



Forestry Commission Scotland
Coimisean na Coilltearachd Alba

Scottish Windblow Contingency Plan

A strategy for dealing with
catastrophic windblow events in
Scottish forests

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This plan is owned by Forestry Commission Scotland Policy Group and the lead contact is:

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Key changes from November 2017 version:

Various. Change of title from Forest District Manager to Regional Manager.

Page 18. Section 2.5. Reference to accessing satellite imagery if available.

Page 20. Section 3.3.2. Changes to contact names for cross border events.

Page 22. Section 3.4. Reference added to a study which would enable easier use of satellite data.

Page 26. Appendix 2. Expert advisors to the SWAC. Changes made to some names and job titles.

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Executive Summary

Introduction

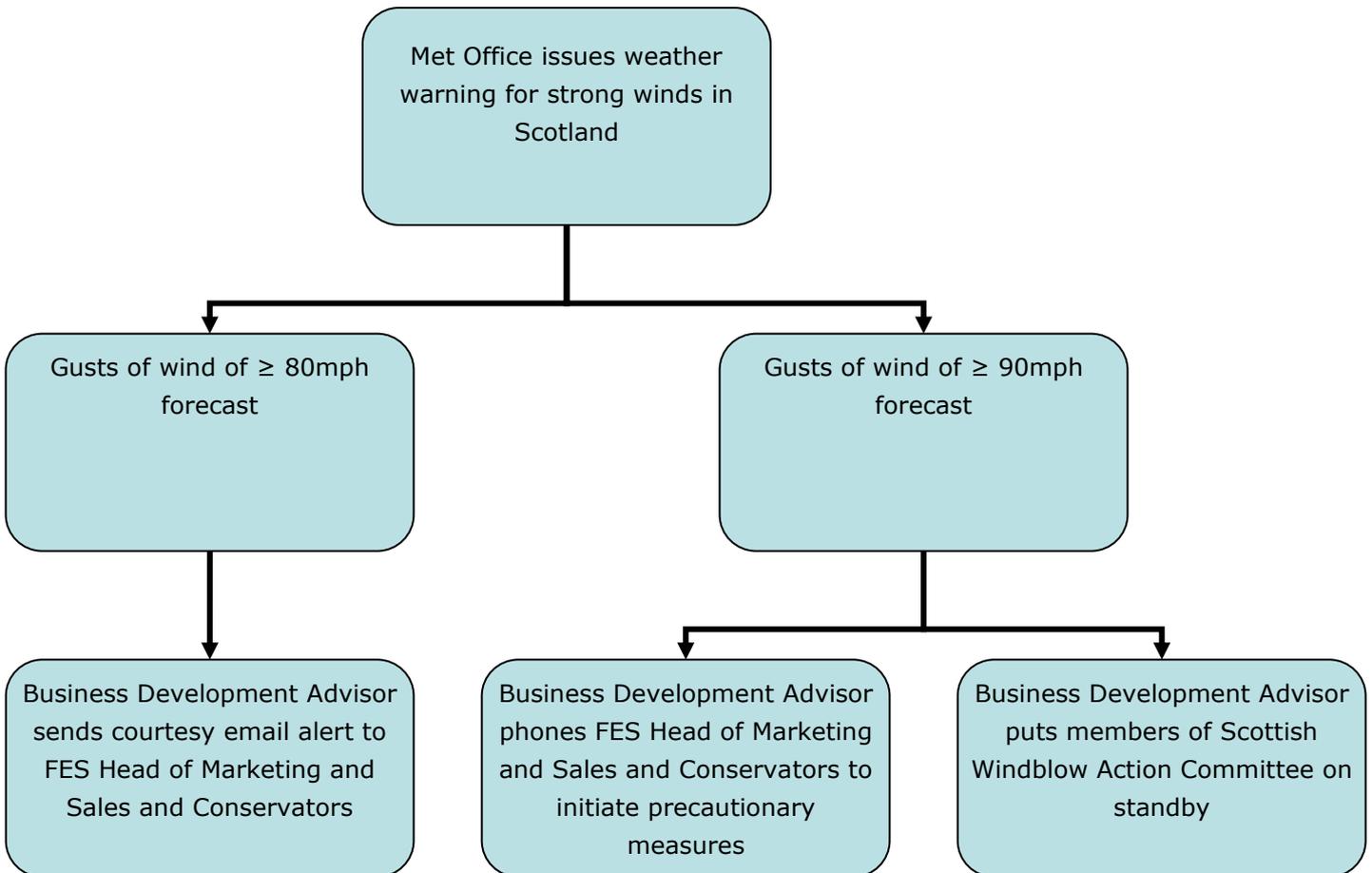
- Catastrophic windblow events are defined as incidents where:
 - the volume of windblown timber is equal to 100% of annual cut (in m³), or
 - >1 million m³ in any one of the timber forecasting zones, or
 - >1.5 million m³ across combined zones.
- Forest Research have concluded that winds of ≥90 mph are likely to cause incidents of catastrophic windblow and thus forecasts of winds at this level are the key trigger for this plan to come into force. This plan also details steps that should be taken to prepare for such an event.

Before a catastrophic windblow event

- Within the Scottish Government's Integrated Emergency Management framework, there are 3 Regional Resilience Partnerships (RRPs). These are made up of 13 Local Resilience Partnerships (LRPs). Together they are responsible for managing preparation and response to emergencies in their local areas.
- Resilience Partnerships are responsible for developing and co-ordinating risk registers and must ensure that they capture the full range of regional/local hazards that could accompany a catastrophic windblow event.
- To increase the resilience of individual forests to storm events, risk assessments can also be undertaken at the forest-level using a range of different tools.
- FCS National Office will alert Forest Enterprise Scotland (FES) Head of Marketing & Sales and Conservators by email when gusts of wind ≥80 mph have been forecast in their area.
- When gust of wind of ≥90 mph have been forecast (*as much as is possible to determine, in afforested areas*), the Business Development Advisor will phone FES Head of Marketing & Sales and Conservators.
- FES Head of Marketing & Sales and Conservators are then responsible for informing key staff, e.g. FES Regional Managers and key private sector interests respectively.
- The forest industry should initiate precautionary measures, including moving essential equipment, placing on standby those individuals key to response efforts as well as warning the public and any forest event organisers.

- In the event that gusts of wind ≥ 90 mph are forecast, the Business Development Advisor in FCS National Office will also put members of the Scottish Windblow Action Committee on standby.

