PROVIDE

Overshoot proofing adaptation plans and policies

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Overshoot proofing adaptation plans and policies

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Abstract: This report presents the updated version of the Overshoot Proofing Methodology and outlines why and when it is relevant to consider overshoot scenarios in adaptation planning.

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Summary

Adaptation planning tools often recommend considering a wide range of potential future scenarios. But a systematic reflection on the futures covered by these scenarios is often absent. This is specifically the case when it comes to the risks of overshooting certain warming levels, or local impact thresholds, as a result of insufficient global mitigation action.

This report lays out how risks arising from future overshoot scenarios can be accounted for in adaptation planning. To this end, we have developed the Overshoot Proofing Methodology, a self-assessment tool designed to guide adaptation planners and policy-makers in including overshoot risks. We reflect on how to go about high-risk scenarios in climate risk assessments and provide explicit methodological links to existing EU adaptation planning guidelines and tools. Based on our insights, we suggest potential avenues for systematically incorporating overshoot risks in planning processes.

1. Why is overshoot relevant for adaptation?

In the 2015 Paris Agreement, state leaders have agreed on limiting global warming to 1.5°C by 2100 to prevent the worst impacts of climate change. This, however, leaves the door open to a temporary exceedance of this limit before 2100, if global mean temperature peaks and decreases back to 1.5°C by the end of the century.

As time progresses and climate change mitigation remains highly insufficient, the risk of an overshoot scenario occurring increases. This means that there is a high chance that global warming will temporarily exceed the 1.5°C target agreed under the Paris Agreement before it is brought down again in the following decades.

In these scenarios, climate change impacts would likely become more severe and while some may be reversible in the long-term, not all will be. Considering the implications of these scenarios is crucial for adaptation planning as they may imply different urgency in the options deployed, different cost-benefit ratios and the need to account for lock-ins and adaptive management approaches. Adaptation plans and measures that span over several decades are particularly relevant in this context.

In the EU H2020 project PROVIDE (Paris Agreement Overshooting: Reversibility, Climate Impacts and Adaptation Needs), we discuss the relevance of overshoot for adaptation and present avenues for its integration into policies and plans.

2. How can overshoot risks be included in adaptation planning?

Raising awareness and building capacity around the topic of overshoot is one of the first steps for it to be better incorporated into adaptation policy and plans.

In this section, we outline definitions of key concepts relevant in this context before presenting a methodology that allows to evaluate if specific indicators relevant to overshoot have been adequately considered in an adaptation policy or plan. Finally, we discuss the inherent uncertainties of climate impact projections and how they can be addressed in adaptation planning.

2.1. Definition of key concepts

TERMS	DEFINITIONS	SOURCES
Overshoot scenarios	Scenarios that temporarily exceed a specific warming limit expressed in global mean temperature increase above pre-industrial levels before bringing the temperature back down again, e.g., by deploying carbon dioxide removal. A wide variety of overshoot scenarios exist, we suggest to focus on the three primary scenarios described below for planning and policy-making purposes as they cover a wide array of potential futures. • **Current Policies**: explores the consequences of continuing along the path of implemented climate policies in 2020 with only mild strengthening up to 2100. • **Delayed Action**: explores the case in which serious decarbonisation efforts are delayed to the 2030s. Fossil fuel use never fully stops, instead reforestation and other negative emissions technologies are deployed. The IPCC AR6 refers to it as "Gradual Strengthening". • **Sustainable Pathway:** explores how a broader shift towards sustainable development can be combined with climate policies consistent with keeping warming to 1.5°C. The IPCC AR6 refers to it as "IMP-SP".	https://climate-risk-dashboard.climateanalytics.org/explore/impacts The scenarios originate from the IPCC Sixth Assessment Report (AR6)
Limits to adaptation	The point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions. • **Soft limits**: options may exist but are currently not available to avoid intolerable risks through adaptive action. • **Hard limit**s: no adaptive actions are possible to avoid intolerable risks.	IPCC glossary (2022)
Unavoidable impacts	Climate impacts and risks that are projected to materialize also under the Paris Agreement compatible scenario with the strongest global mitigation action (lowest emissions) assessed. We consider these risks to be unavoidable as of today.	PROVIDE consortium

