

# Climate Risk Management Plan

to assess historic places for climate change impacts and associated adaptation planning

Singular historic place

Name of place

Threave Garden



*Figure 1 Behind the walls of the Victorian-style walled garden at Threave Garden and Estate.*

Image © The National Trust for Scotland

Assessment details	
Names and affiliations of assessors	Richard Polley (National Trust for Scotland) Michael Lawrie (National Trust for Scotland) Carsten Hermann & Vanessa Glindmeier (Historic Environment Scotland)
Version number of assessment	V1.0 DRAFT
Date of completion of assessment	29 May 2020
Assessment type	<input type="checkbox"/> Advanced Level <input checked="" type="checkbox"/> Standard Level
Comments on assessment process	Thank you to all attendees of the workshops at the Threave Estate in the summers of 2018 and 2019 and all other contributors to and reviewers of this Climate Risk Management Plan.

# EXECUTIVE SUMMARY

## Overview Historic Place/Group of Historic Places/Place Categories

Name of historic place / place category to be analysed		ID where applicable
Threave Garden		
Description of historic place / place category and its wider surroundings		
Brief description of historic place / place category	64 acres landscaped garden dating back to post WWII, encompassing rockery, rose and Victorian-style walled garden; glasshouses.	
Brief description of place's immediate surroundings	Threave House, a Scottish Baronial style building dating back to 1871 in its midst; National Trust of Scotland School of Heritage Gardening (since 1960) on site.	
Brief description of places' wider environs	Located on the Threave Estate, 1 mile west of Castle Douglas in the south-west of mainland Scotland, the gardens are surrounded by agricultural land beyond which, to the north and west, rise the hills of the Laurieston Forests. To the south-east are the hills of Screel and Bengairn. The gardens lie on the west-facing slope of the local landmark called Kelton Hill and, although there are natural outcrops of rock, the soil is heavy with high silt content.	
Cultural heritage designations		
Designation	Title	
Designated	Garden & Designed Landscape	
Key cultural significance values		
Key value	Rating	
Outstanding horticultural value	3	

## Overview Risk Assessment

<b>Summary of Risk Register (incl. Advanced Level)</b>		<input checked="" type="checkbox"/> Standard level: <b>Risks ratings are 0-16 (inherent risk)</b> <input type="checkbox"/> Advanced level: <b>Risk ratings are 0-64 (heritage risk)</b>		
<b>List of unacceptable risks</b>				
state risks consider as unacceptable at the respective time horizons ranked by decreasing risk rating				
Impact				
ID	Description	Risk rating		
		Time horizon 1	Time horizon 2	Time horizon 3
		Today	2070	n.a.
1	Uprooting of trees	8	12	n.a.
2	Saturated lawns causing surface flooding and wilting	8	12	n.a.
5	Damage to and suppression of local plant species and material	6	12	n.a.
<b>Highest-ranked acceptable risks</b> (state multiple if of the same rating at time horizon #1)				
Impact				
ID	Description	Risk rating		
		Time horizon 1	Time horizon 2	Time horizon 3
		Today	2070	n.a.
4	Dried up grass and crops	4	6	n.a.
3	Changes to flowering periods, including lack thereof entirely	3	3	n.a.
<b>Summary of increasing risks</b>				
Risk of uprooting of trees is increasing due to increased storm intensity and frequency, as well as increased precipitation in the winter months.				
Risk of saturated lawns causing surface flooding and wilting is increasing, due to increase winter precipitation.				
Risk of damage to and suppression of local plant species and material, dried up grass and crops and changes to flowering periods, including lack thereof entirely is increasing due to projected temperature changes, namely warmer winters and hotter summers.				
<b>Summary of decreasing risks</b>				
n.a.				