Key steps before a catastrophic windblow event



After a potentially catastrophic windblow event

There are two key responses that will occur after a potentially catastrophic windblow event:

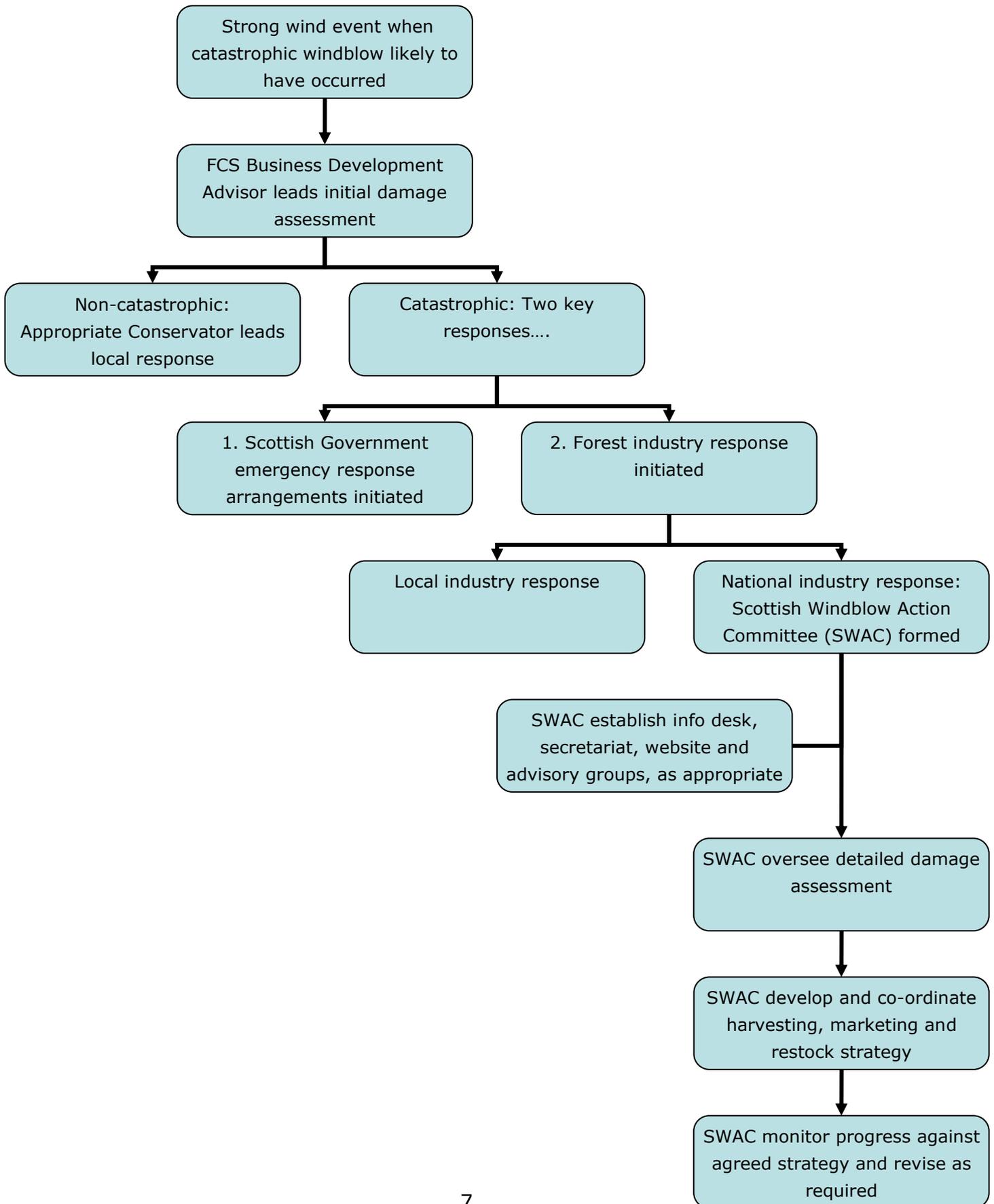
1) Multi-agency emergency response led by Regional Resilience Partnerships (RRPs) or Local Resilience Partnerships (LRPs) dependent on the scale of the event.

After a significant storm event (which may or may not be deemed 'catastrophic' in terms of windblow), the immediate priorities are rescuing injured/trapped people, and clearing transport links, communications, public utilities and buildings of fallen trees. This process will be led by Resilience Partnerships but FCS will assist where it has the capacity and appropriate skills.

2) Forest industry response led by Strategic Windblow Action Committee (SWAC)

- Initial damage assessment: The Business Development Advisor will carry out an initial damage assessment by liaising with key stakeholders to establish if the damage is likely to have been at a 'catastrophic' level.
- If so, the Scottish Windblow Action Committee (SWAC) will develop and co-ordinate a response strategy at the national level, drawing on specialist advice and, as appropriate, establishing a Scottish Windblow Information Desk, secretariat and website.
- At the local level, under the strategic direction of the SWAC, Conservators and FWS Regional Managers will help to secure public safety and regain access to the forests.
- Detailed damage assessment: The Business Development Advisor, working with FES and Conservators, will lead a thorough damage assessment using helicopter/aerial/satellite surveys to establish the extent of the windblow and its likely implications.
- In-depth ground-based surveys may also be required at the local level. These should be co-ordinated by FES Regional Managers and Conservators.
- A strategy for harvesting, marketing and restocking will then be developed and implemented by the SWAC.
- Progress against targets will be monitored to ensure that, where necessary, adjustments to the strategy can be made.
- The SWAC may wish to commission an independent evaluation of the response to inform future responses to catastrophic windblow events.

Key steps after a potentially catastrophic windblow event



1. Introduction

Key point:

Catastrophic windblow events are defined as incidents where:

- the volume of windblown timber is equal to 100% of annual cut (in m³), or
- >1 million m³ in any one of the timber forecasting zones, or
- >1.5 million m³ across combined zones.

1.1 Background

Catastrophic windblow events are rare and their frequency, scale and location are unpredictable. However, research suggests that the incidence of severe storms in the UK has been increasing over the last few decades and may continue to do so as our climate warms¹. Table 1 and figure 1 below detail the location of previous catastrophic windblow events across Britain and Europe over the last 60 years, and the volume of windblown timber involved.

