University of Edinburgh Adaptation Framework

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# Introduction

Scientific evidence, for instance from the IPCC 5th Assessment Report, identifies anthropogenic causes of current climate change, with impacts in every world region and leading to a need not only for action in mitigation but also for adaptation strategies, as climate change is already occurring and will continue to occur despite mitigation efforts. The IPCC special report, [SR15](http://www.ipcc.ch/report/sr15/), published in October 2018, sets out the significant, detrimental difference between warming of up to 1.5 degrees C compared to warming of up to 2 degrees C; climate-related risks to health, livelihoods, food security, water supply, human security and economic growth are all increased at 2 degrees of warming compared to 1.5 degrees, requiring mitigation but also adaptation. [The United Nations Framework Convention on Climate Change (UNFCCC)](http://unfccc.int/focus/adaptation/items/6999.php) explains adaptation as:

“Adjustments in ecological, social, or economic systems in response to actual or expected climate stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change.”

The [EU Strategy on Adaptation to Climate Change](https://ec.europa.eu/clima/policies/adaptation/what_en) describes alterations of natural processes, patterns of precipitation, glacial melting and rising sea levels. Europe has experienced a faster increase in temperature than the global average in the last decade, amounting to 1.3⁰ C above preindustrial levels, with more frequent extreme weather events.

The University of Edinburgh Climate Change Strategy 2016-2021 addresses mitigation through a whole institution approach but also recognises the role of adaptation in such an approach. As noted in the Strategy, climate change in Scotland has already brought warmer, wetter autumns and winters and hotter summers. The consequences of climate fluctuations with potential impact on the University of Edinburgh include:

**Physical risks:**

* Increased flood risk, threatening the estate (particularly the historic environment); water shortages from drought in summers, affecting University-owned land
* Changes in the balance between heating and cooling, leading to the need to adapt performance and design, construction, management and use of buildings and surroundings

**Physical and supply chain risks:**

* Global energy market impacts affecting energy supplies and energy security, and disruption to global water supply and food supplies
* Possible disruption of transport, energy and communication networks in Scotland and around the world, impacting markets and affecting supply chains

**Reputational risks:**

* Lack of resilience in terms of physical and supply chain risks could mean that the University feels the effects of a potential decrease in student enrolment and international collaboration ambitions
* Lack of action and collaboration on climate change adaptation, on the University’s direct premises and with external actors, could damage the University’s brand reputation for excellence in teaching and research, in addition to its vision to make impactful contributions to society more broadly.

The whole institution approach of the Climate Change Strategy encompasses research, learning and teaching, operations, investments and partnerships. Any of these core activities could be disrupted by the impacts of climate change, posing potential risks to the University’s functioning. Therefore, the requirement for adaptation efforts to address these potential impacts is critical in order to future proof core operations. Reputational as well as regulatory risks must be considered along with the more tangible physical risks. Tackling these risks can be seen as an opportunity to take a key leadership role in climate change adaptation, particularly within the public sector.[[1]](#footnote-1)

Developing climate resilience beyond existing measures within the University ensures compliance with the Public Bodies Climate Change Duties under the Climate Change (Scotland) Act 2009. Such measures can also lead to cost and efficiency savings. Much evidence exists to support the case for taking proactive measures to prepare for the predicted impacts of climate change. This financial case, which focuses on win-win options for the University as a business entity and adaptation progress, are likely to be the most successful; cost-benefit analysis can be considered across the University’s adaptation framework in identifying priorities for action. Innovation UK has developed a business case for adaptation, which can be referenced when building the financial argument for adaptation on the University estate. At the same time, adaptation often involves expansion of green and blue spaces, which has benefits in terms of student experience of campuses, well-being for both staff and students and biodiversity conservation, also contributing to the city of Edinburgh, which will be a member of the [Biophilic Cities Network](http://biophiliccities.org/about/).

The following paper sets out an adaptation framework for the University of Edinburgh. It describes a whole institution approach that can result in a more resilient, “climate ready” estate and acknowledges embeddedness in the city of Edinburgh. It has been developed through the involvement of the University community, including academics, students and support groups, and with support from Adaptation Scotland. The Framework should be seen as evolving rather than static, changing with increased understandings of what adapting will mean within the University context. We have the following vision for the University of Edinburgh:

The University will bEcome more CLIMATE-resilienT, creating a sense of place on campuses and PrOMOTING well-being and biodiversity, As An integral part of the wider context of the city of edinburgh.