Avoidable impacts	Difference between the assessed unavoidable impacts and risks and those materializing in a scenario where emissions follow current projections, without reinforcement (Current Policies scenario). In essence, these correspond to the impacts and risks that could be avoided depending on global mitigation outcomes.	PROVIDE consortium
Irreversible impacts	A perturbed state of a dynamical system is defined as irreversible on a given timescale, if the recovery time scale from this state due to natural processes is substantially longer than the time it takes for the system to reach the perturbed state.	IPCC glossary (2018)
Uncertainty	A state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from imprecision in the data to ambiguously defined concepts or terminology, incomplete understanding of critical processes or uncertain projections of human behaviour. Uncertainty can therefore be represented by quantitative measures (e.g., a probability density function) or by qualitative statements (e.g., reflecting the judgment of a team of experts).	IPCC glossary (2022)

2.2. The Overshoot Proofing Methodology

The Overshoot Proofing Methodology is a methodology for "advanced" adaptation planners and policy-makers, willing to conduct more robust risk assessments as part of their adaptation process. It is composed of five indicators (defined in Section 4.1 above) that can be evaluated through five questions against a set of criteria, to identify which ones should be considered more comprehensively to make the policy or plan "overshoot-proof".

- As a first step, define your system(s) (e.g. policy, plan or adaptation option).
- Secondly, go through all the following questions and select your answers based on the outlined criteria.

GENERAL CRITERIA
☐ No assessment
☐ Some awareness but no explicit assessment
☐ Partial assessment
☐ Comprehensive assessment
☐ Comprehensive assessment used to select and prioritize adaptation options

INDICATORS	QUESTIONS	SPECIFIC CRITERIA
Overshoot scenarios (e.g.: current policies, delayed action, sustainable pathway)	Are overshoot scenarios considered?	☐ Overshoot scenarios are not assessed. ☐ Awareness that overshoot scenarios should be considered but they are not assessed here. ☐ Overshoot scenarios are partially assessed. ☐ Overshoot scenarios are comprehensively assessed. ☐ Overshoot scenarios are comprehensively assessed and are used to select and prioritize adaptation options.
Limits to adaptation (e.g.: maximum number of days above x degrees during a heatwave)	Are limits to adaptation identified?	☐ Limits to adaptation are not assessed. ☐ Awareness around limits to adaptation but no assessment. ☐ Limits to adaptation are partially assessed. ☐ A comprehensive assessment of all limits to adaptation affecting the system has been made. ☐ Limits to adaptation are comprehensively assessed and are considered to select and prioritize adaptation options.
Impact unavoidability (e.g.: committed sea level rise/glacier melt)	Are unavoidable impacts identified?	☐ Impact unavoidability is not assessed. ☐ Awareness around impact unavoidability but no assessment. ☐ Unavoidable impacts are partially assessed. ☐ Unavoidable impacts are comprehensively assessed. ☐ Unavoidable impacts are comprehensively assessed and are considered to select and prioritize adaptation options.
Impact irreversibility (e.g.: irreversible desertification)	Is impact irreversibility after overshoot considered?	☐ Impact irreversibility is not assessed. ☐ Awareness around impact irreversibility but no assessment. ☐ Irreversible impacts are partially assessed. ☐ Irreversible impacts are comprehensively assessed.

		☐ Irreversible impacts are comprehensively assessed and are considered to select and prioritize adaptation options.
Uncertainty (e.g.: 90% confidence interval for the range of models considered)	Are uncertainty ranges linked to impact projections taken into account?	☐ Uncertainty is not assessed. ☐ Awareness around uncertainties but no assessment. ☐ Uncertainties are partially assessed. ☐ Uncertainties are comprehensively assessed. ☐ Uncertainties are comprehensively assessed and are considered to select and prioritize adaptation options.

