Electric Mountain Biking (e-MTB) in Scotland's Mountains – Report for Scottish Mountaineering Trust

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1. Introduction

The use of electric mountain bikes (e-MTBs) in Scotland's mountains has increased rapidly in recent years. This potentially opens up the mountains to a whole new segment of society including younger generations and those with mobility requirements, but it also brings challenges and impacts for: mountain rescue; mountain users; sensitive upland habitats and species and footpath maintenance. There is little data available on the use of and impacts on mountains by e-MTBs, the thoughts of bikers and other mountain users on the new and developing trend, and the implications this might have on the right to responsible access in Scotland's mountains.

This study sought to collect views on the use of e-MTBs from bikers, land managers and mountain rescue services in three areas of Scotland: the Cairngorms, the Ochils and Torridon, with predicted differences in levels of e-MTB use and access to mountains. It sought to collect data to better quantify use and understand the potential impacts, challenges and opportunities associated with e-bikes in the mountains and to engage with respondents to map out potential best practice guidance. It was funded by the Scottish Mountaineering Trust and the University of the Highlands and Islands' Tourism sector group and took place from June to October 2026.



2. Background

In the UK, an e-MTB, as an 'electrically assisted pedal cycle' can be ridden anywhere pedal bikes are allowed (Developing Mountain Biking in Scotland, 2026). Under the Scottish Outdoor Access Code (SOAC), cyclists have the same rights of responsible access to the countryside, on paths and off-road, as walkers, for example (NatureScot, 2025). National laws regarding off-road access vary. In Norway, for example, it is illegal to use electric bikes in protected areas such as National Parks (Burrow, 2021); similarly, in New Zealand the Department of Conservation only allows e-MTBs on formed roads in national parks, and some parks, such as the popular Abel Tasman, have their own byelaws which do not permit motorised bikes (Nelson Mountain Bike Club, 2022). In the USA, the picture is complicated, as "currently, e-MTBs are not defined or dealt with consistently across land management agencies" (International Mountain Bicycling Association, 2026). The US Forest Service, for instance, classes e-MTBs as motorised vehicles, while there is no consistent policy across national parks (Ibid.). Their use in the USA is also clouded by having three different classes of e-bike, class one being relatively similar to the classification used in the UK (Trek Bikes, 2006).

E-MTBs enable wild areas to be more accessible to a much wider spectrum of riders. As Burrow (2021) suggests, "bikers can go further and faster and many other path users may not be used to their presence in areas they once never had to share". In Colorado, USA, Perry & Casey (2020) reported the average age of a mountain biker and an e-MTB rider was 32 and 58 respectively. However, it is suggested that the average age of e-MTB users is now falling, with e-MTBs offering opportunities for younger riders with less fitness and stamina (Kesteven, 2022). This has a number of implications in terms of land management. Within Scotland, research conducted by Taylor et al. (2023) highlights tensions between traditional mountain bikers, walkers, land managers, and emerging e-MTB users.

This study, conducted jointly by the Centre for Mountain Studies and the Centre for Recreation and Tourism Research at the University of the Highlands and Islands explored the opinions and perceptions of landowners, land managers, mountain bikers and e-MTB riders regarding the responsible and sustainable use of e-MTBs in the landscapes of Scotland. Taylor et al. (2023) reported that e-MTB use has been increasing in Scotland and that while some prefer to use dedicated MTB trail centres, for others it has increased the area of land that can be accessed and ridden on, including mountains. Taylor et al. (2023) argue that e-MTBs challenge established norms of non-motorised recreation in Scotland's outdoor spaces, despite Scotland's access rights under the Land Reform (Scotland) Act 2003. Their work found mixed stakeholder perceptions: some viewed e-MTBs as increasing inclusivity and sustainable tourism opportunities, while others feared greater trail erosion, and conflict with walkers.

Intergroup conflict is inevitable in the outdoors, where different user groups have different motivations for being there: whether the quiet enjoyment of natural spaces that walkers may seek to the fast-moving dynamics associated with mountain biking (Taylor et al., 2023). The introduction of e-MTBs also raises the possibility of a new form of conflict: while

it is generally accepted that mountain bikers and e-MTB riders are part of the same 'group', riding trails on bikes that are, to the layperson, indistinguishable, it has been suggested that intragroup conflict (Mann and Absher, 2008), that is between riders of mountain bikes and e-MTBs, may also become more common, with the latter perceived as an 'outgroup' encroaching upon the playground of regular mountain bikers (e.g. Chaney et al., 2019; Moesch et al., 2022).

Some studies indicate that both mountain biking and e-MTB use can contribute to soil erosion, vegetation trampling, and wildlife disturbance (e.g., Kuwaczka et al., 2023; Pickering et al., 2010), as well as management implications (Mitterwallner et al., 2021), economic and social effects (Ciascai et al., 2022), and broader socio-ecological consequences (Weiss et al., 2015). Although current evidence suggests that rider behaviour and trail construction may influence impacts more than motor assistance itself, researchers note a lack of long-term ecological studies specific to e-MTBs in fragile upland environments, such as those found in Scotland. In a survey, Ingrim-Sills et al. (2022) found that e-MTB users preferred to ride on forest or gravel access roads and multiuse trails /paths, with fragile areas with limited or no trails or paths the least frequently ridden terrain, although they also found that male riders more likely to access moorland or Munros/mountains than females. The authors also noted there was very limited data available on e-MTB vs non e-MTB erosion in the literature, reporting on one study in dry weather in Western Oregon that found no statistical difference in erosion between MTB and e-MTB at 500 passes in uphill or downhill riding (IMBA, 2015). However, when they interviewed focus groups, Ingrim-Sills et al. (2022) found that the consensus among users was that e-MTBs potentially did cause a greater degree of wear and tear to trails. This was mostly the result of a greater volume of riders, their behaviours and riding techniques. The results suggested that respondents are more likely to ride e-MTBs than non-e-MTBs in wet weather. Even if research to date has been relatively inconclusive about the potential damage that e-MTBs can do to trails in comparison to regular mountain bikes, it is recognised that "the ability to do more laps of trails, increasing the number of wheels on trails, *is likely* [our emphasis] to have a direct impact on the wear and tear of trails" (Developing Mountain Biking in Scotland, 2026). In Taylor et al.'s (2023) study "most of the interviewees recognised the importance of educating riders, of both e-MTBs and mountain bikes, when it comes to issues such as minimising trail impacts or avoiding conflict with other trail users".

