motorized, passive recreation and therefore excludes the use of e-bikes given their motorized status. In addition, the ordinance mandated that the management responsibilities for all underlying OSMP trail segments dispersed within the city's multi-use path network be transferred to the City Transportation Department and Greenways program. The City of Boulder anticipates reviewing their e-bike policy on OSMP lands in 2020 [xxv].

Larimer County Department of Natural Resources (LCDNR). LCDNR allows class 1 and 2 e-bikes on paved trails under their jurisdiction. These trails traverse 5-6 miles through three of the ten county open spaces which were designed to allow a higher level of use and also connect other regional trail corridors. LCDNR does not allow motorized uses, including e-bikes of any class, on its park and open space natural surface trails. Following the state's new regulation, LCDNR does not currently have a definition of passive recreation within its guiding document [xxvi].

City of Fort Collins Natural Areas Department (NAD). On April 19 the City of Fort Collins City Council approved a one-year e-bike pilot program allowing e-bikes on paved trails beginning May 1, 2019. The impetus for the pilot was prompted by the rising popularity of e-bikes and the 2017 state law that allowed e-bikes on trails state-wide unless otherwise restricted by a local jurisdiction. The pilot program does not allow e-bikes on any unpaved trails and permits only class 1 and 2 e-bikes on paved trails within the city. Throughout the pilot, the city plans to

conduct extensive community outreach, education. and evaluation. This decision was endorsed by several city committees and unhindered by an informal definition of passive recreation on their trail system [xxvii].

Jefferson County Open Space (Jeffco). Following a 2018 pilot period that involved extensive community outreach including surveys, demo-days, and collaboration with local bicycle organizations, Open Space adopted a permanent policy allowing class 1 e-bikes on all Open Space managed lands, and class 1 and 2 e-bikes on all paved trails under their jurisdiction [xxviii]. Anecdotally, Jeffco managers have encountered very little pushback from its trails users over this change and have qualified e-bike introduction and subsequent propagation as a current non-issue.

Roaring Fork Transportation Authority (RFTA). In 2018, Pitkin County Open Space and Trails worked in conjunction with Roaring Fork Transportation Authority (RFTA) to conduct a one-month public process project gathering public opinions about e-bike allowance on 42 miles of paved trails within the Rio Grande trail network from New Castle to Aspen. The project included electronic and paper surveys and comment cards regarding class 1 and 2 e-bikes. The project partners also hosted community demo events for community members to ask questions, fill out surveys, and test out e-bikes [xxix]. Following the public comments period, class 1 and 2 e-bikes are allowed on the Rio Grande Trail from between Two Rivers Park in Glenwood Springs and the Pitkin County line at Emma Road in Basalt. Only class 1 e-bikes are allowed from Emma Road to Aspen, and thus the entirety of the trail system [xxx]. The Rio Grande trail does maintain a 20mph speed limit for all bikes and mandates that all cyclists ride single file.

Eagle County. Eagle County allows e-bikes per the prescription of Colorado state law [xxxi]. Within Eagle County, the town of Vail allows e-bikes on certain recreation paths for a six-month trial period that started on July 12, 2019. During the trial period, class 1 and 2 e-bikes with motors of 500 watts or less are allowed. E-bikes may only be operated by those age 16 and older. In addition, the town has identified several “blackout zones” or areas where e-bikes must disengage their pedal or throttle assist function. These zones include sections of trails within and immediately outside of the town center. The trial period was enacted in order to accommodate several bike rental companies that operate during the summer tourism season and to encourage

the use of sustainable transportation by Vail guests and residents [xxxii].

Summit County. Summit County is not currently considering eMTB use on natural surface trails. These restricted areas have been designated for non-motorized use and include trails under the jurisdiction of Summit County, the town of Breckenridge, and the Forest Service. However, class 1 eMTB's are allowed on the Recpath, Frisco Peninsula Recreation Area, and all roads open to other motorized uses. Additionally, class 1 eMTB's are allowed on trails at Copper Mountain, Breckenridge, and Keystone Ski Areas.

This decision follows a public engagement period in which the Summit County Board of Commissioners and the Open Space & Trails Department gathered public input via open houses and an online survey which included over 1,000 responses. The final decision from all community input codified class 1 e-bikes as acceptable while class 2 and 3 are prohibited.

Summit County allows class 1 e-bikes to be allowed as an OPDMD and adheres to the following regulations: (the e-bike) "has a maximum power-driven speed equal or less than 20 mph, is no wider than 36 inches, and has brakes that enable the operator to make the wheels skid on the dry, level and clean pavement. No Other Power-Driven Mobility Devices (OPDMD) may be used, including but not limited to any gas or combustible fuel-powered devices, ATV's, golf carts, or motorcycles. Wheelchairs and manually- powered mobility aids are allowed" [xxxiii].

Towns of Durango and Grand Junction. Following a 1-year pilot study in the Town of Durango, e-bikes are allowed on paved trails. The decision came after Durango's Parks and Recreation Department didn't receive a single negative public comment regarding e-bike presence. Durango allows class 1 and 2 e-bikes on paved trails while restricts class 3 to roadways and designated bike lanes. The town has indicated that it will explore the possibility of opening the non-paved trails to e-bikes in the future [xxxiv].

Similarly, the City of Grand Junction will also allow class 1 and 2 e-bikes on their paved trails. This decision follows a year of public outreach that included extensive conversations between local bike groups, the public, and government officials [xxxv].

e. Notable Local Regulations Across the Country

Maricopa County, AZ and Santa Clara County, CA currently allow class 1 and 2 e-bikes wherever bicycles are allowed, while other jurisdictions such as Boise, ID and the encompassing Ada county regulate class 1 and 2 as conventional bikes, but only allow class 1e-bikes on a 125-mile path system respectively [xxxvi.]. Park City, UT allows e-bikes on all paved multi-use trails as well as soft-surface trails that are wider than 5 feet. The city also mandates a 15-mph speed limit for all trail-users.

f. Conclusion: Local Jurisdictional Change and Follow-up Research

- Agencies at all levels are currently at their most receptive to user, visitor, and community demand. However, there must be concentrated public demand if there is to be an impetus for revised regulations [xxxvii].
- As of this writing, the roll-out of these policies across the country hasn't been empirically documented, and the existing evidence of how these communities are receiving e-bikes is anecdotal.
- Class 1 e-bikes are generally considered the most akin to a conventional bicycle, and therefore, the most generally accepted. It is also evident that the agencies or municipalities that have allowed e-bikes on paths or trails have done so with accessibility and congestion-reduction in mind.
- Several Colorado agencies, including Jefferson County and Durango, the City of Fort Collins, Colorado also used pilot-studies as a means of engaging the public and trying-on policies before they are implemented [xxxviii].

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Chapter 8: Conclusion

Since e-bikes have entered the outdoor recreation scene, there have been early adopters of the technology and those who are adamantly opposed to their widespread use. For each side, there are multiple reasons behind their level of support, including perceptions of e-bikes speed and safety, their influence on accessibility/crowding, and their impact on the trails themselves.

Jacob and Schreyer's theoretical model of conflict highlights the asymmetrical nature of the conflict between trail users, citing that one group of trail users has negative attitudes towards another group, while the reverse isn't always true. In the research surrounding how this model impacts the relations between bikes, e-bikes, and pedestrians, it appears that pedestrians maintain a similar relationship to e-bikes as they do to conventional bikes, and cite concerns about the speed, safety, and on-trail etiquette of e-bikes frequently, demonstrating asymmetrical conflict. Whether this is perceived or actual conflict is up for debate. As a proposed remedy to this, there are several types of education and outreach, use allocation and rationing, and behavior enforcement options that may alleviate potential conflict.

Education and outreach campaigns that focus on etiquette and on-trail behavior may help to reduce situations in which a cyclist or e-biker is perceived as displaying inconsiderate or risky behavior towards another trail user. In the same vein, hikers, runners, and walkers may benefit from learning how to change their behavior while hiking in groups, with music, or with dogs, thereby minimizing their role in conflict scenarios. As another education option, e-bike demos have the potential to inform and possibly change users' perceptions of the e-bikes themselves and their place on.

Use allocation and rationing management tactics, including spatial and temporal strategies such as biker or hiker only days, and single-use trails may be another option to reduce potential conflict points. However, these strategies may be resource-intensive due to higher levels of enforcement required to maintain spatial and temporal segregation. In addition, shifting an area from multi-use to single-use may require the building and management of additional trail miles.

As another option, enforcing behavior may work to reduce conflict between users. Instituting a courtesy speed limit may self-regulate users to travel at safe speeds for trail conditions. Maintaining a suggested speed for all users may reduce a speed differential between

the two bike types. Even if the limit isn't enforced, the presence of an expectation for bike speeds may slow users down. Following research on the riding behavior of e-bikes compared to conventional bikes, there isn't a clear consensus of whether or not e-bikes travel at faster average speeds. This approach has proven successful for the City of Fort Collins who adopted it shortly after Boulder County started its' pilot study. Some studies found e-bikes to be faster on roads, but slower on paths, and others found their speeds to be largely comparable.

Another commonly cited concern regarding e-bikes is the perception that they will increase crowding. Current research shows that most early e-bike adopters were already regular cyclists, suggesting that e-bikes are not appealing exclusively to an entirely new user group. In addition, outdoor recreation as a whole, and especially along the Front Range of Colorado is gaining popularity, and it is likely that crowding as a result of this increase will occur regardless of whether e-bikes are allowed in select areas. Given this inevitable increase of trail users, it is recommended that managing for increased annual visitation rather than restricting use of a select group of users is more practical and equitable.

Following this recommendation for maintaining equitable trail opportunities, one of the most frequently addressed benefits of e-bikes allowance in the increased access to trails that many people enjoy. Since e-bikes allow populations who are differently-abled or aging to ride further and up steep inclines, more people can ride bikes. This increase also has effects within the transportation sphere including road-congestion and emissions reductions. E-bikes also reduce the adverse effects of weather, aid in confidence while navigating roadways and intersections, and enable families and/or friends to ride with each other regardless of physical ability or age.

In terms of trails impacts, there is a singular study that analyzed potential differences in trail impacts between mountain bikes, eMTBs, and dirtbikes. While the study was conducted in a very specific environmental setting, the results suggest that eMTB's and mountain bikes have similar trail impacts, both of which are far less damaging than the impacts from dirt bikes. Research results on ecological impacts are mixed. According to recreation ecology research, most forms of recreation have a disruptive and potentially harmful impact on wildlife. Some evidence suggests that motorized recreation has a higher impact (e.g., the distance at which motorized uses are found to cause disturbance is smaller compared to non-motorized recreation). There is also research that suggests that motorized recreation cause less disturbance because they

move through an area more quickly and their travel behavior is more predictable (they are more likely to stay on trail compared to non-motorized modes) with the result that wildlife may be more able to adjust to them; however, motorized uses may also penetrate further into back-country areas, thus distributing impacts over a larger area.

A final consideration when analyzing the results of empirical research and pilot studies is whether or not the findings are specific to e-bikes or if they apply to conventional bikes as well. This is perhaps most important when evaluating the results of pilot studies in areas in which the market penetration of bike compared to e-bikes is significantly different, and trail users may project their perception of conventional bike behavior onto e-bikes. Given that NIMBY and emerging technologies research demonstrates there will be a resistance to change following the introduction a new technology or management prescription, especially if it is in a neighborhood or local area, it is vital to understand who is resistant to change. With that understanding, land managers can make more informed, equitable decisions on how to balance the benefits of e-bikes vs. the costs, and how to communicate effectively about e-bikes with their constituents.

Attachment B

Boulder County E-bike Pilot Study Results

Boulder County
Parks & Open Space

October 2019

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Table of Contents

Executive Summary

In December 2018, Boulder County Commissioners approved a one-year pilot study to allow e-bikes on certain county open space trails on the plains starting January 1st, 2019. During the pilot period, staff studied visitor and trail impacts of e-bikes on county trails utilizing three methodologies: a visitor intercept survey, a speed observation study, and a phone survey of Boulder County residents. The phone survey was conducted by Drake Research and Strategy Inc. and the results are in a separate report on the Parks & Open Space E-bike page. The main goal of this pilot study was to assess knowledge of trail use policies, trail use behaviors, and perceptions regarding allowing class 1 and class 2 e-bikes on paved and natural surface trails in Boulder County.

The objectives of this pilot study include the following:

1. Collect a statistically significant sample of opinions from visitors to Boulder County open space properties regarding e-bikes, recreation preferences, and recreation conflict;
2. Use this data to inform discussions about updating the definition of "passive recreation" in the Open Space Element of the Boulder County Comprehensive Plan;
3. Utilize this data to better integrate visitor opinions, values, and recreation goals into the ongoing management and maintenance of open space properties, with the possibility of adding speed control measures, additional trail courtesy signage, and bicycle education opportunities.

Key Findings:

- Intercept Survey
    - Nearly three-quarters of POS users hike, bike, or walk the dog while on the trails
    - Overall, POS trail users support or are neutral about allowing e-bikes on the plains and regional trails, but do not support allowing e-bikes on the foothills trails
    - The majority of POS trail users (96%) did not experience conflict on the day of the survey
- Speed Observation Study
    - E-bike observations were a fraction of the total bike observations across Boulder County. Only 12 e-bike speeds were recorded out of a total of 503 bike observations
    - The average speed for all bike types and inclines was 14.8 mph. By bike type, the average speed of conventional bikes was 14.9 mph and 13.8 mph for e-bikes.

Background

The governor signed Bill HB17-1151, Electrical Assisted Bicycles Regulation Operation April 4, 2017. This bill changes how e-bikes are classified in the Colorado Revised Statute, defines three classes of electrical assisted bicycles, and grants permission for class 1 and class 2 e-bikes to be ridden on bike or pedestrian paths where bikes are authorized to travel. The bill also provides local governments authority to prohibit class 1 and class 2 e-bikes on paths under their jurisdiction. Class 3 e-bikes are not allowed on bike or pedestrian paths unless local governments act to allow them.

Motorized recreation is not allowed on Boulder County open space trails, with exceptions for individuals with mobility disabilities. The Open Space Element of the Boulder County Comprehensive Plan defines passive recreation in part as "non-motorized outdoor recreation with minimal impact on the land, water, or other resources that creates opportunities to be close to nature, enjoy the open space features, and have a high degree of interaction with the natural environment" and may include bicycling if specifically designated. In December 2017, Boulder County Parks & Open Space (BCPOS) staff proposed updates to POSAC about the Rules & Regulations including a clarification that bicycles are defined as being exclusively human-powered wheeled devices. These clarifications maintained the prohibited status of e-bikes on Boulder County Parks & Open Space trails, with the exceptions of individuals with mobility disabilities. Based on the high public interest and a significant number of comments against the prohibition of e-bikes following the December Parks & Open Space Advisory Committee meeting, POS staff decided to conduct a community engagement process to consider if, and where, e-bikes could be considered on Boulder County trails.

In December 2018, Boulder County Commissioners approved a one-year pilot study to allow e-bikes on certain county open space trails on the plains starting January 1, 2019. From April to September 2019, staff studied visitor and trail impacts of e-bikes on county trails utilizing three methodologies: a visitor intercept survey, a speed observation study, and a phone survey. The main goal of this pilot study was to assess trail use behaviors, monitor visitor conflict, and gauge public perceptions regarding allowing class 1 and class 2 e-bikes on paved and improved surface trails in Boulder County.

In addition to assessing the effects of allowing e-bikes on POS trails, a secondary goal of the pilot study was to document the speed of all cyclists using the trail. The speed observation study sought to observe the speeds of several bike types (e-bike, conventional, recumbent) to discern whether there is a speed differential between cyclists.

Methods

Visitor Intercept Survey

Starting April 2019, Boulder County employees were briefed on the study objectives, trained on proper intercept survey and speed observation protocols, and provided with specific trail locations for conducting surveys by Michelle Marotti (Education and Outreach/Visitor Studies). Survey dates were randomized to gain a broad perspective of opinions. Survey times were divided into three separate blocks: morning (8:00am - 12:00pm), afternoon (12:00pm - 4:00pm), and evening (4:00pm - 8:00pm). Within these four-hour blocks, surveys were conducted for two consecutive hours. In addition to different times of the day, surveys were scheduled on both weekdays and weekends. For the survey schedule, see Appendix A. Survey locations were chosen to represent regional and plains trails (see Table 1). For the intercept survey instrument, see Appendix B. A total of 427 complete responses were collected.

Speed Observation Survey

Following the same survey schedule as the intercept survey, starting in early June, speed observations were conducted for two-hour periods either preceding or following the intercept survey shift. Speed observations were conducted at the same POS properties, but at slightly different coordinates (Table 1) in order to gain a representative view of trail use and capture a potential discrepancy between uphill and downhill speeds. At each speed observation location, speeds of oncoming cyclists were taken 100 ft away from the observer. The type of bike was recorded (conventional vs. recumbent vs. electric) and cyclists were noted as going uphill or downhill. Other landscape information including the trail condition (wet vs. dry) and weather were recorded (see Appendix D).

In addition to surveying the locations outlined in the intercept survey schedule, speed observations were also taken at Betasso Preserve and on the US 36 Bikeway. Betasso Preserve was selected to compare bike speeds in the foothills to the regional and plains trails. This foothills location was selected due to the good sight-distance on the trail and since there has been previous trail user concern about cyclists' speeds. Observations on the US 36 bikeway were taken to observe cyclists speed on a paved, multi-use, commuting path. In addition, due to e-bikes popularity as a commuting tool, POS staff anticipated observing more e-bikes on the US 36 bikeway than BCPOS trails, allowing for a more complete understanding of e-bike speeds.

Speed observations were taken using a Bushnell Velocity speed gun. Prior to using the speed gun, its accuracy was tested against the radar gun used by the Boulder County Deputy Sheriffs at Coalton Trailhead Superior, CO. After several tests, the Bushnell speed gun was deemed accurate enough for this study. A total of 503 speed observations were collected.

Table 1: Intercept survey and speed observation data collections sites

Intercept Survey Locations	Coordinates
1. Carolyn Homberg Preserve at Mary Miller and Cradleboard Trail intersection	39.945747, 105.104909
2. Coal Creek Trail at Flagg Park	39.989540, 105.059683
3. Coal Creek Trail at South Public Trailhead	39.980000, 105.091000
4. Coalton Trailhead at Meadowlark Trail	39.928785, 105.167431
5. Lagerman Ag. Preserve at Pike & 75th Street	40.137881, 105.179543
6. Lagerman Ag. Preserve Trailhead	40.135600, 105, 190400
7. LoBo Trail at Monarch Trailhead	40.122156, 105.148411
8. Niwot Trail at Niwot Loop Trailhead	40.093858, 105.173277
9. Pella Crossing	40.184008, 105.176145
10. Twin Lakes	40.062660, 105.200623
Speed Observation Locations	**Coordinates**
1. Betasso Preserve	40.017238, 105.344969 40.016388, 105.34320
2. Carolyn Holmberg Preserve at Cradleboard Trail	39.945728, 105.104873
3. Coal Creek Trail at Flagg Park	39.979782, 105.09066
4. Coal Creek Trail at South Public Trailhead	39.980000, 105.091000
5. Meadowlark Trail Meadowlark Trail at Key Bank	39.945833, 105.165555 39.929722, 105.166944
6. Lagerman Ag. Preserve at Pike & 75th	40.137913, 105.180178
7. LoBo Trail at Monarch Trailhead	40.087990, 105.173074
8. Niwot Trails at Niwot Loop Trailhead	40.093896, 105.173131 40.093742, 105.173361
9. Ron Stewart Preserve at Rabbit Mountain	40.246688, 105.216112
10. Twin Lakes at LoBo Trail	40.060116, 105.200660 40.059722, 105.20222
11. US 36 Bike Path (Overlook on Davidson Mesa)	39.966901, 105.187699
12. US 36 Bike Path (Broomfield Park-n-Ride)	39.906330, 105.085537
13. US 36 Bike Path (Scriffiny Property at S 88th St.)	39.949090, 105.147470
14. US 36 Bike Path (S Cherryvale Rd.)	39.976957, 105.213146

Results

Intercept Survey

For the count of responses for the all the results listed below, please see Appendix C.

