

CLIMATE RESILIENCE IN GLASGOW CITY REGION

A POSITION PAPER ON THE NEW LANDSCAPE FOR CLIMATE RISKS, FINANCE
AND OPPORTUNITIES

SUMMARY OF RESEARCH CONDUCTED AS PART OF THE ECONOMIC IMPLICATIONS OF CLIMATE
CHANGE IN GLASGOW CITY REGION PROJECT PHASE 2: ADAPTATION REPORT

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A REPORT BY

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FOR

Climate**Ready**Clyde

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About Climate Ready Clyde

Climate Ready Clyde is a cross-sector initiative funded by the Scottish Government and 15 member organisations to create a shared vision, strategy and action plan for an adapting Glasgow City Region.

Climate Ready Clyde is governed and steered by a board comprising senior representatives from each of the funding organisations. The board is supported by a small secretariat who lead the implementation on their behalf. The Climate Ready Clyde secretariat is managed and delivered by Scottish sustainability charity Sniffer.



Summary

Climate Ready Clyde (CRC) is developing a regional Climate Change Adaptation Strategy for the Glasgow City Region (GCR). The first stage of this work completed a Climate Risk and Opportunity Assessment for the region, with an accompanying analysis of the economic costs of these risks.

The second stage is looking at the actions needed (through to 2025) to address these climate risks. This includes the development of an Adaptation Strategy and Action Plan, which is now underway. This position paper presents key policy messages on the changing landscape for climate change resilience, and the implications for GCR. It also tests the suitability of best practice approaches for managing these climate risks, and the potential benefits of doing so for the Glasgow City Region.

The first key message of this study is that while climate change presents a risk to society and the environment, it is also an important economic and financial risk for Glasgow City Region. This recognises that the climate debate has changed and public lenders and financial markets are now aware of climate change. As a result, climate risks are now being considered as financial risks. This is important because the region has potentially high climate risks (if not managed) and this could affect requirements on GCR from lenders and the attractiveness of the region for investment.

The second key message is that these climate risks can be managed. There are therefore large benefits in taking action. A key priority is for Glasgow City Region to develop an approach to demonstrate that risks are being managed in a fiscally responsible way, and to build organisations' in-house capacity and share knowledge on how climate-related risks are being managed.

To support this, this position paper presents a draft Climate Change Adaptation Framework, to help structure early resilience measures for Glasgow City Region. This focuses on early adaptation decisions, which might be introduced over the next five or so years, to address short, medium and long-term climate risks. The framework is designed to help identify those options that have a strong economic justification. It focuses on three different types of early priorities.

1. Addressing existing climate risks by implementing 'no-regret' or 'low-regret' actions;
2. Intervening early to ensure that adaptation is considered in decisions that have long lifetimes, such as major infrastructure developments; and
3. Starting the early adaptation steps, and putting plans in place, for long-term issues using a pathways approach.

These approaches are complementary and together form an integrated approach for early adaptation. The framework uses the approach developed for the UK Climate Change Risk Assessment (CCRA) and also aligns to national and regional public policy and project appraisal, recognising the challenges involved in adaptation. This paper presents applications for each of these three areas, drawing on international best practice to showcase opportunities for the Glasgow City Region.

The first application has focused on early low and no-regret adaptation, i.e. early wins. The previous phase of the economics study identified that there are already high weather-related impacts in the Glasgow City Region, and these weather events are projected to increase in frequency due to climate change. These have important financial and economic costs. However, there are many early, low-regret options that can be introduced to address these existing risks, which will also help build resilience to future climate change. The analysis has identified a number of these and used detailed

review, and initial economic analysis, to identify options with high benefits and low costs, i.e. options that could be introduced as early quick wins in the forthcoming Adaptation Action Plan. It identifies options to address flood risks, as well as new measures to start preparing for the anticipated increase in heat (and heat-waves). The application demonstrated the use of economic analysis to help select promising options and build the case to justify action. Further work would be beneficial to develop these early priorities into business cases, to put forward as concrete actions in the adaptation plan.

The second application focused on the use of Climate Risk Assessment for city-region investments, particularly infrastructure projects. The analysis applied a climate risk management approach to the Glasgow City Region, using a framework adopted by the major European public development banks, looking at the relevance and application for GCR City Deal. The objective was to set out the rationale for including climate risk management approaches in future rounds of City Deal or other large-scale public sector investments. The application found that many of the City Deal investments have important climate risks: while many of these risks will have been addressed, a structured climate risk approach for such projects, and as a test for wider investment in GCR, might be useful going forward. The key finding was that there is a growing use of climate risk screening for infrastructure projects (by both lenders and borrowers) and that there are opportunities to introduce these systems for public investment decisions in the Glasgow City Region. Climate risks could be an important factor in the success of the City Deal projects and subsequent major public infrastructure projects.

The third application was on the use of long-term Adaptation Pathway planning. This is a new approach to manage long-term climate risks, that uses an iterative approach that reviews and updates plans over time, to take advantage of new information. The application focused on the potential use of such an approach for coastal flooding in the region, transferring international best practice to the Clyde Corridor. The key findings were that there is a valuable role for these methods in structuring and communicating a long-term and iterative approach, and they help demonstrate that climate uncertainty is not a barrier to action. The application concluded that this type of long-term approach would be particularly useful for Climate Ready Clyde, but that detailed approaches are resource-intensive. It might be useful for other stakeholders to consider for developing a longer-term adaptation plan, aligned to broader land use planning and regional development.