As the 'voice of the Scottish mountain bike community', Developing Mountain Biking in Scotland (2026) has developed guidance for mountain bikers, entitled 'Do the Ride Thing', interpreting "the key points within the Scottish Outdoor Access Code relevant to… mountain biking". The guide uses positive messaging to encourage 'sustainable trail behaviours' and try to avoid some of the negativity perceptions that surround mountain biking (Taylor et al., 2023). As part of the guide, specific e-MTB guidance recognises that there is a concern that riders with less experience of the potentially rapidly changing weather conditions, the fragility of mountain paths, and the fact that any accident may become more serious in remote terrain will lead to increased call outs to mountain rescue, an unfair burden on the NHS, and real and sustained damage to our precious wild places.

The guide is therefore designed to encourage responsible behaviours, so that mountain bikers can demonstrate that they can simultaneously enjoy and respect the environments in which they recreate (Developing Mountain Biking in Scotland, 2026).

3. Methodology

This study sought to understand the views of relevant respondents in relation to the use of e-MTBing in Scotland. Three study areas were selected and 18 interviews conducted for the Cairngorms, the Ochils and Torridon, across land managers, Mountain Rescue members and e-MTBers. These areas were chosen as all include upland environments and represent a mix of land use, management and ownership, access to urban centres, and all three areas are home to e-MTBing trails. This approach to the study areas also meant that the research could include a more in-depth understanding of the dynamics in particular areas in Scotland which may be representative of upland areas as a whole. Additionally, each area had an appropriate sample size of land managers, mountain rescue members and e-MTBers.

Ethical approval was granted by the Ethics Committee at the University of the Highlands and Islands (ETH2526-1070). Semi-structured interviews were conducted online via MS Teams, with respondents provided with a Participant Information Sheet and a Consent Form prior to any interview being conducted. Some interviewees had multiple roles (i.e. a land manager in the Mountain Rescue) and e-MTBers covered more than one area (e.g. the Ochils and the Cairngorms). Interviewees were asked broad questions around the themes of: increasing access participation and enjoyment; potential damage to upland areas; user conflict; communication, information and guidance; and safety and mountain rescue. All interviews were recorded, and transcripts were then checked before being uploaded to Nvivo. Coding themes were initially created using the interview questions, and then responses from the transcripts were coded. For example, the following themes were created for e-MTBer responses:

- Conflict
- Ecological
- Enjoyment
- Information
- Safety

The coded responses were then analysed within these themes, and key respondent quotes were extracted to add depth to the reporting of the results. Finally, an element of triangulation was achieved through the four researchers discussing and confirming these themes at an in-person meeting.

4. Results

4.1 Increasing access, participation and enjoyment

The general consensus from the interviewees was that e-MTBing positively opened up access to all sociodemographic groups. Riders and land managers reported seeing all different age groups using the bikes and that they themselves had taken advantage of some of the more accessible aspects of assisted riding, such as being able to ride whilst pregnant or carrying a new puppy. One respondent said *"it also meant I can, um, like get biking with the kids in an easy way as well while pregnant and postpartum"* (E1). They also mentioned how e-MTBs enabled a better work/life/cycle balance through less strenuous rides which could be achieved in quicker timeframes:

> *I can get so much more riding with life and work and the family and stuff. I could jump on the bike and get an hour, which would have normally taken me like two hours. So it's reducing how much time commitment I need to ride* (E5)

The e-MTBers acknowledged that while the energy expenditure required for uphills was less than on an analogue MTB, potentially allowing more users to cycle the uphill routes, a certain level of fitness and technical ability was still required:

> *I think in general the hills, so in terms of technicality, to ride any hill in Scotland, you've actually got to be quite a good rider. Like, and even if you've got an e-bike, it still doesn't take away technicality or even the physicality, like an e-bike is generally quite heavy. And to get over, you know, steps or uneven ground is not easy. And even with an e-bike, it's still quite a big, you know, barrier* (E2)

Some e-MTBers mentioned the physical struggles with pushing or carrying a heavy e-MTBs:

> *Mine is like 26 kilogrammes or something. So like, I wasn't having it up and over my head, but still like lifting it up and over boulders, even when it was on my shoulder. Like, you know, up top, I had like a bruise on my right shoulder, which took weeks to heal* (E4)

Or when they couldn't be ridden: "*Unless you can ride it all the way up, which there are very few tracks and hills that you can do that on, then they're a blinking pain to lug up the hill"* (E7).

Another barrier to access and a divisive inequality factor is the high cost of an e-MTB, with several respondents emphasising this.

> *I guess that's the thing about like the justice and inequality of it all because there are more expensive….. it's actually really hard for some folks, especially, you know, like a lot of my friends are single moms, like how they have spare cash to like*

> *maintain their bike, let alone an e-bike, you know? They're not, they're not cheap* (E1)

The additional equipment required for transporting heavy e-MTBs was also felt to restrict access to specific e-MTB locations:

> *You've got the entry price is £2, 3,000 at least to buy the bike. And then there's all the other kit that comes with it as well. So you've got to move it to get it there. So you need racks that will cope with it. In general, you can't easily get them in the back of a car. So, there's a whole lot of barriers to entry that make it quite hard to get an e-bike out onto the hills* (E7)

The e-MTBers generally felt that they weren't accessing more remote or upland destinations: "*I don't necessarily think I've seen a massive change in behaviour of mountain bikers, and with introduction of e-bikes, especially in the hills…. the people who could already use them might now do it on an e-bike"* (E2). If they were accessing these, it was because they were already motivated to go to such places on their analogue bikes. For example, one respondent said: *"I'm the kind of individual that is taking my bike into the most inaccessible places anyway"* (E5). A few did mention that the e-MTB did enable them to access the remote places more frequently due to the shorter amount of time needed to complete the ride and therefore not requiring as large a weather window, *"I can bike in, run, do the two hills and then e-bike back. And I did it in like a few hours, whereas that would have been like a full like pretty much weekend"* (E1).