Table 1: Previous catastrophic windblow events in Europe

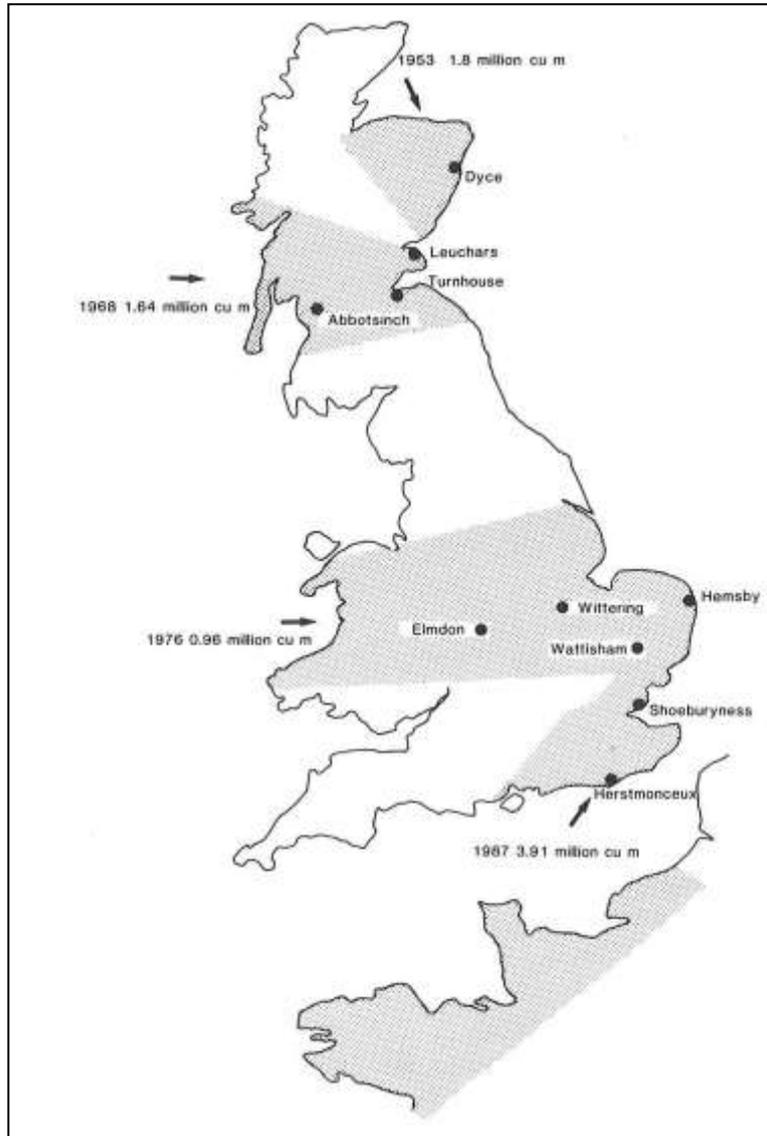
Date	Region/s affected	Volume of windblown timber (million m ³)
January 1953	North-east Scotland	1.8
January 1968	Central Scotland	1.64
January 1976	Mid-Wales, Midlands and East Anglia	0.96
October 1987	South-east England	3.91
December 1999	France, Germany and Switzerland	90

¹ UK Climate Impacts Programme. Recent climate trends
<http://www.ukcip.org.uk/essentials/climate-trends/>

Ray, D. January 2008. Research Note: Impacts of climate change on forestry in Scotland – a synopsis of spatial modeling research
[http://www.forestry.gov.uk/pdf/fcrn101.pdf/\\$FILE/fcrn101.pdf](http://www.forestry.gov.uk/pdf/fcrn101.pdf/$FILE/fcrn101.pdf)

Norwegian Meteorological Institute and Norwegian Academy of Science and Letters. 2013. Extreme Weather Events in Europe: preparing for climate change adaptation
<http://www.dnva.no/binfil/download.php?tid=58783>

Figure 1: Previous catastrophic windblow events in Britain²



Such events have the potential to cause major disruption to electricity, water, phone, gas, public transport and emergency services, and are likely to have a significant financial and practical impact on the Scottish forest industry; in the short term, the principal issue is likely to be regaining access to the forests, and in the medium term the principal issues are likely to be a need for greater harvesting capacity and a glut of timber needing to come to the market. There will be knock-on effects throughout the supply chain. Good preparation is therefore essential and a windblow contingency plan is

² Figure 1 taken from: Grayson, A. J. (ed.) 1989. The 1987 Storm Impacts and Responses. Forestry Commission Bulletin 87. HMSO, London, p7.

required to improve resilience and ensure that a strategy for a co-ordinated response is in place.

This plan is intended for anyone who may have a part to play in planning for, and responding to, a catastrophic windblow event. Interested parties will include the Scottish Government, FCS staff, private sector forest management companies, the timber processing industry and small woodland owners.

1.2 Definition of a catastrophic windblow event

For the purposes of this plan, a catastrophic windblow event can be defined as follows:

1. The volume of windblown timber is equal to 100% of the annual cut (in m³), or more than 1 million cubic metres in any one of the timber forecasting zones (see table 2 and figure 2 below), or more than 1.5 million m³ across combined zones. The timber forecasting zones cover both the National Forest Estate and privately owned woodlands.

(In such an instance, the impacts of the windblow event may also constitute an emergency as defined by the Civil Contingencies Act 2004³ eg. may seriously threaten human welfare and may be likely to cause major regional/national disruption to infrastructure and/or services.)