Activities on Day of Survey

Hiking was the most common activity for survey respondents. Biking and walking the dog were the second and third most common, respectively. The least common activity was e-biking, with only four survey respondents (Fig. 1).

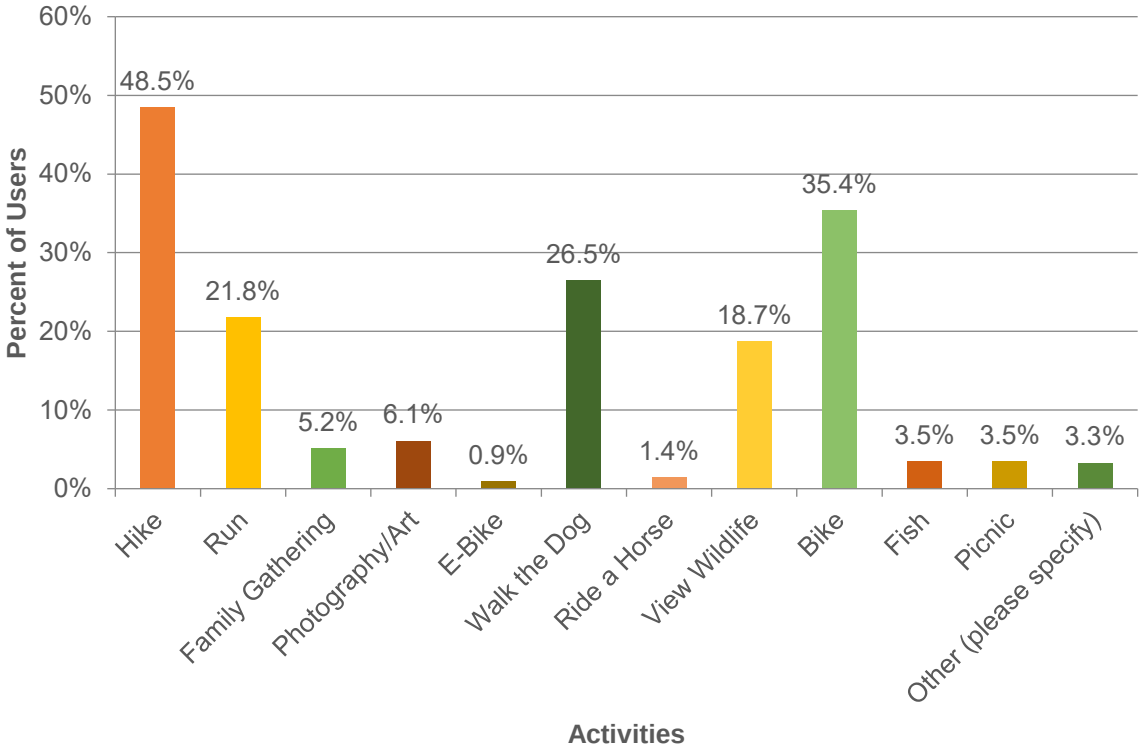


Figure 1. POS survey respondents' activities Respondents were able to choose more than one response (n=427).

E-bike Sightings on Trails

Only 4.5% of the total survey respondents had seen an e-bike and 4.9% weren't sure if they had seen one on the day of the survey. The majority of trail users (90.6%) did not see an e-bike on the survey day (Fig. 2). As mentioned above, four survey respondents were riding e-bikes.

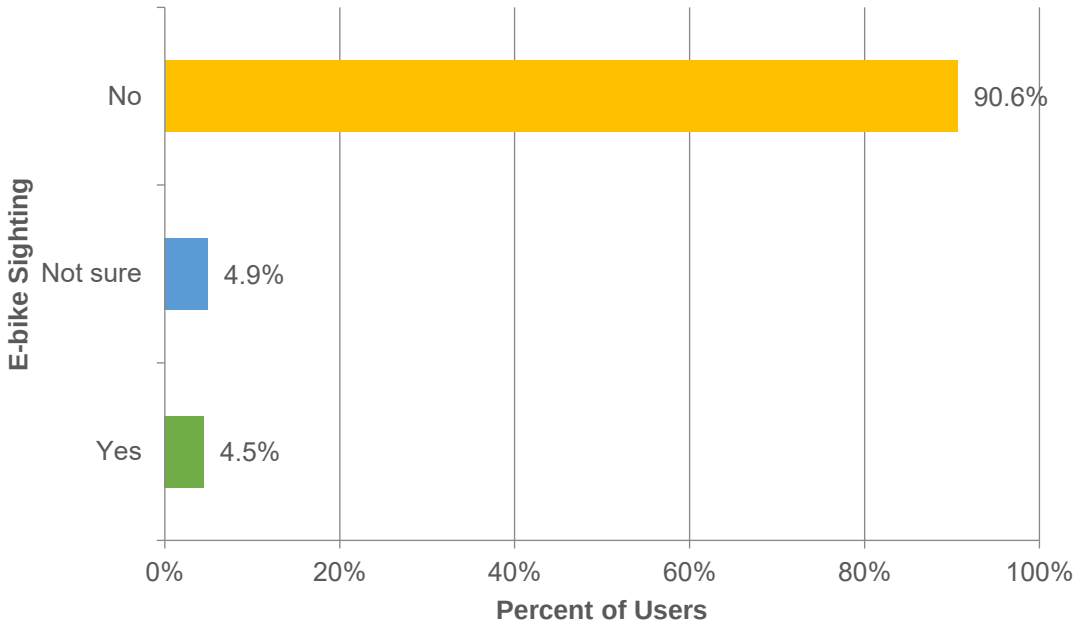


Figure 2. Percent of survey participants who had/had not seen an e-bike or weren't sure if they had seen one on the day of survey (n=426)

Level of Support for Allowing E-bikes on POS Properties

Level of support was evaluated for three different types of trails (flat trails in the plains, regional trails, and foothills trails) using a Likert scale ranging from strongly support to strongly oppose.

42% of respondents support allowing e-bikes on flat trails on the plains and 41% support allowing them regional trails, while 28% and 27% respectively are opposed and nearly one-third are neutral or unsure. Feelings about foothills trails is the reverse: 49% opposed allowing e-bikes and 29% were in support, with nearly one-quarter neutral or unsure (Fig. 3).

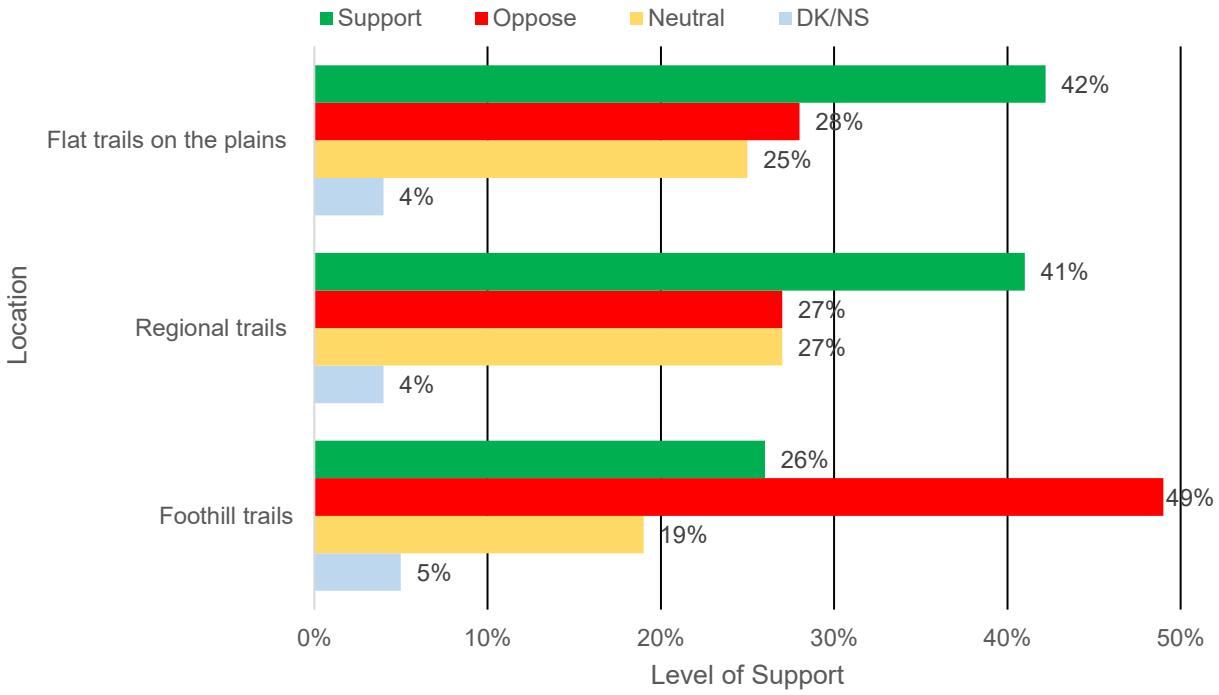


Figure 3. Support for Allowing e-bike on POS Trails (n=427).

Reasons for Level of Support

Trail users were given an opportunity to explain their level of support for each of the POS properties. Following their answers, comments were either for e-bikes, against e-bikes, and neutral towards e-bikes. In total, 40% of respondents left positive comments, 13% left neutral comments, 39% left negative, and 8% were neither. Responses that were deemed representative of common sentiments expressed within each level of support are documented below. (Please note these are direct quotes from the intercept surveys and have not been edited for coherence or grammar.)

Representative Responses- Pro e-bike access

- *"While there are always people who go too fast on e-bikes, when responsibly ridden, e-bikes open the experience to more people which is positive!"*
- *"I feel like bike or e-bike is not the problem or the answer. It is and always will be the human attached to the mechanism."*
- *"I currently use an e-bike in place of a car. Limiting access means more pollution or less safe roads."*
- *I'm in my 60's and ebike (specifically mtn ebike) has been a life changer. e-bike riders are by and large responsible riders "*

Representative Responses- Con e-bike access

- *"E-bikes are "cheating". If disabled, elderly, etc. e-bikes may be ok. If able bodied please use e- bikes on less "nature-friendly" areas"*
- *"They are dangerous. People can go too fast. There are already a lot of bicyclists that do not follow proper right-of-way procedures. E-bikes would exacerbate this issue."*
- *"can damage trails when wet; can degrade experience for those biking, hiking; awareness of e-bike riders may be low; many people who use trails are seeking space away from motorized vehicles"*
- *"E-bikes should be reserved for commuting on the streets. No electric vehicles should be on trails"*

Representative Responses- Ambivalent- e-bike access

- *"I feel like e-bikes are fine on flat trails, for commuting or enjoying the outdoors, as long as they don't pose a threat to hikers or other cyclists due to speed. I feel like e-bikes on mountain trails could lead to more rescue situations."*
- *"I'd have to see and hear one to decide"*

Visitor Conflict

Conflict was defined as "sometimes, visitors interfere with one another's goals on the trail, causing unpleasant experience." The majority of trail users (96%) did not experience conflict or were not sure if they had (2.1%) on the day of the survey (Fig. 4). Of the 1.9% of individuals who did experience conflict, their issues arose from the following three categories:

1. Off-leash dogs or dogs crowding the path
2. Other trail user was wearing headphones or blasting music and couldn't hear the individual approaching
3. Cyclists not announcing themselves when passing

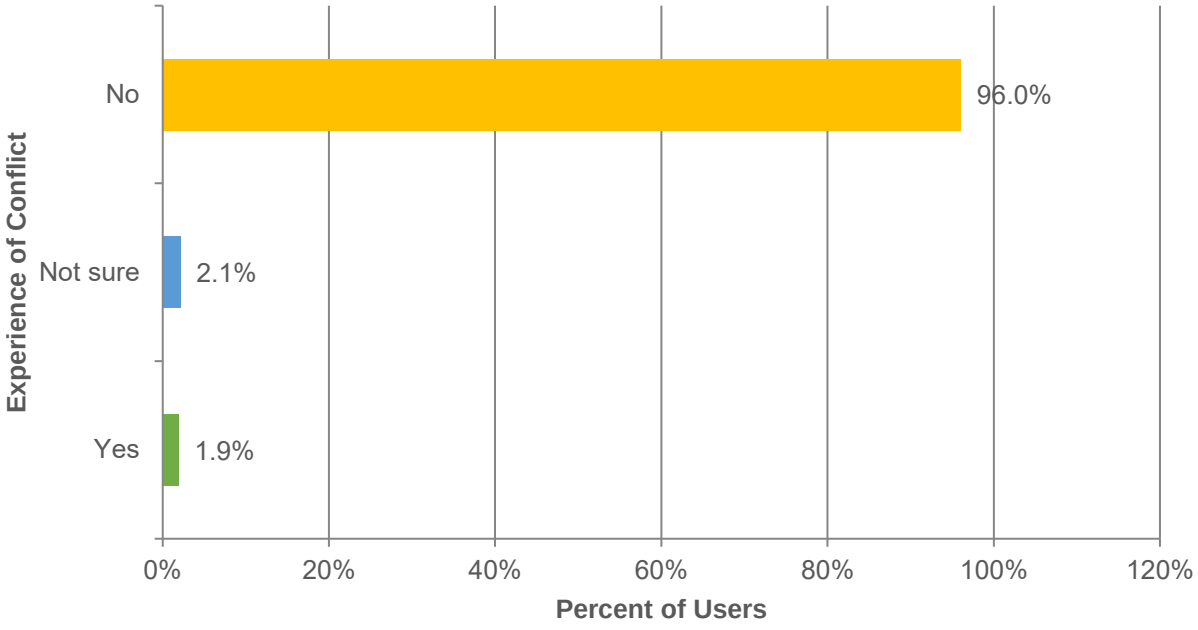


Figure 4. Visitor Conflict on POS Trails (n=425)

Rate of Conflict with an E-bike

Of those trail users who did experience conflict, about 93% did not experience conflict with an e-bike and about 7% were not sure if their experience constituted as a conflict (Fig. 5).

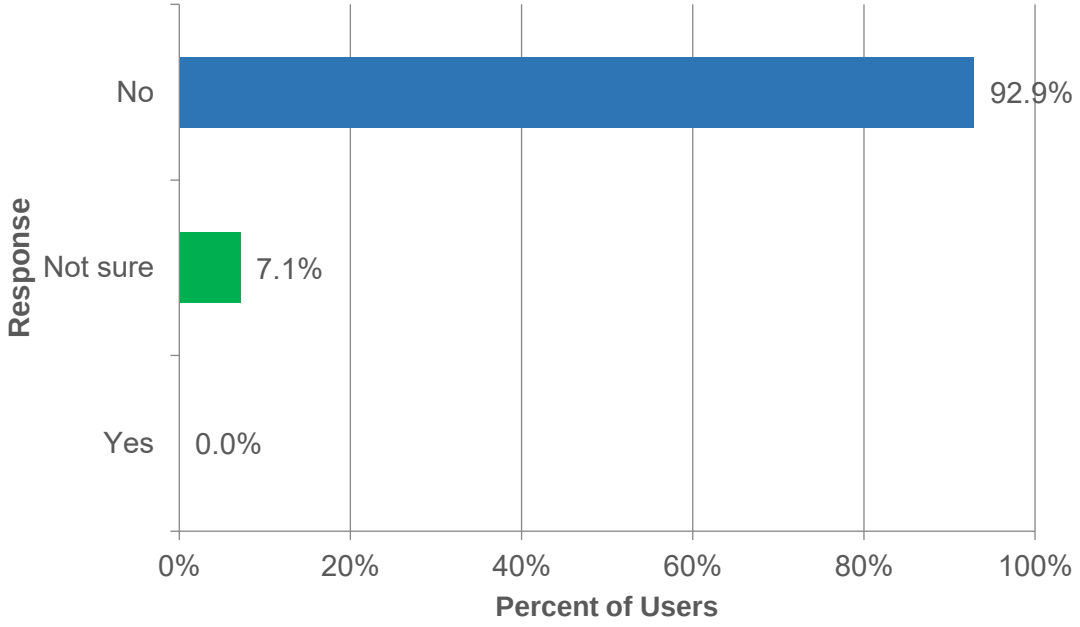


Figure 5. Of those who experienced conflict on the day of survey, percent of those who experienced conflict with an e-bike (n=14).

Age

Most of the surveyed trail users were middle aged (53%), or young adults (25%), followed by adults age 65 and older .

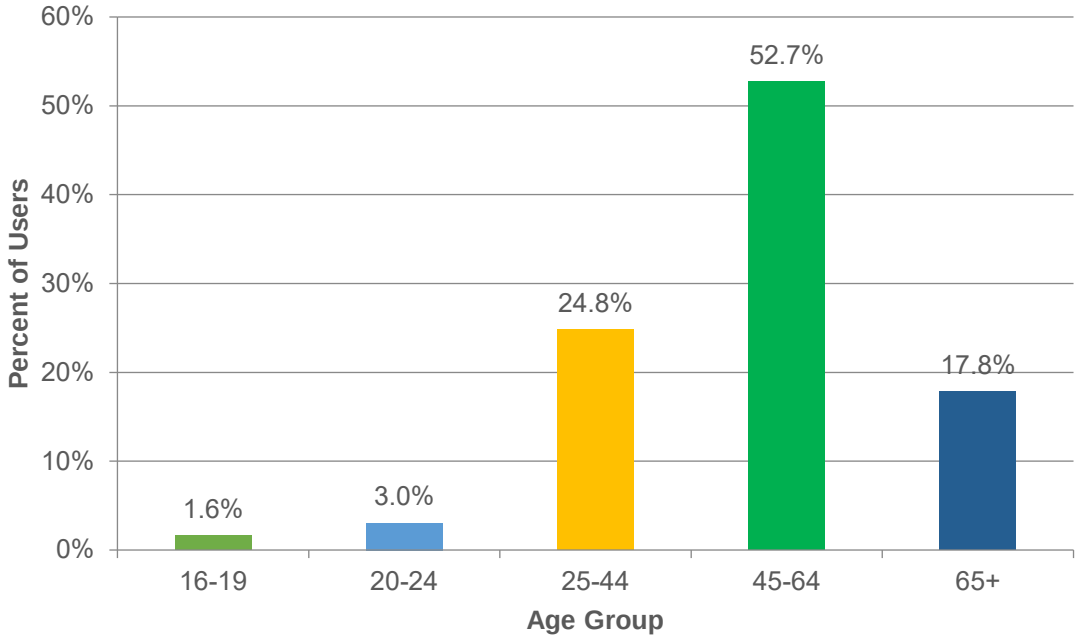


Figure 6. Age of Survey Respondents (n=427)

Residency

Most survey respondents lived in Longmont, Boulder, Broomfield, and Lafayette (Fig. 8).

