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National Parks and Wildlife Service

ASSESSMENT OF MAIN CONTRIBUTING FACTORS LEADING TO THREE MAJOR PEATLAND FAILURES IN LEITRIM, KERRY AND DONEGAL

POTENTIAL TO UPDATE NATIONAL LANDSLIDE SUSCEPTIBILITY MAP

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Abstract: Task 4 of the project involves an assessment of the potential to update the National Landslide Susceptibility Map using data collated and analysed in this project. Review and assess whether areas of peatland within the study areas of this project, currently mapped as low to moderate susceptibility on the National Landslide Susceptibility Map, are likely to have a higher classification of susceptibility to landslides.

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1. Introduction

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science, and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.90 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

FT have been involved in over 100 wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, design, construction and operational stage and have established themselves as one of the leading engineering consultancies in peat stability assessment, geohazard mapping in peat land areas, investigation of peat failures and site assessment of peat.

1.2 Project Description

The Services for this project comprise the carrying out of a detailed scientific assessment, using available data and data provided, along with appropriate site visits, to determine the main contributing factors that led to a series of peatland failures located in Counties Donegal, Leitrim, and Kerry. The project seeks to characterise the environmental setting of the landslides, determine the main contributing factors to the failures and further determine any shared conditions that may identify susceptibility in 3 additional areas of interest to GSI and NPWS.

The results of this assessment will be used to assess the potential to update Geological Survey Ireland's National Landslide Susceptibility Map and to produce technical notes for documentation(s) related to peatland land use and peat stability in Ireland.

This Technical Note covers Task 4 of the Specification of Requirements, namely *"Assess the potential to update the National Landslide Susceptibility Map and associated database using data collated and analysed in this project. Review and assess whether areas of peatland within the study areas of this project, currently mapped as low to moderate susceptibility on the National Landslide Susceptibility Map, are likely to have a higher classification of susceptibility to landslides due to factors, not previously included in the analyses, for example those associated with peatland ecology, peatland degradation, hydrology, stratigraphy or geomorphology or historic or recent land use changes etc. and produce a short technical note based on this review."*

2. Landslide Susceptibility Map

2.1 Summary of Existing Mapping

The existing National Landslide Susceptibility map was developed between 2007 and 2016, with the purpose of assessing landslide susceptibility to assist in the identification of areas that are likely to experience landsliding and develop a model for susceptibility mapping on a national level.

The susceptibility map was developed using what was referred to as “Unique Condition Units” (UCU), which are made up of a series of attributes, in this case: slope (based on a 20m DEM), soil type and Topographic Flow Index (TFI). A total of nine slope bands, seven soil types and three TFI’s were used to develop the UCU. The UCU methodology assumes that where a landslide is observed in an area with a specific combination of attributes, then if that combination occurs elsewhere that location is also susceptible to landslides.

The UCU model was then weighted by applying a known inventory of landslide events (following a quality control check of events) to the combined parameters and values for the number of landslides per UCU was calculated. This basic count was then normalised by dividing the area of the relevant UCU to give values of incidence per area of a UCU i.e. number of landslides/km^2. These incidence values were then multiplied by 100 which give the number of landslides/100km^2 (GSI, 2016).

The susceptibility map refers to areas where landslides may occur and these areas are ranked, in accordance to slope stability and associated topographic factors, into categories that range from low to high.

It should be noted that the term “susceptibility” refers to the identification of areas which are predisposed to landslides (including peat failures), and this is measured by the number of incidences per square km, or density of landslides per UCU. This map should not be treated as a “Hazard” map which shows the potential to cause damage by frequency/probability or intensity or a “Risk” map which shows loss potential (GSI, 2016).