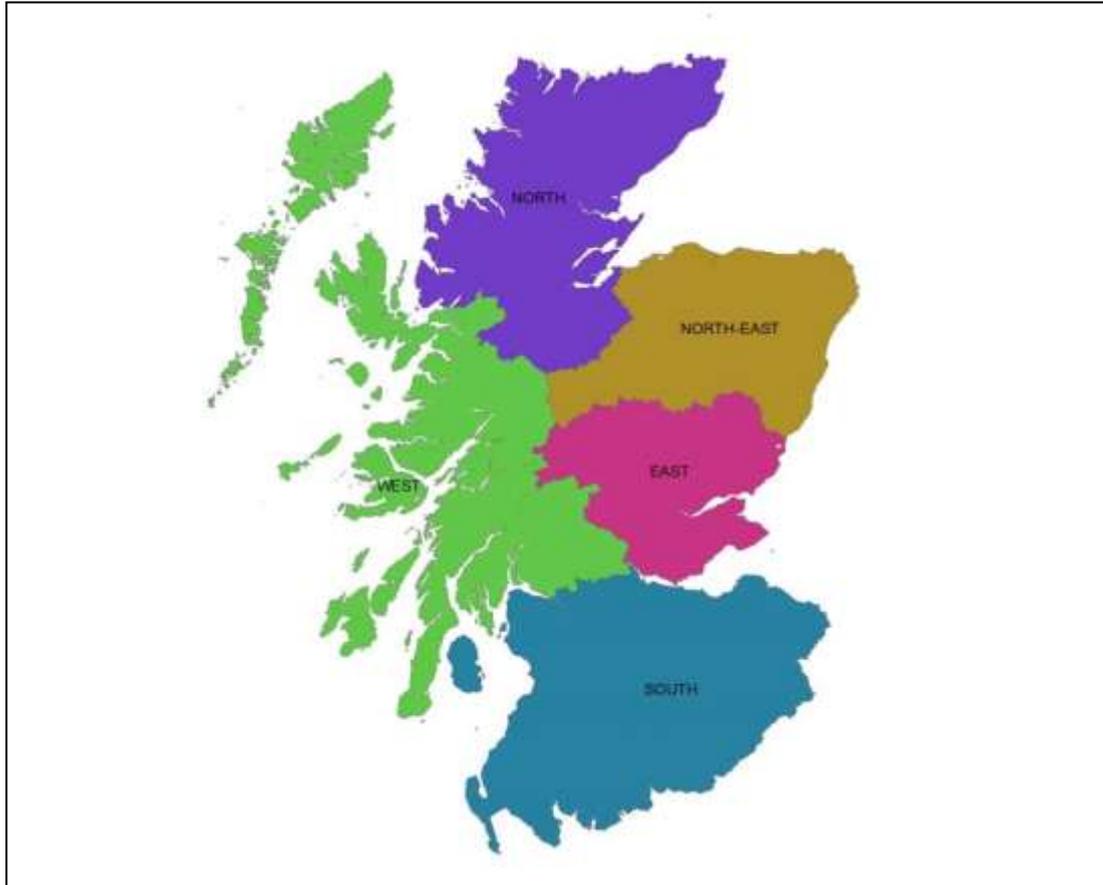
Table 2: The volume of timber that would equate to a catastrophic windblow event in each timber forecast zone (in 2017-2021).

Timber forecast zone	Annual Cut in M ³	Volume of windblown timber resulting in a catastrophic windblow event
North	1,263,000	1 000 000
North East	1 608 000	1 000 000
East	1 200 000	1 000 000
West	3 102 000	1 000 000
South	3 862 000	1 000 000

Source: Average annual volume: 25 year forecast of softwood availability (2016)

³Civil Contingencies Act 2004 – <http://www.legislation.gov.uk/ukpga/2004/36/section/1>

Figure 2: 2011 timber forecast zones in Scotland



© Crown copyright. All rights reserved. Forestry Commission. 100025498. 2009.

1.3 Structure of the plan

The Scottish Government's approach to emergency planning and response is based on the principles of Integrated Emergency Management (IEM) which includes five core activities:

- assessment,
- prevention,
- preparation,
- response, and
- recovery⁴.

⁴ Scottish Government. 2012. Preparing Scotland: Scottish guidance on preparing for emergencies <http://www.scotland.gov.uk/Publications/2012/03/2940/4>

This plan groups these activities into two phases:

- a) before, and
- b) after a catastrophic windblow event.

Section 2 covers the first three IEM core activity areas (assessment, prevention and preparation) and describes the actions that should be taken to plan for and mitigate against a catastrophic windblow event.

Section 3 covers the activities required in the aftermath of such an event to respond to the emergency situation and recover from it.

This plan defines the key roles, responsibilities and co-operative IEM management structures necessary to support the emergency planning network and the forest industry in preparing for and responding effectively to a major windblow event at a regional, national and/or cross-border level. The co-operative structures set out here aim to ensure that health and safety is a primary consideration in the emergency response to any windblow event.

1.4 Key contacts and leave arrangements

Contact details for key individuals (e.g. members of the Scottish Windblow Action Committee, and expert advisors – see Appendices 1 and 2) will be held on the FCS Contacts Database (within Microsoft Outlook) and maintained by the Business Development Advisor. The Business Development Advisor will also maintain a separate document listing contact details for the key individuals above as well as Conservators, Forest Enterprise Regional Managers and Scottish Government Regional Resilience Team members.

The Business Development Advisor will arrange cover for windblow contingency for planned leave periods and other key FCS contacts should make similar arrangements for emergency contacts. Where the Business Development Advisor is unavailable for other reasons (e.g. sickness), another member of the Business Development team will carry out the necessary windblow contingency plan duties.

2. Before a catastrophic windblow event

Key points:

- Risk assessment: At the regional level, risk relating to potential civil emergencies is managed via risk registers which are owned by the Scottish Government's Resilience Partnerships. Risk assessments can also be undertaken at a local or forest-level.
- FCS National Office distributes Met Office weather warnings to Conservancies and FES Head of Marketing & Sales (and through him the Regions), and will inform them by email when gusts of wind ≥ 80 mph have been forecast in their area, and by phone when gusts of wind ≥ 90 mph have been forecast.
- FES Regional Managers and FCS Conservators are responsible for informing staff and private sector interests respectively.
- The forest industry should then initiate precautionary measures, including moving essential equipment, placing on standby those individuals key to response efforts, warning the visiting public and forest event organisers.
- In the event that gusts of wind ≥ 90 mph are forecast, FCS National Office must also put members of the Scottish Windblow Action Committee on standby.

