

Introduction

This discussion paper aims to foster a conversation at the University about the impacts of climate change, how they might affect our operations and what the University may need to do to manage potential risks (adapt).

Context & Background

There is a strong body of evidence that the world's climate is changing¹ and that this will, depending on how much average global temperatures increase, have a disruptive impact on the earth's systems and the populations they support.

Scottish climate records show that temperatures have increased (with the last decade being the hottest on record); rainfall has also increased (average annual precipitation being 27% higher than in 1961) and a higher frequency of heavy downpours (amongst others²).

As part of efforts to mitigate the impact and manage risks in Scotland from climate change, the Scottish Parliament passed the Climate Change Act (Scotland) 2009. The Act sets ambitious carbon emission reduction targets³ and creates a mechanism that enables the Scottish Government to require public bodies to cut their own emissions and prepare for climate change. (A more detailed outline of the Act's requirements is provided as Appendix A).

This discussion paper draws on risks identified for the UK⁴, Scotland⁵ and Glasgow⁶ as the basis for considering how climate change could potentially affect GCU's operations and what the University might need to do to mitigate any detrimental effects.

Climate Change Projections

Drawing on the [UK Climate Projections 2009](#) (UKCP09), [Adaptation Scotland](#)⁷ highlights the following key long-term climate change trends for Scotland:

- Weather will remain variable, it may become more variable
- Typical summers will be hotter and drier
- Typical winters / autumns will be milder and wetter
- Sea level will rise
- There will be an increase in summer heat waves, extreme temperatures and drought
- There will be a higher frequency and intensity of extreme precipitation events
- There will be a reduced occurrence of frost and snowfall

¹ [Adaptation Scotland](#), [SEPA](#), [Scottish Government](#) and the [Met Office](#) all have information about how the climate is changing.

² [SEPA – the effects of climate change \(accessed 27/06/2018\)](#)

³ Scottish carbon reduction targets: 42% by 2020 and 80% by 2050 from a 1990 baseline. However, a revised target of 90% by 2050 is currently being considered by draft legislation.

⁴ [UK Climate Change Risk Assessment 2017](#)

⁵ Scotland Climate Change Risks

⁶ Glasgow City Region Climate Risk and Opportunity Assessment. Climate Ready Clyde – Draft 1 - March 2018 – Unpublished.

⁷ [Climate trends and projections \[for Scotland\] \(accessed 27/06/2018\)](#).

The table below, derived from UKCP09, elaborates on the projections for mean daily temperature and precipitation (under the high emissions scenarios, 90% probability of change⁸) for the west of Scotland for three periods relative to 1961-2004.

Parameter	2020	2050	2080
Mean Daily Temperature (°C) - Summer	2.3	4.4	6.8
Mean Daily Temperature (°C) - Winter	2.0	3.3	4.8
Mean precipitation (mm) change (%) – Summer	8%	2%	-1%
Mean Precipitation (mm) change (%) – Winter	16%	31%	55%

Globally, the climate change will have other effects, which may impact GCU's operations, but for which there has yet been any opportunity to develop our understanding of these⁹.

Climate Change Risk

The remainder of this document details a number of climate change risks that are deemed to potentially impact GCU's operations.

The risks were identified from the UK, Scottish and Clyde region climate change risk assessments, discussions and projects with colleagues and students in SEBE and discussions with colleagues in Estates. Risks are presented overleaf with details of:

- Anticipated impact area,
- Estimated likelihood and severity (rated low, medium or high as a started point until a more thorough evaluation can be carried out),
- Impact timescales (2020, 2050 and 2080),
- The rationale for inclusion
- Initial thoughts about the risk (i.e. what we know/don't know)
- Adaptation gap

Press reports associated with some risks have also been included to highlight that climate disruption is already a current reality.

In considering the risks identified, it is important to note that:

- The University in an early stage of its adaptation journey and there are significant gaps in our understanding of risks and adaptation opportunities. However, it is hoped that by starting to consider climate change risks, the University will develop appropriate adaptation strategies aligned with impact timescales.

⁸ The high emission scenario was chosen because it is aligned with the climate outcomes that current policies will deliver for 2100.

⁹ A project is being explored with colleagues in SEBE to understand international climate change risks, with a particular emphasis on countries that the University attracts the large groups of international students.

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- The impact timescales for some risks may seem quite distant, but for some risk areas (e.g. buildings) there are very limited opportunities to adapt and it is important that climate change risks are considered when those opportunities present themselves.

