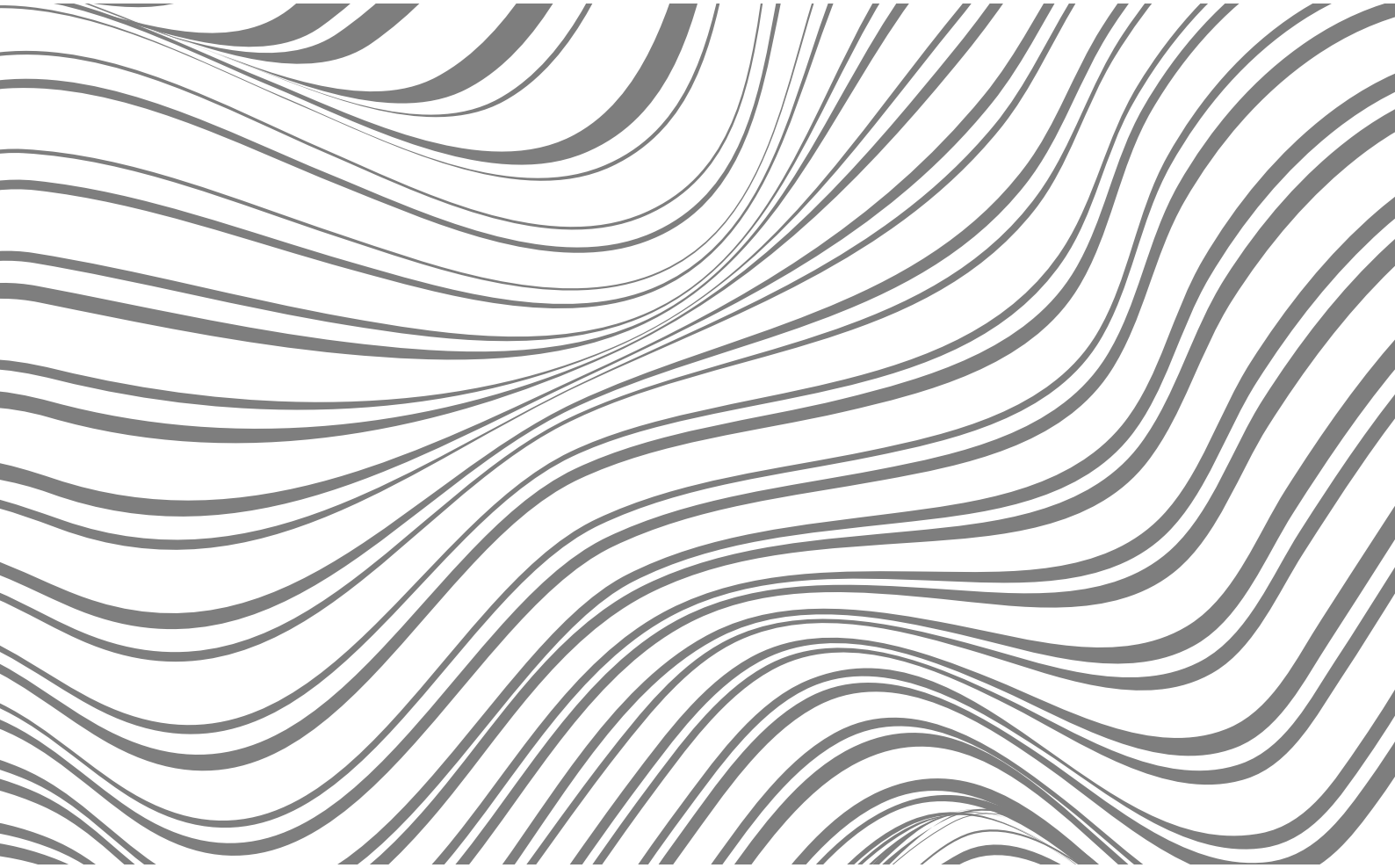
Climate risk storylines: Navigating the uncertainties of climate change

Guidelines for humanitarian practitioners



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Summary:

Integrating climate information into humanitarian decision-making involves navigating significant uncertainties and complexities. In this guidance we describe an approach to facilitating climate-risk navigation. The approach builds on academic research in the areas of climate narrative, storylines, and forensic investigations of disasters (e.g. Jack et al., 2020, van den Hurk et al., 2023) while focusing on the unique challenges and modalities of decision-making in the humanitarian sector. The approach has been developed and continues to be refined by the Red Cross Red Crescent Climate Centre ("the Climate Centre"). Example applications of the approach and the associated outcomes and learning are presented to inspire further applications and refinement.

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1. Storylines as a concept

Background

Climate extremes have always impacted the most exposed and vulnerable people, who are often those the humanitarian sector is striving to support. Many humanitarian crises are either directly caused by, or exacerbated by, climate extremes such as tropical cyclones, floods, and drought. Additionally, the 6th Intergovernmental Panel on Climate Change assessment report (IPCC 2023) concluded that the world is already experiencing the impacts of climate change in the form of increasing intensity and frequency of extreme climate events such as floods, droughts and heatwaves, and there is overwhelming evidence that regardless of global ambitions on emissions reductions, these trends will continue for the next several decades. As a result, many humanitarian organizations are increasingly concerned about, and implementing responses to, the exacerbating impacts of climate on the most vulnerable communities.