2.1 Introduction

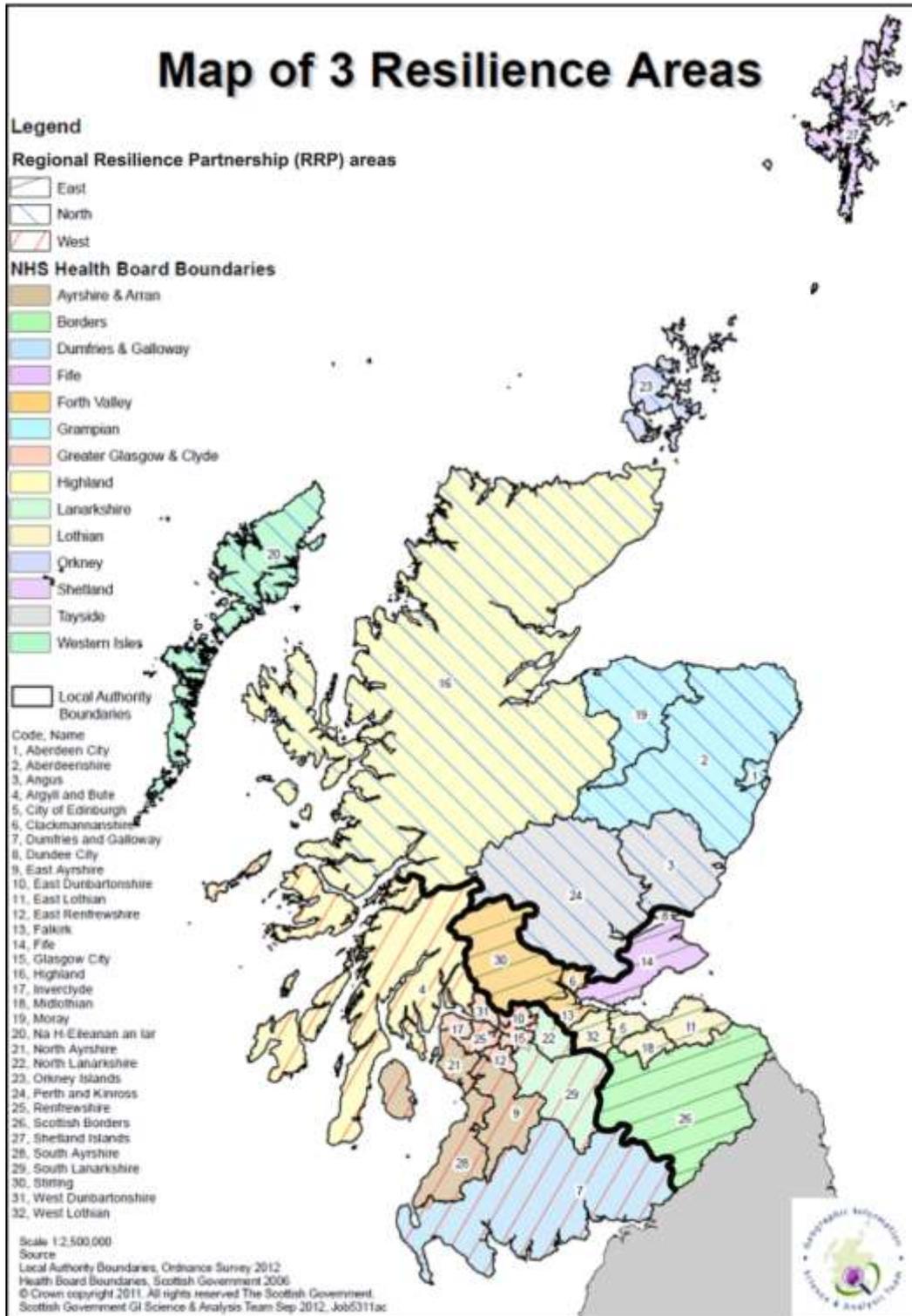
Risk assessment is the first step in the planning process and the focus is on increasing the state of preparedness of emergency responders and the forest industry to deal with a catastrophic windblow event. Prevention requires measures to be taken to eliminate, isolate or reduce identified risks so far as is reasonably practicable. Preparation for responding to a catastrophic windblow event involves planning and informing people so that individuals and organisations that might have to respond to such an emergency will be prepared to do so and understand their roles and responsibilities.

2.2 Regional-level risk management

Within the IEM framework, three RRP's – North, East and West – have been formed to manage preparation and response to emergencies within their designated geographical areas⁵. The three RRP areas mirror the areas established by the Police and Fire services to support strategic management of their local activity and are shown in figure 3 below. The RRP's are broken down into a number of Local Resilience Partnerships (LRPs) – three in the North, three in the East, and seven in the West.

⁵ Preparing Scotland – <http://www.readyscotland.org/ready-government/preparing-scotland/>

Figure 3: Map of Scottish Government's three Regional Resilience Partnership areas.



The Resilience Partnerships are made up of organisations designated as emergency “responders” by the Civil Contingencies Act,⁶ e.g. local authorities, emergency services, and the NHS. Resilience Partnerships are responsible for developing and co-ordinating risk registers for a range of potentially disruptive events, in order to assess risk at the regional and local levels. These provide the basis for the responder agencies to develop, implement and monitor generic and specific emergency response plans. It is important that these risk registers capture the regional/local issues that are likely to accompany a catastrophic windblow event.

Conservators should liaise with Resilience Partnerships to ensure that risks from windblow events are covered in the risk registers. The assessment of risks around such an event should consider the following:

- Completion of a risk assessment of the known limiting factors in effectively managing a catastrophic windblow event within each Resilience Partnership area and development of an action plan to address these issues.
- Identification of the health and safety and wider training requirements of those who will be involved in the emergency response.
- Development of a list of local emergency contact numbers for a windblow related event including Forest Enterprise Scotland (FES), private sector management companies, forestry agents and private landowners.
- Co-ordination with FES and the private sector to compile and maintain a contractor database covering harvesting equipment, cable crane resources, chainsaw operators (with windblow certificates), and tree surgeons etc.
- Testing of emergency arrangements to ensure the emergency plans are current, valid and effective.
- Raising awareness of the Scottish Windblown Contingency Plan within the forest industry and the emergency response sector.

2.3 Local and forest-level risk management

At a local level, FES Regions have their own local windblow contingency plans. Local offices of private forest management companies are encouraged to prepare similar plans. While forest managers can risk assess individual woodlands and use appropriate management regimes to help minimise endemic windblow, it is very difficult to

⁶ Civil Contingencies Act 2004 – <http://www.legislation.gov.uk/ukpga/2004/36/schedule/1>

manage woodlands to withstand catastrophic windblow. However, the use of the following guidance when designing forests and woodlands can help reduce its impact:

- *Windthrow Hazard Classification; DAMS* (Detailed Aspect Method of Scoring); and *ForestGALES*⁷, a wind risk management tool, can all be used to help manage forests to reduce windblow. *ForestGALES* can be used to estimate the probability of wind damage to forests.
- *Forests and Wind: management to minimise damage*⁸; *Climate Change Impacts on UK Forests* (chapter 4)⁹; *Forest Design Planning: A Guide to Good Practice*¹⁰; and the European Forest Institute's book *Living with Storm Damage to Forests*¹¹ each give advice on the silvicultural measures that can be taken to increase the resilience of forests to storm events.

2.4 Wind forecasts

Having advanced knowledge that the risk of a catastrophic windblow event is high enables precautionary measures to be taken. By studying past windblow events Forest Research scientists concluded that gusts of wind of ≥ 90 mph (≥ 40 metres per second) are likely to cause catastrophic windblow damage¹².

FCS National Office, through the FCS Business Development Advisor, facilitates the distribution of alerts from the Met Office National Severe Weather Warnings Service¹³ (NSWWS) to FES Head of Marketing and Sales (and through him all FES Regions) and Conservancy offices.