# University Adaptation and a Whole Institution Approach

## Identifying risks

We can identify key areas of possible physical risk or vulnerability for the University of Edinburgh, based on previous events:

* **water** (damage from flooding, lack of drainage)
* **structural integrity** including power distribution (damage from high winds)
* **comfort** (difficulties keeping buildings cool internally and keeping warm).

Consideration must also be given to: landscaping and biodiversity, communicating adaptation, infrastructure (transport), economic/commercial impacts, identification of key collections and equipment, legal and regulatory mechanisms and compliance, and the boundaries of the Estate. Keeping in mind the reactive nature of putting in place some adaptive measures and the need for long-term thinking, the University would benefit from a comprehensive adaptation strategy, not only to fully capture what is already being done and successful approaches, but to provide a consistent way forward that results in greater University resilience.

## Being climate ready

The Committee on Climate Change (CCC) published the [UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland](http://www.adaptationscotland.org.uk/application/files/4314/7792/6358/UK-CCRA-2017-Scotland-National-Summary.pdf) (UK CCRA 2017 Scotland National Summary), which lists and rates risks in the areas of natural environment and assets, infrastructure, people and built environment, business and industry, and international dimensions; it provides evidence for identification of relevant risks in the Edinburgh context and adaptation measures taken and/or needed. The Adaptation Framework draws from the Scottish Government’s [Climate Change Adaptation Programme](http://www.gov.scot/Resource/0045/00451392.pdf) that includes climate ready buildings and infrastructure networks, natural environment and community/society. The Framework also aligns with the University’s holistic Sustainability Strategy for estates design goals. It promotes the involvement of staff and students in testing possibilities for adaptation on campuses through the Living Lab programme. Following the whole institution approach of the Climate Change Strategy, we have identified priority areas for adaptation in research, learning and teaching, operations, renewables investment, partnership working and communications.

Priorities in **research, learning and teaching**:

* Applying adaptation research to campuses as part of the city of Edinburgh, taking advantage of the upcoming City Deal if and where possible, and as part of living lab projects
* Comprehensive mapping and ranking of risks to research, especially where environmental conditions must be controlled for storage of materials (e.g. biobanking of medical, veterinary and biological samples in ULT freezers); but also risk assessment of potential disruption to supply chains (e.g. impact of interruption in liquid helium deliveries)
* Considering ways of teaching in the context of adaptation that can widen participation and enhance student experience in a changing climate (e.g. remote teaching options and teaching times)
* Including adaptation in induction materials that introduce the Climate Change Strategy

Priorities identified for **operations and landscaping**:

* Comprehensive mapping and ranking of risks to the Estate including buildings, infrastructure services and natural environment and development of Estates adaptation risk management plan
* Ensuring adaptation is central in the development of the Edinburgh estates sustainable design principles for both new builds, existing buildings and their landscaped contexts
* Consideration of climate matching and surface water retention in landscaping, with possible testing of the Natural Capital Standard for Green Infrastructure and geodiversity approaches
* Further mapping of non-Estates (non-physical) risks (financial, student experience, other reputational, etc)

Priorities in **renewables technology**:

* Considering the value of local power generation and supply - solar

Priorities for **partnership working**:

* Maintaining strong relationships within existing partnerships (Edinburgh Adapts, Edinburgh Living Landscape Partnership), including ensuring strong communication links with the City of Edinburgh Council
* Developing new local, regional and international partnerships to progress thinking and action in adaptation
* Exploring funding opportunities at UK and EU levels (pre-Brexit) for innovative pilot projects to test on University campuses

Priorities for **communications as part of a climate ready community**:

* Raising awareness of the importance of adaptation amongst staff and students through targeted events
* Raising public awareness of University projects in this space, considering how to communicate messages effectively, including signposting at sites

The following sections provide detailed descriptions of how the University addresses climate risks and a more granular view of priorities moving forward.