However, humanitarian contexts are generally highly dynamic and complex, and humanitarian action has traditionally been responsive rather than anticipatory. While over the past decade there has been a shift towards Anticipatory Action (AA) (Coughlan de Perez, et al., 2015) for rapid onset (e.g. flooding) as well as slower onset (drought) climate, managing climate risk in humanitarian contexts across both short and longer (multi-decadal) timescales remains a significant challenge.

Broadly speaking, the challenge falls into two categories:

1. *Uncertainty around what climate events are going to happen and when.* While weather and climate is inherently unpredictable beyond a few months into the future, climate change adds further uncertainties, especially around changes related to rainfall. We are starting to experience events of unprecedented magnitude, meaning that the past is no longer a good model of the future.

2. *The complexity of the cascading and compounding impacts of climate extremes.* In humanitarian contexts, climate extremes typically compound with other crises such as conflict, displacement, or pre-existing food insecurity. Furthermore, initial direct impacts such as damage to infrastructure, cascades into further impacts such as loss of livelihoods, education, and increased vulnerability.

Managing climate risks in humanitarian contexts requires approaches that support building evidence and understanding of complex and cascading impacts while engaging directly with the key climate, and non-climate, uncertainties involved.

The storylines concept

The term storyline has been used to describe a range of methods and approaches (Baldissera et al., 2024). In the glossary of the AR6 Working Group I report, storylines are defined as:

> *"A way of making sense of a situation or a series of events through the construction of a set of explanatory elements. Usually, it is built on logical or causal reasoning. In climate research the term storyline is used both in connection to scenarios as related to a future trajectory of the climate and human systems or to a weather or climate event. In this context, storylines can be used to describe plural, conditional possible futures or explanations of a current situation, in contrast to single, definitive futures or explanations."*

Storylines are increasingly used in the climate science community to quantify and describe past and future events and their impacts. Methods are often based on physical climate and scenario storylines.

WGI of the IPCC defines both physical climate storylines and scenario storylines (IPCC 2021):

Physical climate storylines	A self-consistent and plausible unfolding of a physical trajectory of the climate system, or a weather or climate event, on time scales from hours to multiple decades (Shepherd et al., 2018). Through this, storylines explore, illustrate and communicate uncertainties in the climate system response to forcing and in internal variability.
Scenario storylines	A narrative description of a scenario (or family of scenarios), highlighting the main scenario characteristics, relationships between key driving forces and the dynamics of their evolution.

Both physical climate storylines and scenarios storylines offer the possibility of addressing aspects of the two challenges detailed above:

- Questions related to plausible climate outcomes and uncertainty of those outcomes. For example, what future rainfall changes should we anticipate?
- Questions related to the implications of the future climate. For example, what would be the impact of changes in rainfall extremes across different sectors and in combination with other risk drivers/hazards of concern such as conflict, migration, or epidemics?

Physical climate storylines are more aligned with the first category of question related to plausible physical climate futures or events. *Scenario storylines* are more aligned with the second category related to how climate hazards compound and cascade to produce multiple impacts over different timescales.

The storylines approach described here draws on both physical climate storylines and scenario storylines. The approach draws on multiple types and sources of evidence, including expert insights, which traditional probabilistic methods might exclude. Through this, storylines explore, illustrate and communicate uncertainties in the climate system response to forcing and in internal variability.

In our application in the humanitarian sector, **we focus on identifying plausible, evidence-based causal storylines and, through these, developing understanding of complex, compounding, and highly uncertain systems or contexts.** The goal of the storylines is to help decision makers translate uncertain climate projections into more tangible plausible outcomes or scenarios.

Characteristics of storylines

Here we unpack some of these principles or characteristics further. We consider storylines to have the following important characteristics:

Plausible: Storylines aim to represent plausible explanations in the face of uncertainty. Where evidence is uncertain or contested, multiple storyline explanations can be developed and further explored which may or may not resolve uncertainties. Storylines do not aim to quantify the probability of a particular explanation; however, storylines can be complementary and even guide probabilistic approaches.

Evidence-based: Storylines are not imagined; they are grounded in evidence of different types, including expert judgement. They consider both quantitative statistics as well as expert and lived experiences in determining the plausibility of a particular storyline (e.g. modelling might indicate that rainfall reduction reduces crop yield by 30 per cent, but in practice farmers avoid these losses by using traditional knowledge systems).

Causal: Storylines are based on identifying causal relationships between different elements (e.g. rainfall and crop yields) while also recognizing that correlation is not causation and assessing causality can be complex, especially where there is limited or contested evidence. A critical example of this complexity and nuance is the relationship between climate and conflict.

Complex and compounding: Storylines describe potentially causal relationships between different elements, and these relationships can readily describe complex and compounding interactions. Multiple lines of evidence can identify thresholds and non-linear relationships within the explanation. For example, Household Economic Analysis (HEA) can provide evidence of critical thresholds in rural livelihoods (Young et al., 2021).