Effect of occurrence of impacts on key cultural heritage values			
Key values	Current rating	Revised rating	Comments
Outstanding horticultural value	3	1	If garden's signature heritage trees and plant material are exterminated and replaced by invasive species
Conclusions			
<p>Today, two risks are considered unacceptable, namely</p> <ul style="list-style-type: none"> <li>• #1 Uprooting of trees</li> <li>• #2 Saturated lawns causing surface flooding and wilting</li> </ul> <p>By 2070, one more risk will be considered unacceptable, in addition to the two mentioned above, namely</p> <ul style="list-style-type: none"> <li>• #5 Damage to and suppression of local plant species and material</li> </ul>			

## Overview Adaptation Planning

Summary of Adaptation Measures Register					
Impact investigated		Uprooting of trees		Risk ID	1
Impact / Measure ID	Adaptation measure (short title)	Adaptation type	Location where measure would be installed	Potential effect on cultural significance including mitigation example	
1/P1	Build a shelter belt	Protect	Investigation is required to identify at which distance to the garden/forest the shelterbelt should be erected	beneficial	
1/S1	Change up the collection of trees in the gardens	Strengthen	Trees themselves	acceptably adverse without mitigation	
1/D1	Assess any benefits/new opportunities	Respond to Damage	Across garden, wherever damage/loss occurs	acceptably adverse without mitigation	
1/L1	Bringing in fresh stock	Managing Loss	Across garden	beneficial	
1/I1	Surveying work to assess the longevity of strengthening measures	Manage Uncertainty	Across garden	beneficial	

Impact investigated		Surveying work to assess the longevity of strengthening measures			Risk ID	5
Impact / Measure ID	Adaptation measure (short title)	Adaptation type	Location where measure would be installed	Potential effect on cultural significance including mitigation example		
5/P1	Introducing biosecurity	Protect	Throuhgout forest and garden	beneficial		
5/S1	Strengthen the health of plant collections	Strengthen	Trees themselves	acceptably adverse without mitigation		
5/R1	Risk relocating roots	Relocate	Affected plant material	beneficial		
5/L2	Prevent the spread to wider areas	Managing Loss	Across garden	acceptably adverse without mitigation		
5/I1	Interpretation	Manage Uncertainty	Across garden at exhibits where damage/loss has occurred	beneficial		

# APPENDED ASSESSMENTS

## Historic Places and Cultural Significance

Singular place, group of places or place categories

Singular historic place

Geographic information (singular historic place)		
Name of place	Place's address	Place's extent
Threave Garden	Threave Garden & Estate, Castle Douglas, Dumfries & Galloway, Scotland	Threave Estate

### Historic place overview

Name of historic place to be analysed		Place ID if applicable
Threave Garden		n.a.
Description of historic place and its wider surroundings		
Brief description of historic place	64 acres landscaped garden dating back to post WWII, encompassing rockery, rose and Victorian-style walled garden; glasshouses.	
Brief description of place's immediate surroundings	Threave House, a Scottish Baronial style building dating back to 1871 in its midst; National Trust of Scotland School of Heritage Gardening (since 1960) on site.	
Brief description of places' wider environs	Located on the Threave Estate, 1 mile west of Castle Douglas in the south-west of mainland Scotland, the gardens are surrounded by agricultural land beyond which, to the north and west, rise the hills of the Laurieston Forests. To the south-east are the hills of Screel and Bengairn. The gardens lie on the west-facing slope of the local landmark called Kelton Hill and, although there are natural outcrops of rock, the soil is heavy with high silt content.	



## Cultural significance

Conservation policies				
ID	Document title	Author(s)	Version	Date
1	Threave Garden and Estate Management Plan			
Designation		Title	Reference	Comments
Designated		Garden & Designed Landscape	GDL00372	Since 01/07/1987
Rating of key cultural significance values				
Key value		Rating	Comments / reasons	
Outstanding horticultural value.		3	The gardens and estate house a large collection and variety of plant material	