One e-MTBer provided an example from the Ochils where increased e-MTB users have created *"an e-bike line to climb"* up Dumyat where it had not previously *"had a track up it before, because it was quite rocky" (*E5). Additionally, some mentioned that they thought *"e-bikes are making the hills more accessible for people"* (E1) and that *"with the amount of people on e-bikes, there's obviously going to be more people up the hills"* (E3). However, many stated that having battery assistance did not necessarily mean you could go further:

> *The battery life and everything is quite, you know, critical in how far you can go. So if you put your e-bike on a higher mode, the distance you can go is not necessarily huge and a lot of that depends on, it can depend on how basically fit you were before you started e-biking and how much time you've got and also how much discipline you've got in terms of using the power modes* (E2)

Some of the land managers felt that they had seen an increase in mountain bike riders, but they did acknowledge that there is *"no way of knowing the difference between what an e-bike is doing and what a mountain bikes doing"* (LM3):

> *I think we've noticed bikes where we probably never used to see bikes, particularly on Invereshie up on the ridge there, there's quite a popular route that comes up from Glenfeshie and then comes back down through our land. And there did used to be bikes that would do that as a rideable route, but I think it's become more popular as a result of e-bikes* (LM2)

It was commented that geographical areas will have different experiences due to topography and ease of access:

> *I think e-MTB use has increased slowly on the NTS Torridon Estate, certainly compared to the Cairngorms. Possibly due to the nature of the hills. For walkers, it doesn't really benefit you to use a bike to access the hills as isn't really quicker/easier, unlike hills on Mar Lodge* (LM5)

Even still, he noted that riders are still getting to unexpected places *"It's amazing where they do get, especially the more competent riders. It really is quite impressive where they can get"* (LM4). One land manager commented that increased e-bike use would actually be a benefit *"because you're actually, you know, you're able to facilitate people to explore more and actually get into the heart of the NNR [National Nature Reserve] a bit easier where there's no vehicle access"* (LM2).

From the Mountain Rescue perspective, none of the interviewees had noticed an increase in call outs due to e-MTB use in Scotland's mountains The area where e-MTBers felt there was increased use was on specific trail riding locations where the e-MTB enabled them to *"lap them back - to -back cause you can get more laps in [the] same amount of time. So there is more use"* (E3), and that they felt e-MTBs were more suited to the quick up and down style of built trail riding *"I think electric mountain bikes are just a really good tool for the job when it comes to kind of 'winch and plummet' style riding"* (E6).

E-MTBers also talked about increased riding because of benefits associated with a greater payback for time. For example, one e-MTBer said:

> *For shorter evening rides, routes where the trails, and it's somewhere like Dollar, for example, in the Ochils, where there's a forestry track that takes you most of the way to the top, and then you can just ride down the various different trails that are there… you can ride all the way up on your e-mountain bike. And because you've done that, you're not tired at the top. You can go a lot quicker, so you can probably do three or four times the amount of riding that you could do in the same amount of time that you could do on an analogue bike* (E7)

They also spoke about the lower levels of energy expended, compared with mountain bikes. For example, one respondent said:

> *So you'd get three goes on a conventional bike and you're knackered. On the e-bike, you're doing 5-6, you know, so you can get a lot more done on an e-bike* (MR4)

Additionally, they also spoke of the ability for them to increase their skill level. One respondent said:

> *[my] riding has progressed so much like because you're getting so much more downhill time. It's just made me get out on my bike more because it's, you're getting more reward in a smaller time frame* (E1)

Finally, they spoke about the sheer enjoyment of e-MTBing and this was a core draw into the sport. One respondent said:

> *you really focus on the downs because you've basically not expended energy on the ups, so you've got that mental focus and ability to practise more on the descent… I suppose that saving of energy will then mean they maybe go out more* (E2)



4.2 Potential damage to upland areas

From the land managers' perspective, it was felt that there could potentially be some adverse effects of increased e-MTB access to the upland areas but that, at present, it was *"not something we monitor"* so have *"no data"* (LM2) and therefore there is *"nothing we can quantify at this stage"* (LM3). Additionally, they acknowledged that they couldn't feasibly differentiate between MTB and e-MTB users. One land manager said: *"I couldn't say it's e-bike specifically or it's this, it's just general"* (LM4), and noted that other trail users, including walkers, still can cause impacts: even walkers *"and there's still a lot of people that walk up there"* (LM2). Both land managers and e-MTBers felt that, in general, e-MTBers stick to paths, so much of the discussion around erosion and ecological damage was in reference to damaging tracks, trails and paths. The e-MTBers even commented that *"some Scottish hills, they've got quite a vague route. So obviously it's more… people are more likely to stick right on the path when you can kind of see the path"* (E1) and therefore their use of paths can have a *"positive impact is keeping paths clear and defined so that people are sticking to a defined path and not traipsing off the path"* (E6).

Potential issues raised were *"greater disturbance in sensitive areas"* (LM2), *"increase[d] impact on sensitive paths at higher altitude"* (LM4), damage from the heavier bikes, with one respondent noting: *"we see the impact of bikes specifically on that track, the downhill. There's berms forming higher up where it's not a made path necessarily"* (LM3). Finally, several land managers noted the damage from the braking on heavier bikes, with one stating:*"my personal concern would be that they're just heavier brake, that's going to affect how they brake and everything else really"* (LM3). Another noted the impact of braking on steeper gradients:

> *I think where we tend to see more issues is on steeper bits, especially where those corners, because when they break on the loose surface, they tend to they tend to lock the back wheel and skid, and then that's what draws the material up from underneath and makes it less stable* (LM2)

Land managers noted that potential for damage to tracks and paths was closely related to the softness of the ground:

> *I would say, is the impact on some of the poorer paths. You know, like the Land Rover tracks are good, hard, well-maintained ones, but you get on the footpaths, they're not so well maintained, shall we say, and if the soft areas, bikes in general are hard on it* (LM4)

Some specific places where damage has occurred were mentioned. One land manager said: *"there's a section that's got a series of steps coming down to the road and going up the other side. They are getting trashed by mountain bikers because they just use it as jumps"* (LM4). At the opposite end of the spectrum, one land manager did comment on the positive impacts of e-MTBing in Scotland's uplands, bringing in a discussion around deer management. They said:

> *It is quite useful to have mountain bikers disturbing deer. So quite often I have noticed better, whether it's mountain bikers or walkers, but quite often get better regeneration along the edge of paths that are better used* (LM6)

Whereas the research found that the land managers cannot say for certain that e-MTBs are causing damage, the e-MTBers themselves have personal experience to draw from. They felt that the difference between damage from an e-MTB and an MTB was not that great. For example, one respondent said: "*It's no different to riding a bike, a normal bike up there, or no different to, the masses of boots that have trampled on the ground ahead of it in my head"* (E5). Many felt the need to comment that footfall also causes damage. One respondent said: *"I'm not convinced that there's more negative impact, in particular, or significantly more impact between e-mountain bikes and hiking"* (E6). However one e-MTBer did say:

> *I've watched people ride up grassy terrain on an e-bike or something that you couldn't unless you're very, very strong, which I'm not, you couldn't ride up that on*

> *an analogue bike and you're putting a lot of power down through some pretty big knobbly tyres that will generally rip the grass out* (E7)

The use of power was noted as one of the main ways e-MTBs cause damage. Specific examples were provided as to when a quick burst of power is released to navigate tricky sections: "*the motor, the way it kicks in on awkward bits, again, on those particular sections, it's leading to more erosion"* (E4), or when it exasperates land conditions which are already more prone to damage: *"really wet, muddy conditions and you're putting 120 newton metres of torque through a puddle that is going to rip up the terrain"* (E5). A few riders also mentioned that the use of too much power would cause more damage and questioned if this was something that others were aware of:

> *I don't know how many people who ride e-bikes think like that or are aware like that, of that kind of environmental impact. I'm sure some are, but maybe some people are, just, I want to go and ride my bike as hard and fast as I can because it's my only day of escapism adventure experience. So they might not be thinking of a bigger impact because they are thinking quite personally* (E5)

They felt that more advice or awareness to *"ride in a lower mode rather than the highest mode you can or something like that might be useful"* (E4). This then opens up the possibility for riders to become more aware of the extra damage that can be caused by the higher power modes and take that into account: *"is it all right for me to go in turbo mode and fire up something?"* (E7), one respondent asked rhetorically.

Like the land managers, the e-MTBers did feel that the heavier weight of the bikes, the harder braking that this requires, and the increased skid damage will have an impact on the wear and tear of trails. One e-MTBer said: *"I mean, it's a bigger, heavier bike, doing more miles, making more noise, particulates from a heavier bike stopping in terms of tyres and brake pads"* (E6). However, another rider, who also builds trails, commented that *"people [who] are going downhill and not necessarily braking hard on it, and the actual impact of the tyres might be quite minimal, and perhaps even less than, or certainly no more than feet"* (E2).

As with the land managers, the e-MTBers mentioned the connection between erosion and the type of ground:

> *there's the impact on the ground, compressing the soil, whatever surface you're on, I think especially when it comes to bogs…. I suppose, bits of when it's dry, sort of displacing material onto, from the trail off the trail, so rocks coming off* (E6)

They also, however, mentioned factors such as gradient and direction of travel, with one respondent stating: *"It is quite specific to like the slope and the ground and which direction you're going"* (E2). Weather was also seen as a major influence, with an e-MTBer outlining the particular composition of trails in Scotland:

> *If they [e-MTBers] are riding through wet boggy terrain, they're going to start ripping trail tread up and get down to maybe more sensitive layers of peat bog….Braking bumps, depending if it's purpose-built trails or natural trails. These things are all possibilities* (E5)

Despite these comments, many also mentioned that the impact from walkers needed to be taken in context alongside MTB damage:

> *an e-bike will plough, or a bike will plough directly along a trail, whereas 100 people will try and walk around the bog and avoid it, so they're possibly spreading the erosion issues further* (E5)

The land managers stated that apart from following the SOAC they didn't have a specific e-MTB approach. One land manager talked about working with a local group to encourage more sustainable riding:

> *I want to say we're nudging people, so we kind of do that through the, what now, what's the group called? There's a group in the Cairngorms that are kind of working with a project to try and minimise disturbance, and they're kind of a local group of people that are sort of informally trying to encourage mountain biking to be more sustainable* (LM2)

Others mentioned simply trying to influence behaviour through talking to riders:

> *I suppose if we're speaking to people in the car parks, we might try and encourage people to leave their bikes at certain places rather than ride. So if they're going to Carn a Mhaim, for instance, it's like, well, you may as well just leave your bike at Derry Lodge* (LM3)

Whilst another talked about the possibilities of an unofficial *"sacrificial route"* (LM2) which they try to encourage e-MTBers to use. For example, they said it could be akin to the Scottish Wildlife Trust's "snorkel trail…. like a similar thing where e-bikes could be encouraged" (LM2). One e-MTBer specifically referenced the work done at a popular riding spot called Heartbreak ridge where *"there was a horrendous climb to get to it that was just through a peat bog"* (E7) but now they had given it a proper surfaced track:

> *So having places like that where they're well designed for mountain bikes, e or analogue bikes that can take the masses and you know, they're the popular trails, they're looked after well and you know, properly engineered in the first place. That's probably the right answer is to try and get people into those areas* (E7)

There was a suggestion that path design and use are approached from a hiking perspective, with one respondent clearly stating this by the phrase: *"everything is very walker-focused"* (E1). One Land Manager mentioned noticing damage to a path where they presumed bikers had placed stones into human-made drainage culverts so that they could ride down easier, but that this could be prevented if future path design considered other users:

> *I guess just like path design and stuff comes into it. So like, so accepting that you're going to get mountain bikers using a hill path and things like culverts, you can have it. So you've got a stone on the side so they can ride around it, things like that"* (LM1)

An e-MTBer, who was also a trail builder, talked about combining *"ecological improvement works within the areas that we ride bikes in"* by using conservation volunteers to look for invasive species or *"looking to introduce some yellow rattle to sort of grassland areas"* and the potential to *"take up ferry loads of saplings on an e-bike [or] you could, bring tools back and forth"* (E6).

In terms of sustainability issues, respondents made observations, particularly in terms of their environmental awareness and how their connection to the land, or to their specific area, might engender feelings of custodianship:

> *I think* [e-MTBing] *has to have more in terms of that negative impact. Yeah, I mean, it's a bigger, heavier bike, doing more miles, making more noise, particulates from a heavier bike stopping in terms of tyres and brake pads. Yeah, it has to be more. And I suppose, you could take it, take that kind of question further and say, it's charging your battery, that has a climate impact as well* (E6)

The particulates created by tyre and brake degradation have received very little attention in the general or specialised press, so it was an unexpected observation. The battery charging issue was picked up by another respondent, who stated:

> *So the electricity that* [the e-MTB] *consumes, I do think about that… My van does have a solar panel on it. So I think what I will be doing is charging my e-bike off my van solar… Then if my van battery is 100% charged, I might as well put that into my bike and let the van solar replenish itself* (E7)

Several of the respondents who e-MTBs are trail builders and their connection to the environment was apparent in some of their responses: "*I think especially… doing trail work as well, I think that, you know, you kind of get a real sort of sense of stewardship*" (E6). Another trail builder expanded their thoughts: "*Different environments need different kind of care and protection and awareness and understanding.* [It's about] *micro-environments and how they are affected at different times of year and with different weather conditions*" (E5). They went on to say that "*being an outdoor professional is protecting your office as well and trying to share and educate that knowledge as far and wide as possible without preaching*" (E5). That educational element is picked up in section 4.4 below.