Complementary: It is important to note that storyline approaches do not replace other approaches but in many cases are complementary. A storyline approach to understanding climate change impacts on rural livelihoods, for example, does not replace econometric approaches or crop-modelling studies. Rather, storyline approaches can help frame and refine other studies by identifying important uncertainties where more understanding is required, or they can provide descriptions of plausible climate outcomes that can be used in policy developments, scenario assessments, or many other applications. Storylines also depend on evidence from other approaches such as climate model scenarios and impact modelling.

Storylines do not provide predictions of what will happen when. They are not forecasts; they are learning tools to help us manage and make decisions in the face of large uncertainties about the future.

However, storylines approaches including impact pathways and complex risk frameworks offer an important alternative approach and potentially provide more robust and valuable understanding of risk, as well as better supporting the development of effective interventions. With this they are also valuable for the humanitarian sector.

Climate-risk storylines

Building on related work, we have explored an approach that involves elements of climate impact pathways and physical climate storylines to construct *climate-risk storylines*. The approach involves developing causal maps describing potential climate impact pathways within a particular context. The maps are informed by a combination of retrospective analysis of past crises, prior research and associated literature, and expert or local lived experience. Climate science evidence including climate projections are used to construct plausible climate storylines. Often two or three storylines are constructed representing key uncertainties (e.g. increasing or decreasing rainfall). Finally, climate-risk storylines are developed by tracing the physical climate storylines through the causal maps and considering the cascading and compounding impacts including compounding non-climate factors.

We emphasize that this approach is designed to explore and integrate knowledge rather than to provide definitive predictions. With this emphasis in mind and in order to incorporate expert and local lived experience, ideally climate-risk storylines should be developed together with representatives from these communities.

2. Storylines in humanitarian practice: two applications

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Example 1: El Niño storylines and plausible climate futures for the Indo-Pacific region

Using climate-risk storylines to explore how to navigate alternative adaptation approaches under complex future scenarios

Summary of the project:

- The Indo-Pacific region faces a complex array of risk resulting from the interplay of climate change impacts combined with phenomena such as El Niño Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD). This is combined with the risks many communities face relating to contexts of fragility, conflict and violence (FCV)
- The Climate Centre was commissioned by the United Kingdom's Foreign Commonwealth and Development Office (FCDO) to develop a storyline-based approach to produce an alternative understanding of the how the interactions between ENSO, IOD and climate change will impact the region across various sectors for three distinct parts (four states in eastern India, the central dry zone of Myanmar, and the Lower Mekong) of the Indo-Pacific region.
- The storyline methodology employed in this project allowed for the development of:
  1. Five reports (a summary report, three regional case reports, and a methodology report) which outlined the whole project and its outcomes
  2. Impact storylines for each of the three outlined geographical regions
  3. Causal maps depicting the impacts under each storyline according to four typologies
  4. Workshops to incorporate expert feedback from experienced FCDO practitioners in the region.

Why? Using available evidence on projected climatic changes and impacts to guide current and future policy- and decision-making is a complex but critically important process. Given the numerous uncontrollable and unpredictable human and natural variables, it is inherently difficult to produce defensible probabilistic forecasts that can guide decision-making. Thus, it is necessary to explore alternative approaches to navigating future plausible scenarios.

What/ When/ Where? Acknowledging this need for an alternative understanding of future impact scenarios, the project El Niño Storylines and Plausible Climate Futures for the Indo-Pacific was commissioned in 2024 by the FCDO. The research adopted a storyline approach and was led by the Climate Centre's multidisciplinary climate and conflict team.

How? The research applied a climate-risk storylines approach to understand the likely implications of a complex combination of the interplay between El Niño phase of ENSO and the IOD on the socio-economic elements of health, mobility, trade, and security. The investigation focused on the three Indo-Pacific areas over the short term (up to ten years) and longer term, the latter depicting 2°C of global warming.

Impact storylines for alternative understandings of complex futures

This project presents an important example of how impact storyline methodology can be applied to understand plausible climate futures of uncertain, complex interactions between varying factors. ENSO and IOD are two significant drivers of climate variability in the Indo-Pacific region. Understanding their interaction through the lens of a warming world is critical in informing actions that will impact the well-being, security and development of the region, especially in contexts of FCV.. The added complexity of incorporating climate drivers such as ENSO and IOD compounds the challenges routinely faced in the process of producing probabilistic climatological forecasts to guide decision-making. The storyline approach was utilized in this project as a way of offering an alternative approach to supporting government actors such as the FCDO in navigating future scenarios worldwide.

A multi-phase interdisciplinary methodological process for developing an understanding of complex future interactions and adaptation

The project developed a multi-phase methodology in which each component built on the previous one and relied on the careful coordination between physical and social science. The process is depicted in Figure 1 below. The following outlines the unique methodology for tackling questions about the complex climatic drivers of a warming world.