## Site observations, hazards and climate drivers (optional)

Observed damages and deterioration			
Damage and deterioration observed at historic place	Impact type	Environmental hazard associated with observations	Climate drivers
Uprooting of trees	<input checked="" type="checkbox"/> damage <input type="checkbox"/> deterioration	Ground instability	Precipitation, storm (wind speed)
Saturated lawns causing surface flooding and wilting	<input checked="" type="checkbox"/> damage <input type="checkbox"/> deterioration	Flooding	Precipitation
Dried up grass and crops	<input type="checkbox"/> damage <input checked="" type="checkbox"/> deterioration	Prolonged periods of droughts	Temperature
Changes to flowering periods, including lack thereof entirely	<input type="checkbox"/> damage <input checked="" type="checkbox"/> deterioration	Prolonged growing season	Temperature (fluctuations at freezing point)
Damage to and suppression of local plant species and material	<input type="checkbox"/> damage <input checked="" type="checkbox"/> deterioration	Invasive plant species	Temperature, precipitation
		Pest	

Hazard register

Hazard Register							
Climate drivers <i>Description of variables</i>	Climate trends		Environmental hazards			Impact on historic place	
	<i>Observed trends</i>	<i>Projected trends</i>	<i>Description of observed or potential effect</i>	<i>Change in relevance observed / projected</i>		<i>Description of observed or potential impacts</i>	<i>Impact types</i>
Precipitation, storm (wind speed)	<ul style="list-style-type: none"> <li>Annual average precipitation rate increased</li> <li>Summer average precipitation decreased</li> <li>Winter average precipitation increased</li> <li>Storms to have intensified over the past</li> </ul>	<ul style="list-style-type: none"> <li>Fluctuation in precipitation shown, but no great changes to overall levels</li> <li>Further decrease in summer average precipitation projected -&gt; drier summer</li> <li>Winter average precipitation projected to increase - &gt; wetter winters</li> </ul>	Ground instability	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	Uprooting of trees	<input checked="" type="checkbox"/> damage <input type="checkbox"/> deterioration
Precipitation	<ul style="list-style-type: none"> <li>Annual average precipitation rate increased</li> <li>Summer average precipitation decreased</li> <li>Winter average precipitation increased</li> </ul>	<ul style="list-style-type: none"> <li>Fluctuation in precipitation shown, but no great changes to overall levels</li> <li>Further decrease in summer average precipitation projected -&gt; drier summer</li> <li>Winter average precipitation projected to increase - &gt; wetter winters</li> </ul>	Flooding	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	Saturated lawns causing surface flooding and wilting	<input checked="" type="checkbox"/> damage <input type="checkbox"/> deterioration
Temperature (fluctuations at freezing point)	<ul style="list-style-type: none"> <li>Mean annual temperature increased</li> <li>Seasonal (summer &amp; winter) mean temperatures increased</li> <li>Annual maximum air temperature increased</li> <li>Seasonal (summer &amp; winter) maximum air temperatures increased</li> <li>Minimum air temperatures (annual, summer &amp; winter) increased</li> </ul>	<ul style="list-style-type: none"> <li>Mean annual temperature projected to increase</li> <li>Seasonal (summer &amp; winter) mean temperatures projected to increase further</li> <li>Annual maximum air temperature projected to further increase</li> <li>Season (summer &amp; winter) maximum air temperature projected to increase</li> <li>Minimum air temperatures (annual, summer &amp; winter) projected to further increased</li> </ul>	Prolonged growing season	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	Changes to flowering periods, including lack thereof entirely	<input type="checkbox"/> damage <input checked="" type="checkbox"/> deterioration
			Prolonged periods of droughts			Dried up grass and crops	<input type="checkbox"/> damage <input checked="" type="checkbox"/> deterioration
Temperature, precipitation	See above	See above	Invasive plant species	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	<input checked="" type="checkbox"/> increase <input type="checkbox"/> decrease <input type="checkbox"/> no change	Damage to and suppression of local plant species and material	<input type="checkbox"/> damage <input checked="" type="checkbox"/> deterioration
			Pest				