3. Relevance to Peat Failures on Shallow Slopes

3.1 Peat Failures

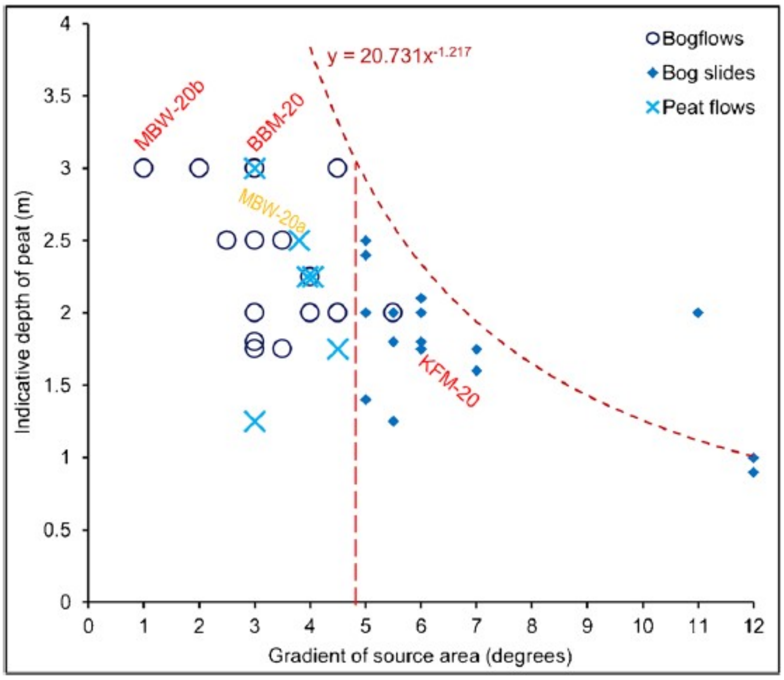
The GSI's landslide susceptibility mapping was designed for landslides in general, not specifically peat failures, and as such it does not consider the possibility of specific peat failure mechanisms or the possibility of peat failures on relatively shallow slopes. This is understandable, as the purpose of the susceptibility mapping was to provide a national assessment covering a wide variety of soil types and failure mechanisms.

While peat was included as one of the seven soil types in the existing mapping, the failure mechanisms within peat are often different to landslides which occur in other types of superficial deposits or in bedrock, and as such different attributes must be considered. A review of the landslide database indicates that around 55% of the records relate to peat failures (Long, 2022).

The existing mapping is based on identifying areas where landslides have occurred, and at the time this only included a relatively small number of peat failures on shallow slopes.

It can be seen in the figure below, reproduced from a paper by Dykes (2021), that a number of peat failures have been recorded in a shallow slope angle band between 3 and 7 degrees. Importantly this slope angle range is also the range where large scale (in terms of peat volume) peat landslides are typically encountered.

Figure 3.1: Characteristics of Irish Peat Failures (Dykes, 2021)



3.2 Potential Changes to Account for Peat Failures

3.2.1 Additional Caveat on Peat Stability

The simplest option in lieu of making significant changes to the existing landslide susceptibility mapping (through further research) may be to add an additional layer (or note) to the existing susceptibility mapping for areas that can be identified as having the following characteristics:

- Presence of an upland blanket bog or active raised bog setting
- Slopes of 3-10 degrees (as an example)

The additional layer/note would state that these areas are considered to be at higher risk from peat instability than indicated on the landslide susceptibility map, and that an appropriate peat stability assessment should be undertaken for any works proposed in these areas, irrespective of the current landslide susceptibility rating. The peat stability assessment should include the gathering of site-specific data on vegetation and ecosystem condition including effects of land uses (past and current); extent of the peatland and condition of the peat and drainage conditions (hydrology and hydrogeology) on the site and in its vicinity and sub-catchment area including upslope and downslope areas.

An alternative to the above would be to apply a filter layer to the existing susceptibility mapping, effectively “greying-out” all areas of upland blanket bog. A note would also be added to the legend stating “Areas of upland blanket bog should be considered at higher risk of peat failure. Any development in these areas should include an appropriate site-specific peat stability assessment undertaken by a multidisciplinary team of suitably qualified and experienced professionals including blanket bog ecologist and hydrologist”.

3.2.2 Use of more detailed survey information

As the GSI susceptibility mapping was undertaken based on a 20m DEM, an option would be to look to update the mapping based on more detailed topographic information (such as LiDAR), which would allow for a refinement in the calculation of the TFI as well as providing a more detailed slope angle assessment, which may alter the landslide susceptibility classification of certain areas. However, this would not address the issue of identifying the potential for peat failures on relatively shallow slopes.