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No.	Risk	Immediate Impact Area	Likelihood	Severity	Impact Timescales (from)	Rationale	What we know	Adaptation Gap
1	Damage to building envelope – wind	Estates, Security	M	M	Unknown.	The University's location on one of the City's highest points potentially makes some of its taller, more exposed buildings vulnerable to wind damage. There is also a risk of windblown objects. KA reports that in Jan 2013 roof of H.Wood boiler-house roof blew off (see Appendix B for photos).	We do not know extent of building vulnerability to wind damage. We know items/objects on the campus that are vulnerable to high winds. Wind strength during Jan 2013 storm delayed ability to carry out repairs/remedial works.	Understand vulnerability.
2	Damage to street lighting columns - wind	Estates	M	L	Unknown.	Street lighting columns' shape makes them vulnerable to strong winds. KA reports that in 2013, the top of a lighting column was blown off (nr. N. Hanover) into an adjacent office building (see Appendix B for photos).	There are a large number of street lamps with large surface areas. Maintenance could reduce the risk of loose fittings/corrosion increasing vulnerability of lamps becoming loose.	Review maintenance programme for early identification of risk.
3	Damage to building envelope – water ingress (flooding, damp and mould)	Estates	H	M*	Existing issue.	The size and height of GCU's estate provides a large surface area exposed to rainfall. GCU also has a lot of flat roofs (built when climate change was not an issue). Flooding (water ingress) already occurs during current moderate to intense rainfall events .	Water ingress during moderate to intense rainfall events is a current risk to GCU's estate. Persistent water ingress could lead to mould which could potentially impact occupants' health.	Understand vulnerability.
4	Damage to building - heat	Estates	Unknown	H	Existing issue.	Diurnal temperature changes can cause building materials to contract and expand at different rates. This could be particularly problematic where buildings join together. Pavement in Leith (Edinburgh) buckles in afternoon heat (June 2018).	A significant number of buildings at GCU, built at different times, join together (inc. in southerly aspects). Expansion and contraction of pipework can also result in damage to buildings and pipework. Thermal expansion has caused cracking of stone slabs in the main University Boulevard (causing a trip hazard - see Appendix B for photos).	Understand vulnerability.
5	Disruption to utility supply - electricity	Estates, ITC	L	H	Unknown	The majority of the electricity is supplied through the National Grid. Disruptions to supply would have a significant impact on GCU's ability to operate its campus and impact the operate ITC systems. CC risks reports identifies # of critical infrastructure at risk of CC disruption over a range of timescales.	Distribution company likely to have adaptation work and procedures for speedy service re-instatement. There is potential to power essential services (e.g. ITC) with the CHP, but procedure to operate CHP on island mode is does exist at present.	Understand risk to GCU. Develop procedure to operate CHP in island mode.
6	Disruption to utility supply – gas	Estates	L	H	Unknown	All of gas used in the Glasgow campus is supplied	UK gas storage capacity has been	Understand risk to GCU.

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No.	Risk	Immediate Impact Area	Likelihood	Severity	Impact Timescales (from)	Rationale	What we know	Adaptation Gap
						through the National Grid. Freezing weather (UK, Europe) could reduce UK nat. gas stocks with implications for availability and potentially prices.	depleted and the gas supplier does not guarantee supply to the University. GCU Estates Manager notes that there was a case of Stirling University having its gas supply cut during peak hour in 2017-2018	
7	Disruption to utility supply – electricity and gas – on-campus flooding	Estates	M	H	Unknown.	Electricity and gas mains supply to campus is below street level and susceptible to flooding due to increased rainfall.	Electricity and gas main supply @ back of west side of COB.	Understand resilience opportunity of existing location and investigate alternative locations.
8	Disruption to utility supply - water	Estates	L	H	Unknown	All water used in the Glasgow campus is supplied by Scottish Water.	Distribution company likely to have adaptation work and procedures for speedy service re-instatement.	Understand risk to GCU.
9	Damage to grounds – surface and sewerage flooding	Estates	M	H	Potentially existing issue.	GCU has a combined sewage and surface overflow network (completed in 1995) that is already under strain during extreme rainfall events. SEPA's flood map (2015) also identified the East side of the COB (around Central Stores) as having a medium risk of flooding. Increased intensity of rainfall events (but not in number of rainfall events) already put the existing system under pressure and its ability to cope with higher volumes of water unknown.	No record of areas flooding (or anywhere else on campus) although there is anecdotal evidence of some sewerage drainage off some buildings struggling during heavy rainfall events.	Understand capacity of drainage system to cope with extreme rainfall events of the magnitude predicted for CC.
10	Overheating buildings	Estates, Students, Staff, Financial, Reputational	H	M	Potentially an existing issue - 2020	Many of GCU's building have significant glazed areas susceptible to solar gain (potentially exacerbated by higher ambient temperatures) which, without additional cooling, may make working in those buildings difficult. Examples – Milton St., southern façade of the G Moore. Mbeki less of an issue now because neighbouring student residences reduce direct sunlight hitting the building. The UK Climate Change Risk Assessment 2017 (pages 6 and 38 of 86) identify lower productivity as a risk associated with higher temperatures.	The majority of the University's building control systems are designed to warm, rather than cool buildings.	Understand risk and building vulnerability. Explore alternatives to mechanical cooling, e.g. when work can be done from other locations/home.
11	Increased insurance premiums	Financial	unknown	unknown	2050	Weather damage to buildings and also disruption to travel arrangements could result in an increase in insurance premiums due to an increase in	Risk linked to flooding on-campus.	Understand weather damage risk.