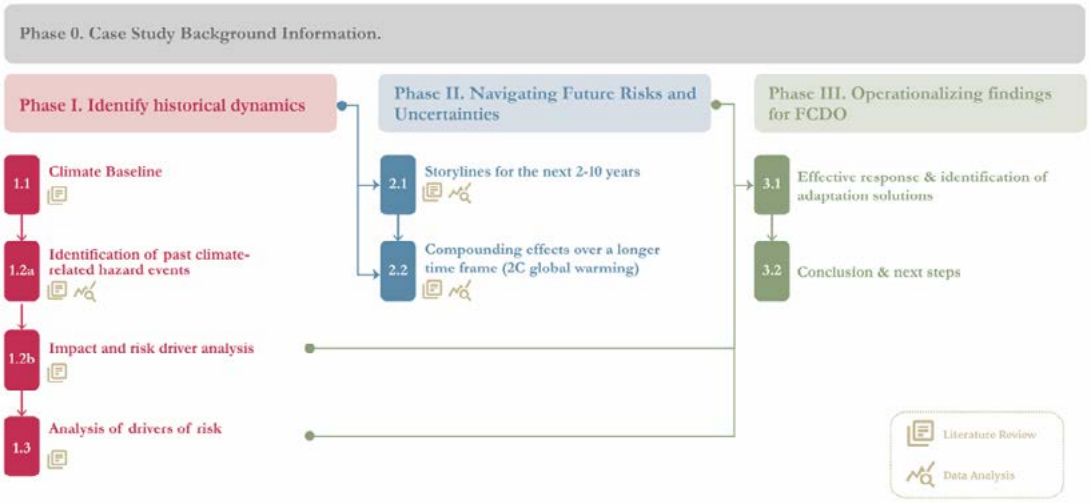

Figure 1.
Multi-phase methodology.

For more details on each of the phases presented in the figure above, the methodology report from this series dives into further detail of how each was carried out. There are several elements that are important to highlight in this document as they provide insight into the uniqueness of such an approach and how it can be used to support humanitarian actions going forward.

An opportunity for multi-method collaboration through cross-disciplinary retrospective analysis

This project presents an interesting case in which it is possible to see the connections between understanding the socio-economic evidence and the science evidence in a given research context.

Phase 1 exemplifies how combining an analysis of the historical climate events in each region with a retrospective analysis of the impacts those events had can produce nuanced understandings of the past to help guide the future.

Through identifying historical climate patterns and exploring the impacts on the human security of populations across the lenses of inquiry (health, trade, mobility and security), it was possible to see the foundations of cross-disciplinary collaboration between the scientific, quantitative approach and social, qualitative narrative-based understandings.

The figure below depicts the foundations of this approach for the Mandalay region of Myanmar, showing the basis of a longer, more nuanced analysis which then led to the creation of a series of causal maps.

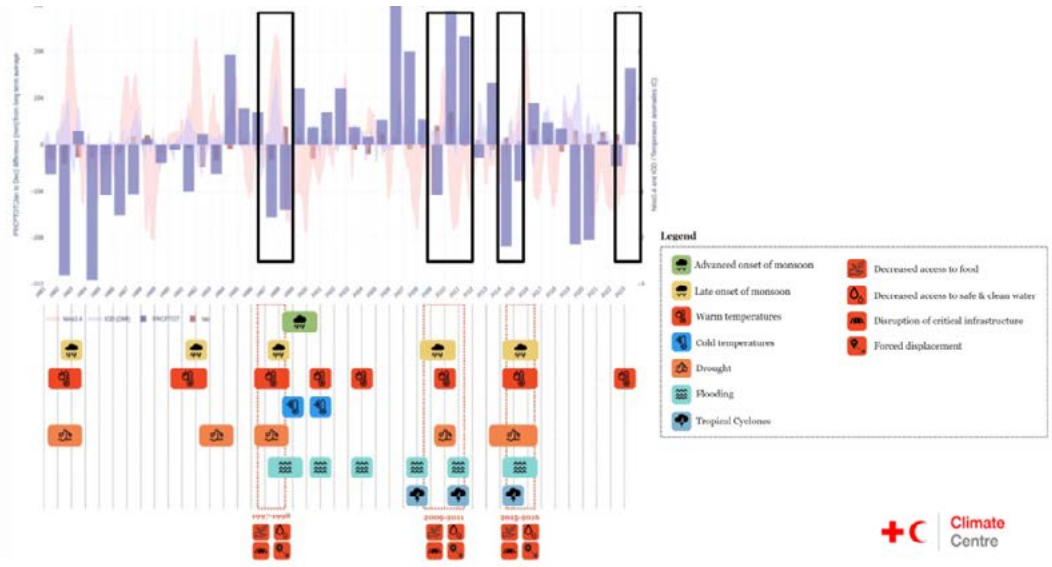

Figure 2.
Time series of historical climate and impacts in Mandalay, Myanmar.