3.2.3 Updated Landslide Susceptibility Mapping

To be relevant specifically to peat failures, it is considered that additional factors would have to be included to create a specific assessment of the landslide susceptibility of peat deposits. This would involve the collation of a series of datasets, such as blanket bog and wet heath GIS data, peat depth data, forestry plantation GIS data, natural and artificial drainage systems, topographic data, catchment boundaries data and others. However, a difficulty with any such assessment is applying suitable weighting factors to datasets, as not all datasets have an equal impact on peat stability.

As an example,

- Slightly different slope bands to the original slope bands applied would need to be selected, providing more bands at lower slope angles (<15 degrees) with only a couple of bands above this, as peat typically cannot accumulate on steep slopes in significant quantities. This would require more detailed topographic information (ideally LiDAR) than that used in the current susceptibility mapping.

- The slope characteristics, such as areas of concave/convex breaks in slope would have to be identified, as these areas are considered to be at higher risk of failure based on available data. LiDAR data would also facilitate this. In all these cases, the surface slope angle is assumed to reflect the slope angle of the base of the peat, unless evidence to suggest otherwise is available. However, mapping using airborne geophysics may, with appropriate ground truthing (by probing or use of Ground Penetrating Radar (GPR)), be able to provide an estimate of peat depth and therefore the slope of the base of peat.

- Additional factors, such as location of areas within the headwaters of watercourses would also need to be considered (possibly identifiable using LiDAR and also often identifiable on aerial imagery to an experienced peatland specialist), as well as drainage patterns (natural/man-made). This may be possible through a revision to the existing TFI calculations. Rainfall levels may also be a part of this assessment, in order to assess the likely flow volumes. This would need to be extrapolated from the nearest rainfall station but taking in account higher rainfall levels at higher elevation etc.

- The condition (level of peat decomposition as per Von Post scale (1926)), thickness of a peat deposit and water level/hydrogeological conditions within the peat deposit should also be considered. The shear strength of peat is also important, although there are issues around the accuracy of field measurements of peat strength and this parameter can typically only be recorded following some form of site investigation (either through peat probing or using geophysical methods).

- The current and past human activities / land use of an area, and specifically any change in land use, (such as peat extraction or forestry, for example) would also need to be considered. Degradation of peatland areas is reported as a pre-conditioning factor in some peat failures, and these areas would need to be identified and mapped, likely from high quality satellite imagery/aerial photography. This would require significant time and effort if applied to all upland peatlands across the country.

Each additional factor would need to be given a ranking, such as on a simple 1-3 or 1-5 scale. Some factors may also have to be weighted, due to them being considered more important in terms of peat stability. Existing examples of this type of assessment typically sum the ratings for all the relevant attributes, and provide ranges indicating susceptibility, such as the low/moderately low/moderately high/high classification already in use. This would require the existing methodology to be significantly altered. As steeper slopes (>10 degrees) are typically already classified as moderately high/high susceptibility, it may be easier to isolate areas of peat or peatlands currently with low/moderately low susceptibility and use additional attributes to denote a revised or “Peat Specific” susceptibility classification for these areas.

To implement the above would be time consuming to undertake for large areas, especially given the coverage of Blanket Bog across the country (up to c.775,000 ha). However, the TE/EPA National Land Cover and Habitat Mapping would assist significantly with this and potentially also with the above mentioned NPWS NSUH and other peatland habitat distribution data.

It may be possible to exclude certain areas of peat from any such assessment where raised bogs are present, with the caveat that these areas can be susceptible to bog bursts/flows should water become impounded behind large banks of peat as occurred at Knocknageeha (1896).

Given the number of factors involved in peat stability (see Section 3.3) it is unlikely that it would be possible to fully update the current national landslide susceptibility map with any degree of certainty. However, it may well be possible to indicate areas which have potentially a higher susceptibility to failure.