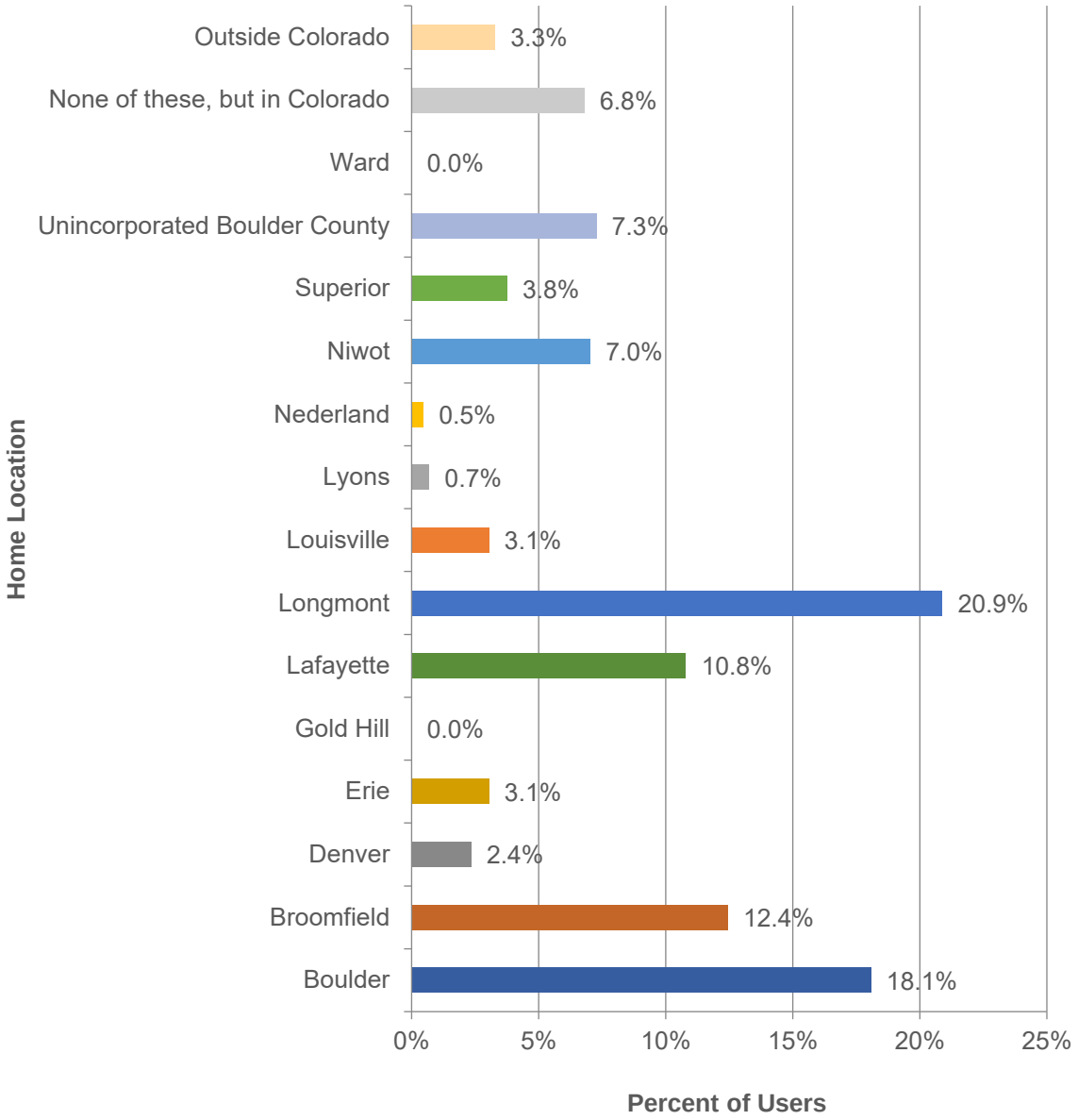


Figure 7. Residence of Survey Respondents (n=426)

Other Comments

Trail users were also given the opportunity to list any other comments regarding Parks & Open Space trails and/or management. The following were the most common response categories:

1. The speed and on-trail etiquette of both conventional bikes and e-bikes is a concern
2. Gratitude for the continued management of the trails
3. More bathrooms at BCPOS trailheads
4. Concerns about off-leash dogs
5. Trail users had experienced conflict on a different day than they were surveyed. Often this point of conflict occurred when a cyclist passed another user. Both the passing cyclists and the pedestrians being passed reported conflicts prior to the survey dates.

Speed Observation Survey

Speed observations were recorded starting in early June until mid-September. During this period, a total of 504 speed observations were taken of conventional bikes and e-bikes. There were 2 observations of recumbent bikes, and a singular one-wheeled skateboard, however, their speeds were omitted from the analysis. Below, these observations are analyzed by, average speed by bike type, speed frequency by bike type, average speed by location and bike type, and average speed of downhill vs. uphill observations by bike type.

Average Speed by Bike Type

The average e-bike speed was 13.8 mph (n=12) and the average conventional bike speed was 14.9 mph (n=491). Due to an insufficient amount of data, no statistical tests were conducted.

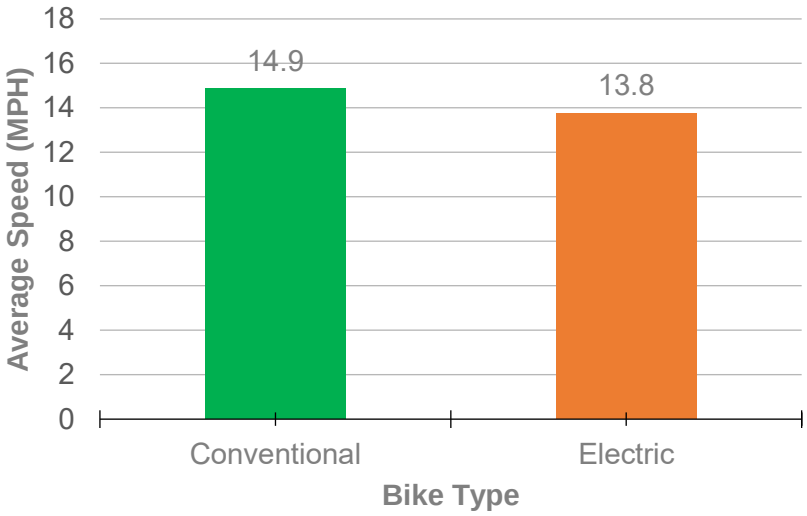


Figure 8. Average speed (mph) by bike type [n(conventional)=492, n(electric)=12]

Speed Distribution

A distribution of electric and conventional bike speed across all locations illustrates the frequency of bike speeds (Fig. 9). The most frequent conventional bike speed was 15 mph (n=76). The most frequent e-bike speed was 13 mph (n=4). The range of conventional bikes speeds includes a max of 26 mph (n=1) and 6 mph (n=3). The range of electric bike speeds spanned 17 mph (n=1) and 11 mph (n=1).

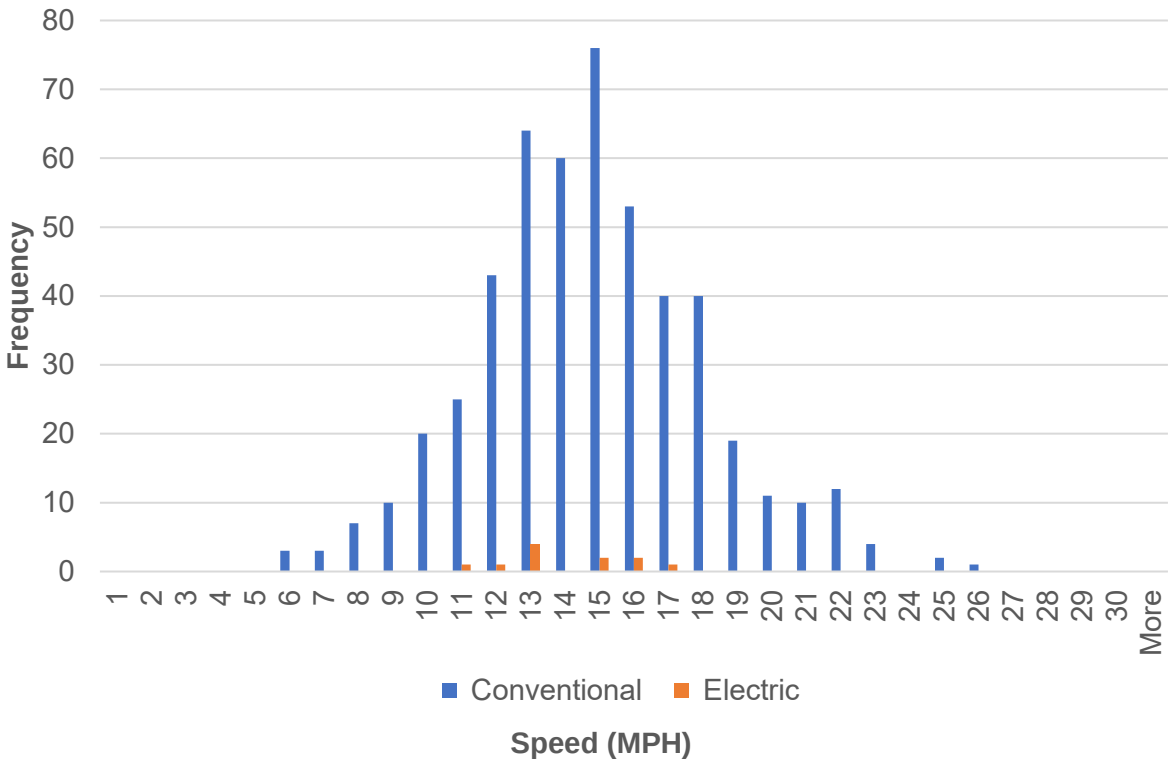


Figure 9. Speed frequency for conventional and electric bikes in Boulder County [n(conventional)=492, n(electric)=12]

Average Speed by Location

The highest average speed of e-bikes was recorded on the Meadowlark Trail near Coalton Trailhead (M=16.0 mph), the lowest average e-bike speed was recorded at Carolyn Holmberg Preserve (M=11 mph). The highest average conventional bike speeds were recorded at Betasso Preserve (M=15.9 mph), the lowest average conventional bike speeds were observed at Niwot Trails (M=13.2 mph).

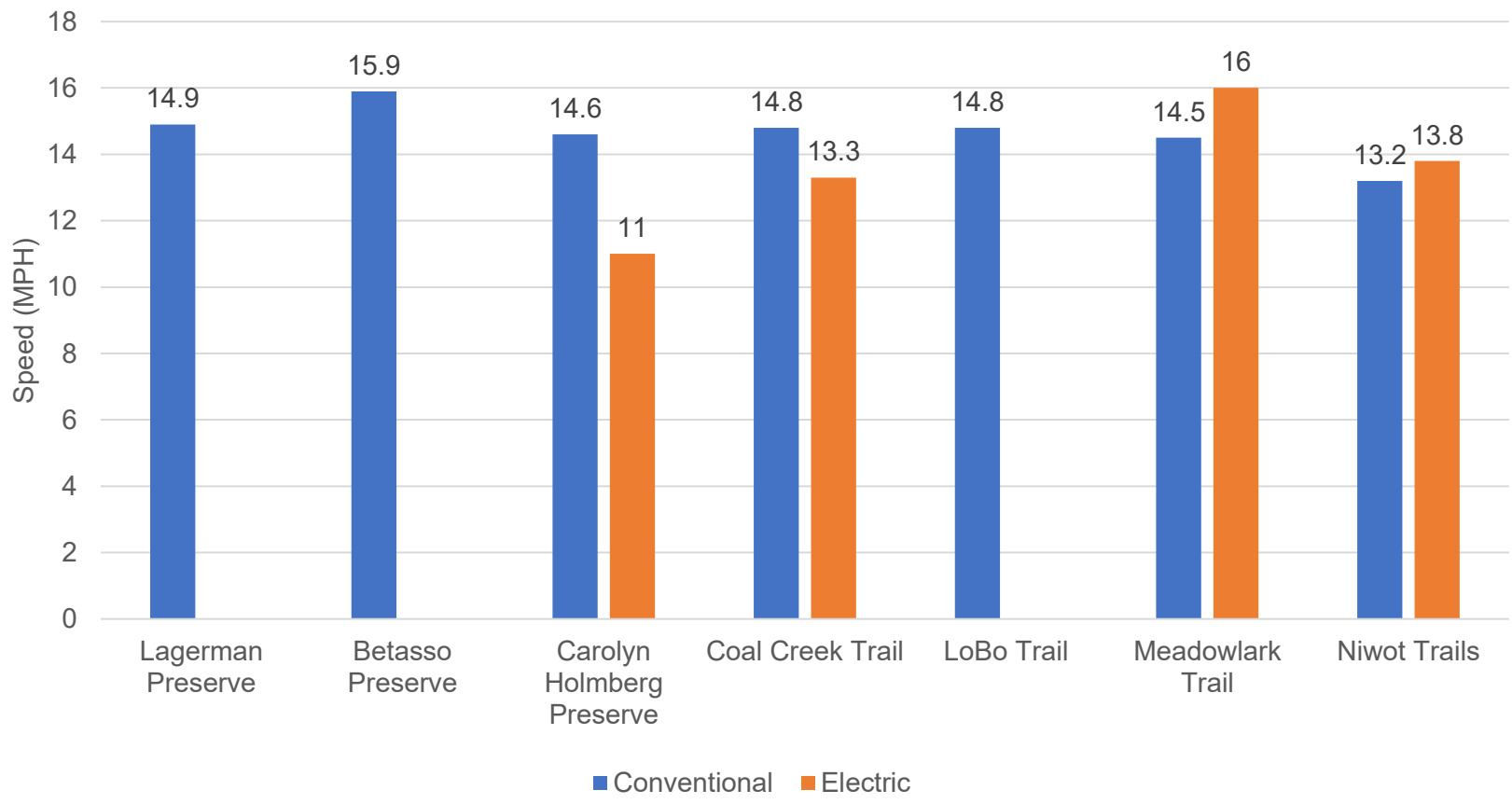


Figure 10. Average speed of conventional and electric bikes by observation location [n(conventional)=492, n(electric)=12]

Average Uphill and Downhill Speeds by Bike Type

The average speed for all bike types was 14.8 mph. When analyzing by bike type and incline, the average uphill speed of conventional bikes was 12.9 mph and 13.8 mph for e-bikes. For average downhill speeds, conventional bikes traveled at 15 mph on average, while e-bikes traveled at a slower average speed of 13.5 mph. Due to an insufficient number of data points for electric bike speeds, no statistical tests were conducted.

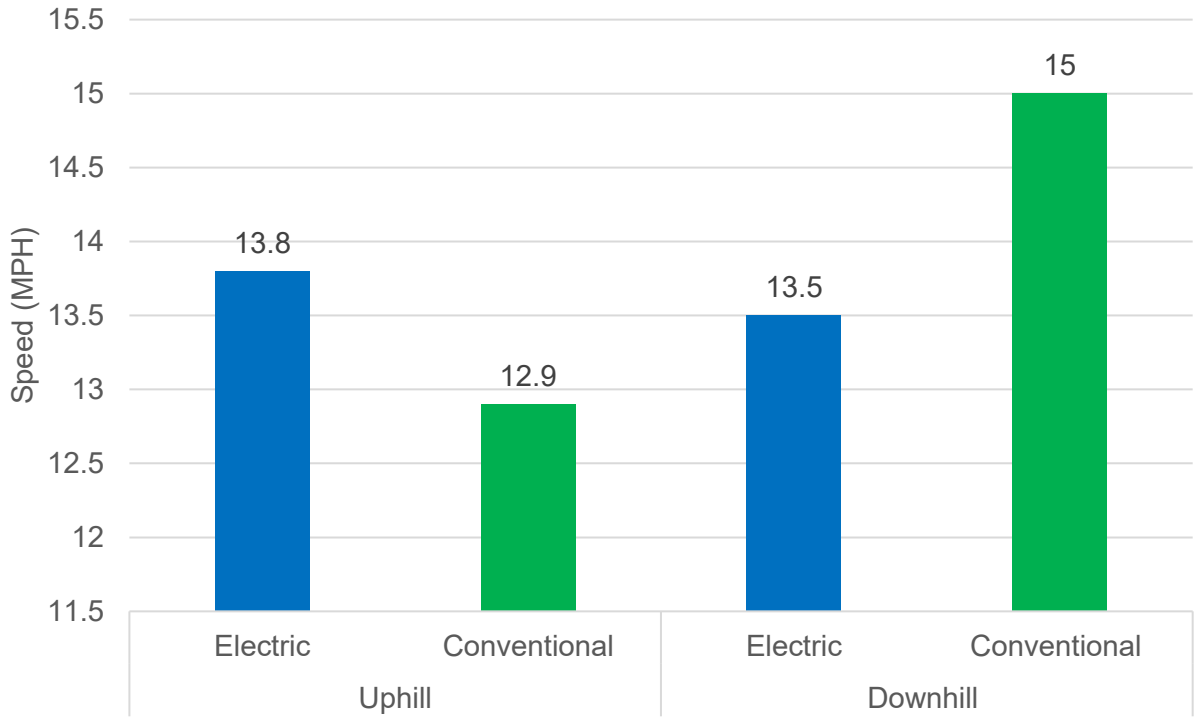


Figure 11. Average uphill and downhill speeds for electric and conventional bikes across all survey locations [n(electric uphill)=10, n(conventional uphill)=152, n(electric downhill)= 2, n(conventional downhill)=339]

Speed Observations on US 36 Bikeway

The average speed for conventional bikes and e-bikes used for commuting or recreation purposes on the US 36 bikeway were 15.7 and 16.9 mph respectively (Table 2)

Table 2. Electric and conventional bike speeds on the US 36 Bikeway

	Electric	Conventional
Mean	16.9	15.7
Minimum	10	10
Maximum	27	29

.

Discussion & Conclusion

In Boulder County, most POS trail users either hike, bike, or walk their dog on POS trails. The majority of respondents hadn't seen an e-bike on the survey date, nor had any trail users perceived personally experiencing conflict with an e-bike and very few users experienced any conflict at all. However, there were many comments from respondents expressing concern about the safety speed, and on-trail etiquette of both e-bikes and conventional bikes on the trail. Several other trail users pointed out it is the rider, not the bike that creates adverse situations. These comments suggest that whatever policy recommendations follow this pilot period, strategies to address these bike etiquette concerns must be included.

When asked to rank their level of support for allowing e-bikes on certain types of POS properties, respondents generally supported or were neutral about allowing e-bikes on flat trails in the plains and on regional trails. Many respondents commented that allowing e-bikes could aid in getting cars off the road and allow more people to enjoy POS properties. Conversely, the largest portion of survey respondents did not support allowing e-bikes in the foothill properties. Heeding several trail-user comments, this sentiment follows a concern that e-bikes will exacerbate crowding in the foothills, or their speed differential will adversely impact other trail users.