4.3 User conflict

Some of the land managers interviewed acknowledged that the 'potential' for user conflict exists on the trails they manage: "*It's people haring down mountain paths on bikes with people walking up the paths… that's potentially an accident waiting to happen. So, but we get that with mountain bikes, non-e-bike mountain bikes anyway*" (LM2). This was echoed by another participant, who relayed that there had been "*a handful of visitors just saying they were flying down the hill really and just concerned about the speed of them*" (LM6). One of the mountain rescue team members felt that "*there are some people on both bikes and e-bikes who probably don't slow down enough for walkers… especially if the walkers have got dogs with them*" (MR4). Building upon this, another land manager thought that there could probably be more awareness raising of potential issues among riders: "*I do think there needs to be a little bit more education… so they do make their presence known. So because some of these things can come up behind you before you know where you are. I think that's just a general courtesy thing"* (LM4).

That said, one of the land managers admitted that in terms of 'actual' conflict, "*I don't think I've ever had anyone complaining*" (LM3). They went on to add that: "*I've only had positive experiences with them [e-MTBers]… [with] throw away conversations with people saying how much, how good it is that they can go further on the e-bike*" (LM3). This sentiment was endorsed by another manager, who felt that "*most of the time I would say the users that we've encountered are being quite responsible. You know, they're not tanking around like muppets*" (LM4).

A similar thread was apparent through the responses from e-MTB users, as most felt that there wasn't really any conflict but recognised that there could be occasions or circumstances where conflict could potentially arise. Some of this was put down to a feeling of negative perceptions of e-MTBers, and mountain bikers generally, among other trail users, as one rider explained:

> *It's something that me and my husband get really frustrated with, like the judgment people have towards bikers. Everything is very walker focused and I'm like, how is this any more damaging to the landscape… There's a lot of frowning and a like negativity towards bikers… It's a shame because everyone's just out enjoying themselves as well* (E1)

Other riders picked up on this, but not in terms of personal experience, only hearsay: "*In other areas I have heard of people having issues with conflict of use in places maybe, disrespecting the sort of etiquettes when you're riding… people having a few issues with like horse riders*" (E5). Another admitted "*I am under no illusions that there are some mountain bikers, including e-mountain bikers, who are not as considerate. And I can see that can annoy people*" (E6).

It was acknowledged that the potential speed of the e-MTBs could cause some issues, as perhaps people aren't prepared for how fast an e-MTB can approach, although "*with them being limited speed-wise in the UK, then that obviously helps* [minimise problems]" (E2). Yet as one person noted, on "*the descent, you're just going the same speed as a normal bike and then the ups, you're probably still not going to be going that fast because it's like technica*l" (E2).

But clearly regular mountain bikes can still descend at relatively high speeds, so the downhill speed is not an e-MTB specific issue, while others have conflicting thoughts regarding the potential speed 'uphill', especially when 'turbo' mode is selected, when someone can be "*going like 25 kilometres an hour up the hil*l" (E4). This relative ease of effort, and the implications for greater speed, when tackling steeper terrain was echoed by another rider: "*I'm used to manhandling my analogue bike up to a summit and it's hard work and it's a big effort to get up there. Some of that effort is potentially removed from an e-mountain biker*" (E7).

The growing concern around illegal or illegally modified e-MTBs, or other electric vehicles being illegally ridden as e-MTBs, lies beyond the scope of this study. However, one respondent voiced the opinion that this was becoming particularly significant in more urban areas.

> *It can get a bit trickier actually nearer built-up areas, especially now more people, you know, have like electric motorbikes and things… It's like kind of hard to stop… where you've got more people and easier access and less barriers to get to the place. Then I could see the potential for more conflicts* (E2)

One other minor element that was mentioned by one interviewee was the potential for the noise of an e-MTB being a nuisance to others on the trail, specifically walkers:

> *Even like the noise, that's something that I have been told about, that the noise levels can be disturbing, which is funny because if you're a bunch of people riding up on normal bikes and talking and laughing, that's also noise. But yeah, maybe there's something about the buzz noise that it makes* (E4)

Yet for all the potential conflict issues one participant acknowledged that "*in my experience, when you meet somebody in the hills, it's usually it's like, Oh, that's nice, there's another person out, and you know, you just need, you see just another kindred spirit, regardless of how they're getting out and about*" (E5); the absence of negative encounters among

respondents would appear to support the feeling that actual, experienced conflict with other trail users is quite rare.

There were elements of potential 'intra-group' conflict between different groups of bikers. One rider noted that "*I think there is a stigma around e-bikes and that people who ride them are lazier but that has changed because so many people have got them*" (E3). Another biker considered that "*I guess if you find yourself in a mixed group of people where some have e-mountain bikes and others don't, then it can be a little bit like not very social*" (E4), and "*you maybe started to feel like you were being a bit left behind*" (E1). That can have an element of inequality – dividing those who can afford e-MTBs and those who can't, because "*they are more expensive. So that can be quite hard in a dynamic of groups of people*" (E1).

It was also recognised that the introduction of e-MTBs into a group scenario can lead to jovial intra-group banter. For example, one e-MTBer outlined the teasing of riders choosing to use an e-MTB: "*There's always been the jovial sort of ripping of each other and, you know, the first person out of our riding crew to get an e-bike kind of… they had the fun and poked out at them*" (E5). Another noted the precipitate acceptance of new technologies and the acceptance of e-MTBs once a rider has tried an e-MTB: "*It starts off with a slagging that you're not doing it properly, and then you give them a wee shot, and then suddenly they go 'Oh, that's quite good*'" (MR4).

4.4 Communication, information and guidance

When asked how e-MTBers found out about where to ride many mentioned *"word of mouth"* (E5) from friends :*"I've got a bunch of friends who have gone up Munros on their E-MTBs and I just asked them how hard was it to actually ride up the whole way"* (E4), or from joining friends for a ride: *"So a lot of it kind of comes down to word of mouth and just sort of knowing people and going out riding with people who will show them the way"* (E6). A few seemed to suggest that routes were well established through *"a lot of history*" (E5) or that *"over the hills are quite obvious, so they're quite easy to find, and I suppose just almost by its reputation, just by the look of it. How well it rides and people just kind of know of it"* (E2). Others, however, mentioned that *"I don't feel like there's actually really good information on what routes are like"* (E1) and that you *"just have to do your own research and try and work out if it was rideable"* (E2). One participant acknowledged that "*maybe for wider general public tourism to pick up on. It does still seem to be quite hidden away and hard to find"* (E5).