### Research, learning and teaching

The University of Edinburgh already conducts significant multi-disciplinary and high impact research on the global challenge of climate change, as detailed in the Climate Change Strategy 2016-2021. This research spans humanities and social sciences, science and engineering and medicine and veterinary medicine. Recent climate change adaptation research projects led by University of Edinburgh investigators or with the University in international partnership include [ARIES](https://www.eng.ed.ac.uk/research/projects/aries-adaptation-and-resilience-energy-systems) (Adaptation and Resilience in Energy Systems), [LUC4C](http://luc4c.eu/project/consortium) (Land Use Change: assessing the net climate forcing, and options for climate change mitigation and adaptation), [IMPRESSIONS](http://www.impressions-project.eu/) (Impacts and Risks from High-End Scenarios: strategies for innovative solutions), [OPERAs](http://www.operas-project.eu/) (Operational Potential of Ecosystem Research Applications) and [CLIMSAVE](http://www.climsave.eu/climsave/index.html) (Climate Change Integrated Assessment Methodology for Cross-sectoral Adaptation and Vulnerability in Europe). [ClimateXChange](http://www.climatexchange.org.uk/adapting-to-climate-change/), located in the Edinburgh Centre for Carbon Innovation ([ECCI](http://edinburghcentre.org/)) at the University has provided evidence through research to the Scottish Government to shape policies in the area of adaptation. The Department for Social Responsibility and Sustainability, in coordination with ECCI, is developing a research knowledge hub to showcase and share the University’s climate change mitigation and adaptation research with the public and to encourage collaborative working and knowledge exchange within and out with the higher education sector.

Comprehensive mapping and ranking of risks to research should be undertaken to ensure that the materials, samples and equipment required by researchers are not in danger from the impacts of climate change such as increasing temperatures in buildings and disruptions to supply chains.

The University provides students with a grounding in climate change adaptation through the [MSc in Carbon Management](http://www.ed.ac.uk/geosciences/postgraduate/taught-masters/msc-carbon-management/structure-teaching-assessment/compulsory-courses), [PG Cert Climate Change Management](http://www.ed.ac.uk/studying/postgraduate/degrees/index.php?r=site/view&id=875) and [MSc Global Challenges](http://www.ed.ac.uk/global/msc-global-challenges/programmes/global-challenges), for example. Staff and student inductions in future will include an introduction to the climate change strategy, considering both mitigation and adaptation. At the same time, student experience enhancement and widening participation could be affected by increasingly volatile weather events. Such events may disrupt students’, and staff’s, ability to travel to attend lectures, so that the ability to switch to remote teaching could become priority at times. Flexibility across University lectures would allow students to continue to participate despite weather conditions and have other positive effects, such as providing access to disabled students with mobility issues; the recent action to video record lectures across University teaching provides a first step in mitigating this risk. Climate change affects disadvantaged groups most and could potentially create barriers to the University experience for potential students from sub-Saharan Africa or the Middle East. University programmes are already addressing this issue through, for example, [20 scholarships](http://www.ed.ac.uk/student-funding/postgraduate/e-learning/climate-change) to fund students from climate change vulnerable countries for the Postgraduate Certificate in Climate Change Management, as a component of the MSc in Carbon Management.

While the University exhibits strong leadership in adaptation through research and teaching, there are steps that can be taken to push this engagement further, with a view to the Scottish context. Other universities in Scotland are already significantly transforming their campuses to adapt to a changing climate through applied research. The University of Glasgow and the University of Strathclyde have considered adaptation in the city through use of big data; University of Glasgow is leading the way in adaptation applied to campus buildings. Glasgow Caledonian University is developing approaches to urban heat islands and green infrastructure. The Glasgow City Deal has opened up opportunities for further work, currently in drainage and flooding. These examples can provide inspiration and drive for the University of Edinburgh and the upcoming City Deal for Edinburgh may offer opportunities to contribute to adaptation at city level. [Recent research](http://www.sciencedirect.com/science/article/pii/S2405880716300371) has shown the importance of a city focus in mitigation and adaptation efforts, and has also noted the failure of one-size-fits-all solutions due to the complex and unique contexts of each city.