Given that speed and safety was a top concern in the intercept study, the speed observation survey lends several key takeaways. First, the speed of all bike types varies across the county. The highest speeds were documented on the US 36 bikeway which is a paved trail used mostly for commuting. Given that the US 36 bikeway is not exclusively under the jurisdiction of Boulder County and allows class 3 e-bikes, its importance in this analysis is a helpful comparison, though not indicative of the speed profile of Boulder County cyclists. The highest speeds on Parks & Open Space trails were observed at Betasso Preserve. Despite not allowing e-bikes on this property, POS staff felt it was helpful to compare bike speeds on a foothills property given that these areas are usually more crowded with higher conflict ratings. These higher speeds likely occurred given that these Betasso observations were recorded at two downhill locations and were mountain bikers only. However, even the average speeds at Betasso were around 15 mph, a speed that is often cited as reasonable. The lowest speeds were recorded at Niwot Trails which are relatively flat and feature a mixture of cyclists.

Secondly, this study found average conventional bike speeds to be higher than average e-bike speeds. However, on uphill slopes, e-bikes were on average faster than conventional bicycles. On downhill slopes, the opposite was found to be true, with average conventional bike speeds faster than average e-bike speeds. Given that total e-bike observations were a fraction of the overall speed observations, at just12 total e-bike observations, this data should not be broadly interpreted, nor should it be used as evidence for a speed differential between conventional

bike and e-bikes. When incorporating these conclusions into policy recommendations, it is imperative that the limitations of this data be considered.

Finally, in regard to the range of speeds observed, the highest e-bike speed observed was 17 mph and the fastest conventional bike speed 26 mph. The slowest observed speeds were 11 mph for e-bikes and 6 mph for conventional bikes. Overall, there were far fewer e-bikes at all locations (n=12) than conventional bike speed observations (n=491). This finding, in conjunction with the small percent of trail users who had seen an e-bike while on the trail, suggests that the market penetration of e-bikes is still relatively low on Boulder County trails.

Appendix A: E-bike Pilot Study Survey Schedule

April:
Friday 4/19 Carolyn Holmberg Preserve (morning 8 – 12) - John
Saturday 4/20 Niwot Trails (evening 4 – 8) - Molly
Wednesday 4/24 Pella Crossing (evening 4 – 8) - Molly
Thursday 4/25 Lagerman Pike and 75th (evening 4 – 8) - John
Saturday 4/27 Lobo (morning 8 – 12) - Emily
Sunday 4/28 Twin Lakes (afternoon 12 – 4) - Emily
Sunday 4/28 Coal Creek Trail – South Public Road (evening 4 – 8) – John
May:
Thursday 5/9 Niwot Trails (morning 8 – 12) - Emily
Saturday 5/11 Lagerman (afternoon 12 – 4)
Friday 5/17 Twin Lakes (afternoon 12 – 4) – John
Saturday 5/18 Coal Creek Trail – Flagg Park (afternoon 12 – 4)- AB
Sunday 5/19 Carolyn Holmberg Preserve (morning 8 – 12)-SMP
Tuesday 5/21 Coalton (morning 8 – 12)
Saturday 5/25 Pella Crossing (morning 8-12)-AP
Sunday 5/26 Lobo (evening 4-8)-SMP
Wednesday 5/29 Coalton (evening 4 – 8)-AP
June:
Sunday 6/2 Twin Lakes (weekend morning 8 – 12)-SMP
Tuesday 6/4 Lagerman (weekday afternoon 12 – 4)-AP
Sunday 6/9 Coalton (weekend morning 8 – 12)-SMP
Monday 6/10 LoBo (weekday morning 8 – 12)-AP
Saturday 6/15 Carolyn Holmberg Preserve (weekend afternoon 12 – 4)-AP
Tuesday 6/18 Coal Creek Trail – South Public Road (weekday evening 4 – 8)-SMP
Wednesday 6/26 Niwot Trails (weekday afternoon 12 – 4)-SMP
Saturday 6/29 Pella Crossing (weekend evening 4 – 8)-SMP
July:
Thursday 7/4 Lagerman Pike and 75th (weekday morning 8 – 12)-AP
Sunday 7/7 Pella Crossing (weekend afternoon 12 – 4)-AP
Saturday 7/13 LoBo (weekend afternoon 12 – 4)-AP
Sunday 7/14 Carolyn Holmberg Preserve (weekend evening 4 – 8)-SMP
Tuesday 7/16 Coalton (weekday afternoon 12-4)-SMP
Sunday 7/21 Niwot Trails (weekend morning 8 – 12)-SMP
Saturday 7/27 Twin Lakes (weekend evening 4 – 8)-AP
Wednesday 7/31 Coal Creek Trail – Public Road (weekday morning 8 – 12)-AP
August:

Thursday 8/1 Carolyn Holmberg Preserve (weekday evening 4 – 8)-AP
Saturday 8/3 Lagerman Pike and 75th (weekend morning 8 – 12)-AP
Tuesday 8/6 LoBo (weekday evening 4 – 8)-SMP
Friday 8/16 Niwot (weekday evening 4 – 8)-SMP
Saturday 8/17 Coalton (weekend evening 4 – 8)-AP
Sunday 8/18 Coal Creek Trail – Flagg Park (weekend morning 8 – noon)-SMP
Monday 8/19 Pella Crossing (weekday afternoon 12 – 4)-AP
Wednesday 8/28 Twin Lakes (weekday morning 8 – noon)-SMP

September:

Sunday 9/1 Niwot Trails (weekend afternoon 12 – 4)-SMP
Monday 9/2 US 36 Scriffiny Property (weekday evening 4 – 8)-SMP
Saturday 9/7 US 36 Broomfield Park & Ride (weekend afternoon 12 – 4)-AP
Sunday 9/8 US 36 Overlook (weekend evening 4 – 8)-SMP
Tuesday 9/910 Coal Creek Trail—Flagg Park (weekday afternoon 12 – 4)-AP
Friday 9/13 US 36 Cherryvale Intersection (weekday morning 8 – 12)-SMP

Appendix B. E-bike Pilot Study (Page 1)

Welcome! We'd like your help. Boulder County Parks & Open Space is conducting this survey during a pilot period allowing e-bikes on this trail. We want to know about your experience today. Please help by responding to the following questions.

Thank you for taking time to participate!

E-Bike Definition
E-bikes are bicycles with an integrated electric motor that does not exceed 750 watts of power. Class 1 and Class 2 e-bikes are allowed on this trail during a pilot period that runs until Dec. 31, 2019. Class 1 e-bikes provide electrical assistance only while the rider is pedaling. Class 2 e-bikes provide electrical assistance regardless if the rider is pedaling or not. Electrical assistance stops if a bicycle reaches 20 mph.

1. **Which activities did you participate in today?** (check all that apply)

____ Hike	____ Run	____ Family Gathering	____ Photography/Art
____ E-Bike	____ Walk the Dog	____ Ride a Horse	____ View wildlife
____ Bike	____ Fish	____ Picnic	____ Other - describe:_____

2. **Which activity listed above in Question 1 do you consider your primary activity today?**
(write only one activity) _____

3. **Did you see any e-bikes on the trail today?**
   - ☐ No
   - ☐ Not sure
   - ☐ Yes

4. **Thinking about Boulder County Parks and Open Space properties, please indicate your level of support or opposition for allowing e-bikes on the three types of trails listed.**

	Strongly Oppose ▼	Oppose ▼	Neutral ▼	Support ▼	Strongly Support ▼	Not sure ▼
Flat trails in the plains (Pella Crossing, Lagerman Agricultural Preserve, Legion Park, Twin Lakes, and Carolyn Holmberg Preserve at Rock Creek Farm)	☐	☐	☐	☐	☐	☐
Regional Trails (LoBo Trail, Coal Creek Trail, Rock Creek Trail, and Niwot Trails)	☐	☐	☐	☐	☐	☐
Foothills and mountain trails (e.g. Betasso Preserve, Hall Ranch, Heil Valley Ranch)	☐	☐	☐	☐	☐	☐

Please briefly explain why you answered that way:

OVER ►

5. **Sometimes, visitors interfere with one another's goals on the trail, causing unpleasant experiences. This is generally referred to as "conflict." Did you experience conflict at this park today?**

   ☐ No – skip to question #6

   ☐ Not sure – skip to question #6

   ☐ Yes - *Please describe the conflict you experienced today and answer 5b:*

5b. If you described conflict with someone riding a bike, was the biker using an e-bike?

☐ No

☐ Not sure

☐ Yes

6. **What is your age?**

   ☐ 16 - 19

   ☐ 20 - 24

   ☐ 25 - 44

   ☐ 45 - 64

   ☐ 65 and over

7. **Where do you live?** (check only one)

☐ Boulder	☐ Gold Hill	☐ Lyons	☐ Unincorporated Boulder County
☐ Broomfield	☐ Lafayette	☐ Nederland	☐ Ward
☐ Denver	☐ Longmont	☐ Niwot	☐ None of these, but in Colorado
☐ Erie	☐ Louisville	☐ Superior	☐ Outside Colorado

8. **If there is anything else you would like to tell us, please use the space below:**

Staff Use Only: *Property*_____ *Date*_____ *Time*_____

Appendix C: Intercept Survey Results

Which activities did you participate in today? (check all that apply)		
Answer Choices	Responses	
Hike	48.5%	207
Run	21.8%	93
Family Gathering	5.2%	22
Photography/Art	6.1%	26
E-Bike	0.9%	4
Walk the Dog	26.5%	113
Ride a Horse	1.4%	6
View Wildlife	18.7%	80
Bike	35.4%	151
Fish	3.5%	15
Picnic	3.5%	15
Other (please specify)	3.3%	14
	Answered	427
	Skipped	0

Which activity listed above in Question 1 do you consider your primary activity today?		
Answer Choices	Responses	
Hike	29.58%	126
Run	15.73%	67
Family Gathering	0.23%	1
Photography/Art	0.70%	3
E-Bike	0.70%	3
Walk the Dog	16.20%	69
View wildlife	4.46%	19
Bike	27.70%	118
Fish	2.82%	12
Picnic	0.00%	0
Other (please specify)	1.88%	8
	Answered	426
	Skipped	1

Did you see any e-bikes on the trail today?		
Answer Choices	Responses	
Yes	4.5%	19
Not sure	4.9%	21
No	90.6%	386
	Answered	426
	Skipped	1

Thinking about Boulder County Parks and Open Space properties, please indicate your level of support or opposition for allowing e-bikes on the three types of trails listed.												
	Strongly Oppose		Oppose		Neutral		Support		Strongly Support		Not sure	
Flat Trails in the plains	11.5%	49	16.9%	72	25.1%	107	26.2%	112	15.9%	68	4.5%	19
Regional Trails	10.1%	43	17.4%	74	27.2%	116	24.7%	105	16.7%	71	4.0%	17
Foothills and Mountain Trails	23.0%	98	25.8%	110	19.9%	85	15.9%	68	10.8%	46	4.7%	20
									Answered 427			
									Skipped 0			

Sometimes, visitors interfere with one another's goals on the trail, causing unpleasant experiences. This is generally referred to as "conflict." Did you experience conflict at this park today?		
Answer Choices	Responses	
Yes	1.9%	8
Not sure	2.1%	9
No	96.0%	408
	Answered	425
	Skipped	2

If described conflict with someone riding a bike, was the biker using an e-bike?		
Answer Choices	Responses	
Yes	0.00%	0
No	92.86%	13
Not sure	7.14%	1
	Answered	14
	Skipped	413

Age		
Answer Choices	Responses	
16-19	1.6%	7
20-24	3.0%	13
25-44	24.8%	106
45-64	52.7%	225
65+	17.8%	76
	Answered	427
	Skipped	0

Where do you live?		
Answer Choices	Responses	
Boulder	18.1%	77
Broomfield	12.4%	53
Denver	2.4%	10
Erie	3.1%	13
Gold Hill	0.0%	0
Lafayette	10.8%	46
Longmont	20.9%	89
Louisville	3.1%	13
Lyons	0.7%	3
Nederland	0.5%	2
Niwot	7.0%	30
Superior	3.8%	16
Unincorporated Boulder County	7.3%	31
Ward	0.0%	0
None of these, but in Colorado	6.8%	29
Outside Colorado	3.3%	14
	Answered	426
	Skipped	1

Boulder County Parks and Open Space E-Bike Location		
Answer Choices	Responses	
Coal Creek South Public Trailhead	5.15%	22
Coal Creek Trail at Flagg Park	3.98%	17
Lobo	11.94%	51
Carolyn Holmberg Preserve	18.03%	77
Lagerman Agricultural Preserve Trailhead	4.22%	18
Lagerman Agricultural Preserve Pike and 75th	5.39%	23
Pella Crossing	14.99%	64
Niwot	10.54%	45
Twin Lakes	14.52%	62
Coalton (Meadowlark Trail)	11.24%	48
	Answered	427
	Skipped	0

Time of Day		
Answer Choices	Responses	
Morning (8:00 - noon)	44.7%	190
Afternoon (noon - 4:00)	25.9%	110
Evening (4:00 - 8:00)	29.4%	125
	Answered	425
	Skipped	2

Appendix D. Speed Observation Data Sheet

Speed Study Observation Record
Date and Time:
Location/Coordinates:
Weather Conditions:
Trail Use/Trail Condition:
Distance from Coordinates:
Surveyor:

No.	**Incline** Uphill = U Downhill = D	**Direction of Travel** Toward Observer = T Away from Observer = A	**Bike Type** Conventional = C Electric = E Recumbent = R	**Speed** (MPH)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Attachment C

2019 BOULDER COUNTY AUGUST ISSUES SURVEY

E-Bikes on County Open Space Trails

Report

~August, 2019~

Prepared for:

I. OBJECTIVES & METHODOLOGY

OBJECTIVES

The objective of this study is to better understand voter usage of e-bikes and reaction to use of e-bikes on Boulder County Open Space.

METHODOLOGY

Drake Research & Strategy, Inc. conducted the 2019 Boulder County Issues Survey in August of 2019. A random sample was drawn from a list of Boulder County voters, containing both landline and cell phone numbers.

- *Interviews were conducted between August 1 to 12, 2019.*
- *Results are based on 605 telephone interviews, 64% of which were conducted on respondent cell phones.*
- *The margin of error is plus or minus 4% about any one reported percentage.*

KEY FINDINGS

Support for e-Bikes on Open Space

- *Level of Support:* Should the current e-bike Pilot Program end up suggesting expanding the use of e-bikes on County Open Space trails, respondents are inclined to allow them on flat or regional trails, but not so much on trails in the foothills.
- *Displacement:* Allowing e-bikes on trails will dissuade about 32% of respondents from using those trails, while 50% say it would make no difference to them, and 9% say they would be more likely to use those trails if e-bikes were allowed on them.

USAGE OF COUNTY OPEN SPACE

6.

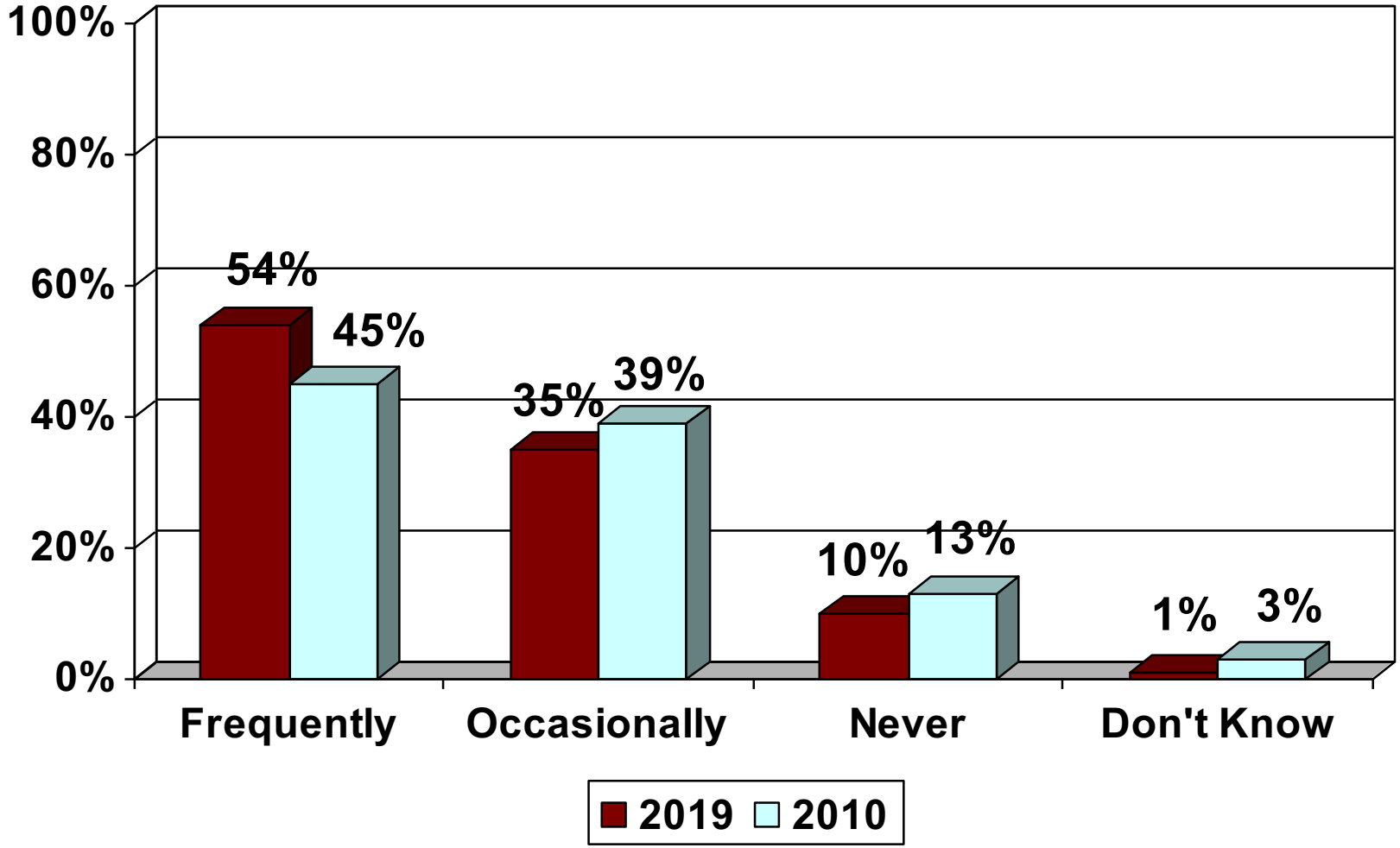
Usage of County Open Space

In order to add context to the use of e-bikes on County Open Space, Boulder County wants to find out how frequently people visit its Open Space, and what kinds of activities people participate in while on the Open Space. Voters were also queried as to whether there were particular trails they avoided using, and if so, why.

It turns out that over half (54%) say they frequently use County Open Space trails (understanding there may be a degree of confusion as to which are actually County trails), with the median usage being 20 times per year. And frequency of use has increased almost ten points since Talmey-Drake's 2010 survey (45% in 2010).

Further, 18% of Open Space users (16.5% of all respondents) say there are trails that they choose to avoid, largely because they feel they are too crowded or there are too many bikes on those trails.

How Often Do People Use Open Space Trails?