It may be advisable to select three or four of the more common peat landslide susceptibility factors and apply them to the existing landslide susceptibility classification. These factors would need to be quantifiable from existing datasets/survey data, and should for example include:

- peatland areas
- topography/slopes
- breaks in slope,
- land uses e.g. causing peatland degradation such as drains, roads, infrastructure, forestry, fire breaks, turbary, fire damage, erosion complexes,
- natural drainage
- artificial drainage
- evidence of historic failures

Each of these factors would need to be ranked in order of its likely role and importance in peat instability (say on a simple 1-3 or 1-5 scale), with the resulting sum of factors indicating the chosen area's revised landslide susceptibility.

3.3 Study Areas Susceptibility and Relevant Factors

A review of the existing landslide mapping within the areas of the three failures indicates that the current susceptibility rating, as indicated, in these areas is mainly linked to slope angle. Where the slope angle is steeper, the landslide susceptibility rating is indicated as higher.

The landslides at Meenbog, Shass Mountain and Mount Eagle occurred in areas indicated as Low or Moderately Low susceptibility on the current Landslide Susceptibility Map. These areas had slope angles of between 2 and 6 degrees, which are considered to be relatively shallow in general slope terms.

The following is a non-exhaustive list of site factors that may influence peat stability, from published papers (See References and Bibliography):

- Peat depth
- Peat strength
- Ecosystem condition/condition of peat (vegetated, bare, degraded, drained, desiccated, degree of humification, presence of peat pipes, water level etc)
- Slope Angle, including the angle of the base of the peat layer
- Break in slope (convex/concave)
- Underlying geology (substrate conditions)
- Human activity on site
- Land use (current and past) and change in land use causing peatland degradation
- Presence/absence of drains, such as dense systems of forestry drains. Direction of drains is also important.
- Drainage feeding surface runoff into headwaters of streams (interface between man-made and natural drainage systems)
- Rainfall amounts and rainfall patterns

There are limitations on the type or resolution of data that can be remotely (i.e. without site investigations) gathered in terms of these factors:

- Peat depth/strength: peat depth can only be inferred from slope angle, requires site specific data requiring site visits and site investigation to confirm peat strength.
- Slope angle: this can be determined in general terms from the publicly available 20m DEM, but this mapping is too coarse to pick up subtle changes in slope. Site specific surveys, using LiDAR or similar would be required to identify subtle or small-scale features which would be important in terms of peat stability.
- Slope of base of peat layer: unless sufficient probing or GPR surveys are undertaken, this is assumed to be the same as the surface slope angle.
- Break in slope: convex/concave breaks in slope have previously been identified as one of the contributing factors in peat failures. These can be identified where sufficiently detailed survey information (such as LiDAR) is available and could likely be used in conjunction with GIS to identify such areas.
- The temporal variation in peat condition: can be determined in a general case from recent aerial photography, plus comparison of aerial photography over several years can show any changes over time. The presence of peat pipes can usually only be determined by site visits, and often require intrusive investigation. The presence of flushes and wetter areas of peat may be determined from aerial photography or from remote sensing (satellite imagery) and existing habitat GIS datasets (though incomplete).
- Change in land use: can possibly be determined from a comparison of historical and current Corine databases or land cover mapping and aerial photographs, or Coillte and Forest Service forest inventory GIS data, provided these are up to date.
- Land use (forestry): the direction of furrows and drains can have an adverse impact on stability. Drains parallel to slope can allow for rapid drainage of surface water (provided a suitable outfall is present), but oblique drains may trap water on the slope. If the area has been recently felled, but not replanted, a higher water table can be expected, and this may lead to a higher risk of instability in some circumstances. Direction of drains/furrows can often be determined from aerial photography in felled areas but can be more difficult to determine where forestry is still present. Historical aerial photographs can sometimes show these features. The Coillte and Forest Service forest inventory GIS data could also be considered.
- Land use (peat cuttings/turbary areas): these have been linked to certain peat failures, as they expose the more humified catotelm to the elements (rainfall). The machine cutting of peat has been directly linked to peat failures, as the blade of the machine slice the peat into thin sections and remove a significant proportion of the strength of the peat mass. Generally, peat cutting can be easily identified from aerial photography, but this may not indicate if the peat has been machine cut. GIS data on turbary areas is available for blanket bog SAC.
- Drains: if sufficiently large, these can be recorded from aerial photographs, otherwise they can only potentially be inferred from contours. Typically, drains are visible on LiDAR surveys. Otherwise, these require site inspections to confirm the extent of any drains present. Presence of drains may require an assessment of the relative impact of drains parallel to/or oblique to the slope. Oblique drains would typically hold water on a slope, potentially saturating the peat present, increasing the risk of failure. Drains parallel to the slope will typically aid the drainage of a slope, as long as an appropriate outfall is provided. However, increased drainage of a peat deposit can reduce the water table, leading to desiccation of the peat surface and an increase in erosion, increasing the risk of peat failure.
- Interface between natural and man-made drainage regimes: often visible from aerial photography, typically located directly upslope and downslope of forestry areas and also often associated with areas of peat cutting (turbary areas).