In conclusion, the study has identified that Glasgow City Region is well positioned to evolve the approach to economic development to account for this new climate investment landscape, where climate change is being viewed as a financial risk, creating new expectations and requirements from lenders, investors, developers, and others. The paper concludes that the development of a strategic adaptation framework, and the identification of early adaptation priorities (the three building blocks) would be extremely beneficial in the development of the regional Adaptation Strategy and Action Plan. This would help to identify the (urgent) actions that could be prioritised in the next plan cycle (i.e. next five years or so) and provide a strong economic rationale to ensure value for money.

Finally, the three applications of the framework demonstrated that employing such an approach would support Glasgow City Region in managing future climate risks. These actions would have major economic and financial benefits, and would also demonstrate that GCR are managing risks to external stakeholders. Taking such action, and communicating progress, would give the region an important first mover advantage in this new landscape. A number of recommendations are made to take forward the study findings.

Introduction

Climate Ready Clyde (CRC) is developing a strategic approach to underpin a regional climate change strategy and action plan for the Glasgow City Region.

The first stage of this is completed. In 2019, The Glasgow City Region Climate Risk and Opportunity Assessment (GCRCROA) was published. This set out a detailed assessment of the 67 climate change risks and opportunities facing the area.

Alongside this, Climate Ready Clyde commissioned an Economic Assessment of the Climate Change for Glasgow City Region, to assess the costs and benefits from each of the individual risks or opportunities. The latter analysis found that climate change could create risks which could cost Glasgow City Region £hundreds of millions a year by the 2050s, although it would also have significant benefits from reduced heating costs and cold related health impacts. The assessment also highlighted that Glasgow City Region has a small, but important sector helping society adapt to climate change which employs 8,000 people and generates £146m a year in sales.

However, these climate risks can be managed. The second stage of the work is therefore looking at the types of actions needed (through to 2025) to address climate risks in the short, medium and long-term. This includes the development of an Adaptation Strategy and Action Plan, which is now underway.

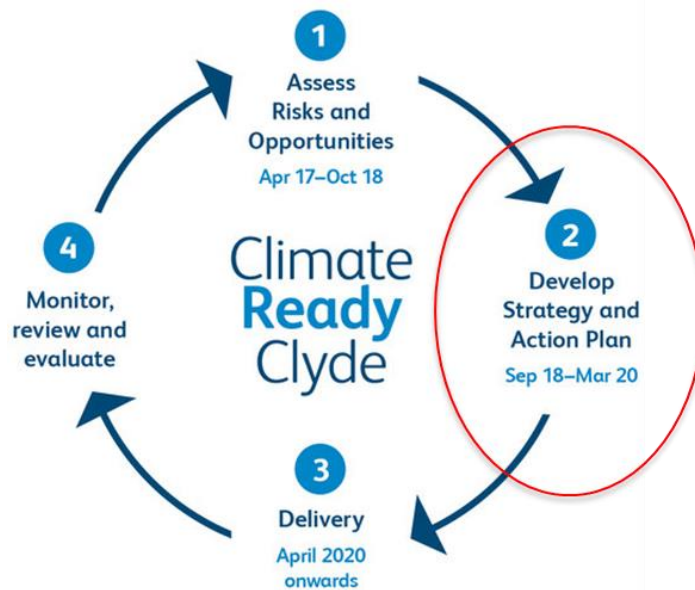


Fig 1: Glasgow City Region's adaptation policy cycle.

This position paper – undertaken for Climate Ready Clyde (CRC) and Sniffer – is designed to inform the Strategy and Action Plan. It is based on the second phase of a study on 'The Economic Implications of Climate Change for Glasgow City Region' for Climate Ready Clyde (CRC) and Snifferⁱ, funded by CRC and the Scottish Government.

The paper outlines the key policy messages on the changing landscape for climate change resilience, and the implications on climate risks and opportunities for Glasgow City Region. It also sets out some of the key principles for managing climate risks, and tests the suitability of best practice approaches for managing climate risks, for Glasgow City Region.

Climate Change as an Economic and Financial Risk for Glasgow City Region

Historically, climate change has been seen as an environmental issue. However, this is changing and there is growing awareness of the potential risks of climate change on infrastructure and urban development investments. As examples:

- A statement by 34 Central Banks (including the Bank of England), under the Network for Greening the Financial System (NGFS)ⁱⁱ, has identified climate change as a source of financial risk. This is because climate change is likely to increase the severity and frequency of extreme events, as well as changing the average climate, leading to infrastructure and property damages, lower productivity and potential economic disruptions. These could result in high financial losses.
- The NGFS also highlights that to bridge the data gaps, and enhance the assessment of climate-related risks, public authorities should share, and if possible, make publicly available any climate-risk data.
- There is also an increasing focus on the financial reporting of these climate risks, and their consideration in financial markets, notably with the Task Force on Climate-related Financial Disclosure (TCFD)ⁱⁱⁱ established by the G20's Financial Stability Board. Properly accounting for physical climate risk could - on average – reduce company enterprise values by 2-3% due to the risk costs of insuring assets, and more than this in some sectors^{iv}. TCFD is developing protocols for reporting climate risks, to help improve the integration of climate risks into private sector decisions, and to ensure these are recognised as financial risks by the financial markets.
- In April 2019, the Bank of England requested all banks, building societies and insurers to report on the physical risks of climate change at a Board level – this will have long term implications for lending, with climate risk becoming an increasingly likely consideration in lending.
- All major infrastructure projects funded by European Commission Funds, and the European Investment Bank^v, are now subject to mandatory climate change risk assessments, which consider climate risks. These are undertaken as part of the safeguard process (due diligence) for project approvals, and they are a precondition for lending. This means climate change has become part of the standard project development and project risk management.
- The UK government has set up a National Infrastructure Commission^{vi}, to assess long-term infrastructure needs and provide independent advice to the government. Its National Infrastructure Assessment (2018) identifies climate change as a key risk for infrastructure. This is also likely to be a key theme for the Infrastructure Commission for Scotland, which will provide independent advice on the nation's vision, ambition and priorities to create a 30-year infrastructure strategy to meet the country's future economic growth and societal needs.

These issues are important for Glasgow City Region, because the region has a high baseline of current climate related costs, particularly from coastal, river and surface water flooding. Furthermore, as identified in the climate risk and opportunity study and the accompanying economic analysis, these climate impacts are projected to increase in the future, with potentially high economic costs for the region. This has a number of implications.

First, a failure to account for these climate risks in regional investment decisions could lead to economic and financial costs for public authorities and private organisations, either from weather-related damage of assets, or from climate change affecting operation, performance or revenues/benefits. This reflects the fact that infrastructure investments have a long lifetime and will

be exposed to future climate change, but also because they are often difficult or costly to retrofit later.

Second, growing awareness of these climate risks by the financial markets is likely to affect the attractiveness of Glasgow City Region for investors. There are already tools and organisations supplying climate risk information to financial investors, although these methods are still being developed and there is low cross comparability^{vii}. Nonetheless, the rating agencies and investment advisors are factoring in such climate risks into country, city and company assessments. As a large global city, with a coastal and river location, Glasgow is already appearing on some global maps of cities at risks. For example, a recent review informing real estate investments has identified Glasgow as a city at risk^{viii}.

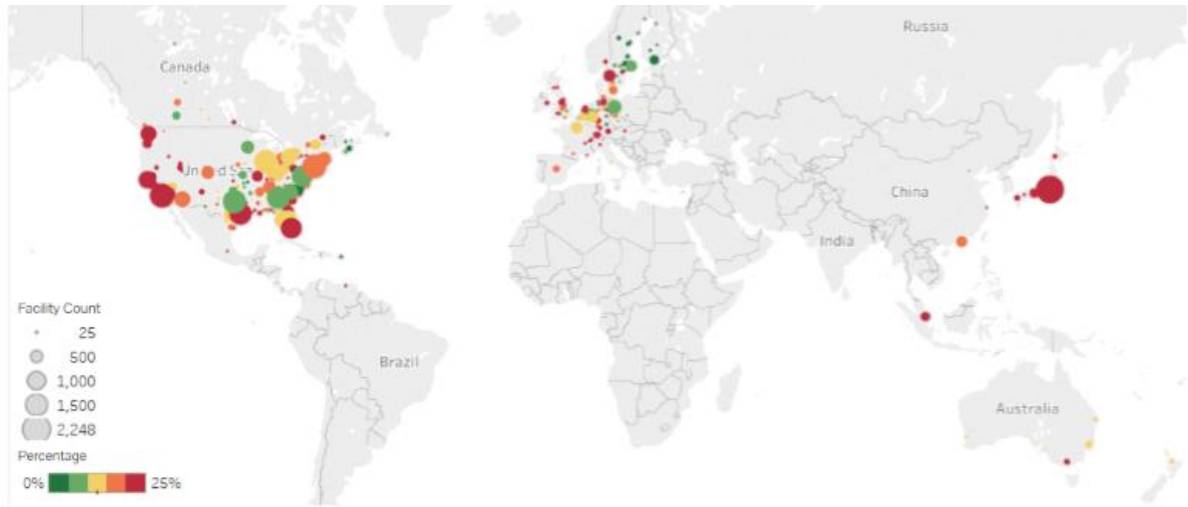


Fig 2: Example of Risk Information for Real Estate Investors –% of properties exposed to flood at 74000 sites. Glasgow is identified as having high exposure. Source GeoPhy and Four Twenty Seven.

If public authorities don't manage climate risk information and highlight action that is being undertaken, others will do it for them.

Key message – Climate change is an important economic and financial risk for the Region.

The climate debate has changed and public lenders and financial markets are now aware of climate change: as a result, climate risks are now being considered as financial risks. This is important because Glasgow City Region has potentially high climate risks (if these are not managed). This could affect requirements on Glasgow City Region from lenders – affecting public financial management. It will also affect the attractiveness of the city for investment.