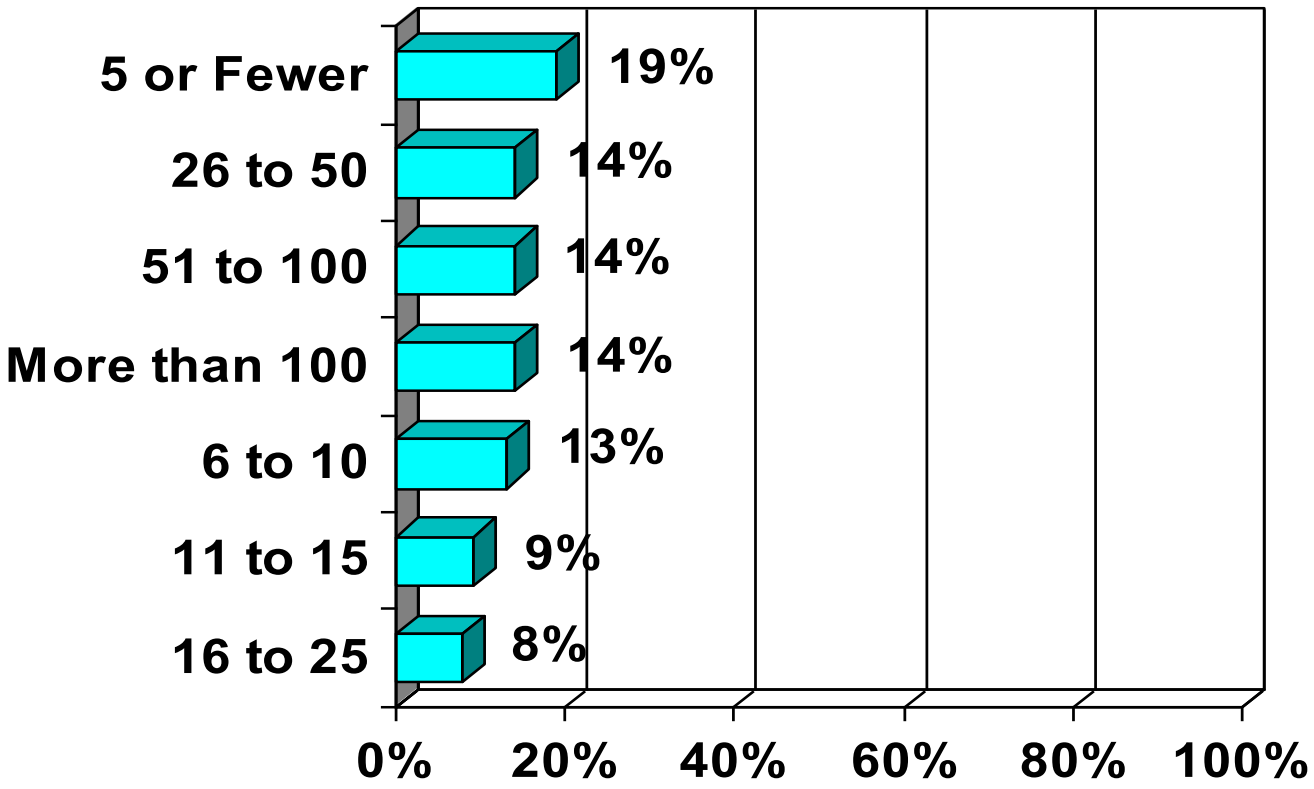
[n=605/603]

8.
D5

How Many Times In The Past Year Have You Gotten Out Onto County Open Space?

-Asked only of the 89% who say they use County Open Space-

[n=545]



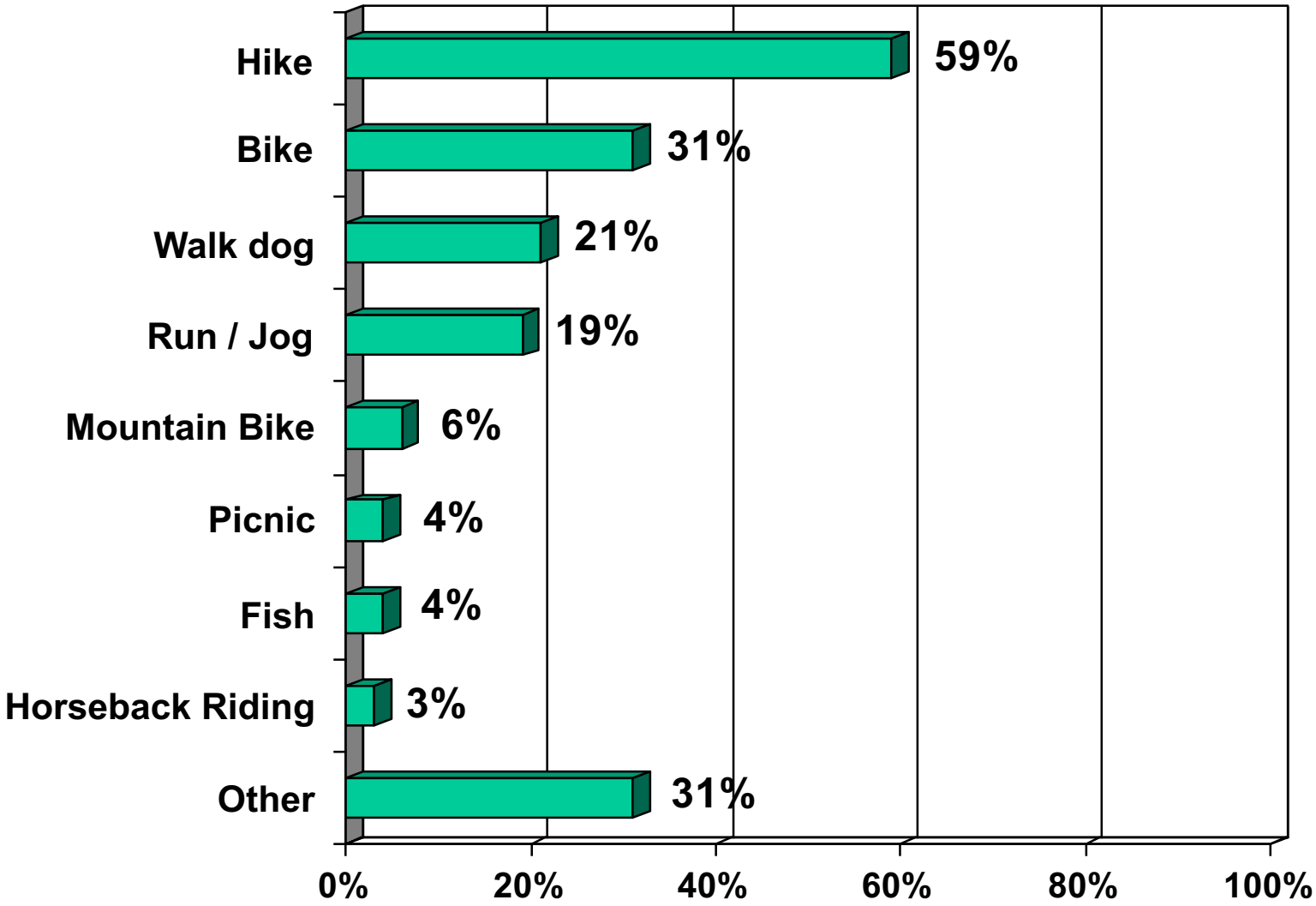
9.

D5a

What Kinds of Activities Do You Do On Boulder County Open Space?

-Asked only of the 89% who say they use County Open Space-

[n=545]



10.

D5b

e-BIKES ON COUNTY OPEN SPACE

11.

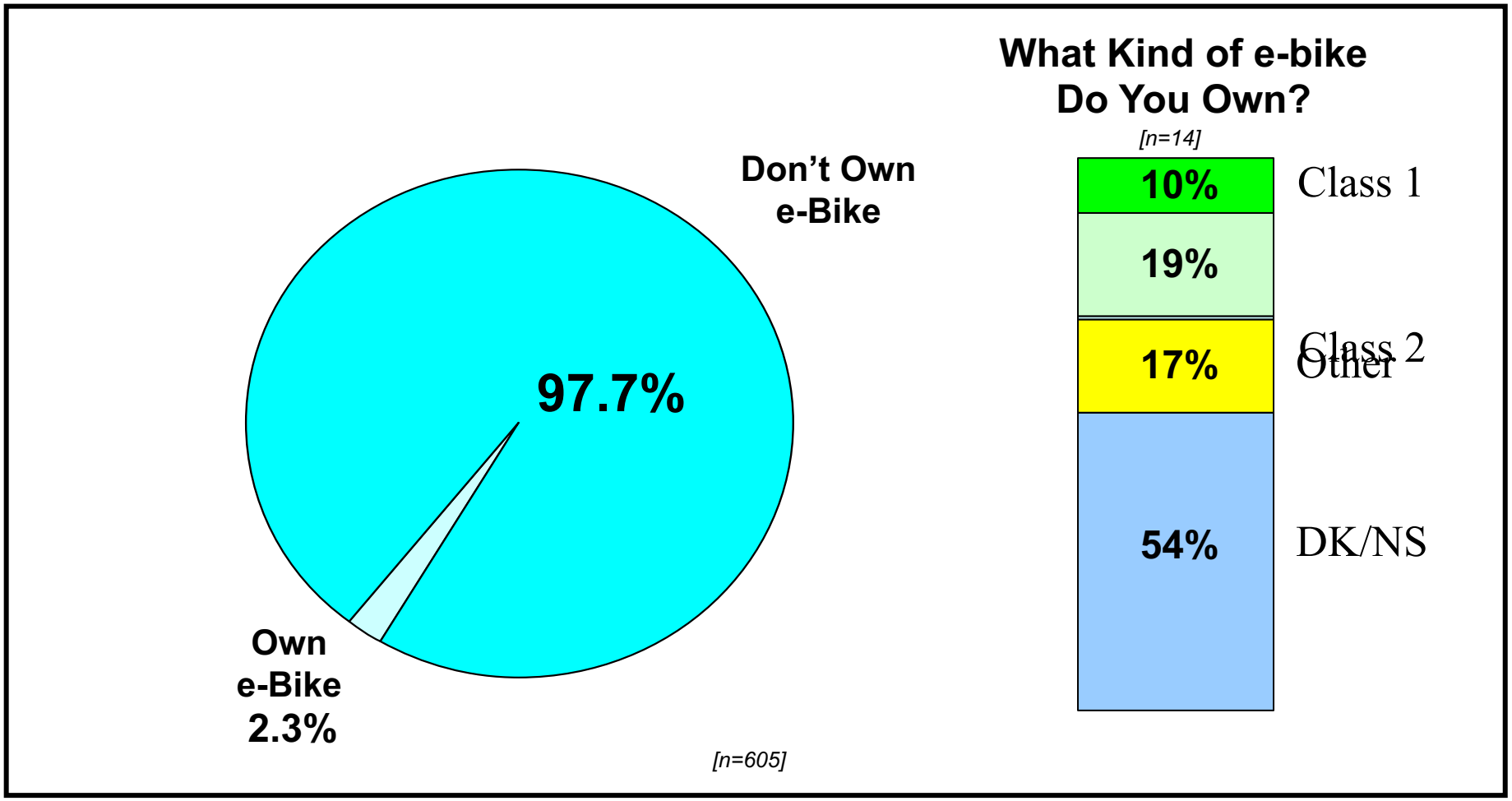
e-Bikes and County Open Space

Earlier this year Boulder County began a pilot program to allow some lower-powered e-bikes to be used on selected trails on the plains of Boulder County. Once the pilot is completed, and based on the results of that study, the County will consider the whether to allow e-bikes on County trails.

In conjunction with that pilot program, among other things, the Commissioners want to better understand e-bike usage in the County: How many have ridden or own an e-bike; what type of e-bike they own, as well as for what purposes owners of e-bikes use those bikes. As the following results show, e-bike ownership is still in its infancy, as few (2.3%) say they actually own one.

Note: Should future studies ask e-bike owners what class of bike they have, some clarification may be necessary as more than half of owners could not say which class of e-bike they own.

Ownership of e-Bikes



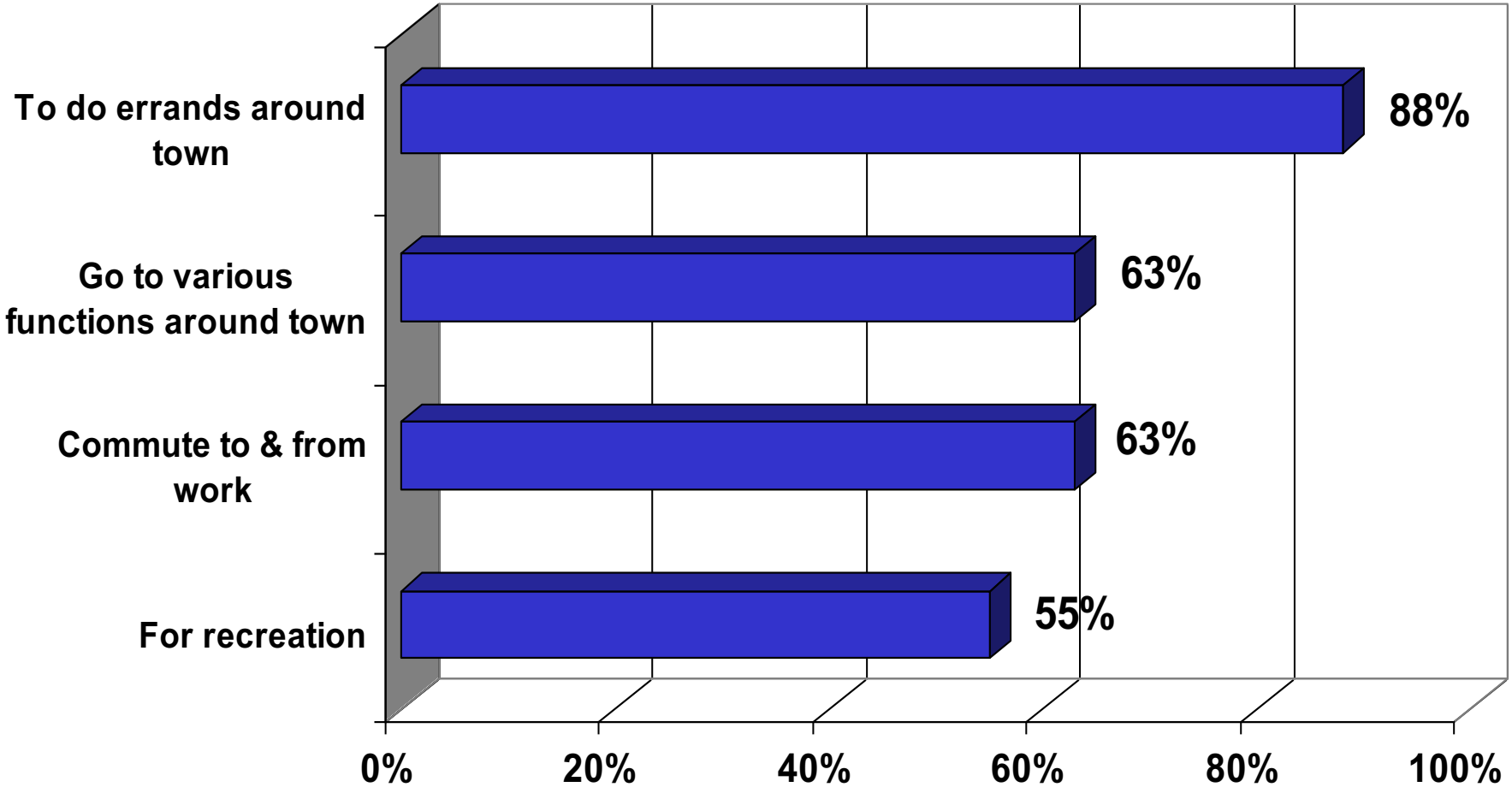
*0% own a class 3 e-bike

Q9a & 9b

For What Purpose Do You Use Your e-Bike?

-Asked Only of e-Bike owners in Boulder County-

[n=14]



Q9c

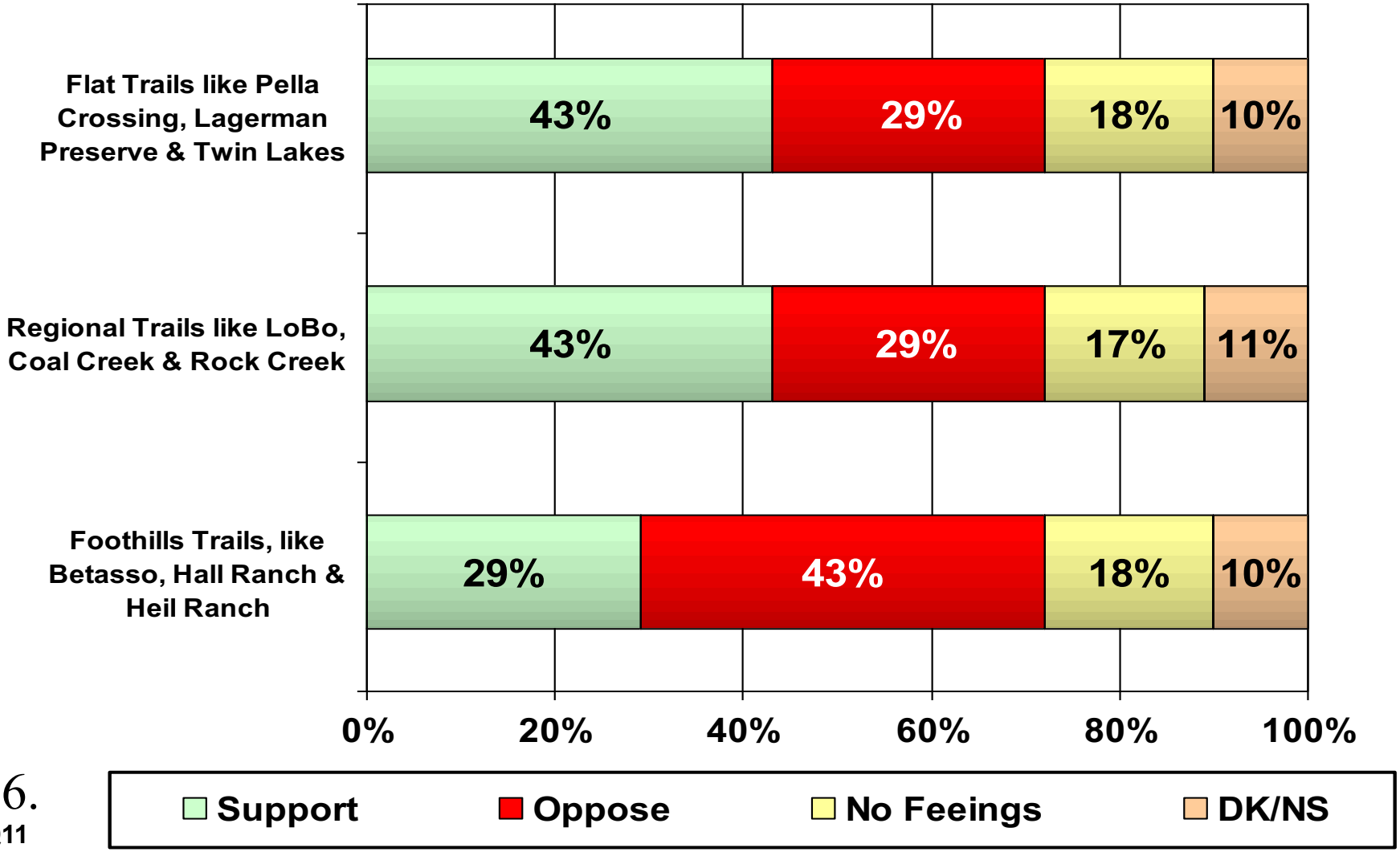
e-Bikes and County Open Space

In relation to the Pilot Program allowing certain e-bikes on some Open Space trails, survey respondents were asked if they had read or heard anything about that Pilot. As expected, a relatively few, but hardly insignificant, number of voters (23%) across the county say they are aware of this new program. This number happens to correspond closely with the 24% of County folks who have ridden an e-bike. However, whether they own one or not, people do appear to be receptive, as opposed to being against, allowing e-bikes on non-foothills trails throughout County Open Space. However, support is far weaker when it comes to opening up foothills trails to e-bikes.

