



Exploring preconditions for effective global responses to climate change

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23 April 2020, Motu Webinar



Professional experience

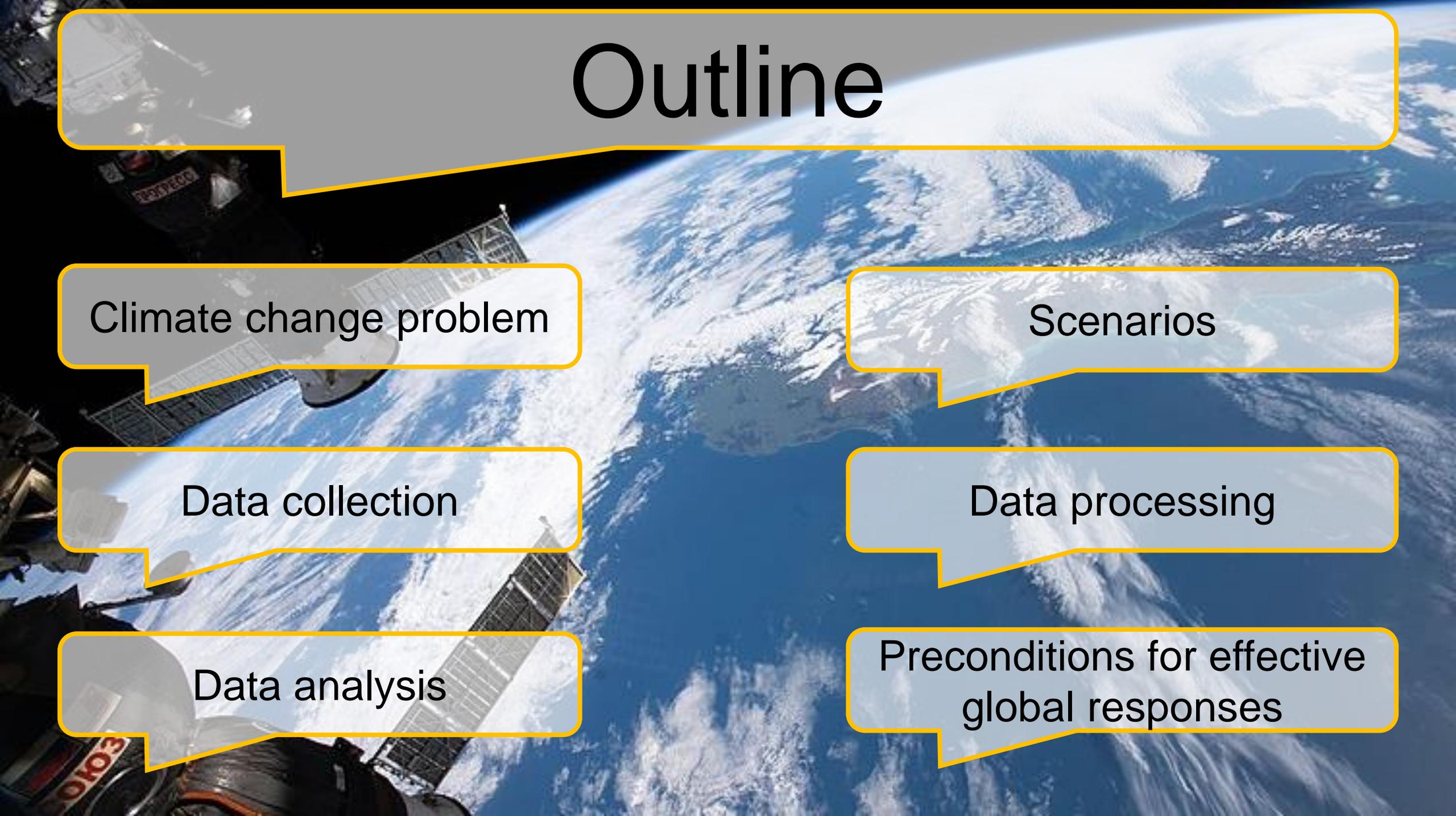
Environment Canterbury | Field technician
Statistics New Zealand | Environmental-economic accounts
United Nations Statistics Division | Environment statistics
African Climate Policy Centre | Programme management
African Centre for Statistics | Economic statistics
African Minerals Development Centre | Geological information

Academic training

University of Canterbury BSc, MSc | Geology
Massey University PGDipDevStud | Development studies
University College London, Doctoral Candidate | STEaPP

Doctoral Candidate | University College London | Department of Science, Technology, Engineering and Public Policy
Solar Subgroup Lead | Expert Group on Resource Management | United Nations Economic Commission for Europe
Founder and Director | Tiaki Institute