However, these risks can be reduced and managed. A key priority is for Glasgow City Region to develop a strategy (the Adaptation Strategy and Action Plan) to demonstrate that risks are being managed, and following the recommendations of the NGFS, to build in-house capacity and share knowledge with other stakeholders on management of climate-related risks.

It is also important to recognise that if this can be undertaken successfully, Glasgow City Region could achieve a competitive advantage. For example, a recent analysis of over 1800 cities as part of a Climate Change Vulnerability Index (CCVI)^{ix}, identified Glasgow as one of the top five cities (of the

1800 globally) that was insulated from the impacts of climate change. While this highlights the lack of direct cross comparability (e.g. with the map above) it does demonstrate that if Glasgow is successful at managing risks, and communicating the action it is taking, it could gain a comparative advantage.

Based on the discussion above, this position paper reports on a recent study that has tested a number of international best practice methods for managing climate risks in the Glasgow City Region. The aim has been to help assess the potential applicability and benefits of such approaches, and to help showcase examples of how to manage climate risks.

Key message – Climate risks can be managed and there are large benefits in taking action.

A key priority is for Glasgow City Region to develop its Adaptation Strategy and Action Plan to demonstrate that risks are being managed, and to build in-house capacity and share knowledge within relevant city and regional organisations on the management of climate-related risks.

The position paper first presents a possible Climate Change Adaptation Framework, to help structure the risks and opportunities for Glasgow City Region. This helps to prioritise where early action is justified. This identifies three early priorities. The position paper then reports on applications in each of these three areas.

Developing a Climate Change Adaptation Framework for Glasgow City Region

While managing climate risks is possible, and has high benefits in reducing future economic and financial damages, it does involve a cost. Therefore, with rising climate risks, the reality is that there will be increased pressure on public budgets to manage them. For example, this might be in the form of additional capital expenditure on resilience measures, such as flood protection investments.

It is therefore important to focus any resilience measures in the areas where they will have greatest benefit. This is particularly important because many of the impacts of climate change happen in the future. The issue for Glasgow City Region is thus where to invest today, i.e. in the next five years, to ensure value for money.

The study has developed and applied a framework to guide this action. This focuses on early adaptation decisions, which might be introduced over the next five to ten years. This framework builds on the latest approach used in the UK Climate Change Risk Assessment (CCRA) and the adaptation literature. It also aligns to national and regional public policy and project appraisal.

The framework is designed to help identify those options that have a strong economic justification. It focuses on three different types of early priorities:

1. Addressing existing climate risks in the region by implementing ‘no-regret’ or ‘low-regret’ actions.
2. Intervening early to ensure that adaptation is considered in decisions that have long lifetimes, such as major infrastructure developments, in order to avoid ‘lock-in’.
3. Starting the early adaptation steps, and putting plans in place, for decisions that have long lead times or involve long-term major risks.

These three approaches are complementary and together form an integrated approach for early adaptation. It is shown below in the figure.

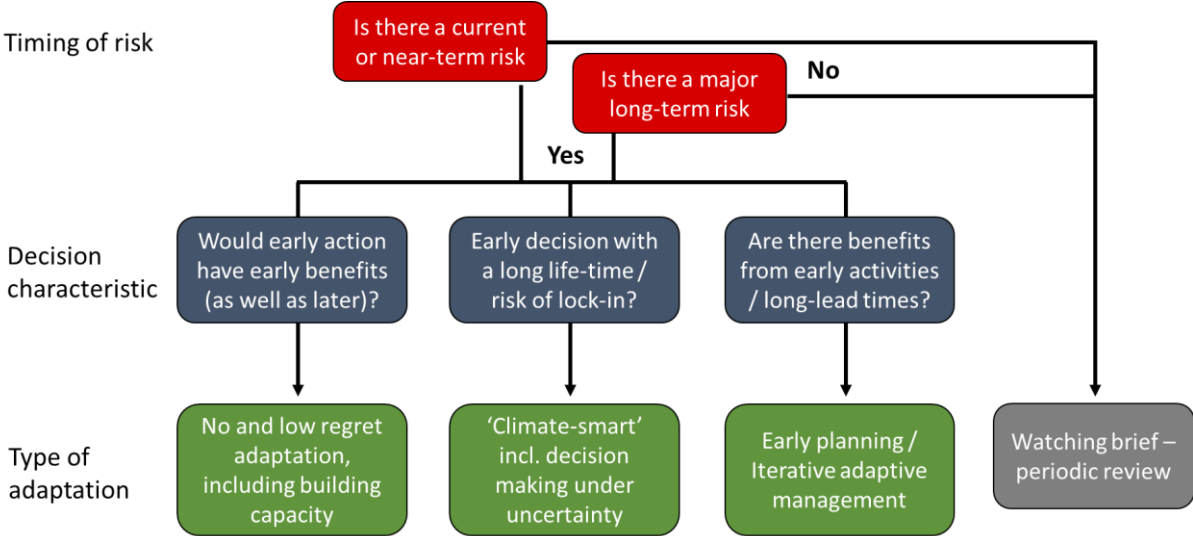


Fig 3. A framework to prioritize early adaptation. Source CCRA3.