Participants also mentioned the use of Trailforks, Komoot, Strava, Walk Highlands, YouTube, Facebook and group chats, noting *"there's online forums that talk about that route"* (MR2). Trailforks was the most commonly mentioned among respondents.

> *"I make a lot of use of Trailforks. The Trailforks app is certainly the one that I would go to straight away whenever if I was going somewhere that I was less familiar with and was wondering what the mountain biking there would be like"* (E7)

However, a few also pointed out that the recorded routes on Trailforks or Kamoot should not all have been put on there:

> *I've seen something over maybe near Kinlochewe where somebody's marked on like a hill path [on Trailforks] and then all the like reports on it are like, this is terrible. I don't know why anyone would like put this as a route or whatever* (E2).

Some respondents have experienced poor rides because of these apps and information, with one person noting: *"I've had a few howlers with Komoot"* (E1). One participant did mention that their trail building group have been trying to accurately record routes:

> *So there's been a concerted effort over the last year and a half, two years where we've been updating Trailforks to, reflect on what's possible in and around the Ochils and the Stirling region is a wider area* (E5)

In terms of information sharing among land managers, these respondents said they did not have specific policies nor information sharing for e-MTBers on how they should be used on the land that they manage: *"No, so there's nothing policy wise about e-bikes"* (LM3), and most didn't provide formal information on riding routes: *"They just use the infrastructure that's already there"* (LM4). A few did mention that they had general cycling policies and that they were happy for people to cycle:

> *Like, obviously, we're supportive of people accessing the sites. And obviously, e-bikes allows, you know, potentially different people to get to places that they maybe couldn't get to before, which is a good thing* (LM2)

Most respondents across all groups said that they were unaware of any specific codes for e-MTBs: *"I didn't even know there was a code for mountain bike e-bikes"* (LM4) and that they would *"just follow what the National Access Forum has outlined in so much as, you know, the power limit, speed limit, assist only"* (LM3). The Scottish Outdoor Access Code was repeatedly mentioned: *"I guess we don't really manage either [MTB or e-MTB]. I guess under Scottish Outdoor Access Code both are permitted as long as done responsibly"* (LM6), but also concern raised as to whether it effectively covered e-bikes:

> *Albeit regarding e-biking and SOAC, I don't think there's actually a section in there that addresses it because we've raised it before where what's the definition of a motorised vehicl*e? (LM4)

The difference between an e-MTB and a motorised vehicle was seen to be an important issue to land managers and one which caused uncertainty for them from a management point of view:

> *I could be wrong on this, but as far as I'm aware, there's no kind of distinction in SOAC. I mean, obviously, it's whether they're classed as a motorised vehicle or not. My understanding is that our position is that what we've maybe not really fully quantified that or qualified that, but I think we're still considering them as bikes rather than vehicles in the sense of SOAC. So, but I think there was some work being*

> *done in various access forums about kind of thinking about this and maybe developing something more, but I don't know.* (LM2)

Respondents also noted members of the general public being unaware of legality and what is allowed on trails, and what is not:

> *I think the biggest issue we have is with [electric] off-road motorbikes, and actually we get some visitors confusing what is legal and what is not. So some people are confusing electric push bikes with the [electric] motorbikes, which are obviously illegal*. (LM6)

4.5 Safety and mountain rescue

The respondents were asked about any safety issues related to e-MTB use in the study areas. From a mountain rescue perspective, it was not deemed to be a priority area, as: "*I think we've had one e-biker [call out] over the last three years*" (MR4). Another mountain rescue team (MRT) member in another area, adding that "*10 years, so I think I'm trying to think if I had any [call outs] in that time. We might we might have had one mountain bike call out in that time*" (MR1). Another MRT member mused: "*it actually always amazes me that there's not more, to be honest*" (MR2). Another respondent acknowledged that "*there's not been a specific policy by the team, so I don't think any actual mountain rescue teams have a specific thing about e-bikes*" (MR4).

One respondent did note that there had been some localised spikes in call outs:

> *What complicates our picture is Tarland Trails a little bit. So statistically, then yes, of course, MTB call-outs have gone up since Tarland Trails open. But actually, that's dropped down to one or two a year at Tarland, which is good because initially we were like, bloody hell, we're going to have to have a separate team based in Tarland, you know (MR2).*

As they explained: "*If it was becoming a massive issue, we might be a bit more proactive, you know*" (MR2). Given the lack of formal policy, in more informal discussions with e-MTB users, this same respondent noted stated that:

> *We would probably pan out the same story about being prepared, thinking about what you're doing. Have you actually worked out how long is it going to take you to do this route? And we would obviously be saying to them, well, what actually is the capacity of your bike in terms of its range? And what are you going to do if it runs out…?* (MR2)

Picking up on this specific issue, one MRT member reflected that "*we've never had a rescue for anybody who's run out of battery, but I'm sure it may have happened. But yeah, I think that's why it's probably quite important for folk to be aware of the limitations of their batteries*" (MR4).

Respondent MR2 acknowledged that there had been a couple of related injuries, but the issue was related to how the emergency services were called out. They recalled "*they got injured and they called an ambulance and that tends to cause delays to getting the mountain rescue team*", going on to emphasise that "*most of the Scottish mountain rescue posts, and a lot of team posts, will say at the bottom: if you need us, '999 police', mountain rescue*".

From a land manager perspective, it was felt that e-MTBs might be enabling people to go further or to places where bikes had not been seen before: "*I think we've noticed bikes where we probably never used to see bikes, particularly on Invereshie, up on the ridge there. There did used to be bikes that would do that as a rideable route… but I think it's become more popular as a result of e-bikes*" (LM2). It was notable however that it wasn't acknowledged as an issue in the other two study areas. They went on to consider: "*People realise that this is a route that you can do, then maybe see it on Strava or whatever, and then those routes become more and more popular because more people are doing them*" (LM2).