Support or Oppose Use of E-Bikes on Certain Types of Open Space Trails?

-Asked of both e-bike owners and non-owners-

[n=605]

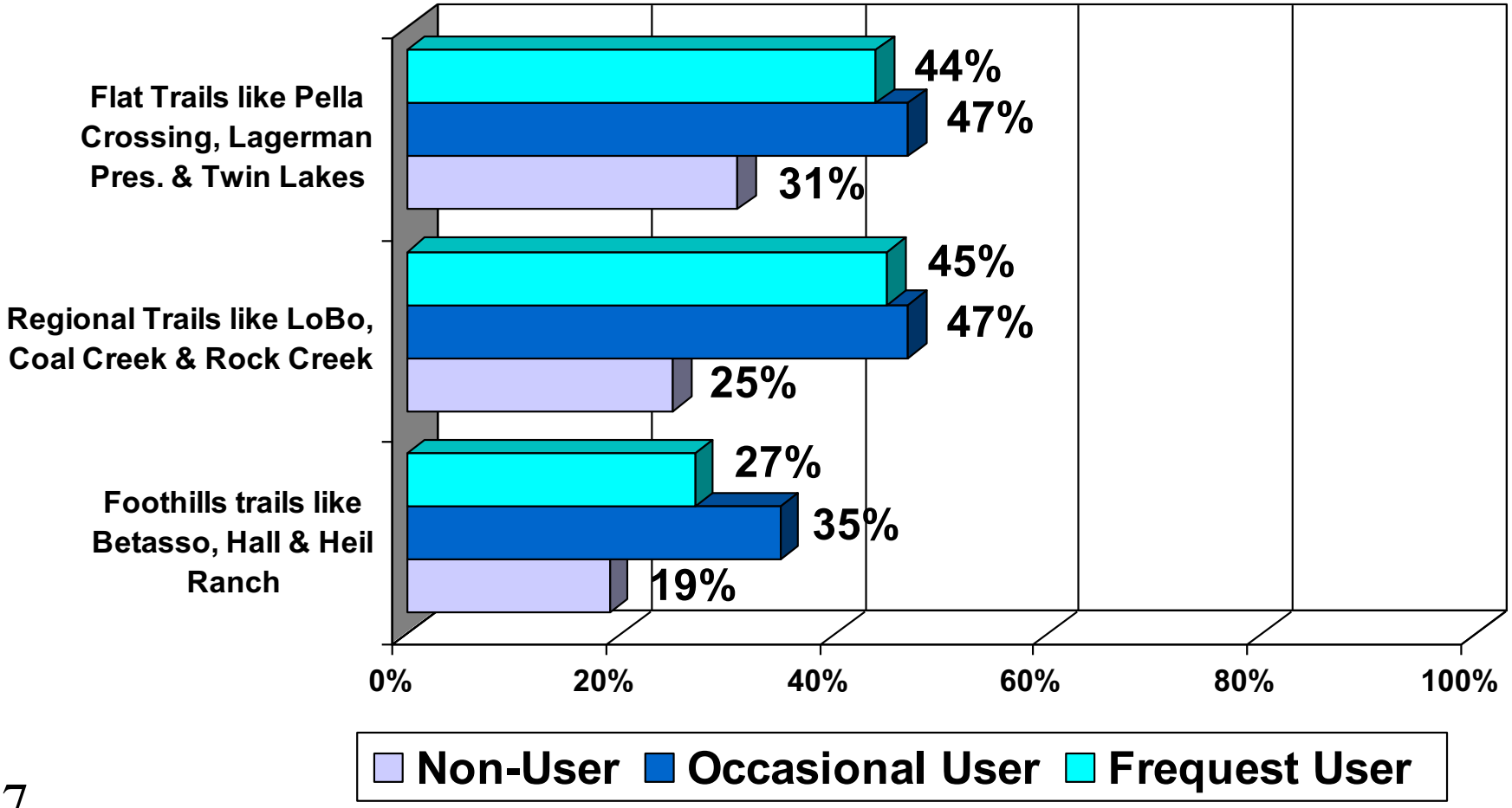


16.
Q11

Support For Using E-Bikes on Certain Types of Open Space Trails

-Comparing Support Levels of Open Space Users v. Non Users-

[n=605]

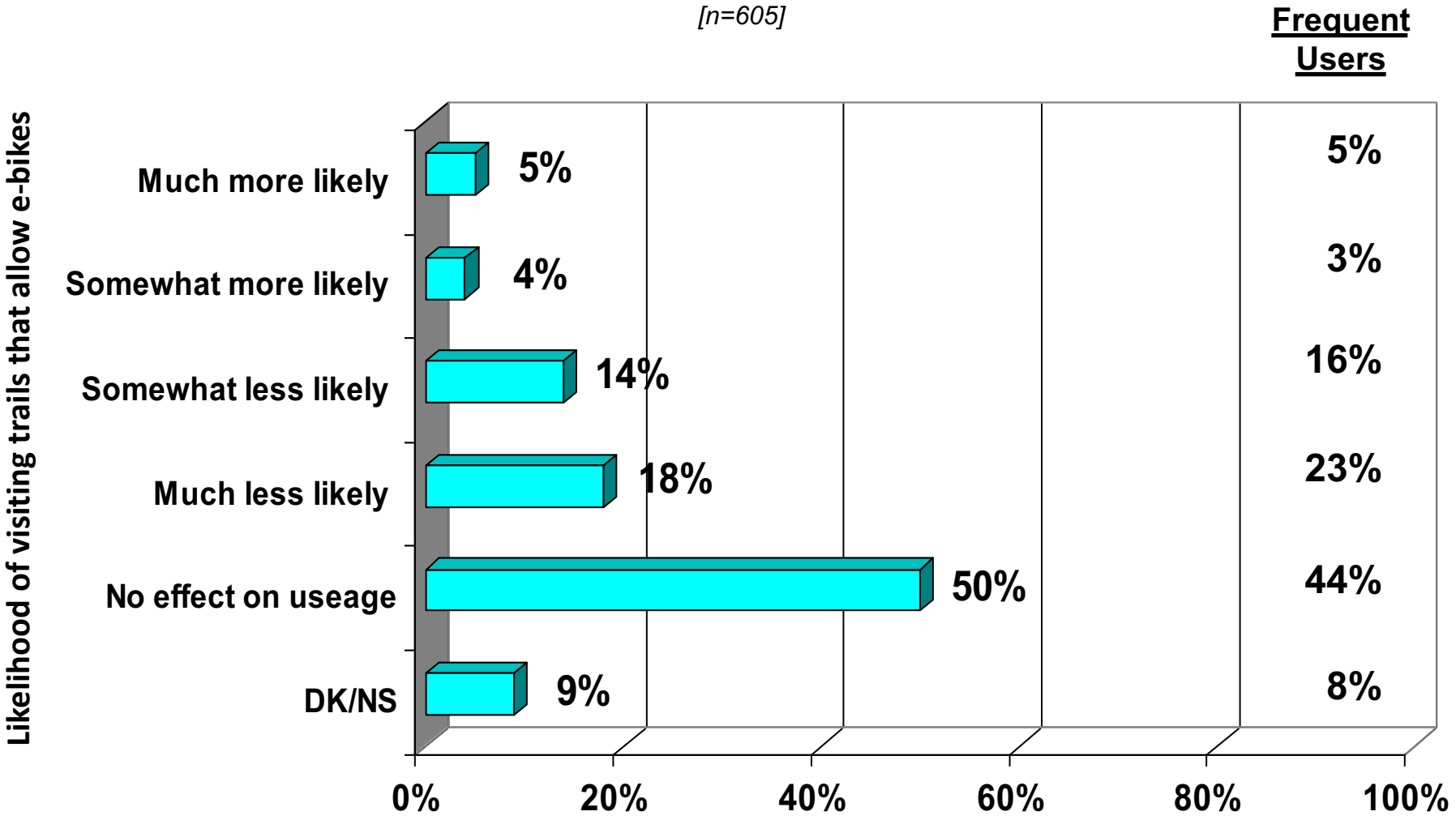


17.

Q11

Possible Displacement due to e-Bikes on Trails

-Asked of both e-bike owners and non-owners-



Q12

E-bike Public Comments March-Sept. 2019: Con

Thomas Halicki
2/17/2019

I am fully opposed to the use of e-bikes on anything except concrete trails (such as the 36 corridor trail) that are used for commuting. The Front Range is already overcrowded and will only get more crowded in the years to come. Introducing e-bikes on trails will only increase the use of trails (by people who aren't willing to use human power), increase negative user interactions between e-bikers and other users, and increase the speed with which those negative interactions occur. It's not like open space trails are so long or vast that one can't use human power to pedal them. Allowing e-bikes on dirt trails is like giving a big middle finger to all the other users. Nothing like bird watching and having someone zip past you at 20mph. Nobody "needs" to ride an e-bike on any Boulder County trail.

Rochelle Rittmaster
3/2/2019

When in the proximity of pedestrians (walkers, runners) the cyclist should be required to go into pedal mode - period. It is tricky enough, as paths are "mixed use", not to be injured by cyclists, boarders, etc as they can quickly come up from your backside. So a minor mis-step can already cause a collision between a cycle and an unwitting pedestrian. E-bikes tend to be heavy (I just test-rode one - it weighs in at 47 pounds, not unusual), and if moving by motor power, a collision of such weight and force is potentially DEADLY, if not life-threatening (I think of head injuries and other things if such a bike collides with an unprotected walker/runner). Or think of a person who is in motor-mode, and as a collision starts to occur and they panic, they could hit the throttle and make the accident much, much worse. So being required to be in pedal-only mode at that point only makes sense. One must conduct oneself to always minimize what a collision could look like. I would also say (if it is not already a requirement) to go at no more than 10 mph when in motor mode. Again, an e-bike is to be an "assist" - to perhaps help in certain areas or toward the end of a ride when someone may be tired. To just "let it rip" at speeds upward of 15 and 20 mph is irresponsible and is not what is intended for e-bike as an assist method. One wanting to go at those speeds should be out on the streets in a bike lane.

Betina Mattesen
3/3/2019

I had my first rude e-biker experience when someone ran a stop sign and cut sharply in front of me while walking on 1st Street in Nederland. Classic. I'm sure I can expect to see him illegally on local forest trails. Please protect a quiet use hiking tradition encompassing the values of passive recreation as defined in the Comprehensive Plan: " minimal impact, nonmotorized opportunities to be close to nature, enjoy open space features, have a high degree of interaction with the natural environment". This is great language promoting connection and a land ethic that

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a gearhead may thank you for someday. Nature is more than a dirty gymnasium. I see a lot of nature appreciation, bird and wildlife viewing, and "forest bathing" on Open Space.. At times bikes can startle, annoy, conflict, and destroy the peace that nature provides. Well funded Bid Rec (the newest extractive industry?) is making more of the decisions for public lands. Let's stand for something different in Boulder.

Ziggy Majerczyk
4/4/2019

Why people believe that they listening comments here, they never allow ebikes even class 1 to go on trials, they just old grumpy people, look what Jefferson Co. did, they allow ebikes class 1 on their trials, they allow it permanently because study shows there is no damages made by ebike class 1 on trials, why boulder county have to have own study not look at them? Just look people what horses do, they damaging all the trials and they do nothing! Boulder County just carry own business that not look for people needs! their only business is watch how their properties worth grow! Sorry for my frustration but they like communists! nothing comes to their head.

Ziggy Majerczyk
4/4/2019

Just one more thing that want to add to my comment, what kind of study is that when all pawed trials are closed to ebikes class 1 ?????? it is so interesting how they do that? by guessing??

Ziggy Majerczyk
4/4/2019

Maybe class action suit against Boulder Count and Open Space???

Mark Bockmann
6/9/2019

Saw a rider on an ebike yesterday on Wapiti Trail at Heil Ranch. These bikes do not belong on this type of trail, and rangers need to enforce the regulations strictly. In my opinion, ebikes should be treated as motorcycles. Essentially, that's exactly what they are: a motorized cycle. If a motorcycle is allowed, ebikes should be allowed. Otherwise, no. Another issue is that now the door has been opened to motorized travel of other types. I am seeing more and more vehicles like one-wheeled-something-or-others screaming along at 25 mph on Boulder Creek path. Is that what we want? I say no.

Dawne Dem
6/26/2019

You can’t police class 1, 2 or 3. Let’s be real. It’s all or none. And when a class 4 comes out that can go 30 mph without pedal assist and 45 with, you won’t be able to police that off either. They will look just like the class 2’s of today as technology evolves. As a teenager, I rode dirt

bikes and ATV's. My two brothers still ride. My brothers' take: I like the idea of being able to dirt bike more conveniently, closer to home, on OSMP trails. Albeit it will be with a rev limited dirt bike and instead of having a gas engine, it will be an electric one but it will still be the fun of dirt biking. Safety will be a transient issue for hikers. We bikers will create a separate and parallel trail path. We aren't going to slow down for hikers, horses, or other mountains. Why should we? We can effortlessly go around them. With our heavier weight, and the torque beyond what the average mountain biker can produce, we will easily be able to wear down new e-mountain bike/dirt biker trails. We can also effortless (class 2) or all but effortlessly (class 1 and 3) create all news trails to new areas that do not currently have routes to relieve congestion and conflict with hikers . I love the idea of being able to dirt-bike on weekdays near home – I don't care if it's on a "rev limited" electric dirt-bike. It will still be a ton of fun. That paragraph was my brothers take on this. He loves the idea! E-bikes are motorized vehicles. There is no arguing that. If you want to allow motorized vehicles, then widen the trails and allow motorized vehicles. Don't pretend Boulders trail's are an enjoyable commune with nature. Don't pretend Boulder is the 'nature' place anymore. Scrap the very thing that makes Boulder so … Boulder. Put Boulder's trails on Motorized Vehicle Use Maps. You will negatively impact wildlife. Don't think of your open spaces as sanctuaries for wild animals anymore. Anything flying through nature at 20 or 28 mph, or faster with the next generation of e-bikes, is not part of nature. It is horrifyingly disruptive to everything that is nature. Imagine the impact of that on wildlife. You might as well pave a highway through the OSMP lands. I own three bikes, a road racer, compact road racer and mountain bike. I have always, my entire life, had bikes. Since adulthood, I have always had two. A road bike and a mountain bike. Always. I commute to work from Broomfield to Boulder using the 36 bikeway and various multiuse paths to get to north boulder. I mountain bike on OSMP single track trails where mountain bikes are allowed. During my commute to work, I am frequently passed on uphills by bikes going insanely fast. As in class 3 speeds. On flats, same deal. I can easily go 20-23 mph on flats and these bikes pass me like I almost standing still. Luckily I am not on the heavier trafficked paths. There is usually plenty of space and little crowding. If not for that, I would not feel safe. An accident caused by the faster moving and inevitably less skilled 20 something (e-)bike riders would be unavoidable. It is always the young 20-30 something riding the e-bike like a maniac. The older riders are always nice, in control and careful. It's not the 60+ crowd that is the issue. For the 60+ crowd, I am going to vote for allowing e-bikes on commuter paved paths and in bike lanes. It is a solution for older folks and an option to get cars off roads. I get it and in spite of it being with serious negatives, I think it should be allowed. The advantages outweigh the disadvantages, for now. And honestly, the 20-30 year olds that are riding e-bikes, … that is just pathetic on a whole other level. And they are the ones operating a motorcycle recklessly where bicycles are the traffic. E-bikes have no place anywhere on single track trails. You are talking uneven terrain, short sight distances, hikers, both adults and children, dogs, and horses. You are talking heavier bikes, essentially motorcycles, which means heavier erosion under the torque and weight, longer stopping distances and faster speeds. You are talking amateurs without bike skills going fast on something heavy. The beauty of actual mountain biking is your fitness level will keep your speed down while you are learning bike handling skills. By the time you have trained enough to go fast enough to be dangerous, you are usually skilled enough to not be. This is not true with e-mountain bikes. You can go 28 mph on day one, with a bike that is heavy, gains and holds more momentum, and is harder to handle, at all speeds. Aka. You want to put a motorcyclist with no permit and without sufficient skills to 'get' a permit on a singletrack trail with hikers, children,

dogs and horses? Can users sue you when their arm or leg is no competition for a hit from a heavy "e-bike" going 28 mph when it hit them as a hiker? What about the horse that spooks and the rider that ends up with a spinal injury? What about the dog that gets run over and killed? Even the largest dogs will not fare well in a hit by a ebike, even at 20mph, with an e-bike's weight. Before you think this ludicrous, re-read "novice capable of going 28 mph on crowded single track trail", and you have youths 'entitled' and reckless enough to do it. The only thing that will keep trails safe is the very fact ebikes are not going to slow down for slower traffic. They will go off trail to go around, with little to zero effort, and create an entire second and third track where it is now single track. That second and third track is the only thing that will help keep the rest of users safe, as long as they stay on the far right track. The average hiker travels 3 mph, the average mountain biker probably goes 5-15 mph on single track. Now add someone with going 28 mph on that same trail. (or faster with Class 4 bikes, and make no mistake, there will be a class 4 and they will be faster and you will not be able to actually exclude them from trail use when they become available) A lot of folks are saying "at 79" (or whatever age) they should be able to ride their ebikes on all trails. Access is not a right. It's a privilege. And if opening it up for seniors puts everyone at danger because it has to open it for everyone… do we really want to cater to that kind of selfishness? It's at the cost of the quality of the OSMP experience for everyone. If one needs an ebike to access, should one really be accessing? If that older person falls, how many bones will they break? And how many bones will break in the person they hit? And how far out will they be? If something goes wrong and that older person has to actually push the bike out, can they? Do they even have the strength to handle a heavy bike on single track? A heavy bike is even harder for an older person to control than a light one. Does someone that doesn't have the strength to ride a light bike really belong on a crowded single track on a heavy one? We all have to let go of things we once enjoyed as we age. E-bikes are motorized vehicles. There are many trails, which can be found on the Motorized Vehicle Use Maps published for free by the forest service, they can avail themselves of. They can have a grand time, not having to worry about slow hikers, slow mountain bikers, horses or dogs, because the trails are designed for motorized vehicle use. Everyone is not entitled to do whatever they want, where they want, how they want. OSMP lands are for the nature experience, not for motorized vehicles. That you would turn OSMP trails into motorized dirt-bike trails is just without sensibility.

Dawne Dem
6/26/2019

In addendum to my earlier comments about it's all or none as OSMP is not going to be able to police out class 2 or 3. they can't police current policies. if OSMP allows e-bikes on the single track and other similar trails, permanently, the first thing I am going to do is go buy a class 3. Dirt biking as a kid was FUN! it takes 1.5 revolutions of pedaling on a class 3 to get above 15 mph. The acceleration is really incredible. To be able to go almost TRULY dirt biking (albeit on an electric dirt bike) in my own backyard, sign me up, as well as anyone else that has ever loved dirt biking as a kid. I have already scoped out a Class 3 e-mtb, full suspension, fat tire. Let the fun begin. With a 70lb bike with really good torque on that back wheel, making new trails along side existing ones used by hiker and human powered mountain bikes will be no problem. Once those are made, speed is not an issue. if you can't beat 'em, join em. Dirt biking is a lot of fun. An electric mountain bike (e-dirt bike) just means you don't have hearing loss to go with it.