The study has subsequently undertaken three applications, which demonstrate each of the priorities (from left to right in the figure).

Key message – It is important to prioritise early adaptation actions and justify investment

Climate risks will increase in the region, and addressing these will involve additional costs. This has implications for public budget and operations. It is therefore critical to identify the priorities for early adaptation, identifying where there is value in investments. The use of an adaptation framework – as set out above - can help identify such prioritise and deliver value for money.

Application 1. Early no and low-regret adaptation

The first application built on the earlier analysis of the current and future economic costs of climate change in the Glasgow City Region. The previous study identified that there are already high weather-related impacts in region, primarily from floods (river, coastal and surface), and to a lesser extent from wind storms. Critically, all of these weather events are projected to increase in intensity and/or frequency due to climate change, and there are new potential risks related to heat. This could also mean an increase in very large economic shocks from extreme weather events, which could have very high one-off impact on the region in a given year.

All of these weather related impacts will lead to high financial as well as economic costs. It is also highlighted that many of these economic impacts could disproportionately affect socially deprived and vulnerable groups. There are also strong geographical patterns for the distribution of risks across different authorities.

The first application looked at the potential costs and benefits of reducing future climate impacts, focusing on some of the largest economic risks.

It found that while future economic costs of flooding (coastal, river and surface flooding) are projected to increase significantly with climate change in Glasgow City Region, there are adaptation measures that can reduce these impacts. Many of these have high economic benefits (i.e. they have high benefit to cost ratios). Complementing these, there are also other low-cost (low-regret) options for enhanced early warning for floods, and there is the potential for some household level resilience and resistance options, which are most cost-effective when fitted in new buildings. Cutting across all these options, there are benefits from reducing future risks by ensuring new housing and non-residential development take future flood risks into account in their siting and design.

The application also looked at a new risk that might emerge in the region over coming years, focusing on heat. While heat extremes (including heat-waves) are not currently an issue in the region, they are projected to increase in the future under climate change – and this could be a particular issue for Glasgow due to the urban heat island effect. These heat extremes are still low in absolute terms (i.e. compared to regions and countries to the South of Glasgow) but they involve high relative increases for the region, affecting a population and urban design that has not previously experienced such heat levels before. This could lead to some important new impacts, but could also generate some important benefits. An economic analysis was undertaken to identify early low-regret options to address emerging heat issues. This focused down on the potential introduction of a Heat Health Watch System (HWWS) for Scotland and Glasgow. The application estimated the potential benefits of a scheme, and assessed the additional costs for the health system in Glasgow City Region from its implementation. It concluded that such a scheme would have a high benefit to cost ratio.

Overall, the application demonstrated the use of economic analysis to help select early promising options and build the case to justify action. Further work would be beneficial to develop these early priorities into business cases, to put forward as concrete actions in the emerging adaptation plan.

Key message – there are early low-regret opportunities to address current and near-term climate risks, which have high benefits and low costs

Glasgow city region is already affected by weather-related impacts, and these have high economic costs, which are projected to increase with climate change. However, there are low-regret options that can address these current risks and help build resilience for the future. The economic framework used here can help to identify promising options and build the economic case to justify such actions.

Application 2. Climate Risk Management in long-term investment decisions and financing

The failure to account for climate risks in infrastructure investment decisions could lead to economic and financial impacts, either from weather related damage of assets, or from climate change affecting operating costs, performance and anticipated benefits. This reflects the fact that these investments have a long lifetime and so will be exposed to future climate change, but also because they are often difficult or costly to retrofit later, so it is useful to consider climate resilience in their design.

There is growing awareness of the potential for climate risks on infrastructure and urban development investments, among national, regional and local Government, as well as among developers, infrastructure providers, and the financial markets. As a result, climate risks are being factored into project safeguards and financial risk management. Indeed, many lending organisations

– notably the most forward-thinking public investment and development banks -have already introduced climate risk management systems (CRMs) as part of their safeguard (due diligence) process. These systems assess project investments and assess their level of climate risk, and if needed, they then assess and include adaptation (resilience) measures in projects.

Recognising these issues, Climate Ready Clyde (in partnership with Adaptation Scotland) has already produced a toolkit which incorporates these approaches to support the incorporation of climate adaptation in projects in the built environment ([Climate Ready Clyde and Adaptation Scotland, 2019](#)), and is working with public sector partners to encourage its adoption.

This application investigated the potential introduction of a climate risk management and climate resilience (adaptation) approach in the Glasgow City Region, looking at the potential relevance and application for [Glasgow City Region City Deal](#). The application was undertaken to consider the potential need and opportunities for enhancing climate resilience in the City Deal process and portfolio. This builds on the existing initiatives on climate risk screening methods that are being used in investment appraisal by the public investment banks.

These climate risk screening and adaptation assessments usually proceed through a two-step process. The first step is an initial climate risk screening, which assesses whether a project is a low, medium or high climate risk. Projects that are assessed as medium and high risk are then investigated with a more detailed climate risk and adaptation assessment. The application undertook a high-level climate risk screening of the projects included in the Glasgow City Region City Deal portfolio, assessing their level of potential risk. The findings were:

- All the existing City Deal infrastructure projects are a medium or high climate risk, i.e. if these projects went through a typical investment bank CRM, they would require a more detailed climate risk and adaptation assessment.
- In contrast, the skills and employment projects in City Deal were all screened as being low climate risk, and would not require further analysis.

