The environmental impact of off-road motor vehicles using green lanes in protected landscapes. A summary of the scientific evidence

1. **Protected landscapes are areas of great biodiversity.**
2. **Off-road vehicles significantly contribute to erosion on unpaved roads.**
3. **They are high polluters with a detrimental impact on areas surrounding unsealed roads.**
4. **Off-road vehicles on unsealed roads negatively affect biodiversity (e.g. through habitat fragmentation, sedimentation, dust, noise, light).**
5. **Climate change represents a major threat to protected landscapes, exacerbating the impact of green lane motoring.**
6. **The qualities of protected landscapes (scenic beauty, opportunity for quiet enjoyment) are in conflict with the motorised use of unsealed roads for leisure purposes.**
7. **Motor vehicles using green lanes degrade the enjoyment of other users.**

1 Protected landscapes are areas of great biodiversity

As Defra points out in its response to the Glover landscapes review, protected landscapes are home to nearly half of all priority habitats in England, including many of our most important sites for nature. Some of them, such as the High Fells of the Lake District, are internationally important for their biodiversity.

2 Off-road vehicles significantly contribute to erosion on unsealed roads

Off-road vehicles have been identified as one of the primary sources of soil erosion and compaction on unpaved roads (Ouren et al., 2007). Wheels of motor vehicles expose surface material to shear stresses, loosening particles and exposing them to erosion. If the dislodged soils are subjected to rainfall, they may be washed away, producing runoff and sedimentation (Ngezahayo et al., 2019).

Unsealed forest roads change the hydrological behaviour of hillslopes and are important source points for runoff generation. They can increase the hillslope-scale sediment production rates by up to four orders of magnitude relative to undisturbed conditions (Jordán-López et al. 2009).

A comparison between erosion and sedimentation on different types of unsealed road suggests closure to motor vehicles as an effective reduction strategy (Marion et al., 2019).

3 Off-road vehicles are high polluters likely to have a detrimental impact on areas surrounding unsealed roads

The most commonly used motor vehicles on green lanes are diesel-powered 4WDs and petrol-powered motorbikes. Vehicle emissions are linked to vehicle age and fuel type (Ntziachristos & Samaras, 2019) Among diesel vehicles the ones with an unknown Euro classification are the most polluting (Ghaffarpasand et al., 2020)

Road grade and gradients have a marked effect on tailpipe emissions from motorcycles. For uphill road driving pollutant factors were shown to be above Euro 5 emission limits for even the most modern motorcycles (Yang et al., 2021).

Different forms of pollution decay at different rates, with many pollutants deposited in the immediate vicinity of roads (Phillips et al., 2021); trace element concentrations in the topsoil of the first 5 metres beside the road are heavily influenced by road traffic (Werkenthin et al. 2014), Other forms of pollution (noise, light) with different dispersion patterns affect wider areas. Noise from motorcycles elicited a significantly higher annoyance response than noise from other traffic, pointing to prohibition as a more effective prevention measure than setting limits on the number of motorcycles (Lechner et al., 2020).

Elevated levels of pollution occur on an estimated 94% of land in Britain, especially for NO_2 and particulate matters, with lower pollution levels mainly restricted to the uplands. Green lanes used by motor vehicles therefore play a significant part in spreading traffic pollution into protected landscapes where they are not needed for connectivity to the local road network and cannot be used by ordinary road vehicles (Phillips et al., 2021).

4 Off-road vehicles on unsealed roads have a negative impact on biodiversity

Off-road vehicles on unsealed roads are a cause of habitat fragmentation, loss of connectivity and barrier effects. These impacts were observed even on narrow tracks, which may disrupt the movement and dispersal of many wildlife species between and within habitats (Ouren et al., 2007).

Vehicular traffic is a source of noise and other stimuli with potential to disturb wildlife. Examples are lapwing and godwit populations which undergo density depressions linked to the presence of a road over distances varying from 200 to 2000m. an effect observed even near quiet rural roads (Van der Zande et al., 1980) and of relevance for the habitat of threatened bird species such as curlew.

Light pollution from vehicles has been reported on some green lanes in the Lake District. It is becoming an increasing problem because of the characteristics of modern vehicle headlights. As light from passing vehicles is experienced as a series of pulses, it is likely to have major biological impacts (Gaston & Holt, 2018).

Pollution in the form of noise, turbulence, dust and metals has been shown to affect pollinators in road verges, leading to lower pollinator densities, particularly within the first 2m where pollution is greatest (Phillips et al., 2021).

Roads (including unpaved forest tracks) are one of the determining factors limiting plant diversity in forests. The effect is at its maximum in the first 0-20 m forest-to-

road segment and becomes mitigated after the 200 m threshold (Marcantonia et al., 2013).

There is evidence of the impacts on individual plant species from exposure to NOx associated with vehicle emissions and that these are greatest within the first 50-100m from roads but may be discernible at greater distances. Vehicle emissions are also a source of metal contamination for vegetation close to roads (Natural England, 2016).

Lichens are particularly vulnerable to excess nitrogen deposition which reduces lichen abundance and increases the metabolism of sensitive species. This applies especially to regions with greater precipitation (Gutiérrez-Larruga et al., 2020). Cumulative nitrogen deposition can lead to a cascade of soil chemical reactions that display widely through the environment (Air pollution Information System).

The negative impact of roads, including unsealed roads, on the ecosystem is adding urgency to the protection and creation of roadless areas. Roadless areas protect biodiversity and ecosystem services, and are of particular importance in the context of climate change (Psaralexi et al., 2017; Selva et al., 2011).

5 Climate change represents a substantial threat to protected landscapes
It is widely agreed that climate change will have a direct and dramatic impact on protected landscapes and demands a radical and transformative response. Although proportionately the contribution by off-road vehicles to the **causes** of climate change is small, it is not zero. Allowing them access to green lanes in remote areas sends the wrong signal about our commitment to tackle climate change. For this reason alone any policy on motor vehicles using green lanes for leisure purposes has to be part of Defra's response to climate change. But off-road vehicles also greatly exacerbate the **effects** of climate change, particularly of more frequent weather events, e.g. through erosion (see 2 above).

Prohibiting motor vehicle access to green lanes could act as both a signal and a leverage point to bring about a wider transformation (Riechers et al., 2021). Conversely, any decision to allow motor vehicles access to green lanes is likely to signal the opposite: an unwillingness to put sustainability policies into practice.

6 The qualities of protected land landscape (scenic beauty, opportunity for quiet enjoyment) are in conflict with the use of unsealed roads by recreational motor vehicles.
Some of the most important qualities of protected landscapes (DEFRA 2011) are diminished by recreational motor vehicles on green lanes, in particular scenic beauty relative wildness and tranquillity, defined by the CPRE as freedom from disturbance and from both noise and visual intrusion (CPRE, 2006).

7 Motor vehicle using green lanes degrade the enjoyment of other users.
An evaluation of responses to a survey carried out by the Lake District National Park Authority (Lumber 2021) shows that motor vehicles on green lanes substantially degrade the enjoyment of walkers and cyclists. The main themes emerging from the survey are:

- Tranquillity and beauty diminished
- Stresses from city life introduced
- Connection with nature disrupted
- Cultural heritage threated
- Community of walkers besieged
- Physical danger from motor vehicles on narrow sections
- Feeling of apprehension before and while walking the route
- Harm caused to the landscape, flora and fauna

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