Outline



Climate change problem

Data collection

Data analysis

Scenarios

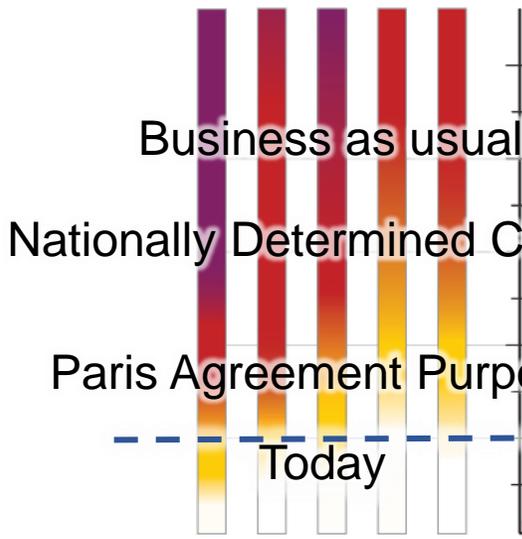
Data processing

Preconditions for effective
global responses

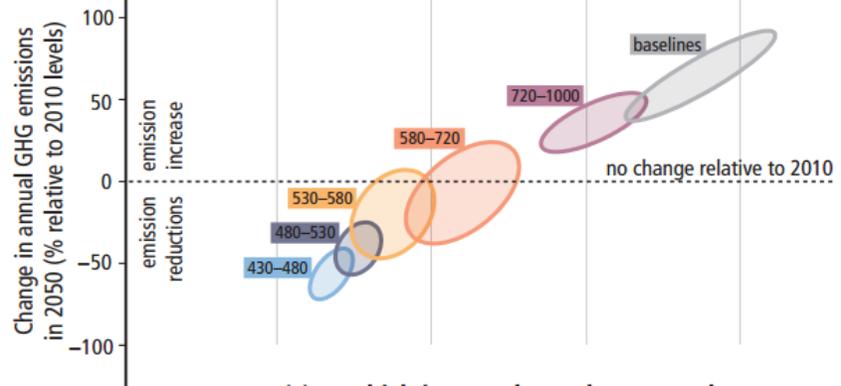
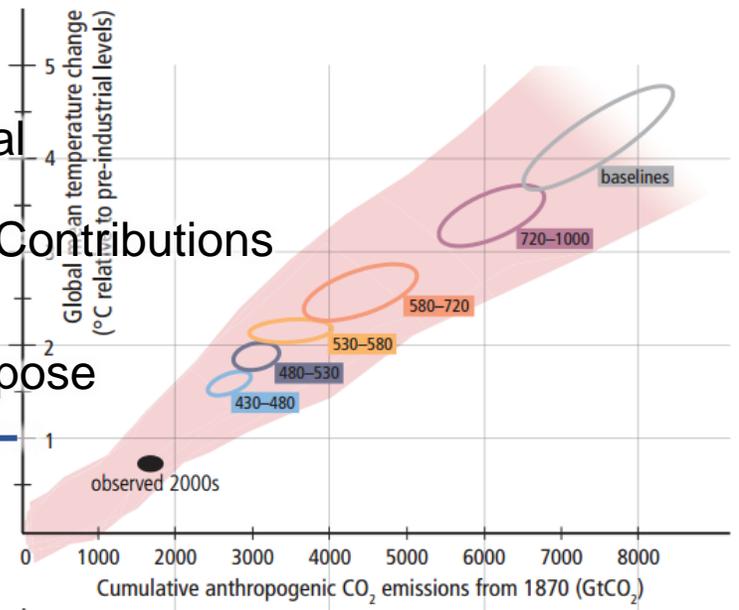


Background

(a) Risks from climate change...



(b) ...depend on cumulative CO₂ emissions...



(c) ...which in turn depend on annual GHG emissions over the next decades

Three years to safeguard our climate



Christiana Figueres
Hans Joachim Schellnhuber
Gail Whiteman
Johan Rockström
Anthony Hobley
Stefan Rahmstorf
Nature, 2017,
Vol.546(7660), p.593