## Risk register

Risk register for multiple time horizons													
Impact		Time horizon #1: Today						Time horizon #2: 2070					
Impact ID	Impact description	Likelihood rating	Severity rating	Inherent risk rating	Inherent risk rating definition	Acceptability of risk	Recommendations for action	Likelihood rating	Severity rating	Inherent risk rating	Inherent risk rating definition	Acceptability of risk	Recommendations for action
1	Uprooting of trees	2	4	8	Major risk	Unacceptable level of risk	Consider timely adaptation action	3	4	12	Extreme risk	Unacceptable level of risk requiring immediate attention	consider immediate adaptation action
2	Saturated lawns causing surface flooding and wilting	2	3	6	Minor risk	Acceptable risk level, subject to monitoring	Consider active risk monitoring	4	3	12	Extreme risk	Unacceptable level of risk requiring immediate attention	consider immediate adaptation action
3	Changes to flowering periods, including lack thereof entirely	2	2	4	Minor risk	Acceptable risk level, subject to monitoring	Consider active risk monitoring	3	2	6	Minor risk	Acceptable risk level, subject to monitoring	Consider active risk monitoring
4	Dried up grass and crops	3	1	3	Significant risk	Acceptable risk level	No action required	3	1	3	Significant risk	Acceptable risk level	No action required
5	Damage to and suppression of local plant species and material	4	2	8	Major risk	Unacceptable level of risk	Consider timely adaptation action	4	3	12	Extreme risk	Unacceptable level of risk requiring immediate attention	consider immediate adaptation action

## Summary of risk register

Summary of Risk Register (incl. Advanced Level)		<input checked="" type="checkbox"/> Standard level: <b>Risks ratings are 0-16 (inherent risk)</b> <input type="checkbox"/> Advanced level: <b>Risk ratings are 0-64 (heritage risk)</b>		
<b>List of unacceptable risks</b>				
state risks consider as unacceptable at the respective time horizons ranked by decreasing risk rating				
Impact				
ID	Description	Risk rating		
		<i>Time horizon 1</i>	<i>Time horizon 2</i>	<i>Time horizon 3</i>
		Today	2070	n.a.
1	Uprooting of trees	8	12	n.a.
2	Saturated lawns causing surface flooding and wilting	8	12	n.a.
5	Damage to and suppression of local plant species and material	6	12	n.a.
<b>Highest-ranked acceptable risks</b> (state multiple if of the same rating at time horizon #1)				
Impact				
ID	Description	Risk rating		
		<i>Time horizon 1</i>	<i>Time horizon 2</i>	<i>Time horizon 3</i>
		Today	2070	n.a.
4	Dried up grass and crops	4	6	n.a.
3	Changes to flowering periods, including lack thereof entirely	3	3	n.a.
<b>Summary of increasing risks</b>				
<p>Risk of uprooting of trees is increasing due to increased storm intensity and frequency, as well as increased precipitation in the winter months.</p> <p>Risk of saturated lawns causing surface flooding and wilting is increasing, due to increase winter precipitation.</p> <p>Risk of damage to and suppression of local plant species and material, dried up grass and crops and changes to flowering periods, including lack thereof entirely is increasing due to projected temperature changes, namely warmer winters and hotter summers.</p>				
<b>Summary of decreasing risks</b>				
n.a.				

Effect of occurrence of impacts on key cultural heritage values			
Key values	Current rating	Revised rating	Comments
Outstanding horticultural value	3	1	If garden's signature heritage trees and plant material are exterminated and replaced by invasive species
Conclusions			
<p>Today, two risks are considered unacceptable, namely</p> <ul style="list-style-type: none"> <li>• #1 Uprooting of trees</li> <li>• #2 Saturated lawns causing surface flooding and wilting</li> </ul> <p>By 2070, one more risk will be considered unacceptable, in addition to the two mentioned above, namely</p> <ul style="list-style-type: none"> <li>• #5 Damage to and suppression of local plant species and material</li> </ul>			