Each of the bullet points above would require the collation of a series of existing datasets, refinements of some existing datasets, and in some cases the creation of new datasets to allow these factors to be included in a landslide susceptibility assessment.

3.4 Revised Study Area Susceptibility

From a review of available data and site visits to the three study area failure sites, the following is noted:

- Meenbog: the failure occurred where a floating road was being constructed along a break in slope, downslope of a large area of relatively deep, very soft peat (Active Blanket Bog). Peat strengths recorded using a hand shear vane in this area were all <10kPa, and often <5kPa, indicative of very soft (i.e. weak) peat.

- Shass Mountain: the failure occurred following heavy rain, in the blanket bog in the upper catchment of a stream. This area was fed by artificial drainage channels within the forestry on the upslope side of the failure. Deep peat (up to 4.5m) was present on shallow slopes (2-6 degrees). The failure point also occurred upslope of a slight convex break in slope.

- Mount Eagle: the failure occurred within an area of forestry and regressed upslope to an area of open blanket bog. Peat depths were between 2 and 2.5m with relatively shallow slopes of 3-5 degrees. No significant breaks in slope are present. Artificial drainage is present within the forestry plantation. A previous failure had occurred adjacent to the failure studied in this report.

In terms of susceptibility to peat failure at the sites of the 3 slides in this study, the following table uses four (depth, strength, slope, drainage (artificial and natural) of the contributing factors in peat failures previously identified and applies a relative risk to each factor using a simple 1-5 scale, where 1 is the lowest risk to susceptibility and 5 is the highest. The sum of these factors is then used to determine if a change in the susceptibility rating should be considered. The table below provides an example of this procedure.

Table 3-1: Example of 'peat specific' risk assessment for shallow slopes for the three landslides sites

	Meenbog	Shass Mountain	Mount Eagle
Peat Depth 0-1m = 1 (unless on slope >15 degrees = 5) 1-3m = 3 >3m = 5 (unless slope angle < 2.5 degrees = 1)	3	5	3
Peat Strength (as indicated by shear vane) 0-10kPa = 5 10-20kPa = 3 >20kPa = 1	5	3	3
Slope Characteristics Convex = 5 Concave = 3 Planar = 1	5	1	1
Drainage (artificial) Presence of transverse/oblique drains = 5 Presence of drains parallel to slope = 3 No artificial drains = 0	3	5	5
Drainage (natural) Presence of Flushes/Headwaters of stream in immediate vicinity = 5 No flushes/headwaters present = 1	1	5	1
Total	**17**	**19**	**13**
0-9 – no change 10-14 – elevate by one Category (such as from "Low" to "Moderately Low") 15-20 – elevate by two Categories (such as from "Low" to "Moderately High")) >20 – elevate to "High" susceptibility (irrespective of previous classification) Notes: As an additional check, if any site records three values of 5 the susceptibility should increase to "High". Peat strength may alternatively be replaced by Von Post classification, or moisture content if site specific results are available.			

The above assessment would apply for the immediate failure area, plus any other areas within the landslide study sites with similar attributes. It should be noted that this assessment is only possible because of data gathered during site visits, such as peat depth, peat strength and spacing and orientation of drains. The above assessment is effectively treating the trigger for a failure as rainfall, as this is most common trigger factor noted in Irish peat failures.