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No.	Risk	Immediate Impact Area	Likelihood	Severity	Impact Timescales (from)	Rationale	What we know	Adaptation Gap
						claims. The Financial Risk of Climate Change (a report by the Met Office for the Association of British Insurers) anticipated a 21% rise in the cost of insuring flood losses in the UK based on a 4°C rise in temperature.		
12	Lost opportunities (funding/commercial)	Financial & Reputational	unknown	unknown	unknown	SG require that publicly funded bodies disclose adaptation plans/arrangements (through the Public Bodies Reporting Duties (PBRD) introduced through the Climate Change Act (Scotland) 2009 – See Appendix A). As the impacts of CC become better understood, it is possible that funding/commercial opportunities are linked to climate resilience/adaptation.	PBRD require public bodies disclose their adaptation arrangements. The University is in the early stages of this process and would struggle to provide evidence demonstrating a cohesive, Institution-wide approach.	Develop an adaptation plan.
13	Scottish Gov. Policy change	Estates, Financial	unknown	unknown	unknown	SG may determine that insufficient progress is being made by public bodies to mitigate climate risks (i.e. adapt) and introduce new legislation to address this.		Watch for developments.
14	Supply chain disruptions	Supply chain, Financial & Reputational	M	L	unknown	Supply chain disruptions (e.g. service/supply interruptions, reduction in choice and higher costs) could compromise particular aspects of the University's operations (e.g. ITC equipment replacement, catering). Examples: Floods in SE Asia affect global supply of hard drives in 2011 ; 2017 cold snap reduces fresh produce supply from Spain ;	External to University, could potentially manage through contractual requirements.	Understand supply chain vulnerability, risks and options to mitigate risks.
15	Travel – Business – Lost time	Staff	H	L	existing	Extreme weather can cause delays and cancellations of travel arrangements making business travel more costly (due to lost time, additional expenditure and insurance claims). Extreme weather can also make travel more uncomfortable. Examples: Beast from the East – causes disruption to road, rail and air travel (2018) ; New York airports closed due to flooding (2017) ; Hot weather cancels flights (2017) ; Hot weather increases turbulence .		Understand risk.
16	Travel – Commuting – Lost time	Student,	M	L	existing	Extreme weather events can disrupt local and	The University has in place robust	Evaluate arrangements for

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No.	Risk	Immediate Impact Area	Likelihood	Severity	Impact Timescales (from)	Rationale	What we know	Adaptation Gap
		Staff, Security				regional transport networks (delays and cancellations) and hinder students' and staff's ability to get to the University. This could be particularly challenging for (a) ensuring adequate security on campus and (b) for students around exam time or when assignments have to be physically submitted. Examples: Beast from the East – causes disruption to road, rail and air travel (2018) ; Heat disrupts services to/from Glasgow Central (28 May 2018) ; Flooding disrupts Glasgow rail travel (10 June 2018) ;	contingency measures to deal with large (city-wide, regional) weather disruption. However, feedback from SEBE students working on an adaptation project suggests that students don't necessarily know about where to find relevant information.	disruption that may affect small numbers of individuals.
17	Localised weather disruption – flooding/storms	Students (all)	M	L	existing	Localised weather disruption could hinder small groups of students' ability to meeting deadlines or sit exams. Weather disruption 9 June 2018 – The Scottish Sun & Glasgow Live (train cancellations) .	The University has in place robust contingency measures to deal with large (city-wide, regional) weather disruption.	Evaluate arrangements for weather disruption that may affect small numbers of individuals (rather than large groups).
18	International extreme weather events – short-term (storms, floods, heatwaves)	Students (international)	unknown	unknown	existing	14% of GCU's student population in 2016-17 ¹⁰ international, many from countries with limited capacity to adapt to and mitigate the effects of climate disruption. Such events may cause anxiety amongst some of GCU's international students as they worry about the fate/wellbeing of friends and relatives back home.	unknown	Understand whether there is/might be a need to support international students and how they can best be supported.
19	International extreme weather events and associated civil unrest – long-term (drought, sea-level rise)	Students (international), Student recruitment, Financial	H	L	unknown	14% of GCU's student population is international, many from countries with limited capacity to adapt to and mitigate the effects of climate disruption. Long-term weather disruption may impact the University's ability to recruit students from particular parts of the world.	Unknown. Exploring a project with SEBE to understand impacts from climate change of regions GCU attracts international students from.	Understand GCU vulnerability.
20	Rising sea level- Western Scotland	Students, Staff	L	M	2080-2100	0.5m rise by 2080 (under high emission scenario) projected for the Forth of Clyde. Properties and other infrastructure along the coast line vulnerable to storm surges, coastal erosion and flooding. Here is likely to be a high risks to individuals'	The Scottish summary from the UK Climate Risk Assessment 2017 notes that sea level has been rising around 1.4mm/year since 1901.	Watch developments.