## Adaptation Planning

Impact to be investigated	
Impact description	Uprooting of trees
Associated hazard	Ground instability
Risk rating	8
Impact ID	1
Longlist of adaptation measures	
PROTECT	
P1	Build a shelterbelt
STRENGTHEN	
S1	Change up the collection of trees in the gardens
RELOCATE	
R1	Not an option to relocate larger trees, but could for smaller, less vulnerable trees
RESPOND TO DAMAGE	
D1	Assess any benefits/new opportunities of invasive plant material
MANAGING LOSS	
L1	Accept loss of old plant material and bring in fresh stock
MANAGE UNCERTAINTY	
I1	Surveying work to assess the longevity of strengthening measures

Adaptation measure appraisal	
Impact / Measure ID	1/P1
Adaptation measure (short title)	Shelterbelt
Details of measure (brief description)	Build a shelterbelt to minimise wind impact on garden/forest and add canopies to protect trees from falling. Restricting public access within the shelter belt to minimise risk.
Adaptation type	Protect
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Investigation is required to identify at which distance to the garden/forest the shelterbelt should be erected.
<i>If adaptation type is Protect, Strengthen, Relocate or Respond to Damage, use below table:</i>	
Adaptation measures appraisal: Adjustment of severity rating (Standard Level only)	
Effect of measure on risk <i>The risk would be...</i>  Complete sentence by using answer from <b>Error!</b> <b>Reference source not found.</b> <sup>7</sup>	Slightly reduced
Associated effect on severity rating <i>Severity rating would ...</i>	Reduced by 2 points
<i>If the answer to the first query is left unchanged or increased, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input checked="" type="checkbox"/> beneficial
If the response above was “subject to mitigation”, name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.</i>	



Adaptation measure appraisal	
Impact / Measure ID	1/S1
Adaptation measure (short title)	Tree care & restoration
Details of measure (brief description)	Change up the collection of trees in the gardens to help larger groupings, tree surgery, crown reduction, general care and maintenance ongoing
Adaptation type	Strengthen
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Trees themselves
<i>If adaptation type is Protect, Strengthen, Relocate or Respond to Damage, use below table:</i>	
Adaptation measures appraisal: Adjustment of severity rating (Standard Level only)	
Effect of measure on risk <i>The risk would be...</i>  Complete sentence by using answer from <b>Error!</b> <b>Reference source not found.</b> <sup>7</sup>	Slightly reduce
Associated effect on severity rating <i>Severity rating would ...</i>	Reduced by 2 points
<i>If the answer to the first query is left unchanged or increased, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input checked="" type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input type="checkbox"/> beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.</i>	

Adaptation measure appraisal	
Impact / Measure ID	1/R1
Adaptation measure (short title)	Move trees and garden elements
Details of measure (brief description)	Not an option to relocate larger trees, but could for smaller, less vulnerable trees. Heritage value must be considered beforehand. Relocating can remove ecology opportunities; microprovocations and labs etc
Adaptation type	Relocation
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Trees and garden elements themselves

Adaptation measure appraisal	
Impact / Measure ID	1/D1
Adaptation measure (short title)	Damage overview
Details of measure (brief description)	Assess any benefits/new opportunities as a result of damage and loss
Adaptation type	Respond to Damage
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Across garden, wherever damage/loss occurs

*If adaptation type is Protect, Strengthen, Relocate or Respond to Damage, use below table:*

Adaptation measures appraisal: Adjustment of severity rating (Standard Level only)	
Effect of measure on risk <i>The risk would be...</i>  Complete sentence by using answer from <b>Error!</b> <b>Reference source not found.</b> <sup>7</sup>	Left unchanged
Associated effect on severity rating <i>Severity rating would ...</i>	n.a.