The identification of medium and high risks does not necessarily mean that major threats exist or that costly adaptation is needed, but rather that there is need for further investigation. It is also stressed that some (possibly many) of these risks will have been addressed already as part of the design work. The main cause of the medium and high ranking is the level of current and future flood risk in the Glasgow City Region.

The second step in these processes involves a more detailed climate risk and adaptation assessment. This involves a detailed project by project analysis of the climate risks, followed by the identification of possible climate resilience (adaptation) measures, with analysis of their costs and benefits. The application looked at the main project investments in the infrastructure portfolio, focusing on thematic issues in road projects, coastal area development, and urban built environment, and investigated relevant issues. This focused on:

- How important climate change could be for each City Deal project. This is influenced by the life-time and level of lock-in (the level of irreversibility in the investment decision);
- The importance of climate change on the economic and financial performance of projects; and
- Promising adaptation options.

The analysis identified that those projects in the City Deal portfolio that have longer life-times and greater lock-in should be priorities for adaptation, because of the higher risks and the greater need (but also the greater opportunity) to include resilience during their design. Complementing this, the application reviewed the potential economic and financial risks of climate change. This assessed the potential risk on assets, operating costs and performance, benefits and revenues, and ultimately on the potential for projects to deliver the anticipated economic growth.

The final part of the application identified examples of climate resilience (adaptation) options that could address the potential climate risks in infrastructure projects, focusing on some of the key City Deal investments.

Overall, the application found that climate risks are relevant for the City Deal portfolio, and while these may be being tackled in individual projects, a more structured climate risk approach for City Deal might be useful going forward. It is therefore recommended that climate risk screening and potential fuller climate risk and adaptation assessment requirements are embedded into the City Deal assurance framework. This would involve a process to undertake an initial climate risk screening of new projects, and subsequently enhance the climate risk and adaptation assessment components for medium and high-risk projects. It is highlighted that the GCR City Deal projects have already been through an extensive assessment and identified as having high economic and social benefits, nonetheless, there may be an opportunity at future Gateway Reviews to put them through an additional climate screening process to make the proposed projects even more valuable and cost-effective. These approaches would also be useful for subsequent investment projects in the Glasgow City Region.

Key message – there is a growing use of climate risk screening for infrastructure projects – there is an opportunity to introduce such a system in the region

Climate risks could be an important factor in the success of the City Deal project and subsequent major public infrastructure projects. While many of these risks will have been captured, a structured climate risk approach in Glasgow City Region might be useful going forward.

Application 3. Long-term adaptation pathway planning

The final application focused on adaptation pathways. These are a new approach that look at how to manage long-term climate risks, using an iterative approach that reviews and updates plans over time to take advantage of new information.

A good example here is with sea level rise. Coastal flooding already has large economic costs in the Glasgow City region: the last SEPA assessment estimated the annual average damages caused by coastal flooding are currently £19 million/year^x. Climate change could lead to major sea-level rise, and when combined with storm surges, this could have major impacts in increasing coastal flooding and damage in the Clyde Corridor. However, the level of future climate change and sea-level rise are uncertain. Even if sea-level rise is relatively modest (e.g. 0.5 metres this century), then these coastal flood damages are projected to increase significantly, potentially doubling. However, there is the potential for much higher levels of sea level rise, especially under high emissions scenarios. These could lead to 1 metre or more this century, which would have very dramatic impacts on the Clyde Corridor, and lead to much larger damages. It is highlighted that although countries have set a global

goal to reduce emissions significantly under the Paris Agreement to limit warming to 2°C (relative to pre-industrial levels), current emission pledges are not on track to achieve these^{xi}.

The application developed an initial adaptation pathway for coastal flooding for the Clyde Corridor. It explored the potential for a long-term planning approach (from current to the 2050s) using an iterative framework. This provided an example of a strategic approach for sequencing adaptation priorities over time. This has the advantage that decisions and investments can be brought forward or delayed as borne out by the evidence, rather than having to make high-cost, irreversible decisions now. An illustration of the sequencing of risks over time, and according to different future pathways is shown below.