- **Meenbog**: any change to the landslide susceptibility classification (increase from "Low" to "Moderately High") would be limited to areas with a convex break in slope with relatively deep peat (>2.5m) and low peat strengths (<10kPa). An assessment of the contours across this study area highlighted several areas of peatland with a convex break in slope. One of these areas recorded peat depths in excess of 5m, and this area would be considered similar to the area of the failure and therefore to have a higher susceptibility classification.

- **Shass Mountain**: any change to the landslide susceptibility (“Low” increasing to “High” and “Moderately Low” increasing to “High”) would likely be limited to areas downslope of forestry around open peatland, especially close to existing natural drainage channels/flushes. This combination of factors would appear to be limited to locations immediately to the east and west of the failure.
- **Mount Eagle**: the main contributing factor in this appears to have been the alteration of the natural drainage around the perimeter of the forestry plantation. The entire southern boundary of the forestry appears to have the same geotechnical characteristics and given the presence of a historic failure adjacent to the recent failure, this entire boundary would have to be given an increased landslide susceptibility classification (increase from “Moderately Low” to “High”).

The above can be seen to potentially increase the landslide susceptibility assessment of the three areas to a point where there would be an increased risk of failure following a suitable trigger event. However, the extent of any potential failure would be significantly harder to determine.

The Meenbog failure was triggered by activity associated with the construction of a wind turbine access road across blanket bog. Such human impact can only be assessed on a site-specific basis.

In the case of Shass Mountain, a very heavy rainfall event is considered to be trigger for the peat failure. However as heavy rainfall does not always lead to a peat failure it is clear that there are other predisposing factors operating at Shass, as detailed in the report “Main Factors Considered To Have Contributed To Three Major Peat Failures In 2020”, GSI, 2024.

The Mount Eagle failure appears to have been mostly related to the drainage of the site contributing to increased volume of surface water runoff over time. Forestry drains may have reduced the strength of the fibrous acrotelm layer and contributed to collapse of the bog by ingress of the volumes of surface water.

As different triggers and conditioning factors are associated with each failure, producing an assessment which can accurately reflect all of these failures is not considered feasible.

Within each of the three upland locations of the landslide sites there are areas with similar characteristics (and similar landslide susceptibility) to the failure areas. In the cases of Shass Mountain and Mount Eagle, several locations in these uplands are likely to have experienced the same rainfall/runoff as the areas that failed. However, the failures were localised, indicating that specific factor/s are present at the failure locations that are not replicated in nearby areas that incurred the same rainfall event.

As the Meenbog failure was triggered by construction activity, any areas with similar characteristics would be considered a high risk of a peat failure if similar construction activity was planned at that location but would not necessarily be considered to be at high risk of peat failure in the absence of that human activity trigger.

4. Summary

This technical note was produced in order to review and assess whether areas of peatland within the study areas of this project, currently mapped as low to moderate susceptibility on the National Landslide Susceptibility Map, are likely to have a higher classification of susceptibility to landslides due to factors not previously included in the analyses.

The most straightforward option may be to add an additional layer (or note) to the existing susceptibility mapping for areas that can be identified as having the following characteristics:

- Presence of an upland blanket bog or active raised bog setting
- Slopes of 3-10 degrees (as an example)

The additional layer/note would inform that these areas may be at higher risk from peat instability, and that an appropriate peat stability assessment should be undertaken for any works proposed in these areas, irrespective of the current landslide susceptibility rating. The peat stability assessment should include the gathering of site-specific data on the condition and extent of peat and drainage (hydrology and hydrogeology) on the site.

An alternative to the above would be to apply a filter layer to the existing susceptibility mapping, effectively "greying-out" all areas of upland blanket bog. A note would be added to the legend stating "Areas of upland blanket bog should be considered at higher risk of peat failure. Any development in these areas should include an appropriate site-specific peat stability assessment undertaken by multidisciplinary teams of suitably qualified and experienced scientific and technical professionals".

As the susceptibility mapping was undertaken using a 20m DEM, another option would be to look to update the mapping based on more detailed topographic data such as LiDAR, which would allow for a refinement in the calculation of the TFI, which may alter the landslide susceptibility classification of certain areas. It may also allow for the identification of concave and convex breaks in slope, which are a known conditioning factor in peat failures.