**The University is showing leadership through development of an adaptation framework focusing on the following priorities to strengthen engagement with adaptation in research, learning and teaching:**

* Ensure inclusion of adaptation research in development of the Climate Change Research Knowledge Hub
* Encourage researchers to apply their adaptation research to University campuses as part of the city of Edinburgh, also considering the upcoming City Deal (learning from Glasgow examples)
* Ensure student participation in living lab projects around climate change adaptation
* Consider ways of teaching in the context of adaptation that can widen participation and enhance student experience in a changing climate (e.g. remote teaching options, including facilities in all new builds, and teaching times)
* Ensure integration and review of Adverse Weather Policy for staff, considering increases in extreme weather events
* Include adaptation in induction materials that introduce the University’s Climate Change Strategy

### Operations

The University of Edinburgh has responded with adaptation actions to past extreme weather events that affected campus buildings. The University has experienced flooding, high winds, complaints of overheating in buildings and high snow fall over the past ten years. Flooding has been a significant issue in some parts of the estate. The Kings Buildings campus has experienced flooding, which has led to an infrastructure project to increase site resilience. Some University buildings have basement levels (e.g. Old College listed buildings) or two to three floors below ground level, and some offices in basements provide storage for collections. The central campus is particularly vulnerable due to the amount of concrete paving. Other vulnerable areas of the University estate have been identified, such as Peffermill, sited beside a river; new flood-adapted pitches have been designed but with significant financial cost. A flood risk assessment was undertaken with regards to critical engineering infrastructure that could be vulnerable (high voltage electricity networks and district heating). A comprehensive investigation of general flood risk would be valuable so that a resilience plan identifies all areas of vulnerability. The nature of rainfall has changed, with torrential downpours becoming straight run off, not allowing water the chance to sink in or evaporate. The University also must rely on City of Edinburgh Council services or infrastructure such as drainage and sewers, particularly on the central campus, and sometimes these may not prevent flooding or other events from occurring. Inter-dependency with the city highlights an additional risk to be managed.

High winds have caused structural damage to campus buildings and have impacted trees. There can be a knock-on effect for power distribution, affecting individual building resilience. University staff have complained about overheating in buildings where they work and it has been noted that a more systematic approach to post occupancy evaluations (POEs) to fully capture how buildings perform in practice would be beneficial; equally, comfort must be considered for students in teaching spaces and during exams. Planning sites does involve consideration of shading and ventilation, but in some cases building design may underperform compared to expectations, for instance in terms of air flow and ventilation. Snow events are less frequent, but significant snowfall in 2010 and 2018 became a city-wide problem for transportation, affecting staff and student commuting. Estates has developed a winter management plan to mitigate future risk from such weather events.

**The University would benefit from an integrated and longer-term approach to adaptation in operations that prioritises the following:**

* Further development and completion of a general flood risk resilience plan
* Mapping existing buildings for flooding, structural and overheating risks, including the case for listed buildings – following Historic Environment Scotland guidelines for adaptation in traditional buildings and ensuring inclusion in development of estates sustainable design standards
* Full consideration of flooding issues and comfort, both present and future, in new build design planning (e.g. considering passive design, natural and mixed mode ventilation) – following the estates sustainable design standards with consideration of mandatory inclusion of future climate predictions for 2020/50/80 as design criteria
* Further mapping of non-Estates risks, e.g. city transport links, financial, student experience, IT and other equipment, identifying reputational risks and referring to the Business Areas Climate Assessment Tool (BACLIAT) method
* Consideration of testing solutions such as building information systems for climate responsiveness and means to insulate campuses against reliance on local/city infrastructure
* Continued support of reuse programmes such as WARPit, and sustainable procurement to shorten supply chains

### Landscaping and biodiversity

The University exhibits a solid understanding of how to implement measures in landscaping to address adaptation, including provision for biodiversity conservation. Landscaping plans for University grounds in 2017-18 include:

* mapping of mowing regimes
* planting beds and biodiversity sites
* a review of grass cutting regimes
* extension of grassland meadows
* expansion of green corridors, mass bulb planting
* identifying potential locations for tree planting
* active involvement in new developments

Sites such as Pollock Halls exemplify a successful approach to adaptation. Sustainable drainage systems using natural land contours have also been employed to reduce flood risk, as can be seen at the Easter Bush campus. However, there is always room for improvement in terms of priorities for adaptation, and closely related biodiversity conservation, across the University Estate. Living walls on new builds in some locations have been problematic, due to the amount of maintenance required and siting issues. In some cases of campus expansions, biodiversity protection may not be prioritised in the face of maximising site possibilities; examples can include tightly mown grass that fails to provide appropriate habitat for diverse species as do small trimmed hedges, and trees dying, or are in the process of dying, due to encroachment on their roots from inadequate distance between trees and the upheaval that results from construction work.