The e-MTB users interviewed identified a range of safety-related issues. The weight of an e-MTB was acknowledged as a potential problem, particularly on trickier terrain: "*Mine is like 26 kilogrammes or something*" (E4). While much of the time this is not an issue, "*to get over, you know, steps or uneven ground is not easy*" (E2). One respondent, acknowledging generally that "*as a woman… you do feel more vulnerable just going out by yourself*", recalled: "*I went out towards Glenfeshie once and got so exhausted going over all these tree stumps ones, and I had the wee one with me, and then I was just getting so exhausted and I thought lugging this e-bike over these stumps, like I was so tired*" (E1).

This issue could come to the fore if the battery expires on the uphills. One respondent acknowledged that:

> *The battery life… is quite, you know, critical in how far you can go… I think there was an initial worry that people would be getting, you know, running out of battery and getting stuck everywhere. And I think that has happened. I have, I do actually know of someone who did that and had to get mountain rescued (E2)*

This additional vulnerability out in the hills was picked up by several interviewees, who reflected on how e-MTBs might encourage less experienced riders into more remote areas: "*e-bikes are making the hills more accessible for people, and it's so cool, but they might not have that mountain awareness*" (E1), and as "*some of that effort is potentially removed from an e-mountain biker… you may find people up there who haven't the same experience of having put all that effort into getting up there*" (E7). Another picked up on this thread: "*I feel like a lot of people [are] coming to mountain biking through e-bikes now, and they might not have learned the basic skills other people did*" (E3).

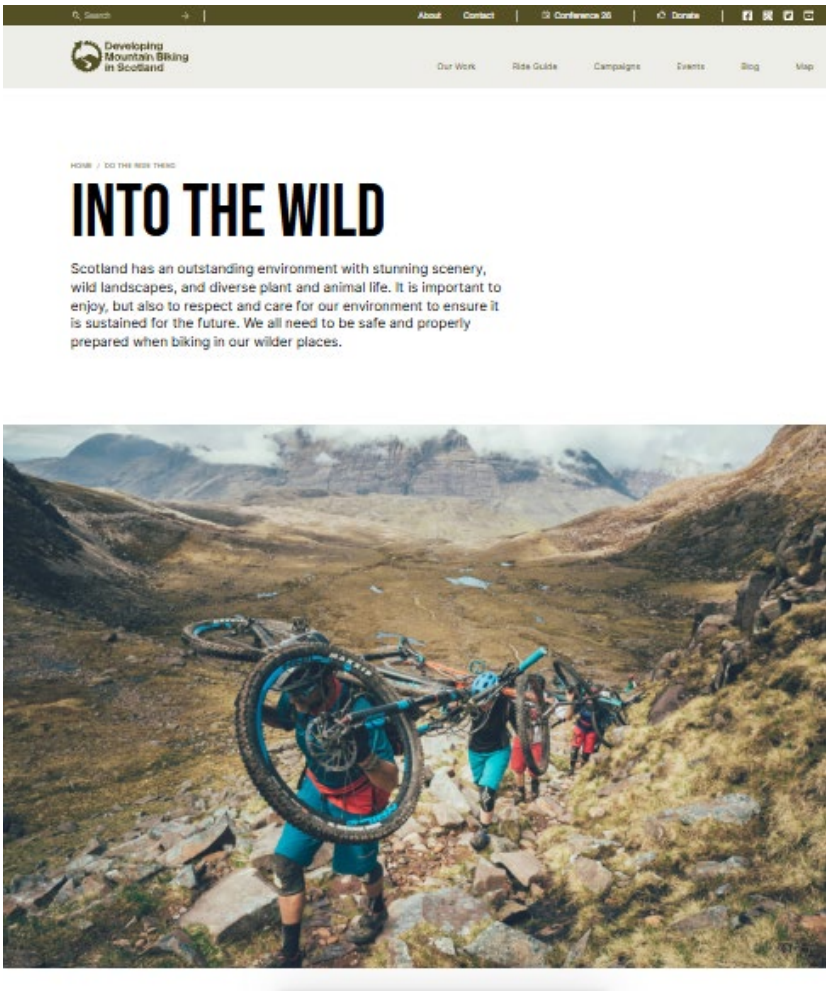
For those e-MTBers who 'have' done their apprenticeship on regular mountain bikes, this creates a scenario where electrical assistance shifts their perception of what is 'doable':

"*Because I'm riding those harder trails more and more, suddenly my kind of margin of what's difficult and what's not, that comfort zone shifted almost. Like, you know, harder things were now within my comfort zone only because I was going up more often*" (E4). This could have implications on longer, more remote rides where an e-MTB may make one overconfident in the bike's abilities. They went on to acknowledge the safety implications: "*You could end up doing like a Munro on your e-MTB and if you're not the kind of rider who can, you know, who is more technically capable and then if you decide that that's where you want to test your capabilities, then there will be consequences*" (E4).

Another rider thought the potential issue to be more basic: *"With the amount of people on e-bikes, there's obviously going to be more people up the hills, so it's also gonna cause some issues, 'cause it'll be, you know, the more people it is, the more accidents there's going to be*" (E3).

A common thread pertained to how e-MTB riders felt that electrical assistance did not encourage them to go further into wild areas; instead, it principally served as a means of doing more loops of local trails: "*There's still a place for the analogue bike, and it probably is out in the bigger hills, the big day, you know, mountain day adventures and things, they're best done on an analogue bike*" (E7). They went on to add that on shorter routes, stating: "*you can probably do three or four times the amount of riding that you could do in the same amount of time that you could do on an analogue bike. So it's going to work really well for that*" (E7). Another participant reflected on this: "*It's not so much about me getting to go further with it, it's more reducing how much time I need to go and have a ride that will sort of satisfy me*" (E5), although they did add that they would take their e-MTB on longer rides, but not really doing anything they wouldn't have done on a regular mountain bike.

In terms of the perceived issue of e-MTBs allowing and encouraging faster riding, it was felt by some respondents that the pedal assistance is used more for the uphills, so the bikes are not inherently more dangerous: "*there's the speed difference for sure, more so in the going up*" (E5). Yet the same person admitted that "*the weight of a mountain bike going downhill definitely I think can increase your speed and descent*", albeit reflecting that "*actually I found handling an e-mountain bike in descent feels a lot more secure and stable because of the weight and the way the bike's built*" (E5).



5. Discussion

This study explored perceptions of e-MTB use from bikers, land managers and mountain rescue services in the Cairngorms, the Ochils and Torridon. Although the study did not seek to examine potential differences between geographical locations, and further research would be needed to do so, the overall comparisons between locations and stakeholder groups were very similar, suggesting a similar picture across Scotland's mountain areas. Overall, this study suggests the perception is that e-MTB use in Scotland's mountains is currently not considered a major issue.