Greg Tantum
8/20/2019

I am all for e-bikes on the roads, but not on any of the trails, especially gravel/dirt. I commute daily to and from work and also ride on the trails for recreation. My experience has been that e-bikes invariably go at their 20 mph max speed creating a dangerous situation for all other trail users and the (motor)cyclists themselves.

Davis Goodbout
9/9/2019

I'm in support of e bikes on bike paths next to car traffic. They should not exceed speeds of other bikes on non traffic oriented bike paths. They should not be allowed on open space properties as they create reckless speeds that are out of place within human powered environments such as wonderland lake and trails alongside the foothills. If we are going to allow e bikes in these places, we might as well let on dirt bikes, as the only difference here is noise/ gas. People's physical capabilities regulate the speed at which people can handle a bicycle and therefore e bikes create excessive speeds . I am a mountain and road cyclist, yet opposed to e bikes encroachment in areas that mountain bikes have worked hard to gain access to.

E-bike Public Comments March-Sept. 2019: Pro

Robert Barron
2/26/2019

Greetings: Thank you for this opportunity to submit a comment. I am a 69 year old man who has been physically active for all of my life. As a much younger man I was involved in two motorcycling accidents and injured both knees. My professional life was largely spent as a Registered Nurse and I provided care in a variety of settings. This work took it's toll in various physical ways and one after- effect is chronic knee pain. Since discovering ebikes I have been able to resume bicycling in a way that hasn't been available to me for years. Electric mountain bikes have been especially beneficial to me in that I can ease the stress on my knees. I've ridden on a variety of trails in the Boulder county region on my ebike and I intend to continue to do so. If I am ticketed or in any way impeded while doing so the result will before a judge where we will consider the implications of interfering with access for the disabled. My physician has provided me with documentation supporting my disability. Again, thank your for this opportunity, Robert Barron

Jerry Jacka
2/27/2019

E-bikes are an important means of reducing vehicle congestion and carbon emissions in Boulder County. As decisions are made about what trails to allow or not allow e-bikes on, please consider the needs of people like myself who bought an e-bike to travel to and from work, to restaurants and grocery stores, and other locations where before I would drive a car. Do not cut off connectivity across the county.

Robert Hastings
2/28/2019

I'm delighted to see ebikes are allowed on most trails. We paid for the trails, and should get reasonable use. I'm baffled as why some trails are prohibited, and regular bikes are OK. If there's an issue with speed limits or other undesirable behavior, then prohibit that behavior for all bikes. Another baffling regulation is prohibiting class 3 bikes. Is staff trained to distinguish them? I sure can't, and I own ebikes. It seems that behavior problems might be spotted during the trial period and regulated. AND BAN RED ONES! IT'S THOSE RED EBIKES THAT INFURIATE ME ;-)

Karen Steenekamp
3/2/2019

Thank you for taking comments. As a 19-year Boulder County resident, an avid bike path user, and an owner of three bikes (one of which is an e-bike), I have yet to witness reasons to ban e-bikes from our bike trail systems. Regardless of the type of bike, the heart of the matter is “biker responsibility.” Statistically speaking, I’ve witnessed and experienced bike accidents and close calls — all involving a reckless cyclist riding a traditional pedal bike. Bottom line, Boulder

County is a famous “bike friendly” region with a forward-thinking image. Banning e-bikes form our bike trails is outdated thinking. The feathers are in the wind; e-bikes are here — let’s evolve with technology while continuing to promote and support “biker responsibility.”

Betty Kaplan
3/2/2019

I think e-bikes should be allowed on all bike paths. I am a senior and the only way I can bike and not use my car is by taking my e-bike. Speed limits could be imposed. I think the racing bikes on the trail are just as dangerous. Many of these riders are going too fast for a bike/pedestrian trail. E bikes will get more people riding long distances instead of taking the car.

Britt Drake
3/2/2019

Sometimes I ride my bike for a workout (apparently "earning" my right to be on a trail), other times I am wearing regular clothes, using my bike to get to work, run errands & simply be outside. This keeps my car off the road & keeps me happy. I am often passed by people on regular bikes. And honestly, I really just use the assist feature to get me up the bigger hills. I see reckless biking on the trails every day, like the time my son was hit by a cyclist flying around a blind curve on the wrong side. To assume that e-bikes are owned by reckless, fast riders who will soon turn our trail system into a super highway of congestion is simply false. What is the ultimate goal here? Less traffic, less congestion on the roads? Or less traffic, less congestion on the trails? Just as there are rules for being on the road, there should be rules for being on the trails. And these rules should be followed regardless of the type of bike you own. Boulder seems like the type of place that would really embrace getting people on the trails. Keep in mind that even in an optimal environment, only a relatively small number of people are going to chose a bike over their car. Bikes of all kinds should be encouraged for all people, as long as everyone follows the rules. And hopefully increased numbers of riders (& decreased road traffic) would help to justify development of an even more extensive trail network. That would be amazing!

Jonathan aka Jody Wirth
3/2/2019

I think this is the best thing for the front range. EBags will help many more people enjoyed biking. Please allow this statue to become permanent. Please do not limit E bikes in the front range. Thank you for the trial.

Melanie Glover
3/3/2019

I think it's a great idea. The more accessible we make trails the better. More exercise means healthier people. Some could transition from ebike to regular bike. More access to outdoors means better mental health, particularly for people who are already limited. The more access we have to beautiful outdoors, the more people will love the land and the environment and will hopefully be more likely to help protect the environment and be concerned about land protection.

Lisa Hughes
3/3/2019

I don't own an ebike but am considering getting one. I would love to be able to ride it on the trails since I don't like riding in the street. I hope the pilot program is successful. E bikes allow others who don't normally bike ride other transportation options besides driving that are better for the environment. I would definitely ride more if I could use an e bikes in trails and bike paths.

Barbara Holub
3/3/2019

Hi, I'm 67 years old and like to cruise on open space trails, but returning up that last hill back to my house is a deal breaker unless I'm on my e-bike. My bike is not silent when on e-power, but its noise is barely noticeable. As far as people who are worried about e-bikes going too fast, let me tell you that there are many regular bikes that pass me up, and some of those regular bikes go at speeds that are definitely on the wild side. Instead of enforcing e-bikes, I think it would be better to enforce speeds. I'm not too sure about allowing e-bikes on mountain bike trails, but I'd love to see them allowed on all other open space trails. Thanks!

Donna Getman
3/3/2019

For years I commuted to my job in downtown Boulder from Lafayette in my bike using roads and trails. I have done some fund-raising bike rides as well as Ride the Rockies. I have had a total knee replacement and a broken femur in the same leg. My bike riding has been sidelined for a few years. I recently bought an e-bike so I could begin to ride again. I can turn the "assist" off making it a regular bike. The maximum speed is limited on the bike. But the "power assist" will allow me to ride again. My tax money goes to support the open space and bike trails. An e-bike is NOT the same as a motorcycle or motor assisted unit. It is a rechargeable battery to provide as needed assistance when riding. I'm over 70 and consider biking an excellent healthy activity to keep active.

Bridget Sargent
3/5/2019

My mom passed away in April 2005, but when the chance to make a comment on e-bikes, an issue that was close to her heart, came up, I couldn't pass the opportunity to share her story about e-bikes. She loved being outside in nature and she especially loved biking through nature. However, she was limited by a disability in that her knees just couldn't take riding a regular bike. So, she never had much of an opportunity to do the thing she loved the most. Access to trails on an e-bike would have made it easier for her to do so. I think for the sake of her memory, it would be a great decision to allow people with conditions like she had to be able to enjoy our beautiful open spaces too. And the best way to achieve that is to allow e-bikes on our trails. Thank You, Bridget Sargent

Susan Gstalder
3/25/2019

I purchased an ebike 2 years ago and I have enjoyed it immensely! I've seen parts of Louisville I've never seen before. It has improved my health and got me out of my car. I'm getting to the point where I only have to use assist uphill. As far as speed, I have never come across an ebiker speeding but I am passed by other bikers very often. Keep all the trails open to all ages and fitness levels!

Andrea Jankelow
3/26/2019

I'm 26 and have a chronic illness that prevents me from being able to ride a regular bike for a distance (as well as hike when flared). E-bikes give me an opportunity to still get some exercise in and get out in my favorite place — nature — without flaring myself to the point of bedrest. E-bikes are not about people being "lazy," but giving opportunity to those of us who weren't blessed with cooperative bodies or have aged out of the fitness level of a regular bike. I don't think having some form of disability should be a barrier to enjoying nature. If people are concerned about speeds, then have a speed limit for ALL bikes (electric or manual). Even on an e-bike, i still am often slower than many of the super fit people whizzing around Boulder.

Alex P
3/27/2019

I am strongly in support of allowing E-bikes on all open space paths and that allow cycling. I think that any regulation that encourages people to ride their bike (electric or otherwise) instead of driving is extremely valuable to the community. This is especially true now that Boulder has significantly more traffic and congestion. As an E-bike owner, I would much rather ride my bike to the trailhead rather than drive to the trail. However, the mountain biking trails around Boulder don't allow E-bikes. I have to drive my bike outside of town, which contributes to pollution and congestion when I would much rather bike from home and use the trails around Boulder. But now I have to take a round trip to Jefferson County to use my E-bike on the trails. I hope that Boulder can see the value in welcoming E-bikes just like our JeffCo neighbors have done already!

Thomas Duffy
4/4/2019

I feel ebikes are a valuable tool for older residents with health issues. Ebikes offer assistance when there is an injury. Instead of having to call an ambulance an older person with an ebike has the opportunity if shifting to full pedal assist and get them home with a reduced threat of injury. The more ebikes you support being in Boulder and out in nature the fewer cars there will be on the roads and reduced greenhouse gases. I would issue a permit to ebikes and have a confidential form that needs to be signed by a doctor simply stating the ebike meets a physical mobility restriction of the person. There is no safety issues associated with an ebike. Some may say the speed they can travel is a factor. But currently, the fastest bikes on open space are the

ten-speed mountain and trail bike riders. You could also limit ebikes to individuals 50 and over no questions asked. Getting older residents out in nature exercising is a very productive step for the city of Boulder. Please allow ebikes on open space trails. Thank you Tom

Christopher Corey
4/13/2019

Hello, Why are e-bikes not allowed on the Cottonwood Trail? I live in Gunbarrel, and commuting on Jay I'm reminded of the dangers of cycling on the road when I pass the ghost bike on my way to work. When ridden responsibly, e-bikes are not more dangerous than traditional bikes. I know several cyclists that can ride 28 mph under their own power. I think the trails would be safer if we enforced speed limits, rather than by limiting the types of bicycles that ride on them. Thanks! -Chris

Mary Ann Schaefer
4/15/2019

I have enjoyed biking for many years and feel so much pleasure to ride where text-wandering cars aren't putting my very life in danger. I am well-versed in biking etiquette when it comes to sharing pathways with pedestrians because, after all, I enjoy walking on byways too. I love my E-bike because injuries would otherwise mean I must give up biking. I love that I can ride this bike with or without assistance, and that even with assistance, I need only touch the brake to be in manual control and carefully pass pedestrians. I always use my bell, and always call an On The Left voice alert so as not to startle people. The point is that we all have a right to share these beautiful byways, and I think we all want to. Just as on the streets, there are some occasional rude drivers who aren't looking out for others' safety, but most of us are. If these pathways also post speed limits and reminders to be mindful, I think we can all enjoy these byways together just fine.

Grant Landsbach
4/22/2019

This is actually a bit odd for me to submit a comment but I did feel motivated to and to share my experience. As a Golden native and very involved and dedicated mountain biker since the 1990's I was dead set against eBikes even a year ago. After having some medical issues now myself and renting an eBike now for an extended period of time I have completely changed my opinion. With proper land management and user etiquette they are no more disruptive than traditional mountain bikes. My argument be fully in favor of allowing eBikes (Class I) 10herever traditional mountain bikes are allowed. (Hopefully most places but with existing rules...one ways, bike vs hike days, etc.) In addition, I cannot stress how much more accessible eBikes make the outdoors to people who have health issues and I believe this is one of the things that local governments should be helping their residents to achieve...to allow them access to their tax funded outdoor spaces. I would even go so far as to say that these health compromised folks, disabled, or even aged people should have this right. With eBikes I could even imagine being able to ride with my father or people of differing ages where we could enjoy the outdoors together in a way that traditional mountain biking makes more difficult. I can't tell you how amazing it is to get a

second lease on life with an eBike and get back outside thanks to this technology. I would also add that I was amazed at just how good of a workout you can still get on an eBike and how much of a better alternative they are to a traditional internal combustion motorized dirt bike. I grew up with motorized dirt bikes as well but I think eBikes are a wonderful solution to the viable arguments against motorized dirt bikes as they essentially eliminate the noise issues as well as the hard impact to the trails and environment. After riding an eBike I thought this IS the solution to end all the arguments with dirt bikes. Finally I would simply point to JCOS and the CO State Parks. eBikes are legal on all the trails in these systems (well all that MTB's are allowed on) and they have really had zero issues with them at all. I think this is really similar to the snowboard negativity when those were first introduced. I understand it but really...after my experiences I suppose I'm just more of an earlier adopter now with this technology. I know we are in an evolution with this technology but I'd simply reiterate what I have said to many of my friends who are still opposed...I tell them that someday they too may have a physical or health issue (and I guarantee someday they will be older too lol) and then I simply encourage them to try one. I have found that the biggest mind changer is when someone actually rides ones and realizes how they work. Thank you for taking comments on this and for looking into this as part of your land use management plans going forward.

Ron Deitchler
4/24/2019

Hi. I'm a 70 year old man who just purchased an electric mtn bike. After finding out which Boulder trails are open to ebikes, I saw that Boulder is in the midst of a yearlong ebike study. I just wanted to thank Boulder open space for keeping an open mind on ebike use. I've ridden bikes my whole life but as I get older it gets more and more difficult. My new ebike allows me to keep riding and getting outdoors. In my opinion, ebikes do not cause anymore trail damage than regular bikes. I hope after your study, you not only keep the current trails open, but open up the rest of the mtn bike trail system. Thanks for listening.

Patti Naumann
5/14/2019

I decided to get rid of my car and only use my e-bike for transportation around Boulder. I am not interested in riding difficult MTB trails but Cottonwood and LoBo, etc provide a much safer path than Jay Road and surrounding roads do. I am always pedaling my e-bike (unless, of course, just like a regular bike, I am going downhill). The throttle is only for getting a start if at a dead stop. I hope non e-bike folks understand these are NOT mopeds. Most e-bikes require the rider to pedal. Most of the time when I am running errands on it, I am passed by a non electric bike.

John Collins
5/17/2019

Boulder County should enter a trial period where e bikes are allowed on certain days on all trails to determine the potential for additional damage, etiquette and interaction with other trail users. I

believe this decision would satisfy all concerns and allow for a comprehensive study based on data versus emotion.

Dan Page
5/20/2019

I have been riding mountain bikes for over 50 years and as my body (but not my spirit) have aged, I have become a big fan of e-mountain bikes. There is no logical reason why Class 1 e-mtn bikes should not be allowed on all trails that already allow regular mountain bikes. They do not tear up the trail any more than regular mountain bikes. The people that use e-mtn bikes are more likely to be polite and sensitive to other riders, especially folks like me who are more..."mature". I have heard some arguments about e-mtn bikes going too fast...but the only time they might be faster is going uphill. Since they can be a little faster (and hence smoother) they are LESS likely to do damage to a trail, since tires would not be spinning out. They are not any faster downhill, since speeds are limited to 20 mph. All of us are aging and it is just a matter of time before they are considered mainstream. The sooner we can get there the better, in terms of allowing e-mtn bikes on all trails where regular mountain bikes are allowed. If people remain concerned about e-mtn bikes tearing up trails, perhaps there can be a small registration fees, with the money going toward train maintenance.

Cathy Berman
5/21/2019

It is important to allow Class 1 e-bikes on Open Space trails. They are quiet, require pedaling (the motor only provides a boost), and the boost is limited based on speed. I pedal my e-bike and engage the assistance as needed going uphill. These e-bikes make it possible for the less able like the middle-aged and seniors, the disabled, those with chronic medical conditions that weaken the body, and others to fully enjoy Open Space trails. If a regular bicycle is allowed, a Class 1 e-bike should be allowed. Boulder is not just home to athletes and the ultra-fit. Please do not exclude the rest of us. We need Open Space.

Richard Berman
5/21/2019

Class 1 Ebikes should be allowed on all trails/paths where bikes are allowed. Prohibiting E-bikes discriminates against the elderly, disabled, less abled, and parents with children onboard. Class 1 Ebikes make no more noise than fat-tire or mountain bikes. Class 1 Ebikes require riders to pedal; the assist cuts out (by law) at 20mph; mountain bikers go much faster than that. Class1 Ebikes do no more damage to trails than fat-tire or mountain bikes. There is no legitimate reason to ban Class 1 Ebikes from bike trails/paths. The current policy against class 1 ebikes puts bike paths off-limits to seniors, disabled, lesser abled, and parents with children on-board (many of such bikes are class 1 ebikes). This is a violation of the spirit of the American with Disabilities act. It is pure snobbery to put bike paths off-limits to a large part of the population (who need some assist to ride uphill) just because they may not be a strong as others.
David Weisheit

2019-05-22 15:38:59
As an older rider (70) an e-bike lets me enjoy getting outdoors more often and for longer rides than I would be able to do without an assist. I think the issue should be education on e-bike safety when used on trails with other bikers and walkers. A common sense approach has worked for me. Just because you may be able to go faster than others on the trail doesn't mean you should. I have not personally seen any abuse of the privilege on the Coal Creek or Rock Creek trails which I use.

Dan Bye
5/30/2019

Allowing class 1 e-bikes on any trails where mountain bikes are already allowed would encourage outdoor activity and awareness of the Open Space we enjoy in Boulder County. E-Bikes open up a lot of commuting opportunities for people wanting to get to work without being sweaty, and those who are just out of their comfortable range for commuting on a normal bicycle. This will also help motivate people to "commute" to trails on their bikes instead of driving to a trailhead. The noise of class 1 e-bikes is not noticeable beyond ~20 feet, especially while the rider is at speed. The wide tires on "Fat bikes" make more noise than adding an electric motor to a bike with a thinner set of tires. This is similar to how a Nissan Leaf or a Tesla sounds normal on the highway to cars around them. The additional wear on trails would only be an issue for higher classes of E-bikes, with class 1, the motor only helps within human achievable speed and power. While e-bikes are generally heavier than their bicycle counterparts, it is not greater than the fluctuation in riders' weights and the difference between the weight of a gravel bike and a "Fat bike". Higher classes of E-bikes should likely be considered further before allowing them on any non-motorized trail, however, the benefits of allowing class-1 e-bikes on non-motorized trails outweigh the initial concerns. They aren't motorcycles or ATVs, and are still primarily human propelled with only assistance coming from the motor.