The role of iterative processes based on feedback and contextual experience

The role that participatory processes have in this methodology is critical. Unlike traditional methods of disseminating information, the storylines methodology builds on the capacity of participants to reimagine and co-create shared future pathways, and analyse gaps in current ways of working, and carves out a space for group processes and thinking to go towards deeper, more in-depth and out-of-the-box thinking. For future iterations, there could be benefit in considering the importance of allocating time and space for engaging in such a way to allow for depth of engagement and pushing of traditional boundaries of thinking and planning which address the complex, systemic and compounding nature of challenges such as those addressed in this report series.

Adopting the storylines methodology to bring a multidimensional, systems thinking perspective into the analysis of climate impacts in settings of FCV

Through this project, the Climate Centre combined different methodological approaches to develop robust and innovative ways to understand the complexity of risk under a changing climate. This methodology offers novelty as it integrates different aspects of human security as a pathway to understand the growing risks related to climate security. Climate security is not a new field, but bringing a more multidimensional and systems thinking perspective into the analysis offers a new way to understand what the future could hold if the planet continues warming; especially considering that already fragile societies and environments face consequences that can be a threat to peace and security at different levels of society. From a development and humanitarian perspective, understanding these plausible complex future risks is critical to developing policies that are fit for purpose, as well as investments and capacities to protect development gains, reduce risks, anticipate crisis, and respond and recover effectively.

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Example 2: The International Committee of the Red Cross Climate Profiles

Applying the climate-risk storyline methodology to highlight risk across specific sectors in FCV contexts

Summary of the project:

- The ICRC works in FCV situations across a multitude of sectors. Incorporating climate change is of critical importance to the ICRC, but this means working in conflict-sensitive ways across thematic areas with differing delegation needs.
- To address the increasing role that climate change plays in its operations, the ICRC adopted a framework for the integration of climate risks into its operations. The Climate Centre was tasked with developing 20 climate profiles to be shared with delegations and which will inform annual and long-term planning.
- The storyline methodology employed in this project allowed for the development of:
  1. 20 climate profiles centred around plausible climate impact storylines
  2. A way of informing humanitarian actors on key areas of concern and highlighting planning next steps in the context of a fast-changing world.
  3. Profiles which form the basis for training, discussion and planning.

Why? If a large organisation such as the ICRC is going to be able to incorporate climate impacts into its work, it needs to offer each delegation a way of quickly and effectively understanding the risks and associated uncertainties that they will face. Doing so in a way that is not based on narrow predictions, and which incorporates the broad element of variables at play in each sector of work is extremely difficult. Applying a storylines approach here allows the flexibility needed to inform, inspire and illustrate uncertainties.

What/ When/ Where? The Climate Centre was tasked with developing a series of climate profiles for the ICRC's climate framework – part of a larger effort that combined sharing information with capacity-building for the Red Cross Red Crescent Movement. Over the course of a year, 20 profiles were developed and shared with delegations.

How? A two-part methodology was employed consisting of the development of climate hazard-based storylines, and the incorporation of resulting compounding and cascading impacts. These two phases were complementary, building on one another and allowing for expert teams to provide relevant input.

Application of climate-risk storyline methodology for the development of the climate profiles

Phase 1: Development of climate hazard-based storylines

Climate scenario storylines normally start with an initial set of physical climate storylines. Even without more sophisticated approaches that disaggregate sources of uncertainty (e.g. Zappa and Shepherd, 2017) it is defensible to use climate model ensembles (e.g. CMIP6 ensemble projections), downscaled projections (e.g. CORDEX), large ensembles of seasonal forecasts (Coughlan de Perez et al., 2023) and other climate science literature, to construct physically plausible climate change storylines. Here we also note the inherent limitations of global climate model ensembles (Nissan et al., 2019) and so assessment of other studies and evidence is important.

In almost all contexts, changes in total seasonal rainfall (combined with changes in seasonal onset and cessation) are the main source of climate system uncertainty and so the storylines should represent this uncertainty. This often means two or three storylines ranging from increasing average rainfall through to decreasing average rainfall. It is important to assess the magnitude and significance of changes. In some cases, studies might derive very small changes that are well within the range of natural variability, even when averaged over several decades. A change in rainfall of 5 per cent by mid-century is almost certainly equivalent to no change in rainfall.

The storylines can be further extended by considering other variables and statistics and how they could plausibly evolve within each storyline. Rainfall intensity is a good example where there is often evidence from climate science, and which is also a key driver of impacts. Thermodynamic principles provide a strong basis for increasing rainfall intensity in many contexts, especially in the tropics and sub-tropics, regardless of other regional climate system shifts. This means that even within a drying storyline there is often a good basis for including increasing intensity of rainfall events, though the frequency of rainfall events may reduce.

Lastly, while two or three storylines are recommended as a good balance between representing uncertainty and a comprehensible number of scenarios, it is clearly impossible to represent all uncertainties within this limited number. Different combinations of changes in rainfall combined with plausible changes in temperature, seasonal onset and cessation, extremes, etc. can rapidly become a challenge. Here we recommend transparent risk framing. By this we mean focusing on changes with potential negative implications but being explicit that this is the approach being taken. For example, we might develop a storyline for the Sahel that describes increasing average rainfall but associated with late monsoon onset but more intense monsoon rainfall. Shifts in onset may be uncertain, but late onset and a more intense wet season is more likely to increase risks in the region and so it is most valuable to highlight this plausible storyline.