⁷ ForestGALES <http://www.forestry.gov.uk/fr/forestgales>

⁸ Forests and Wind: management to minimise damage
<http://www.forestry.gov.uk/website/publications.nsf/WebpubsbyISBN/0117103322>

⁹ Climate Change Impacts: storms <http://www.forestry.gov.uk/fr/INFD-5ZYJ8B>

¹⁰ Forest Design Planning: A Guide to good Practice
[http://www.forestry.gov.uk/pdf/fdp.pdf/\\$FILE/fdp.pdf](http://www.forestry.gov.uk/pdf/fdp.pdf/$FILE/fdp.pdf)

¹¹ Living with Storm Damage to Forests
http://www.efi.int/files/attachments/publications/efi_wsctu_3_final_net.pdf.

¹² Advice from FR scientists based on Gardiner et al. Destructive Storms in European Forests: Past and forthcoming Impacts http://www.efi.int/files/attachments/efiatlantic/2010-storm/storms_final_report_main_text.pdf

¹³ Met Office National Severe Weather Warnings Service
<http://www.metoffice.gov.uk/public/weather/warnings>

The Met Office issue warnings of strong winds based on the likelihood they will occur and the level of impact they will have on the population. Typically this means that high wind speeds must be expected to occur over a widespread area before a warning will be issued. Three levels of warning are used: yellow – be aware; amber – be prepared; and red – take action, with email alerts being issued by the Met Office for yellow and above.

The focus of the warnings is on their potential impact on people, which could mean that warnings of winds strong enough to cause damage in remote areas might not be issued if the impact on people is not perceived to be high. In such events the wind damage is likely to be localised rather than the type of damage covered by this plan.

Where wind is likely to cause damage at a catastrophic level, the NSWWS should identify this. However, it will be important for the FCS Business Development Advisor to consider the specifics of the warning, particularly wind speed, before deciding on the appropriate course of action.

2.5 Precautionary measures

Where a weather warning details winds of ≥ 80 mph, the FCS Business Development Advisor will email FES Head of Marketing & Sales and Conservators as a courtesy to alert them to the warning.

When gusts of wind ≥ 90 mph are forecast, the Business Development Advisor will telephone FES Head of Marketing & Sales and Conservators. The Head of Marketing & Sales will liaise with FES Regional Managers who should ensure that key staff are warned and precautionary measures are taken. Similarly, Conservators should ensure key private sector interests are also contacted.

The Business Development Adviser will also alert members of the SWAC to the potential windblow occurrence and put them on standby. Details of the SWAC terms of reference and membership can be found in Appendix 1.

Where practical, in the event that gusts of wind ≥ 90 mph are forecast, a number of precautionary measures should be taken by the forest industry, with FES Regional Managers and Conservators taking the lead in promoting these activities:

- Move all essential equipment (e.g. harvesters, fuel bowsers, civil engineering plants) from potentially vulnerable areas to locations that will be easily accessible in the event that windblown trees blocks forest roads.
- Place harvester and cable crane operators, civil engineers, tree surgeons, and qualified chainsaw operators who have passed the appropriate windthrow competence unit on standby.

- Place FES Regional, Conservancy and other available staff on standby to undertake ground surveys once the high winds have subsided.
- FES Regional Managers and Conservators to alert contractors working in FES forests, and forest management and harvesting companies respectively, to the potential for strong winds and the associated dangers.
- Advise organisers of forest events to cancel/postpone activities.
- Warn the visiting public of potential dangers e.g. local radio adverts, warning signs at recreation sites and key forest access points.
- Review procedures for initiating a request for satellite imagery of (potentially) severely impacted areas.

3. After a potentially catastrophic windblow event

Key point:

There are two key responses that will occur after a (potential) catastrophic windblow event:

- 1) Multi-agency emergency response led by Resilience Partnerships
The immediate priorities are rescuing injured/trapped people, and clearing transport links, communications, public utilities and buildings of fallen trees.
- 2) Forest industry response led by Strategic Windblow Action Committee (SWAC)
At the national level this will include carrying out damage assessments and developing and co-ordinating implementation of a harvesting, marketing and restocking strategy. At the local level, this will involve securing public safety and regaining access to forests.

3.1 Introduction

There are two key responses to serious windblow and, depending on the circumstances, both may be employed or only one response may be deemed necessary. Following this a recovery strategy will need to be implemented.

3.2 Key response 1: Resilience Partnerships

It is likely in a catastrophic windblow event that other widespread damage will have occurred, including damage to transport and utilities infrastructure. In these circumstances, one or more of the Resilience Partnerships will co-ordinate the multi-agency emergency response. Even where assessment shows the damage should not be classed as 'catastrophic' in terms of the volume of timber blown down, one or more of the Resilience Partnerships could still take action if essential services have been disrupted.

The initial focus of the Resilience Partnerships' response will be to rescue injured/trapped people, restore transport links and public utility services, and remove trees that have fallen on buildings. As part of the overall emergency response, these clearance and other associated activities will be co-ordinated through the Resilience Partnerships but it is likely that FCS assistance will be required. The Resilience Partnerships understand the capacity and skill limitations relating to tree felling within FCS and emergency works are routinely facilitated through local authority or utility company staff/contractors.

may also choose to set up a Scottish Windblow Information Desk (SWID), secretariat and website to act as a central point of contact for media interests and to gather, evaluate and disseminate information as required by the SWAC.

3.3.3 Local/regional forest industry response

The initial local forest industry response will focus on securing public safety and regaining access to the forests. When a windblow event falls outwith the definition of 'catastrophic' it may still have a significant local/regional impact and the response detailed here is also likely to be appropriate at that level. Where the damage is not classified as catastrophic, the relevant Conservator, in liaison with the relevant FES Regional Manager and private sector representatives, should lead the response and recovery phases. Where the event is classed as catastrophic, localised action will still be essential but the SWAC will provide strategic coordination and lead the process.

The following key steps should be taken, where appropriate, to secure public safety:

- Closure of formal recreation facilities and provision of on-site signage at known access points to warn of the potential dangers in a windblown forest.
- Liaison with local access officers over facility closures and the impacts of the storm on core paths and rights of way.
- Cancellation of all planned events in forests and suspension of any formal permissions e.g. firewood permits and sporting permissions.

In addition, local resources may be focused on gaining access to key internal forest roads to provide access to previously inaccessible harvesting equipment, facilitate damage assessments, and secure access to existing roadside timber stocks or harvesting sites to maintain supply to mills.