The indicators that are least taken into account are to be considered more comprehensively when designing or reviewing adaptation plans and policies, to ensure that they adequately consider the additional risks that come with an overshoot scenario.

2.3. Implications of inherent uncertainties from climate modelling

Due to the uncertainty ranges that come along with impact projections, it is crucial to be aware of the fact that impact levels can be reached earlier (or potentially also later) than the median values that are often shown in climate tools and scientific literature.

In *Figure 1* below, the blue line indicates the median estimate for a hypothetical scenario, while the light-blue coloured area shows the 90% confidence interval that illustrates model uncertainty, arising from imperfect knowledge of the amount of global warming caused by greenhouse gas emissions and of the local response to global warming. Although the impact level (black "x") selected here is predicted to occur in 2065 by the median estimate of this scenario, it could occur as early as 2035 if impacts turn out to follow the most pessimistic model predictions rather than the median ones.

This example illustrates why risk cannot be comprehensively addressed when only looking at median values, and instead we recommend looking at the range of model predictions to ensure adaptation options are implemented in a timely manner.

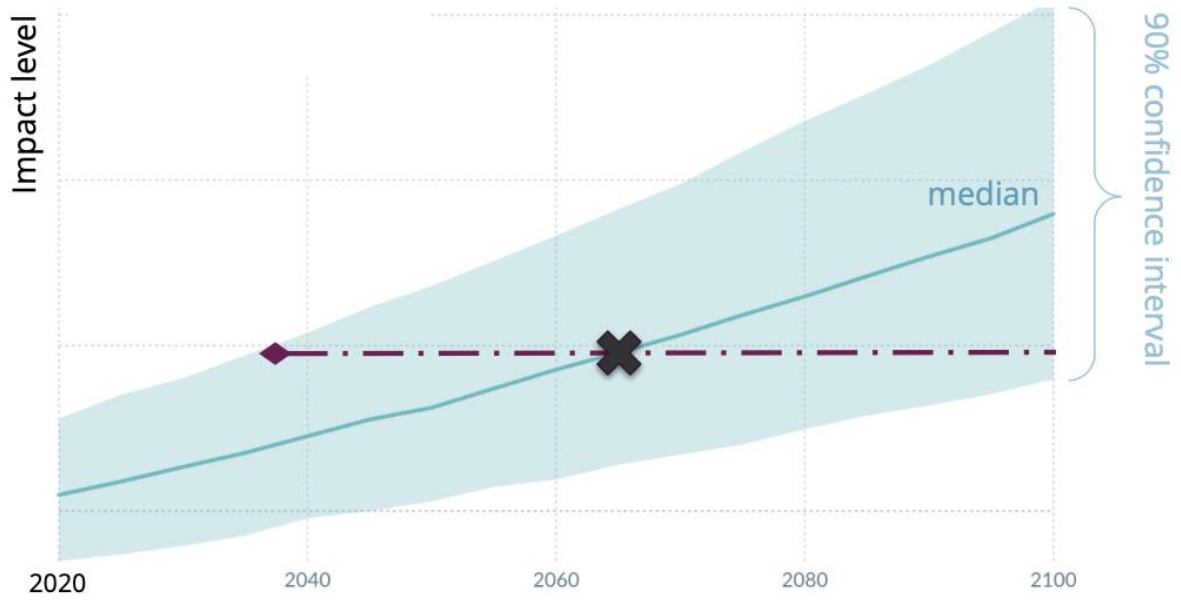

Figure 1: Illustration of the median value and the 90% confidence interval arising from model uncertainties for a specific impact level.