This section draws out the key findings and implications for this research, and explores this in relation to access and inclusion, damage, conflict, information and education, safety, and implications for land management.

5.1 Access and Inclusion

The research findings support the view that e-MTBs can increase access for some groups in society, although it also showed that for others financial, logistical and physical barriers limit opportunities. e-MTBs therefore appear to redistribute some barriers rather than simply eliminate them. The evidence also suggested that while e-MTBs may increase the frequency

of participation they do not necessarily increase the geographical range of activity, specifically when referring to upland mountain riding.

5.2 Damage

There is currently insufficient evidence to determine whether e-MTBs cause more damage than MTBs or hill walking to mountain paths and the wider environment. Respondents were unable to identify specific impacts of e-MTB use from other users but instead offered reasonable suggestions as to how they could increase damage such as via steeper and softer ground, damage that could arise when power or heavy braking was applied, or the ability to complete repeated laps. The findings therefore point towards damage that is dependent on the interaction between the gradient, the ground conditions, the weather, volume of use and rider behaviour.

5.3 Conflict

User conflict was limited and e-MTBs were similar to MTBs regarding the potential for negative interactions with hill walkers. While participants identified many reasons why and where conflict *might* occur, actual recollections of conflict experienced were minimal, demonstrating a fundamental difference between perceived and experienced conflict. The participants introduced 'intra-group' inequality conflicts arising from differing abilities or financial burdens that e-MTBs can bring to the dynamics of a group of riders.

5.4 Information and Education

The findings revealed that there is a gap in generally available knowledge as to where to ride. Most e-MTB routes become known through word of mouth or online fora. While this provides valuable knowledge, it can also create barriers to access and direct those not in the know towards potentially unsuitable routes, causing impacts on upland environments and potentially opening up safety concerns for land managers and mountain rescue teams, alongside potentially putting e-MTBers at risk if they are on trails not suitable for their abilities in more rural and remote regions. It was also noted there was a lack of specific mention of e-MTBs in SOAC and some queries over their status as a non-motorised vehicle.

5.5 Safety

As with the conflict theme, there was a difference between the perceived and experienced issues. From a Mountain Rescue perspective, there were no additional callouts associated with e-MTBs yet the findings indicated many ways in which they thought there could or should have been. However, the findings did also suggest that those who were accessing the upland areas were already experienced in the terrain through their regular MTB use.

5.6 Implications for Land Management

The evidence suggests that the current path networks are perceived to be more geared towards walkers and that if future path design took into account and involved MTBs and e-

MTB riders, this could be a solution to limit damage and conflict issues. The accounts from e-MTBers indicate that environmental awareness *is* present within parts of the e-MTB community and that the e-MTBers interviewed who were also trail builders described a strong sense of stewardship resulting from their practical involvement in trail maintenance. The lack of knowledge of where to ride could also be used positively, to direct riders to areas less sensitive to damage.

6. Conclusion and further steps

This study explored the use of electric mountain bikes (e-MTBs) in Scotland's upland environments, using 18 semi-structured interviews with e-MTBers, land managers and Mountain Rescue representation across the Cairngorms, the Ochils and Torridon. The findings provide an insight into the opportunities and challenges associated with this developing outdoor recreation sport and highlight the need to balance inclusive access to Scotland's mountains with responsible recreation, environmental awareness and protection, conflict management, and information and awareness.

The findings suggest that e-MTB use is not currently perceived by respondents as a major safety concern. However, this does not mean that respondents felt that e-MTBs have no negative impacts or that the future growth of this sport will not present challenges.

A key finding is that e-MTBs can broaden participation in mountain biking, and access to Scotland's outdoor areas, by reducing the physical effort required to climb uphills, enabling riders to make better use of limited leisure time. Respondents described benefits for people with varying levels of fitness, commitments and physical capabilities. However, these benefits are not universal, and barriers exist in relation to the cost of purchasing an e-MTB, the equipment needed to transport it, and the challenge of manoeuvring heavier bikes. e-MTBs, therefore, redistribute barriers to participation rather than necessarily removing them altogether. Additionally, although having battery assistance can enable more frequent riding and lapping, respondents generally did not consider that using an e-MTB necessarily resulted in greater geographical access to Scotland's more remote mountain environments.

Land managers and e-MTBers identified ways in which e-MTB use could contribute to trail erosion and degradation, including with increased bike weight, braking forces, wheel spin and the effects of more frequent use on certain trails. However, respondents were unable to distinguish these impacts from conventional mountain biking and walking. The research findings therefore suggest that the impacts from e-MTBs depend on the interaction of rider behaviour, terrain, gradient, weather, volume of use, and information and awareness of riding, rather than simply on the presence of electrical battery assistance alone.

The study also found limited evidence of conflict between e-MTBers and other mountain users, despite some circumstances being identified which could cause some disagreements. These did include higher speeds of riding, unexpected encounters on shared paths, and a lack of perceived consideration for walkers and other uses. Some respondents did also describe intra-tensions within the e-MTBing community, including the legitimacy of e-MTBs as a recreational sport, differences in riding abilities, and financial inequalities. However, these conflicts did not seem unmanageable among respondents in the study.

Mountain Rescue respondents did not identify e-MTBs as a significant source of call-outs in their areas, despite some concerns over battery range and isolated incidents. However, risks still arise, particularly where having an e-MTB might encourage someone to attempt more difficult trails in more remote areas.

An important finding concerns the availability and accessibility of information on routes. e-MTBers frequently relied on personal contacts and online for finding routes, while land managers reported having no specific e-MTB policies. This might provide an opportunity to improve the information available to riders. Greater clarity on the application of the Scottish Outdoor Access Code might also further support responsible access. Where appropriate, better designed and maintained routes might help direct e-MTB activity away from particularly sensitive areas. Such interventions should be developed with the appropriate stakeholders.

The study identifies next steps for future research and action, including improving the evidence based on environmental impacts of e-MTB use, gathering data on the frequency and location of e-MTB activity in Scotland's uplands, developing better route information and rider education and use existing organisations and platforms developed by Developing Mountain Biking in Scotland, and developing collaborative approaches to trail management.

In conclusion, e-MTBs present challenges and opportunities for Scotland's upland areas, broadening participation in the outdoors whilst also increasing the need for responsible access and behaviour. The evidence from this study does not support a conclusion that e-MTBs are causing significant harm in Scotland's mountains, but its future development and management should continue to be an area for further research, interest and policy development.

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