Storyline 1: Hotter and no rainfall change

Under this storyline average and extreme temperatures continue to increase through the next 20-30 years and beyond. By the 2050s average yearly temperatures are between 1.7°C and 1.9°C higher across the country compared to the recent past (1995-2014) with the largest increases between July and October.

Hot summers in the southern regions with extreme temperatures above 40°C are even hotter, with the number of hot days above 40°C between June and August increases to more than 80 days around 2050 in Nimroz, Hilmand, Kandahar and more than 75 days in in Farah and Kandahar. In the cooler central and northern regions, summers also become warmer, but are less hot than in southern regions. In Badakhshan maximum temperatures reach 27°C, in Baghlan 29 °C, and in Ghor 35 °C.

Rainfall continues to show strong seasonality with the highest amounts between November and May and a dry summer with hardly any precipitation from June to September. Highest rainfall amounts remain in the mountainous north-east region Badakhshan with around 130 mm in April. The southern regions Nimroz, Hilmand, Kandahar remain dry with rainfall amounts of around 15mm in the winter seasons.

Regardless of change in long term average rainfall and temperature, inter-annual variability of precipitation is projected to increase. Therefore, both droughts during cycles of unusually dry seasons and floods during wetter wet seasons should be anticipated.

The increase in temperature will lead to increased heat stress for people and nature. Furthermore, water stress will increase outside the rainy season due to higher temperatures which increase evapotranspiration, particularly in the drier southern regions. In the central regions humid heat stress is also likely to increase at the beginning and end of the rainy season when temperatures are high.

Figure 3.
Example of one storyline on Afghanistan developed for ICRC climate profiles.

Phase 2: Incorporation of compounding and cascading impacts

Building on the initial climate storylines, the impact across different sectors can be developed from the literature and impact assessments as well as local expertise. Information on the impacts of past events within the region is also an invaluable source of evidence. This is especially the case where we are interested in compounding and cascading impacts. This is also where there are strong methodological and evidence links with event forensic approaches.

But it is important to be cautious about generalizing. Sometimes impacts occur because of very local factors and very specific antecedent conditions, so we cannot always conclude the same impacts will unfold elsewhere in the future. For example, health crises may have a climate driver such as heavy rainfall and flooding, but also be driven by access to water, poor health services and poverty. The analysis allows us to determine plausible context-specific future impacts. The results can be summarized in text and visualized with various graphics including maps. Ideally, they should be also shared and discussed with the local stakeholders.

Storylines as outputs that form the foundation for other climate-oriented action

One of the interesting elements of this project is that the storylines and climate profiles produced can act as building blocks to support wider adoption of the ICRC climate framework and progressing the organization towards more climate-oriented action. The storylines have not only served as a reference document but have also been incorporated into discussions on the future of the delegations' work and planning and interactive story-map tools but have also shaped capacity-building and strengthening training and webinars.

Learning from the two applications

The two applications above illustrate the opportunities that the storylines methodology offers to address complex risks. However, we also experienced some challenges that suggest further development:

- Although we would advocate involving stakeholders at the earliest stage to co-develop storylines, time and budget constraints often hinder engagement. In Case Study 2, stakeholders were mainly involved in validating the conceptual model; in Case Study 1, stakeholders were involved in knowledge sharing. An iterative process with stakeholders would support the co-production and make the applications even more context-specific and useful.

- Visualisation of causal maps is challenging as they often grow to become large and complex. Approaches to simplifying visualisation and navigation should be further explored including aggregating some sections of the map into logical groups (e.g. health-related elements).

- The evidence supporting connections in the maps varies significantly in type and strength. The current approach to mapping does not indicate types of strength of evidence. Possible approaches include using line weight or colours to indicate strength of evidence and types of evidence. Further approaches could be explored to indicate positive and negative drivers.