3. When should overshoot risks be included in adaptation planning?

3.1. Adaptation Support Tool from Climate-ADAPT

The Adaptation Support Tool (AST) aims to assist policy-makers and planners in developing, implementing, monitoring and evaluating climate change adaptation policies and plans. It describes an iterative and dynamic process that consists of six steps to prepare the ground for adaptation, explore risks and vulnerability to the current and future climate risks, identify and assess adaptation options, develop and implement activities for an adaptation strategy and/or adaptation plan, and monitor and evaluate its results (*Figure 2*).

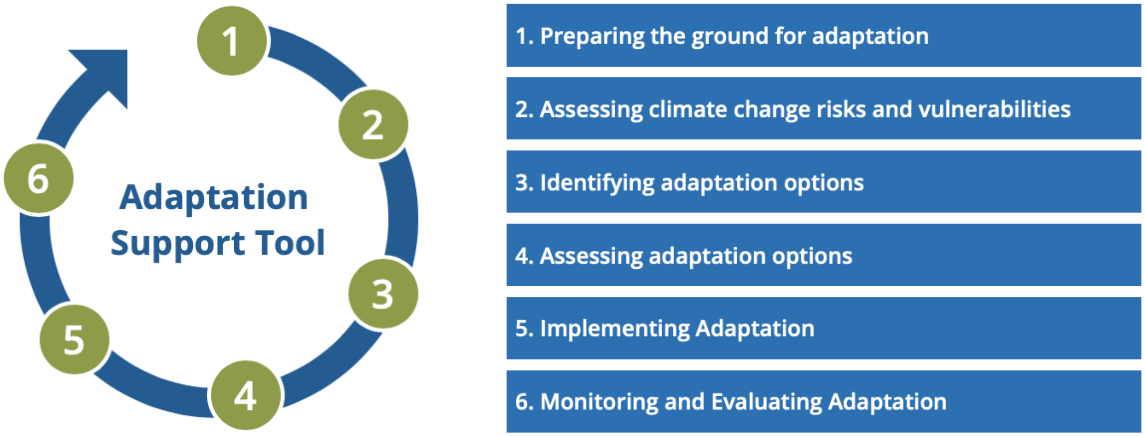

Figure 2: The Adaptation Support Tool and its 6 steps
(source: https://climate-adapt.eea.europa.eu/en/knowledge/tools/adaptation-support-tool)

The Overshoot Proofing Methodology (see *Section 2.2*) fits within the Adaptation Support Tool, more specifically under steps 2 and 6.

- Step 2 is about assessing current and future climate change risks and vulnerabilities through a Climate Change Impact and Vulnerability assessment (CCIV). During this assessment, it is recommended to collect information on climate, hazards, exposure and vulnerability, including future trend projections of various climate variables and hazards and simulations or scenarios on future risk. This is when looking into the indicators included in the Overshoot Proofing Methodology becomes relevant.

- Step 6 addresses monitoring and evaluating adaptation plans and policies, to look into what is being done to ensure the effectiveness and sustainability of adaptation over time. This includes developing Monitoring, Reporting and Evaluation (MRE) indicators against which progress and outcomes can be measured. With increasing, stabilizing or decreasing future global warming levels, it is important to take new baseline conditions and likely future scenarios into account. During step 6, policies and plans should be revised and refined based on evolving conditions and potentially an overshoot scenario.

3.2. EU guidelines on Member States' adaptation strategies and plans

The Guidelines on Member States' adaptation strategies and plans published in July 2023 by the European Commission aim to support EU Member States in drafting and revising their adaptation strategies and plans. They highlight key features required to develop quality adaptation policies and outcomes. While overshoot scenarios are not explicitly mentioned in these guidelines, Step 2a mentions that risk assessments should be based on, inter alia, the latest projections on future climate scenarios. They emphasize that several future scenarios should be taken into account when developing an adaptation policy (Step 2a), to address the inherent uncertainties about the future. Setting a clear timeframe during which differentiated impacts can be expected in the short (2030s), medium (2050s) and long (2100s) terms is also important. Overshoot scenarios would also potentially highlight various impact levels reached based on the point and time and specific scenario chosen.