In order to be relevant specifically to peat failures, it is considered that additional factors would have to be included to create a specific assessment of the landslide susceptibility of peat deposits. This would involve the collation of a series of datasets, such as blanket bog/wet heath areas, forestry plantations, drainage systems, topographic data, catchment data, peatland condition data and others. However, any such assessment would require the application of suitable weighting factors to datasets, as not all datasets have an equal impact on peat stability.

As an example,

- The slope characteristics, such as areas of concave/convex breaks in slope would have to be identified, as these areas are considered to be at higher risk of failure. In all of these cases, the surface slope angle is assumed to reflect the slope angle of the base of the peat, unless evidence to suggest otherwise is available.
- Slightly different slope bands to the originals would need to be selected, providing more bands at lower slope angles (<15 degrees) with only a couple of bands above this, as peat typically does not

accumulate in significant quantities on steep slopes. Such steeper slopes are already classified as 'High' susceptibility.

- Additional factors, such as areas within the headwaters of watercourses would also have to be considered, as well as drainage patterns, (natural/man-made) such as flushes. Rainfall levels and patterns would also be a part of this assessment.
- The condition (level of decomposition), thickness of a peat deposit and water level/hydrogeological conditions within the peat deposit should also be considered. The shear strength of peat is also important, although there are issues around the accuracy of field measurements of this parameter.
- The land use of an area, and specifically any change in land use (such as peat extraction or forestry, for example), would also have to be considered. Degradation of peat areas can also be a conditioning factor in peat failures, and these areas would also have to be identified, likely from high quality satellite imagery/aerial photography and other available data. This would require significant time and effort if applied to all upland peatlands across the country. The National Land Cover and Habitat Map (NLCHM), provides a more detailed dataset of land types nationally and would likely be very useful for this though it will need some prior validation against existing peatland ground truth data.

Each of the bullet points above would require the collation of a series of existing datasets (such as locations of blanket bog/wet heath, forestry plantations, drainage systems and habitats), refinements of some existing datasets, and possibly the creation of new datasets to allow these factors to be included in a landslide susceptibility assessment.

An example of a “peat specific” qualitative risk assessment is provided for the three failures, based on peat depth, peat strength, slope shape and the presence of artificial drains. It shows that this type of assessment would increase the landslide susceptibility classification of the three sites, to “Moderately High” for the area around the Meenbog failure, “High” for Shass Mountain and “High” for Mount Eagle.

The above can be seen to potentially increase the landslide susceptibility assessment of the three areas to a point where there would be an increased risk of failure following a suitable trigger event. However, the extent of any potential failure would be significantly harder to determine.

The Meenbog failure was triggered by activity associated with the construction of an wind turbine access road across blanket bog. The risk associated with work related to a development such as a windfarm must be carefully assessed on a site-specific basis as part of the EIAR process and a precautionary approach is clearly needed.

In the case of Shass Mountain and Mount Eagle, rainfall is considered to be the trigger for the peat failures, however heavy rainfall does not always lead to a peat failure therefore it is clear that there are predisposing factors operating at both sites , which is covered in the report “Main Factors Considered To Have Contributed To Three Major Peat Failures In 2020”, GSI, 2024.

As different triggers and conditioning factors are associated with each failure, producing a single assessment protocol which can accurately reflect all of these failures is not considered feasible.

Creighton (2006) reports that the Irish Landslides Working Group recommends that a large body of research be completed with regard to landslide susceptibility assessment in Ireland. The National Landslide Susceptibility map was published in 2016.

The growing pressure for development in more marginal land areas, and the potential impacts of climate change, make such work an important imperative in the context of the sustainable development of the Irish landscape, and also on health and safety grounds. In the 2006 publication, a need for multidisciplinary studies on landslide phenomena involving geologists, geomorphologists, engineers, peatland ecologists, climatologists, planners and those with GIS expertise was identified. The collaborators would include university researchers, local authorities, government departments and agencies, and consulting geologists and engineers. With progress in these specific themes, more informed approaches can be undertaken on the methodology of landslide susceptibility mapping.

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