3.4 Survey and damage assessment

Following an initial damage assessment (as detailed above in section 3.3.1) which has identified that a catastrophic windblow event has probably occurred, there will be a need for more thorough damage assessment to provide an estimate of the extent of the damage and enable a harvesting, marketing and restocking strategy to be developed.

This may be more or less detailed, depending on requirements. The time taken to carry out this assessment will be highly dependent on the extent and nature of the damage. Ideally it should be completed within four weeks of the storm, however past experience has shown it could take longer.

The damage assessment will be led by the Business Development Advisor working with FES and Conservators. Conservators should liaise with the local forestry sector to assist with gathering estimates of both the spread and extent of damage in private forests within their Conservancy. Based on this information, the most appropriate surveying methods will be proposed to the SWAC. At this stage the likely options and indicative timescales include:

- i. Helicopter or other aerial surveys to confirm Conservator/s' estimates of the extent of damage. (2-5 days to get an indicative total area and geographical spread).
- ii. Field based plot surveys by National Forest Inventory (NFI) surveyors to establish an indicative volume and assortment breakdown based on NFI data (2-3 days to get surveyors targeted and into field, 13-15 days to get quotable outputs).
- iii. Satellite radar images from before and after the storm. Obtain/purchase new post storm images and compare these with images taken just before the event using the algorithms developed in summer 2018 by Carbomap. This aspect is the subject of current work attempting to finalise and refine the process.

The data collected using the above methods can be used to create GIS polygons of windblow which can then be combined with NFI production forecast data to obtain a more accurate assessment of the wind damage. The assessment should aim to provide estimates of:

- Location of damage
- The total volume and area blown
- Species breakdown (and by size class)
- Division of damage between public and private forests

The Business Development Policy Advisor will collate the data available and report to the SWAC.

In-depth ground-based surveys may also be required for detailed damage assessment at a local level. FES Regional Managers and Conservators should co-ordinate these assessments.

3.5 Developing a harvesting, marketing and restocking strategy

Once accurate estimates of the distribution and extent of the damage have been acquired, a strategy for harvesting, marketing and restocking should be developed. This will be the responsibility of the SWAC. The strategy should:

- Set out the overall priorities and targets (including volumes/areas, species and timescales) for harvesting operations;
- Define the roles and responsibilities of the key players in implementing the strategy;
- Detail the priorities for marketing of the windblown timber, measures to limit the impact on the timber market and to define strategic priorities and actions;
- Set out the priorities for restocking (including areas and timescales) and how they will be achieved, including financial and grant considerations;
- Consider the landscape issues relating to the windblow;
- Identify the barriers and risks associated with the strategy, and the measures that will be implemented to address these.

The structure of the strategy will be highly dependent on the nature of the windblow event. Further details on the issues around harvesting, marketing and restocking are set out in Appendix 3.

Experience has shown that the final volume removed from windblow sites can greatly exceed the assessed volume. This is due to the practical difficulties and safety implications of assessing storm damage as well as the need to harvest to wind firm edges.

3.6 Monitoring and evaluation

As the harvesting, marketing and restocking strategy is implemented it will be important to monitor progress against the targets to ensure, where necessary, that adjustments to the strategy can be made.

After previous windblow events in 1968 and 1987, an evaluation of the response was produced and published¹⁴. The SWAC may wish to commission an independent evaluation of the response to the event, including the lessons learnt and recommendations on the response for future catastrophic windblow events.

¹⁴ Holtam, B. W. (ed.) 1971. Windblow of Scottish forests in January 1968. Forestry Commission Bulletin 45. HMSO, London.

Grayson, A. J. (ed.) 1989. The 1987 Storm Impacts and Responses. Forestry Commission Bulletin 87. HMSO, London.

Appendix 1: Scottish Windblow Action Committee

Terms of Reference and membership

Purpose

The Scottish Windblow Action Committee (SWAC) will be convened in the event of a catastrophic windblow event to implement the Scottish Windblow Contingency Plan and develop a response and recovery strategy. These terms of reference will be agreed by the SWAC in the event of a suspected catastrophic windblow event.

Remit

- Ensure the effective implementation of the Scottish Windblow Contingency Plan;
- Develop a co-operative response and recovery strategy in liaison with the forest industries and experts set out in Appendix 2, including strategic guidance on priorities for harvesting, marketing and restocking;
- Ensure the effective use of resources across the forest industry;
- Disseminate up to date information to the forest industries, wider stakeholders and the media; and
- Provide progress reports, as required, to the FCS Management Board, FCS National Committee and Ministers.

Reporting

- An initial assessment will be made by the Business Development Advisor, working with others, on whether a catastrophic windblow event has occurred. The Business Developer Advisor will initially report to the Head of Forestry Commission Scotland.
- In the event of a catastrophic windblow event the SWAC will be convened and a preliminary report produced, ideally within six weeks of the storm event, giving an initial assessment of the damage, proposed action and outline implications for the forest industries.
- Another report should be prepared at a later stage, after further consideration and discussion, setting out a comprehensive assessment of the damage and the proposed actions for harvesting, marketing and restocking, together with the implications for the forest industries.

- At the end of the operational work following the windblow, the SWAC may commission an evaluation of the response to the windblow event.

Membership

Contact details for the following can be found in the FCS Contacts Database and in a separate document in the *Windblow Contingency* folder in Business Development section of the FCS Shared Area:

Jo O'Hara (Chair)	Head of Forestry Commission Scotland, FCS
Mick Bottomley	Head of Marketing and Sales, FES
David Sulman	Executive Director, UKFPA
Jamie Farquhar	National Manager for Scotland, Confor
Nicky Whitaker	Head of Corporate Services, FCS
Jason Hubert	Head of Business Development, FCS
Derek Nelson (Secretary)	Business Development Advisor, FCS

Appendix 2: Expert advisors to the Scottish Windblow Action Committee

Contact details for the following can be found in the FCS Contacts Database and in a separate document in the *Windblow Contingency* folder in Business Development section of the FCS Shared Area:

Jim Baird	Head of Response and Engagement Team, Scottish Government Resilience Division
Peter Weston	Head of Inventory, Forecasting and Operational Support, FR
Ben Ditchburn	National Forest Inventory Programme Leader, FR
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Appendix 3: Issues for consideration when developing the harvesting, marketing and restocking strategy

Harvesting resource availability and skills base

The availability and skills base of contractors to undertake machine harvesting and chainsaw operations may limit the speed and rate of clearance. However, measures can be taken to increase clearance capacity by redeploying existing resources onto windblow clearance operations, and bringing in additional contractors from outwith the area.