In addition, the EU Guidelines describe climate stress tests that should be undertaken to identify potential risks in a specific system or sector due to climate related hazards, as well as a wider set of non-climate related disaster risks. They should be used particularly for adaptation in the sector of infrastructure and systems providing critical services. The results of these tests can then be used to (re)design the adaptation plan or policy. Specific risks arising from overshoot scenarios could be identified through this process.

4. Outlook

4.1. Where can useful information be found?

Climate information used to plan adaptation can be found on numerous platforms such as Climate-ADAPT, weADAPT or the IPCC Interactive Atlas. Below, we highlight two newly developed tools that are particularly relevant in the context of overshoot proofing.

- **Climate Risk Dashboard**

The PROVIDE climate risk dashboard includes state-of-the-art assessments of overshoot scenarios - in which average global temperatures would temporarily 'overshoot' the 1.5°C target of the Paris Agreement - before being brought back down again. It allows researchers, adaptation practitioners and other users to take a risk-based approach. Users will be able to explore the potential geophysical impacts of climate change under various scenarios (e.g., current policies, delayed action, sustainable pathway). They will also be able to select impact thresholds for e.g. heat waves or sea level rise to then access information on the conditions and characteristics of emissions scenarios under which the selected threshold can be avoided, or not. In addition, the users will be able to benefit from the adaptation module of the dashboard (under development at the time of the publication of this report) through the Iconic Cities case studies where the dashboard itself and the Overshoot Proofing Methodology have been applied and used for adaptation planning.

- **Mission Implementation Platform**

The recently established Mission Implementation Platform (MIP4Adapt) of the European Commission supports European regional and local authorities to prepare and plan their adaptation pathways to climate resilience. It aims at facilitating a community of practice and delivering technical assistance to use existing climate vulnerability and risk assessments to develop climate adaptation plans, identify appropriate climate adaptation demonstration projects and stimulate engagement and mobilization of citizens and stakeholders. As the Platform develops and the topic of overshoot gains more prominence, we expect useful resources to be collected there.

4.2. In which contexts is this particularly relevant?

The Overshoot Proofing Methodology is not the first methodology to turn to if you are new to adaptation planning. It is indeed seen as an additional step that can be taken once the process described in the Adaptation Support Tool has been covered. There are nevertheless some cases in which the Overshoot Proofing Methodology is particularly relevant.

Ecosystem-based solutions are often described as 'win-win options' contributing to adaptation while also providing benefits to other social, environmental or economic goals. However, the adaptation limits are also particularly likely for these types of adaptation options. Indeed, the IPCC states that: "Above 1.5°C global warming level, some Ecosystem-based Adaptation measures will lose their effectiveness in providing benefits to people as these ecosystems will reach hard adaptation limits (*high confidence*)" (AR6, SPM WGII, C3.3). In this case it is therefore essential to look into the potential future limits of adaptation options selected. For example, if trees are being planted to adapt to

increasing heat in an urban setting, it is important to look into how heat resistant the tree species being selected are.

Adaptation projects linked to the sector of infrastructure that often require large budgets and long-term planning would also particularly benefit from looking into the potential impacts of overshoot scenarios to avoid maladaptation.

4.3. Future avenues for policy-making

Through interactions, workshops and interviews with a wide array of stakeholders in the context of the PROVIDE project, we identify a need for awareness raising and capacity building around not only the topic of overshoot, but also adaptation limits, impact irreversibility and uncertainty around impact projections. Despite the limited research available on limits to adaptation, future standardization of certain adaptation thresholds and limits would ease adaptation planning and the consideration of the latter. This was confirmed by EU policy-makers at our latest workshop in Brussels in September 2023. We also noted the need for further guidance on what future scenarios to consider when conducting risk assessments and particularly for long-term adaptation planning.