*If the answer to the first query is left unchanged or increased, stop the appraisal of the measure concerned.*

*Regardless of adaptation type, continue with the table below:*

### Potential effects on cultural significance

Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input checked="" type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input type="checkbox"/> beneficial
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If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
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*If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.*

### Adaptation measure appraisal

Impact / Measure ID	1/L1
Adaptation measure (short title)	Tree rejuvenation or replacement
Details of measure (brief description)	Bringing in fresh, non-infected stock, establish new planting (not necessarily to fully replace old stock but be separated from it to protect new stock)
Adaptation type	Managing Loss
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Across garden

*If adaptation type is Managing Loss, use below table:*

### Managing Loss appraisal

How would the measure support communities?	
Which specific communities would be supported?	
Are the answers to the two questions above considered sufficiently relevant to explore measure further?	<input checked="" type="checkbox"/> Yes, explore this adaptation measure further <input type="checkbox"/> No, file this idea of an adaption measure and proceed to next measure on long-list

*If the answer to the last question was no, stop the appraisal of the measure concerned.*

*Regardless of adaptation type, continue with the table below:*

### Potential effects on cultural significance

Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input checked="" type="checkbox"/> beneficial
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If the response above was “subject to mitigation”, name examples for how this might be achieved.	n.a.
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*If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.*

### Adaptation measure appraisal

Impact / Measure ID	1/11
Adaptation measure (short title)	Implementation of specific tree species
Details of measure (brief description)	Surveying work to assess the longevity of strengthening measures; expanding on future planning and researching tree breeds that are more tolerant to impact, which are best to be planted and what does well etc; look into trends in disease and their origins; pooling knowledge of vulnerable species
Adaptation type	Manage Uncertainty
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Across garden

*If adaptation type is Manage Uncertainty, use below table:*

### Manage Uncertainty appraisal

How would the considered measure reduce uncertainty?	The more information accessible to determine which species can withstand the changing climate and / or flourish in it, the better decisions can be made regarding those species to be planted across the garden, thus reducing uncertainty of the species’ wellbeing.
How would the considered measure support other relevant measures?	The results could feed into building of a shelter belt (#1/P1) and inform which species are to be brought in anew (#1/L1).

Are the answers to the two questions above considered sufficiently relevant to explore measure further?	<input checked="" type="checkbox"/> Yes, explore this adaptation measure further <input type="checkbox"/> No, file this idea of an adaptation measure and proceed to next measure on long-list
<i>If the answer to the last question was no, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
<b>Potential effects on cultural significance</b>	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input checked="" type="checkbox"/> beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.</i>	

<b>Impact to be investigated</b>	
Impact description	Damage to and suppression of local plant species and material
Associated hazard	Invasive plant species / pest
Risk rating	8
Impact ID	5
<b>Longlist of adaptation measures</b>	
<b>PROTECT</b>	
P1	Introducing biosecurity
<b>STRENGTHEN</b>	
S1	Strengthen the health of plant collections
<b>RELOCATE</b>	
R1	Risk relocating roots
<b>RESPOND TO DAMAGE</b>	
D1	Assess any benefits/new opportunities (see Impact #1/D1)
<b>MANAGING LOSS</b>	
L1	Bringing in fresh, non-infected stock, establish new planting (see Impact #1/L1)
L2	Prevent the spread to wider areas
<b>MANAGE UNCERTAINTY</b>	

11	Interpretation
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Adaptation measure appraisal	
Impact / Measure ID	5/P1
Adaptation measure (short title)	Protection from festation
Details of measure (brief description)	Introducing biosecurity to protect from new and spreading infestations
Adaptation type	Protect
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Throuhgout forest and garden
<i>If adaptation type is Protect, Strengthen, Relocate or Respond to Damage, use below table:</i>	
Adaptation measures appraisal: Adjustment of severity rating (Standard Level only)	
Effect of measure on risk <i>The risk would be...</i>  Complete sentence by using answer from <b>Error!</b> <b>Reference source not found.</b> <sup>7</sup>	Substantially reduced
Associated effect on severity rating <i>Severity rating would ...</i>	Reduced by 5 points
<i>If the answer to the first query is left unchanged or increased, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input checked="" type="checkbox"/> beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.</i>	