John Brantley
6/3/2019

I have been mountain biking for 30 years. Now at age 61 I have had 8 knee surgeries and a hip replacement. Later this summer I will have to have one of my knees replaced. An e mountain bike allows me to still do the sport I enjoy. I know that people are concerned with the speed etc. However, younger riders (20’s, 30’s, 40’s). Still ride very fast and aggressively. The larger issue I see on the trails is still trail etiquette of mtn bikers going too fast and close to hikers....or not pulling over when others are coming up hill. A class 1 mountain bike only works when the riding is pedaling and the motor cuts out at 20 MPH. The front range trails are too technical for those speeds and I don’t believe the trail use will increase significantly.

Randy Levensalor
6/15/2019

We should allow e-bikes on trails where conventional bikes are allowed. Appropriate rules and speed limits for safety and preserving the trails would need to be included.

James Elkins
6/16/2019

I support type 1 e-bikes on all trails. No one should exceed the speed limit. I have seen road bikes on the trails in excess of the speed limit. Besides, it makes no sense to break up the commute between Niwot and Boulder for small sections of prohibited trail. We want people out of their cars on the Diagonal to ease congestion. There should also be a senior citizen exception for the use of e-bikes on Boulder County trails.

James Oday
6/23/2019

Please ride a class 1pedal assist e-bike before making a judgement regarding suitability on public trails. Class 1e-bike will not change the trail dynamic one bit, except possibly to make it more crowded. If that's what the county is after, then by all means make the rules.

Eugene Titov
6/24/2019

Prohibiting e-bikes anywhere where regular bikes are allowed just for the name of them does not make much sense since they can also be used without any assistance from the motor and thus be no different from regular bikes. Perhaps a better strategy should be imposing speed limits and prohibiting using assistance in certain places.

Tom Swihart
6/27/2019

I have enjoyed riding my ebike perhaps 20-30 times in 2019 on Coal Creek and Rock Creek trails from Erie to Stearns Lake. I have not seen a single other electric bike on those trails this year.

Jason Nickel
7/17/2019

I support ebike use on Boulder area trails

Tom Noyes
7/17/2019

My point of view comes from a life time mt. biker turns 60 years old and discovers eMTBs in the same year. I am an early adopter of the sport of riding full suspension electric mt. bikes. I have rode 2500 on my eMTB in the past 9 months. I have ridden my eMTB on legal mt. bike trails all over Jefferson County Colorado, Pocatello Idaho, Ketchum Idaho, and hood River Oregon. I have also ridden plenty of trails in Boulder County. I believe we should allow electric mountain bikes on all mt. bike trails in Boulder County. On some of the busier trails like Hall and Heil eMTBs should be allowed at least a couple days a week - minimum, same with betasso and

benjamin. Marshall Mesa/ Doudy Draw should be legal to eMTBs any time. as should west Magnolia and the dot trails, walker ranch, mud lake, and bald mountain. Just because eMTBs are late to the party does not mean we do not belong on the trails. Like mtbs eMTBs, we are not as pure walking or running, but eMTBs are made exactly for the rocky steep trails that Boulder County is known for. Just like we trust the drivers of automobiles to be careful behind the wheel, we can trust and self manage riders of eMTBs, just like we do mtb riders. Not everyone is perfect all the time, but we are pretty good. Us older Boulderites are not going to stop recreating any time soon and eMTBs are not going to go away anytime soon. Furthermore, I did not bust my butt, working on trails and paying open space taxes for the last 39 years to get pushed off the trails too easily. Who would have thought that today we were going to be riding electric mt. bikes, 39 years ago. Things change and we now have bikes that help us get up the hills, yay for us. If the trails get too busy for all the bicycles and hikers, then maybe we need to build more trails. there are a lot of places in Boulder County to build mt. bike trails. Plenty of contiguous chunks of publicly own land. If the trails get too busy it is not the fault of eMTBs. A growing County needs more trails for current future users. To restrict use to emerging technologies on the trails like eMTBs or other future non-destructive technologies appears closed minded. We are going to be riding our eMTBs somewhere. There are going to be more and more of us. Boulder County should embrace us like many other communities are doing. We are not the enemy. We are part of the solution. We are your neighbors and we care about other trail users. We live in Boulder, we built and are building businesses here. Our kids live here.

Chuck Sanson
7/18/2019

In fairness to all users, the trail network in Boulder must be opened/increased for ebikes so all tax-paying citizens may use and enjoy our resources. I am a 30 year+ resident of Boulder, hiking, riding mountain bikes and enjoying the outdoors, now with my teenage daughters. I own several ebikes and use them daily for commuting and trail riding. I've also been a Board member of Boulder Mountain Bike Alliance, and part of the Outdoor and Cycling Industry for 20+ years. From every point of view, Ebikes and more specifically eMTB's have unlocked a positive experience for many people who could not otherwise participate in the outdoors. eMTB's are a well-accepted form of recreation and successfully share trail systems throughout the world with other user groups. The current pedal-assist technology allows for responsible use by the rider. Concerns such as speed differential, trial damage and excessive additional ridership have NOT been realized on existing and test areas where eMTB's are in use. These are mountain bikes, with inherent limitations due to their construction and components. The bike industry is focused on responsible growth of this segment, consumers are voting with their dollars, it's time for Boulder to step up our efforts!

Art Schwadron
7/19/2019

Please allow e-bikes on all open space trails that are currently open to bikes

Stephen Haydel
7/302019

Open up more trails to eBikes! It is much better to have people eBike to a trail head and ride the same eBike on the trail than to drive a 2-ton SUV to the trail head and ride a bike on the trail. Bikes go faster downhill and with a tailwind than ever do with electric assist.

Jim Doyle
8/4/2019

I am a strong advocate of e bike usage. My e Bike is totally quiet and so efficient that I leave my car in the garage as much as I can. If the leaders of Boulder County want to help reduce carbon emissions, they must become strong advocates themselves. A critical piece of this important advocacy will be unlimited access to paths and trails for e bikes that align with manual bike usage. Stick with speed limits vs trying to disallow usage of quiet, ultra efficient e bikes.

Jason Hilliard
8/4/2019

I hope you will establish an eBike policy based on the following: 1. The most important consideration for all bikes (conventional or electric) is safety. 2. As a nearly daily rider of Boulder's wonderful array of paths for nearly 30 years, on conventional bikes, and now on an electric bike, I can confirm that there are MANY unsafe practices by riders of conventional bikes. Too many of them: - Ride too fast (well above the posted 15 mph limit) - Don't announce that they are passing - Enter the main path from side-ramps at far too high a speed. 3. eBikes are still sufficiently new and are growing sufficiently rapidly that habits and routines will take some time to become established, much as safety practices by riders of conventional bikes are still not sufficiently widely established, despite many years of trying. 4. eBikes can be operated with very little or no motor-assist, making them into virtual conventional bikes (as others and I routinely do, to extract maximum exercise from the riding experience) 5. Restricting eBike use because of the anticipated bad judgment of a minority of riders can have undesirable consequences, including: - Diminishing or eliminating healthy exercise opportunities for people who need some intermittent motor assistance when riding - Causing people to give up on using eBikes for errands and bringing more automobile usage. 6. Class 2 eBikes have the same speed restriction as do Class 1 eBikes. Discriminating against Class 2 bikes, in my view, would be a serious mistake. Their main advantage (especially to older and disabled users) is the availability of the throttle to help with getting started, especially when forced to stop facing an upward incline. 7. Because of their health-promoting and environmental-protection potentials, eBike usage should we ENCOURAGED, and IN NO WAY DISCOURAGED. For context, let me add that I'm 86 years old and have come to highly value my first eBike. It is giving me daily exercise that I consider vital to my health and longevity. It enables me to ride longer and further, and take some of the hills that I did for years on my conventional bikes but no longer feel able to do without straining myself to a level that feels uncomfortable, even risky. Also, like many older folks I am far more aware of my vulnerabilities than are many younger riders on conventional bikes. Daily, I witness aggressive riders on conventional bikes who zoom past me (and engage in other unsafe practices) on the county's paths. Like other older folks I see, I routinely ride within the posted speed limits, and scrupulously follow safe practices on my eBike. Please don't enlarge or even maintain the current restrictions on eBikes. Instead, PLEASE EXERT MORE EFFORT

IN ESTABLISHING A CULTURE OF SAFE PRACTICES for all riders of all types of bikes. Thank you!

Alan Parisse
8/5/2019

The problem is irresponsible riders, not E-Bikes. My car is rated to go 120 MPH. It never has and never will. That's crazy and illegal. E-bikes allow seniors and others to get out of their cars and ride bikes. Please don't restrict E-Bikes because a few purists are offended. Their reaction is reminiscent of those who screamed "get a horse" when the automobile was invented. Please do pass tough laws that restrict speeding and other bad bike behavior and then enforce them.

Mark Perry
8/22/2019

Class 1 E-Bikes should be allowed on all boulder county trails. They are pedal assist only, and the assist stops @ 20mph. I do not own an E-bike but am considering it. I am an avid hiker, dog walker, motorcyclist, and until age and injuries caught up with me, an avid mountain and road cyclist. I have previously commuted to work for 1 1/2 years using the Coalton and south boulder creek trails. I more recently drive up Flagstaff mountain daily and shard the road with cyclist. Because I love all forms of travel to get out and enjoy Colorado, I try to be courteous of others, especially those experiencing the outdoors using a different mode of travel than I might be at that time. 99% of the time the experiences and interaction with those you are overtaken by or overtake are pleasant. There are unfortunately the 1% that you rarely encounter that don't understand common courtesy. This 1% are also spread through out all the different modes people use to get outdoors. E-bike are not the problem and should not be banned. They will only encourage more people to get out and enjoy Colorado. As far as the additional weight tearing up the trails, it is a non issue.

Judah Gaioni
8/26/2019

The commute between Boulder and Longmont is just too far on a regular bicycle. The level 1 ebike (pedal assist) makes it a (still long, but) reasonable ride. Level 1 ebikes typically max out at 20mph, which is a safe speed for a bike trail. To encourage alternate means of transportation in commuting, please continue to allow these level 1 ebikes on the LoBo Trail!. Thanks!

Gary Thornberry
8/29/2019

I'm baffled by the opposition to e-bikes. I don't own an e-bike and may never purchase one, but that's assuming I remain healthy and can still pedal uphill. What about people with disabilities or injuries? What about people who are older and struggle to climb some of the trails, but are efficient cyclists? All the major bike manufacturers are producing e-bikes and we are starting to see many of the MTB riders endorsing them. I'm assuming people are threatened that e-bike users are going to bust their Strava times. e-bikes will become widespread in the coming years.

As for those concerned that riders will blaze past them on an electronic bike - let's just remember that most of these bikes are expensive and the younger (aggressive) riders are not likely the folks who will be purchasing them. I can't even understand an argument against their use as long as they're properly regulated and those regulations are enforced.

Kari Stoltzfus
8/30/2019

I have been a lifelong Boulder a county resident. Unlike so many people in Boulder I have not remained an avid athlete or cyclist through the years. In an effort to get "back in the wagon", I purchased an electric bicycle. I have been astounded by the results. I have been replacing at least 50% of my car trips. I run errands, go out to dinner, go grocery shopping, and visit friends and family on my bike when I used to take my car. I have gone from having a bike in my garage that I haven't sat in once in 3 years, to riding 150 miles a week on my e-bike. The electric assist gives me the confidence to take longer jaunts to pearl street in Boulder (17 miles from home) or even to Lyons. The throttle is the thing that has surprised me the most. If I were to have to stop at a light or stop sign even on a week incline I may have difficulty getting started, and wobble, lose my balance, and sometimes need to walk my bike to safety. This is not only unsafe for me, but also a hassle for the cars and pedestrians around me who have to wait while I figure out how/what to do. With the assistance of the throttle on the electric bike, I am able to safely get through intersections of any kind. I am also FAR less tempted to run a stop sign of not make a complete stop as I would be on a traditional bike. Please consider that so many people riding e-bikes are just trying to get back out there, and for whatever reason need a little extra confidence. I hope that the work I am putting in on the e-bike gets confident enough he get back in my standard bike. Until then you can see me commuting with a big smile on my face. Thank you for your time!

Glenn Ventura
9/4/2019

Ebike class 1&2 should be allowed on multi use trails where bikes are allowed.

Jed Shapiro
9/5/2019

I am a healthy 72 years old. I got an e bike last year so I could continue to commute from home near Evan Fine Park in Boulder to Lafayette by bike (I still use my regular bike about 1/3 of the time) I am very cognizant of the 15 mph limit on the Boulder bike path. I regularly get passed by younger stronger non e bike cyclists going 20 to 25 mph. My philosophy is that it is exactly like permitting cars that are capable of going 100 mph on roads where the speed limit is 25. It's completely about the driver and the speed limit!!!! Please allow e bikes everywhere but enforce and put up signs about speed limits.

Rick Dyson
9/5/2019

E-bikes are a blast and they are the future. We need to embrace this future as it is a fun and effective transportation device to hopefully get more of the masses out of cars. Who cares if they're on trails? They are clean and safe. They are a bicycle with a green boost. Maybe grandma and grandpa can get out of their car and take a fun trail ride. We have got to work together if we have any hope of saving this planet! I want to see more ebikes on all trails - just no gas engines. Can't wait to get one!!!

9/10/2019

Had to make one more comment. I read an interesting article in Singletrack re the differences in acceptance of e-bikes in Europe and the US. While Europe is crazy for e-bikes, we have reservations. We are sort of the last to catch on, I mean look at the Beatles.
One reason is that bikes in Europe are part of their culture, transportation, and heritage. Bikes in the US are still basically toys where we don spandex and go for our weekend rides. Europeans use their trails and ride their e-bikes to these trails. We could learn a lesson here. Why not ride our e-bikes to West Magnolia, Hall Ranch, and Batasso? With e-bikes we could. Is it better to ban them and keep driving our SUVs to the trailheads? something to consider.

E-bike Public Comments March-Sept. 2019: Neutral

Rebecca Shannon
8/20/2019

I do NOT want e-bikes on mountain biking/multi-use trails (Betasso for example). When I ride my bike, it's to be away from cars and vehicles, and to enjoy nature. I can understand using them for transportation on bike paths but once you add a motor, it's basically a motorcycle and should be limited to roads where other motor vehicles operate. As a dog walker and nature observer, I don't want to be run over on a bike path by someone commuting in a hurry. However, when I reflect on my feelings about e-bikes, what I'm most concerned about can't be fixed by banning or allowing them--we all need to share better and be more friendly/considerate of other users. How is the County going to impact/affect that? Good luck discerning a fair and enforceable course of action. And thank you for soliciting public opinion.

E-bikes Emails to POS Staff: Pro

Dan Baldwin
3/06/2019

Hello Tina--

I am a 68 year old long time Boulder County resident. My wife and I have recently become class 1 (pedal assist) e-mountain bike owners. I have ridden most of the counties ebike-legal trails and I just can not understand why NONE of the actual mountain bike trails are approved for ebikes. All of the legal trails are flat multi-use trails that are really very urban and not mountain at all. I just dont get it. I have read the public input statements and I dont see a clear reason why there can not be one or two actual mountain bike trails included in the list of trails participating in the pilot period. I have a bad knee and the ebike allows me to ride without further injury, however there are literally no DECENT trails in Boulder County that allow them.

As things stand now, I must travel to Jefferson County to ride an actual mountain bike trail. Being a long time Boulder county tax payer that doesnt sit very well with me. Is there any hope at all that one or two of the actual mountain bike trails could become legal for ebikes during the pilot period ? How can the pilot period actually test the impact of ebikes if they are limited only to the urban flat trails ?

Is there anything I can do to help my cause ?

Thank you,

Dan Baldwin

3/06/2019

Hi Tina-

Thank you so much for your detailed response. I understand and appreciate the reasons you listed regarding the e-bike prohibition. I would like to say that the class 1 pedal assisted emtbs are much closer to a non-motorized vehicle than they are to a motorized vehicle. If you (or most people) rode one, you would probably realize this fact. The problem as I see it is the overly broad, black and white, interpretation of the word "motorized".

At any rate thank you for your suggestion to look at the ADA provisions. I couldnt find any criteria for determining if a bad knee would qualify. Would I just tell a ranger that "I have a bad knee" or would I need an official determination ?

Thanks again, I really appreciate your response.

Best,
Dan

Jane Toman
8/22/2019

Hello,

My husband has Parkinson's disease. He is supposed to bike regularly for symptom management. He enjoys mountain biking, but it is becoming difficult due to his condition.

A friend mentioned that it ia possible to get a medical exemption so he could use an electric mountain bike on the trails in Boulder county. Is this true? And if so, where do I apply for this?

Thanks for you time on this matter.

Best
Jane Toman

8/24/2019

Hi Vivienne,

Thank you for your prompt response. I really appreciate it, and the willingness of Boulder County Open Space to accommodate people with disabilities. Being able to use an e-bike will really make a difference to my husband's health (both physical and mental).

I filled out the survey today.

Thanks again.

Allen Feld
9/2/2019

HI Sadie,

Thank you for taking the time to discuss the bike trails and e-bike approved trails.

My personal story is that I am in my mid seventies and my bike has been a game changer for me. As a senior with a disability, being able to use my e- bike is allowing me to outside, exercise, use my car less, and enjoy life! I am so grateful that the City of Boulder offered rebates to buy e-bikes. This was a big incentive to me. I am sure these are keeping more cars off the road.

When biking, I use my bell and alert people walking to when I am passing them. I also always slow down when passing people both going uphill and downhill. I often see mountain bike

riders and road bike riders going a lot faster than me both uphill and downhill and passing when it is not safe often without any warnings. It is not the bike- it is the rider and their mentality.

I would like to suggest that seniors and people with disabilities be allowed to use their e-bikes on all City of Boulder and Boulder Country bikes trails, paved or dirt, and that they can have an escort. I think that seniors and people with disabilities will be respectful and mindful. They will have safety for all as a priority.

Please pass this along to any appropriate people that will make decisions for us Boulder community citizens.

I will be happy to discuss this with any one that would like to get my perspective on this situation.

Sincerely,
Allen Feld
1340 6th ST
Boulder, CO 80302

303-447-0461

E-bikes Emails to POS Staff: Con

Betina Mattesen
9/4/2019

Because I work on illegal motorized issues on National Forest land in the mountains (out of control, no resolution in sight) someone contacted me with this story. While hiking quietly on the Boulder Spring Brook Trail identifying new spring wildflowers an E Bike zipped by moving fast and making a whirring sound. Startled, this person stood up. An oncoming mountain biker pulled over. My friend said "did that seem like a regular bike to you?" He replied "no way" and shook his head. I would have called for enforcement; these two did not.

When is a motor not a motor? When the CO legislature says it's not? This is so discouraging to my efforts.

Here is a biker's view that singles out Boulder:

https://www.singletracks.com/blog/trail-advocacy/electric-mountain-bikes-allowed-singletrack-colorado-yes-no/

And look at the impressive push back to a bike trail proposal in Redstone:

https://coloradosun.com/2018/12/18/carbondale-to-crested-butte-trail/

And Steamboat:

https://www.steamboatpilot.com/news/newly-formed-group-advocates-to-slow-trail-building-in-routt-national-forest-to-protect-wildlife/

There's a simple solution to such controversies as CO grows and wild places become sportified and that's habitat first. This stance provides education and a stewardship model that recreationists may have missed, and may thank you for in the future.

Thanks.
Betina Mattesen
Illegal Motorized Trails Task Force
Forest Watch
Nederland