Ability of forest industry to restrict or adjust existing thinning and felling commitments

Timber substitution i.e. harvesting windblown timber rather than other planned harvesting sites, will have an important role to play in both the private and public sectors.

Expected rate of deterioration of the timber

Research shows that pine degrades more rapidly than spruce once felled due to its susceptibility to attack by bark beetles and sap stain fungi (blue stain). Although blue stain has no effect on timber quality, for many end uses blue stained timber is not aesthetically acceptable. Other species, including spruces, Douglas fir, larches and some broadleaves may degrade at a slower rate, but will still be susceptible to decay where their moisture content remains at elevated levels for prolonged periods. The SWAC should take advice from Forest Research on the latest guidance on windblown timber degradation and the pest and disease implications.

Timber storage and preservation options

After the 1987 storm in England water storage was used for pine saw logs and other species to prevent fungal decay. The practical limiting factors are the availability of bulk storage sites, the economic haulage distance from the forest to the storage site, the doubling handling of the material and availability of harvesting resource to process the timber before it degrades. Spruce can be successfully stored under water but the economic viability of this may be limited. *Forestry Commission Bulletin 117*¹⁵ gives

¹⁵ Webber, J.F. and Gibbs, J.N. 1996. Water storage of timber: experience in Britain. Forestry Commission Bulletin 117. London: HMSO.

further guidance on this issue. Internal advice by FR on the degradation of larch and options for storage has been produced¹⁶.

The SWAC will be responsible for assessing any storage requirements and should take advice from Forest Research on the latest guidance.

Capacity of the timber markets to absorb additional volume

Following an assessment of the scale of the damage, likely rate of degrade, restriction of normal production and the expected product split, the SWAC should consider the possible markets for the windblown timber, including export, and the capacity of these markets to absorb additional timber volumes within the relevant timescales. Consideration should also be given to any geographical constraints in terms of the location of the windblown timber and the location of available markets. The domestic processing sector, including sawmills, wood panel and pulp mills and biomass plants, will be an important stakeholder.

The SWAC will need to know whether the high winds have caused similar windblow events in other parts of Europe because this is likely to have an impact on the market as well as harvesting capacity. The UNECE Timber Committee and the FAO European Forestry Commission will hold information on the extent of the windblow in other European countries.

Financial considerations

The windblow event is likely to have financial implications for both the private sector and the National Forest Estate around additional costs for harvesting, impact on timber prices, and restocking costs. After the 1987 storm, payment of a restocking grant was seen to be important, particularly in relation to broadleaved woodlands because these woods had largely been unmanaged and were otherwise unlikely to generate sufficient timber revenue to offset the cost of restocking.

Health and safety

Harvesting windblown wood is potentially dangerous work and should only be carried out by fully trained and properly equipped professionals. It will be essential to engage with both the FC Safety, Health and Environment team and the Forest Industry Safety Accord.

Restocking consideration

The site conditions following catastrophic windblow damage often require the adaptation of normal establishment techniques, either due to pressure on resources or because of

¹⁶ Price, A. and Macdonald, E. 2013. Timber from larch trees infected by *Phytophthora ramorum*: options for harvesting and storage. Roslin: Forest Research

the greater quantities of brash, un-harvested timber and the presence of large upturned root plates. These factors will make access to restocking sites more difficult and will dictate appropriate establishment techniques.

The availability of plants, labour and machinery to carry out site preparation and planting can limit the size of annual restocking programmes. Careful budgeting for the restocking operations will be required as costs are likely to be higher because of the difficult site conditions involved. Other issues which will require consideration include risk of invasion of vegetation which will be difficult to control, likelihood of natural regeneration of an acceptable species, the opportunity cost of not using the site plus the visual and environmental impacts of delaying restocking.

Forest Planning

There are likely to be implications for the planning resource where there is a requirement to amend or review Forest Design Plans on the National Forest Estate and/or Forest Plans for private sector forests which will need to be carefully managed. It will be important to review forest management plans adjacent to key utilities (power lines, gas mains etc.), and to consider how to improve resilience to potential future windblow events.

Appendix 4: Proposed statistical design of the storm damage assessment of woodland areas

- Take a stratified sample of windblow cluster sites, with stratification based on local authority areas and on ownership type: National Forest Estate or privately owned woodland.
- The total sample size will depend on the extent of the damage, the desired level of accuracy of estimates of damage, the geographic scale that results are to be reported on (e.g. individual local authority areas or whole affected area) and potentially the surveyor resource availability. As an example, the assessment of damage caused by the St Jude's storm which affected 16 counties in the south of England, impacting on two million m³ of standing timber (or 10m trees), was based on 50 cluster sites.
- The sample size within each combination of local authority area and ownership type will be proportional to the amount of woodland contained in it, according to the 2012 National Forest Inventory (NFI) woodland map.
- There will be a random selection of individual woods (independent of woodland size) within each combination of local authority group and ownership type, selected from a list of all individual woodlands identified on the NFI map.
- Each selected individual wood forms the central sample of the cluster.
- A circle is drawn at three kilometres radius from the centroid of the selected central woodland.
- If more than two individual woodlands intersect this circle, a selection of two is made from them (probably manually, to ensure maximum spatial separation of sample woodlands within the cluster).
- All woodland areas of >0.5ha are considered for survey in the area of damage, with site selection based on proportionality to size. If selected and its size is less than 6 hectares, the entire woodland is assessed for damage. Otherwise, a random point is generated within the polygon representing the woodland and this is used as the centroid of a four hectare square (200 metres square) which is used as the assessment area of the survey.
- The size of the sample area assessed needs to be recorded for the statistical analysis of the results of the survey.

Clusters are used in this proposed design in order to provide reasonably wide assessment of local damage at the selected location in such a way that a surveyor might be expected to be able to assess an entire location within a working day. The statistical units of the design are the entire clusters.

Assessment carried out in each sampled wood

Category and Level of Damage from Recent Storm Event

	Damage	% of trees in category – total must = 100% per category		
		Pole stage	Mature	Over mature
No damage	1. Trees unaffected by storm: standing with no damage to crown or lifted roots/leaning tree			
Storm damage	2. Crown damage only – branches snapped/broken			
	3. Tree roots lifted/tree leaning only			
	4. Wind snap (tree broken or snapped in stem, so that majority of crown is lost) only			
	5. Wind thrown trees (tree either lying on ground or could not stand / lean without support) only			
	6. Crown damage and tree leaning/roots lifted			
	7. Storm damage sufficient to deny safe access to sample site (% to indicate how much of the sample cannot be visually estimated into one or more of the above categories.			
		Total (each column to total 100%)		