Green infrastructure measures and blue spaces, key elements of adaptation in urban environments, provide significant benefits and thus opportunities for the University to improve student and staff experiences of campus sites, while also improving sites for biodiversity. Green and blue spaces can diminish the urban heat island effect in cities, but they can also provide increased human contact with nature, which can result in health and well-being benefits[[2]](#footnote-2), leading to a valued sense of place. The new sustainable design standards will include a central place for green infrastructure. The University can also reference the Scottish Wildlife Trust’s (SWT) Natural Capital Standard for Green Infrastructure (GI), currently under development, for detailed consideration of options. This standard aligns with the Scottish policy context and includes a range of benefits if implemented: health and well-being and recreation and leisure, enhancing a sense of “place”, climate adaptation and mitigation, improved air and water quality and biodiversity conservation, for example.

**Priorities for landscaping and biodiversity include:**

* Consideration of climate matching, with planning ahead for a future hotter climate, by increasing variety of trees, plants, and flexibility with non-natives (e.g. if by 2080 Edinburgh will have the climate of Nantes, France, what should be planted, considering growth times, etc)
* Bulb planting throughout the year, and tree variety for pollen/nectar production over the entire year to ensure local species populations are supported continually
* Landscaping and siting as integral to building design plans, taking a holistic approach that prioritises green and blue spaces for shade/cooling, well-being, placemaking and biodiversity conservation (e.g. planting more trees, further areas with reduction in grass cutting, respecting existing trees where they are thriving pre-development, bat and bird boxes, etc) – consideration of the Natural Capital Standard for Green Infrastructure and follow on development of a biodiversity strategy
* Surface water retention through permeable surfaces, rain gardens, water recycling and waste water use

### Renewables

The University Climate Strategy actions include further investments in renewable technologies, such as solar. Investment in local energy production and supply (geothermal, PV) may be viewed as both a mitigation *and* adaptation measure.

**This work has potential to address adaptation through:**

* Understanding of local energy production and supply to University adaptation

### Partnership working

The University already works in partnership on adaptation with local organisations such as the City of Edinburgh Council, which leads Edinburgh Adapts, and with members of the Edinburgh Living Landscape (ELL) Partnership. These partnerships link the University to wider city and regional contexts. Edinburgh Adapts launched its adaptation action plan for the city at the end of 2016, including a list of projects that the University can aim to support as part of its own actions. Climate Ready Clyde has become a highly successful regional partnership to tackle adaptation issues that serves as an exemplar. Further work can be undertaken to contribute more fully to existing partnerships and to develop new links.

**The Adaptation Framework proposes the following approach:**

* Promote continued staff and student involvement with adaptation, and place-making, through awareness raising and engagement events and living lab projects
* Continue partnership working with City of Edinburgh Council and other city stakeholders through Edinburgh Adapts and strengthen strategic links with the Council risk and resilience manager
* Continue partnership working through ELL Partnership for adaptation and biodiversity conservation
* Identify and develop other possible partnerships within Edinburgh and more widely in Scotland (e.g. with other regional adaptation initiatives), for instance with Royal Botanic Gardens Edinburgh for knowledge exchange on rain gardens, with Historic Environment Scotland on adaptation for traditional buildings, and with local government to consider climate refugees
* Develop stronger partnerships with other UK and international university estates staff working in sustainability to share best practice and lessons learnt
* Explore funding opportunities at UK and EU levels (pre-Brexit) for innovative pilot projects to initiate on the estate and within the city (e.g. street trees)

### Communicating risks and benefits

Common barriers to action in adaptation have been identified as lack of awareness and support, tendency to focus on the short term, lack of adequate technical information, resistance to changing behaviours and practices and perceived costs for long-term resilience. An adaptation framework for the University can address these barriers through appropriate communications. Eight areas of focus for communicating adaptation, targeted at different stakeholder groups, have been identified and can be considered by the University[[3]](#footnote-3):

Use of a range of communication methods, values-based communication (considering an individual’s or group’s values), expressing additionality (cost-savings, increased non-climate related resilience, brand enhancement), providing a narrative with relatable images and stories, providing choice through a range of scenarios and options to address adaptation, using adaptation language effectively (concrete actions as examples to define adaptation), managing expectations and evidencing leadership through adaptation.