Adaptation measure appraisal	
Impact / Measure ID	5/S1
Adaptation measure (short title)	Plant resilience insurance
Details of measure (brief description)	Strengthen the health of plant collections to ensure resilience
Adaptation type	Strengthen
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Plant material
<i>If adaptation type is Protect, Strengthen, Relocate or Respond to Damage, use below table:</i>	
Adaptation measures appraisal: Adjustment of severity rating (Standard Level only)	
Effect of measure on risk <i>The risk would be...</i>  Complete sentence by using answer from Error! Reference source not found. <sup>7</sup>	Substantially reduced
Associated effect on severity rating <i>Severity rating would ...</i>	Reduced by 5 points
<i>If the answer to the first query is left unchanged or increased, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input checked="" type="checkbox"/> beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.</i>	

Adaptation measure appraisal	
Impact / Measure ID	5/R1
Adaptation measure (short title)	Relocation alternative
Details of measure (brief description)	Relocation is risky for roots and so is not really an option, but infected trees could be moved to an entirely infected area (tree graveyard). Relocating can remove ecology opportunities; microprovocations and labs etc.
Adaptation type	Relocate
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Affected plant material
<i>If adaptation type is Protect, Strengthen, Relocate or Respond to Damage, use below table:</i>	
Adaptation measures appraisal: Adjustment of severity rating (Standard Level only)	
Effect of measure on risk <i>The risk would be...</i>  Complete sentence by using answer from <b>Error!</b> <b>Reference source not found.</b> <sup>7</sup>	Slightly reduced
Associated effect on severity rating <i>Severity rating would ...</i>	Reduced by 2 points
<i>If the answer to the first query is left unchanged or increased, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input checked="" type="checkbox"/> beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.</i>	



Adaptation measure appraisal	
Impact / Measure ID	5/L2
Adaptation measure (short title)	Prevention of pests spreading
Details of measure (brief description)	Learn to live with the pests, as high presence is required to do any large-scale work. Accept that pests can't be completely eradicated but try to prevent the spread to wider areas, accepting that some plants are just too difficult to grow in the gardens (roses etc)
Adaptation type	Managing Loss
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Across garden
<i>If adaptation type is Managing Loss, use below table:</i>	
Managing Loss appraisal	
How would the measure support communities?	
Which specific communities would be supported?	
Are the answers to the two questions above considered sufficiently relevant to explore measure further?	<input checked="" type="checkbox"/> Yes, explore this adaptation measure further <input type="checkbox"/> No, file this idea of an adaption measure and proceed to next measure on long-list
<i>If the answer to the last question was no, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input checked="" type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input type="checkbox"/> beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, top the appraisal of the measure concerned.</i>	

Adaptation measure appraisal	
Impact / Measure ID	5/11
Adaptation measure (short title)	Exposition display
Details of measure (brief description)	Interpretation – stories of individual storms or the weeping ash tree story as signage, in leaflets or included in guided tours
Adaptation type	Manage Uncertainty
Location where measure would be installed (If working at Advanced Level, use <i>place elements</i> .)	Across garden at exhibits where damage/loss has occurred
<i>If adaptation type is Manage Uncertainty, use below table:</i>	
Manage Uncertainty appraisal	
How would the considered measure reduce uncertainty?	Visitors would be educated of climate change impacts to the garden and its plant species and help them understand why certain plants have disappeared/appeared and their effect on the garden's ecosystem.
How would the considered measure support other relevant measures?	
Are the answers to the two questions above considered sufficiently relevant to explore measure further?	<input checked="" type="checkbox"/> Yes, explore this adaptation measure further <input type="checkbox"/> No, file this idea of an adaptation measure and proceed to next measure on long-list
<i>If the answer to the last question was no, stop the appraisal of the measure concerned.</i>	
<i>Regardless of adaptation type, continue with the table below:</i>	
Potential effects on cultural significance	
Descriptive rating of effect on cultural significance of the place	<input type="checkbox"/> unacceptably adverse <input type="checkbox"/> acceptably adverse subject to mitigation <input type="checkbox"/> acceptably adverse without mitigation <input type="checkbox"/> neutral <input checked="" type="checkbox"/> beneficial
If the response above was "subject to mitigation", name examples for how this might be achieved.	n.a.
<i>If the answer to the first query was unacceptably adverse or was acceptably adverse subject to mitigation, with no suitable example identified in the second query, stop the appraisal of the measure concerned.</i>	