3. Applying the storyline methodology: A decision-making framework

Storylines should be

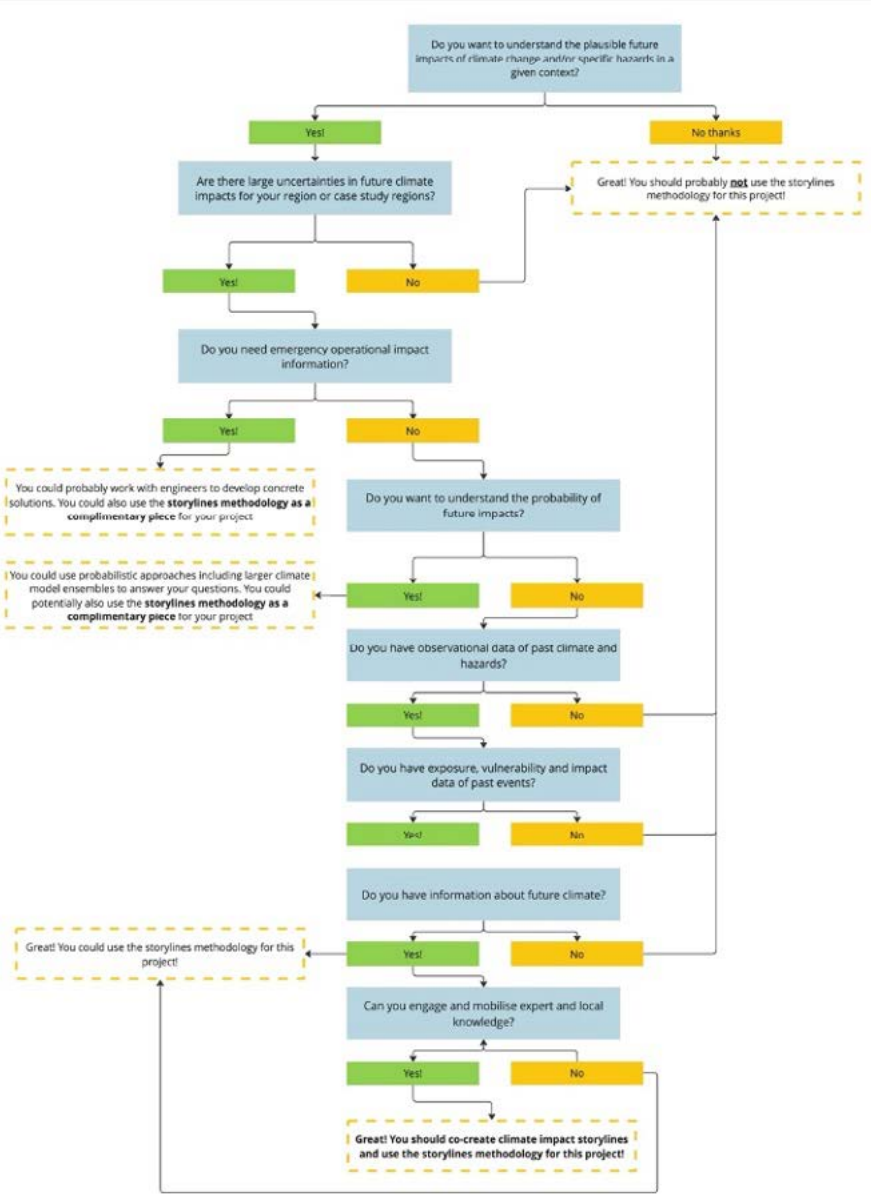
1. **Contextually appropriate**
2. **Co-produced**
3. **Interdisciplinary.**

The decision tree (Figure 5) highlights some of the potential questions that could guide practitioners whether the storyline methodology is appropriate for their project. However, as this also depends on the context it should not be seen as an ultimate standard.

For example, storylines can be constructed that represent very extreme or worst-case scenario events that would have low probability but potentially produce very large impacts, or less extreme but high probability, depending on the decision context. These would produce interesting discussions and spark thinking about climate change impacts and action in a way they might not have before; but that might not be the goal of your work.

Therefore, ideally **climate-risk storylines should be designed together with stakeholders**. Depending on the timeline and budget of the project stakeholders could be involved at various stages (see Figure 6). However, it is important to note that the storyline methodology is not applicable to all types of questions and projects (see Figure 4).

Figure 4. Guidance on the use of storylines methodology for projects.



A shorthand guide to developing climate-risk storylines

The Climate Centre is focusing on the development of climate-risk storylines that capture the interplay between exposure and vulnerability and highlights potential impacts of hazards. Once it has been determined that the underlying question and decision context make sense for the storyline methodology, the following steps can be used as guidance for how to proceed.

Step 1. Decide on places and issues of concern

Different organizations have different focus areas and issues of concern

- For example, the focus may be on rural smallholder farmers and their livelihoods.
- In order for the risk storylines to be useful they need to primarily focus on evidence and causality related to this focus, while highlighting how risk connects issues outside of the focus (e.g. urban growth) with issues within focus (e.g. rural livelihoods).

Step 2. Identification of impactful past events

Identify impactful climate-related past events

- The focus should be on impact and potential climate hazards. At this point it may be unclear if the climate hazard contributed to the impact.
- We may identify a food-price crisis that was preceded by a drought. It may emerge that the drought was a small or insignificant factor and global food markets were the primary driver.

Step 3: Identification of event impact data and possible relations using both quantitative and qualitative information

Assemble as many datasets on impacts as possible, as well as existing studies or research outputs related to the events to identify possible relationships

- These could include crop yields, vegetation indices, number of livestock, water supply, market prices, health system indicators, macro and micro-economics, household surveys.
- Time-series indicators can be plotted alongside or against climate indicators to identify possible relationships. Formal correlations can be included using full time series samples (i.e. not just the selected event), but these correlations may not be strong outside of extreme events.
- It is important to consider time-delayed relationships as often impacts take time to emerge. Market commodity prices are a good example. Low rainfall may only impact market prices after more than a year only after harvesting and once reserves are depleted; demand rises but supplies are constrained.
- Compound hazards and the timing of hazards should be analysed as this can strongly affect exposure, vulnerability and impacts. Extensive flooding after several years of poor rainfall can produce much larger impacts than flooding after several years of good rainfall. Flooding during the harvest season can produce higher impacts than before.
- Non-climate related compounding factors such as displacement and conflict can also strongly affect climate-related impacts. An understanding these relationships often requires drawing on other studies or undertaken focused analyses.