¹⁰ In 2016-2017 GCU had 14,492 individuals registered students, of which 2,069 were from outside the UK. Data provided by Strategy & Planning.

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No.	Risk	Immediate Impact Area	Likelihood	Severity	Impact Timescales (from)	Rationale	What we know	Adaptation Gap
						homes and their ability to maintain them.		
21	Changing weather – impacts on health and wellbeing	Students , staff	M	M	2020-2050	Hotter, wetter weather can have impact on the health and wellbeing of students and staff by introducing new pests/diseases, making homes hotter/damper.	unknown	Understand whether there is scope to provide information to students and staff about managing these risks (e.g. by sharing/signposting to other agencies).
22	Increased maintenance of green spaces	Estates, Financial	H	L	2020-2050	Hotter, wetter weather will increase the growing seasons, which for maintained landscapes, will increase the ground maintenance requirement.	Although only a proportion of GCU's grounds are landscaped, they are in relatively high profile areas which may require increased maintenance to account for the longer growing seasons.	Watch for developments.

Consultation & Final Remarks

In addition to the publications highlighted throughout this document, the following individuals were consulted in the development of this document:

- Richard McAvoy
- Charlie Russell
- Mark Phillipson
- Kenny Allen

The risks identified in this discussion paper were further discussed at an Estates workshop held on 23rd August 2018 with the following attendees:

- Douglas Little
- Therese Fraser
- Kenny Allen
- John Keenan
- David Halliday
- Kit England (Climate Ready Clyde)
- Charles Russell
- Richard McAvoy

It is hoped this discussion paper highlights an initial set of risks to the University from climate change and fosters a wider discussion within GCU about how best these might be managed (i.e. how the University can adapt to become more resilient).

Appendix A – Summary of Climate Change Act (Scotland) 2009

Through the [Climate Change \(Scotland\) Act 2009 \(asp. 12\)](#) (the Act) the Scottish Government introduced a target to reduce Scotland’s greenhouse gas (GHG) emission by 80% by 2050 and 42% by 2020 (using 1990 and 1995 as baselines – depending on the GHG).

Part IV of the Act places **three** climate change duties on a wide range of Scottish public bodies. It requires that, in exercising their functions, they must act in:

1. the way best calculated to contribute to delivery of this Act's emissions reduction targets;
2. the way best calculated to deliver any statutorily adapted programme;
3. a way considered most sustainable.

Progress delivering the above is currently monitored through the [Climate Change \(Duties of Public Bodies: Reporting Requirements\) \(Scotland\) Order SSI 2015/347](#) (PBRD) which requires public bodies (of which the University is classified as one) to report on their:

- Climate Governance
- Management
- Strategy (including the following areas):
 - Adaptation
 - Business travel
 - Staff Travel
 - Energy efficiency
 - Fleet transport
 - ICT
 - Sustainable/renewable heat
 - Waste management
 - Water and sewerage
- Corporate Emissions
- Targets
- Project Data
- Adaptation
- Arrangements for using procurement to meet the objectives of the Act.
- Declare what arrangements are in place for validating the data/information it submits.

Reports covering the above areas are to be submitted annually by the end of November to an online platform.

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Appendix B – Extreme Weather Damage at GCU

This appendix contains some photographs of damage to GCU's campus from extreme weather events.

January 2013 – Storm Damage

Strong winds blew roof off a boilerhouse in Hamish Wood building. An outdoor lamp fitting was blown into North Hanover building.



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Summer 2018 – Heat wave – cracked paving

Paving stones crack as they expand during heat wave in the summer of 2018.



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