## Adaptation Measures Register

Adaptation Measures Register						
Impact investigated		Uprooting of trees			Impact ID	1
Impact / Measure ID	Adaptation measure (short title)	Adaptation type	Location where measure would be installed	Potential effect on cultural significance including mitigation example	Include in summary	
1/P1	Build a shelter belt	Protect	Investigation is required to identify at which distance to the garden/forest the shelterbelt should be erected	beneficial	<input checked="" type="checkbox"/> include	
1/S1	Change up the collection of trees in the gardens	Strengthen	Trees themselves	acceptably adverse without mitigation	<input checked="" type="checkbox"/> include	
1/R1	Not an option to relocate larger trees, but could for smaller, less vulnerable trees	Relocate	Trees and garden elements themselves	unacceptably adverse	<input type="checkbox"/> include	
1/D1	Assess any benefits/new opportunities	Respond to Damage	Across garden, wherever damage/loss occurs	acceptably adverse without mitigation	<input checked="" type="checkbox"/> include	
1/L1	Bringing in fresh stock	Managing Loss	Across garden	beneficial	<input checked="" type="checkbox"/> include	
1/I1	Surveying work to assess the longevity of strengthening measures	Manage Uncertainty	Across garden	beneficial	<input checked="" type="checkbox"/> include	

Impact investigated		Surveying work to assess the longevity of strengthening measures			Impact ID	5
Impact / Measure ID	Adaptation measure (short title)	Adaptation type	Location where measure would be installed	Potential effect on cultural significance including mitigation example	Include in summary	
5/P1	Introducing biosecurity	Protect	Throuhgout forest and garden	beneficial	<input checked="" type="checkbox"/> include	
5/S1	Strengthen the health of plant collections	Strengthen	Trees themselves	acceptably adverse without mitigation	<input checked="" type="checkbox"/> include	
5/R1	Risk relocating roots	Relocate	Affected plant material	beneficial	<input checked="" type="checkbox"/> include	
5/L2	Prevent the spread to wider areas	Managing Loss	Across garden	acceptably adverse without mitigation	<input checked="" type="checkbox"/> include	
5/I1	Interpretation	Manage Uncertainty	Across garden at exhibits where damage/loss has occurred	beneficial	<input checked="" type="checkbox"/> include	

## Summarising the adaptation measures

Summary of Adaptation Measures Register					
Impact investigated		Uprooting of trees		Impact ID	1
Impact / Measure ID	Adaptation measure (short title)	Adaptation type	Location where measure would be installed	Potential effect on cultural significance including mitigation example	
1/P1	Build a shelter belt	Protect	Investigation is required to identify at which distance to the garden/forest the shelterbelt should be erected	beneficial	
1/S1	Change up the collection of trees in the gardens	Strengthen	Trees themselves	acceptably adverse without mitigation	
1/D1	Assess any benefits/new opportunities	Respond to Damage	Across garden, wherever damage/loss occurs	acceptably adverse without mitigation	
1/L1	Bringing in fresh stock	Managing Loss	Across garden	beneficial	
1/I1	Surveying work to assess the longevity of strengthening measures	Manage Uncertainty	Across garden	beneficial	

Impact investigated		Surveying work to assess the longevity of strengthening measures			Impact ID	5
Impact / Measure ID	Adaptation measure (short title)	Adaptation type	Location where measure would be installed	Potential effect on cultural significance including mitigation example		
5/P1	Introducing biosecurity	Protect	Throuhgout forest and garden	beneficial		
5/S1	Strengthen the health of plant collections	Strengthen	Trees themselves	acceptably adverse without mitigation		
5/R1	Risk relocating roots	Relocate	Affected plant material	beneficial		
5/L2	Prevent the spread to wider areas	Managing Loss	Across garden	acceptably adverse without mitigation		
5/I1	Interpretation	Manage Uncertainty	Across garden at exhibits where damage/loss has occurred	beneficial		