Step 4: Develop conceptual models

To better understand and visualize systemic relationship between drivers, system dynamics models such as causal feedback loops or systems maps are central

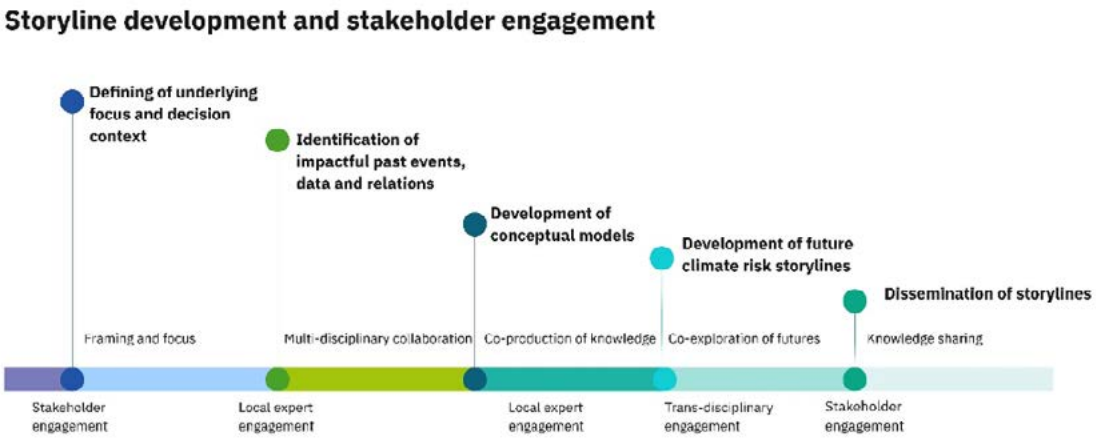
- By doing this, risk pathways can be highlighted, and the system diagrams can highlight plausible future impacts.
- These diagrams can form a fundamental part of the stakeholder engagement and consultation and can present a useful way of visualising connections.

Step 5: Examine how future climate change and other drivers may alter future impacts

Incorporate future climate change and other risk drivers into your storylines (ensure you have not missed any other environmental, social or political drivers) which may play a role in the narratives you have created

- Make use of the climate-risk concept around hazard, exposure, vulnerability and response to make sure that risk is well presented.
- Ideally, all these steps involve co-production with local experts and both stakeholders affected by the climate impacts and those using the storylines to make decisions. Therefore, when designing storyline projects, this needs to be considered both in terms of time and funding.

Figure 5. Overview of storylines development and stakeholder engagement.



4. Closing reflections

Storylines offer avenues to include vulnerability, response and exposure besides climate-related hazards to estimate possible future risks and impacts. They can be powerful tools to prepare for unprecedented events in the long term and to enable long-term adaptation to plausible future impacts where climate projections are particularly uncertain.

Furthermore, they allow practitioners to have a more people-centred approach by considering the local context such as livelihood strategies and impacts for people. As humanitarian actions often take place in the most vulnerable regions of the world the incorporation of the local people is key.

In summary, the development of and engagement with storylines enables:

- The understanding of uncertainty by setting information in context (combining local and climate science information across all risk components) and thus improve risk awareness.
- The understanding of causality by exemplifying how risk components interact in a given context.
- The provision of information about plausible future risks (a given location can experience more droughts and more floods at the same time – similar to impact pathways) and with this provide decision options.
- The estimation of the full range of plausible impacts and a focus on unprecedented, low-likelihood high-impact events.
- Causal attribution (vs risk ratio attribution) of past events (similar to forensic studies).
- Long-term adaptation planning/pathways (decades/centuries).

To make the best use of the storylines methodology, it is essential for the humanitarian sector to:

1. Understand what they are and what they are not.
2. Develop new ways to co-create this information across climate science, stakeholders and humanitarian actors.
3. Strengthen the incorporation of information on exposure, vulnerability and response in decision-making, rather than focusing on climate-related hazards, to better understand system dynamics.
4. Explore how the information provided can be best used and communicated to guide better long-term decisions.

The co-creation of context-specific storylines might be key for to long-term application of storylines. Further efforts have to be undertaken to consider all risk components into plausible futures, such as the role of seasonality and livelihoods strategies. Storylines can serve as starting point for a discussion on climate risk and impacts with different stakeholders.

Using storylines requires a paradigm shift in the communication of climate risk in the humanitarian sector. In order to efficiently communicate storylines, diverse approaches should be explored to make sure that they are understood as tools for plausible futures, not as predictions for the future. Simplified infographics can be valuable, and visualization tools like story maps, designed to illustrate impact pathways, offer tools for an interactive visualization.

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