**To address different audiences and challenges to action, as part of the Climate Change Strategy communications plan, priorities include:**

* Developing a comprehensive approach to University adaptation that maps different audiences and stakeholders and approaches for engagement
* Showcasing building and landscaping adaptation measures through comprehensive signage that presents information accessibly

# Implementation, Reporting and Monitoring

The Framework sets out a whole institution approach that prioritises certain possible actions in the areas of research, learning and teaching, operations, landscaping, investments and partnerships. As presented in the University’s Climate Change Strategy, reporting will be undertaken on a three-yearly basis, with annual monitoring of progress once an assessment and action plan is in place.

Further work will be undertaken, as noted in the priorities laid out in previous sections, to map and rank risks of a changing climate for the University and to determine more specifically how the University should respond, and thus what actions would be most appropriate for the University to take. The following table identifies a timeframe for upcoming/first actions:

|  |  |  |  |
| --- | --- | --- | --- |
| **Area of action** | **Lead** | **Key project(s)** | **Key dates for 2018-19** |
| Mapping and ranking risks across the Estate | Estates -OperationsFinance – Business risks leadSRS – Climate Policy Manager (updating actions) | Flood risk resilience plan; full risk assessment framework developed (including existing buildings, landscaping, other business risks), with development of three yearly reporting – engaging with the UKCCRA 2017 Scotland National Summary and understanding possible barriers to action (business case, etc)Regular prioritising and updating of actions through a yearly reviewed Action Plan | **Autumn 2018 – Autumn 2019****By Autumn 2019** |
| Research, learning and teaching (SRS) | SRS – Climate Policy Manager | Research knowledge hub launch with inclusion of adaptation researchLiving lab projects undertaken in adaptationBetter understanding of the role of distance learning for adaptationSpecific inclusion of adaptation in induction materials | **Spring-Summer 2019****On-going****Spring – Summer 2019** **Autumn 2018** |
| Operations | Estates – Landscaping (Jonathan Long)SRS – Climate Policy Manager | Estates sustainable design - alignmentEdinburgh Adapts and Edinburgh Living Landscape Partnership Partnership actions – ensure alignment (SRS) | **On-going****On-going** |
| Landscaping and biodiversity | Estates – Landscaping (Jonathan Long)SRS – Climate Policy Manager with ELL Partnership;Estates – Development (Gemma Begbie);SRS – Climate Policy Manager and Estates – Landscaping (Jonathan Long) | Estates sustainable design – alignmentInvestigation of climate matching as a response to risk(s)Testing of Natural Capital Standard for Green InfrastructureDevelopment of a related biodiversity strategy | **On-going****Autumn 2018 - Summer 2019****Proposed trial for Spring/Summer 2019****By Autumn 2019** |
| Renewables | Estates – Energy OfficeSRS - Climate Policy Manager | On-site options for solar - understanding of adaptation implications | **From 2018** |
| Growing partnerships (SRS) | SRS – Climate Policy Manager | Continued involvement in Edinburgh Adapts and ELL PartnershipDevelopment of diverse relationships and partnerships with other universities, local and regional organisation | **On-going****On-going** |
| Communications | SRS – Communications Team | Plan for engaging with diverse University and external stakeholders for adaptation and placemaking (SRS)Developing signage to showcase/educate staff/students/visitors on adaptation/biodiversity measures at sites on campus (e.g. badging with ELL Partnership) | **By Autumn 2019****By Summer 2019** |

1. For further discussion of business risks in the University of Edinburgh context, please request the report by Robyn Lockyer, University of Edinburgh Msc Carbon Management graduate, which informed this section of the strategy. [↑](#footnote-ref-1)
2. Please see the WHO Report (2016), “Urban Green Spaces and Health”, at <http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1> [↑](#footnote-ref-2)
3. For further details on these recommendations, please request the report by Chris Guest, University of Edinburgh MSc Carbon Management graduate, which informs the University approach. [↑](#footnote-ref-3)