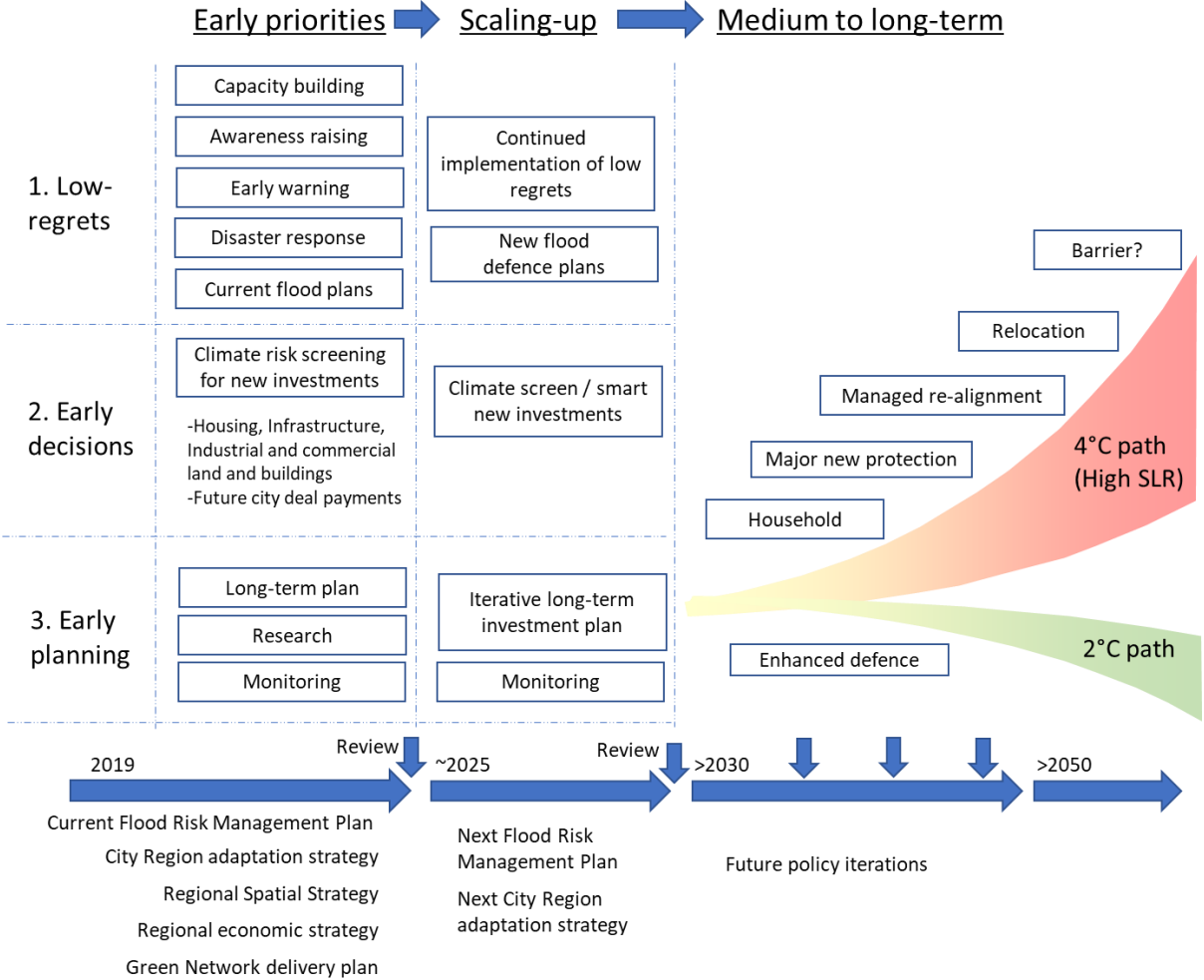


Fig 4. High-level adaptation pathway showing early priorities for coastal adaptation.

A further detailed case study looked at an illustrative dynamic adaptation route-map for the Clyde Corridor, based on unacceptable levels of properties at risk/annual damage from coastal flooding, and showing how dynamic route-maps could help plan pathways over time.

Overall, the application identified the potential role for these adaptation pathway methods for communicating a long-term and iterative approach, and demonstrating that climate uncertainty is not a barrier to action. It also highlighted a way to ensure that the linkages between future pathways are considered, and later options are not closed down from early action. However, it highlighted the resource-intensive nature of such approaches, and that they are more challenging to use when there

are multiple risks and strategies. This means that such approaches should be applied proportionately, although given the potential size of future annual damages from flooding in the region, the need for long-term strategic approaches is critical.

The application concluded that this type of long-term approach is particularly useful for Climate Ready Clyde. It might also be useful for other stakeholders – particularly SEPA, the Local Authorities, MGSDP, the Glasgow and Clyde Valley Green Network Partnership to consider some elements of this type of iterative adaptation pathways thinking, as the basis for developing a longer-term adaptation plan, aligned to broader land use planning and regional development. This could develop this type of long-term concept for the Clyde Corridor, and introduce an iterative monitoring framework to help with the sequencing of adaptation. This could be particularly relevant for the River Clyde Corridor Strategic Development Framework and any aspirations for future inclusion on the next National Planning Framework, especially as each SDF is supported by an iterative action plan.

In support of this, it might also be useful for SEPA to improve consideration of uncertainty in their long-term flood risk analysis. Underpinning this, there is a need to identify and develop a monitoring programme around some of the key threats for the Glasgow City Region, and investing in these now, as well as starting some of the longer-term issues around objectives and thresholds with stakeholders. This should include discussion of possible long-term governance arrangements for these long-term approaches.

Key message – adaptation pathways have a potential role in long-term strategic planning and communication of climate change risks and responses for the Glasgow City Region

These approaches are useful in helping stakeholders think long-term and more strategically. They can help communicate the need for long-term pathways, to ensure long-term options are not closed down from early action, and to demonstrate that climate uncertainty is not a barrier to action.

Summary and next steps

The study has identified that there is new climate investment landscape, where climate change is being considered as a financial risk, and in turn, this is creating new expectations and requirements from lenders, investors, developers, etc.

The paper finds that the development of an adaptation framework, and the identification of early adaptation priorities (the three building blocks) would be extremely beneficial for the development of the regional Adaptation Strategy and Action Plan. This would help to identify the (urgent) actions that could be prioritised in the next plan cycle (i.e. next five years or so) and provide a strong economic rationale to ensure value for money.

Recommendations

- To consider the economic costs and benefits for the City Region adaptation strategy and other relevant plans, strategies and activities, using the framework presented here to frame the analysis;
- To explore the potential for developing new finance mechanisms for adaptation.

Moving to the three applications, these demonstrate new adaptation thinking and apply this to the Glasgow City Region. A number of recommendations for next steps are identified for each area.

Early low and no-regret adaptation. There are early, low-regret options that can be introduced to help address current risks, which will also help build resilience to future climate change. The analysis identified a number of promising options and used detailed review, and initial economic analysis, to identify options with high benefits and low costs, i.e. options that could be introduced as early quick wins in the forthcoming Adaptation Action Plan. This focused on additional options to address flood risks, as well as new measures to start preparing for the anticipated increase in heat (and heat-waves). The application demonstrated the use of economic analysis to help select promising options and build the case to justify action. Further work would be beneficial to develop these early priorities into business cases, to put forward as concrete actions in the emerging adaptation plan.

Recommendations

- To consider future climate impacts as part of any refresh of the Regional Economic Strategy and Action plan;
- To consider more detailed business cases for a number of the early priorities, notably around flooding, heat alerts and information (awareness raising);

Climate Change Risk Management in long-term investment decisions and financing. Addressing climate risks could be an important factor in the success of the City Deal project and subsequent similar infrastructure investments by organisations across Glasgow City Region. It is highlighted that many of the risks identified will have been addressed in the existing design and feasibility studies for the existing City Deal projects. However, the case study suggests that a more structured climate risk approach for City Deal might be useful going forward, particularly for the projects yet to be delivered. It is therefore recommended that climate risk screening and potential fuller climate risk and adaptation assessment requirements are embedded into the City Deal assurance framework. These approaches would also be useful for subsequent investment projects by a range of organisations in the Glasgow City Region.

Recommendations:

- To consider future climate risks (climate risk screening), including the analysis of economic costs, in individual decisions on future investments in the City Region – notably within the City Deal - and to assess potential adaptation measures to reduce these costs;
- To consider the role for a screening framework as part of the new Regional Spatial Strategy and in Local Development Plans as well as in other relevant plans and strategies

Adaptation Pathways. There is a valuable role for these methods in structuring and communicating a long-term and iterative approach, and to demonstrate that climate uncertainty is not a barrier to action. The application concluded that this type of long-term approach would be particularly useful for Climate Ready Clyde, as well as for other stakeholders, for developing a longer-term adaptation plan, aligned to broader land use planning and regional development. This could develop the concepts for the Clyde Corridor, including for the River Clyde Corridor SDF and any aspirations for future inclusion on the next National Planning Framework. Underpinning this, there is also a benefit in starting a monitoring programme for some of the key threats for the region, and to start

discussions in regional government and with stakeholders on long-term objectives and governance arrangements.

Recommendations

- To consider the development of an iterative adaptation pathway for managing risks from flooding, erosion and sea level rise for the Clyde Corridor which could inform relevant regional plans and strategies.

Overall, the three applications of the framework find that these approaches could be valuable for Glasgow City Region, and would support the region in managing future climate risks. The adoption of such approaches would have high economic and financial benefits, and would also demonstrate that GCR are managing risks to external stakeholders. Taking such action, and communicating progress, would give the region an important first mover advantage in this new landscape.

References

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ⁱⁱ <https://www.bankofengland.co.uk/-/media/boe/files/research/greening-the-financial-system-statement.pdf> and https://www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf

ⁱⁱⁱ <https://www.fsb-tcfd.org>

^{iv} <https://www.economist.com/business/2019/02/23/business-and-the-effects-of-global-warming>

^v https://www.eib.org/attachments/strategies/eib_climate_strategy_en.pdf

^{vi} <https://www.nic.org.uk/>

^{vii} These methods have been reviewed by the ClimInvest project. They found that the approaches are at an early stage and often generate results with little cross-comparability:

<https://www.cicero.oslo.no/en/publications/internal/2884>

^{viii} http://427mt.com/wp-content/uploads/2018/10/ClimateRiskRealEstateBottomLine_427GeoPhy_Oct2018-6.pdf

^{ix} <https://www.maplecroft.com/insights/analysis/84-of-worlds-fastest-growing-cities-face-extreme-climate-change-risks/>

^x SEPA, (2015), Flood Risk Management Strategy: Clyde & Loch Lomond. Scottish Environmental Protection Agency. Note that these figures are in the process of being updated as part of the SEPA National Flood Risk Assessment.

^{xi} Recent analysis of emissions pledges under the UNEP mitigation report (2018)

(<https://www.unenvironment.org/resources/emissions-gap-report-2018>) indicates current pledges would lead to a global mean temperature rise of about 3.2°C.