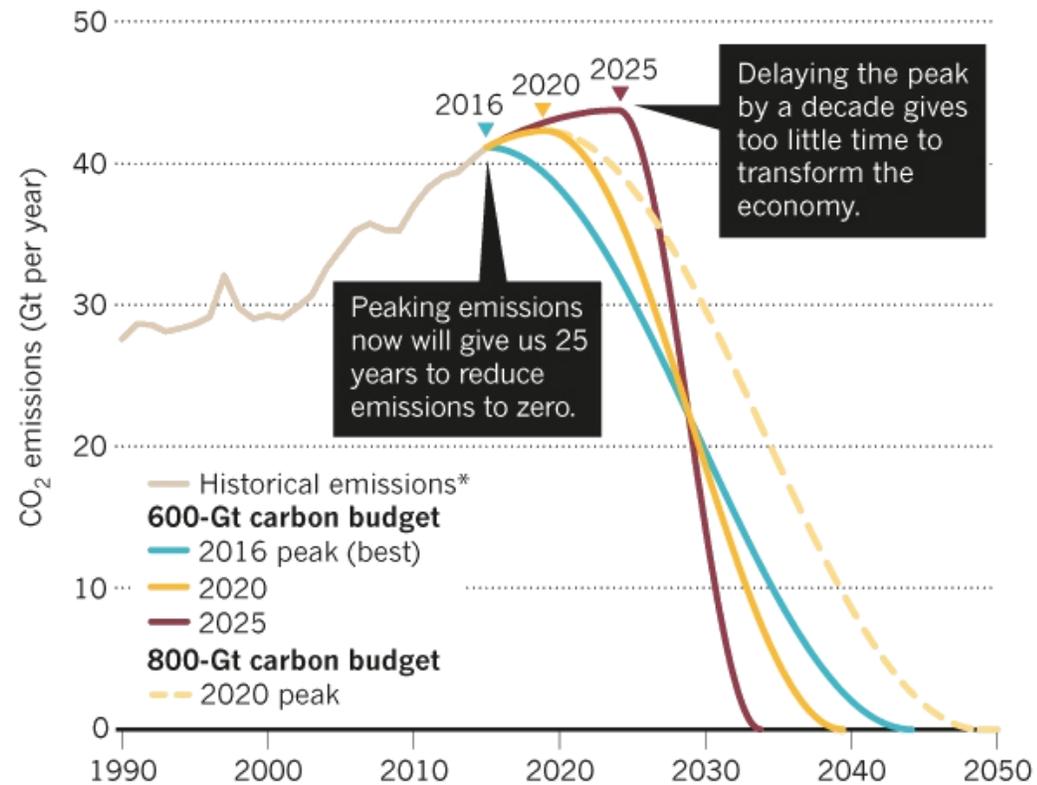
Three years to safeguard our climate

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UN Photo/Sarah Fretwell

CARBON CRUNCH

There is a mean budget of around 600 gigatonnes (Gt) of carbon dioxide left to emit before the planet warms dangerously, by more than 1.5–2°C. Stretching the budget to 800 Gt buys another 10 years, but at a greater risk of exceeding the temperature limit.



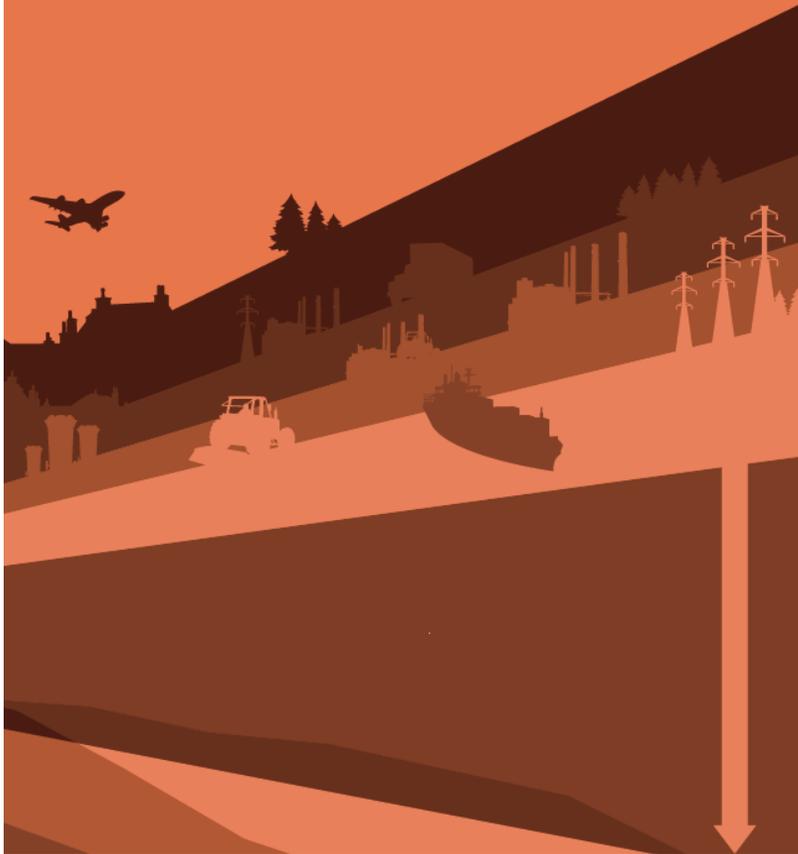
©nature

*Data from The Global Carbon Project.



The Emissions Gap Report 2016

A UNEP Synthesis Report



As in the earlier Emissions Gap Reports, it is important to highlight that most scenarios that are available in the literature, and that limit warming to below 2 or 1.5°C, assume the use of so-called **negative emissions technologies** in the second half of the century -- that is the active and permanent removal of carbon dioxide from the atmosphere.



CLIMATE REALITY CHECK

WE HAVE THE
SOLUTIONS TO PREVENT
CATASTROPHIC
CLIMATE CHANGE

- ☀️ Paris Agreement
- ☀️ Affordable renewable energy
- ☀️ Business investment
- ☀️ Public support
- ☀️ Technology

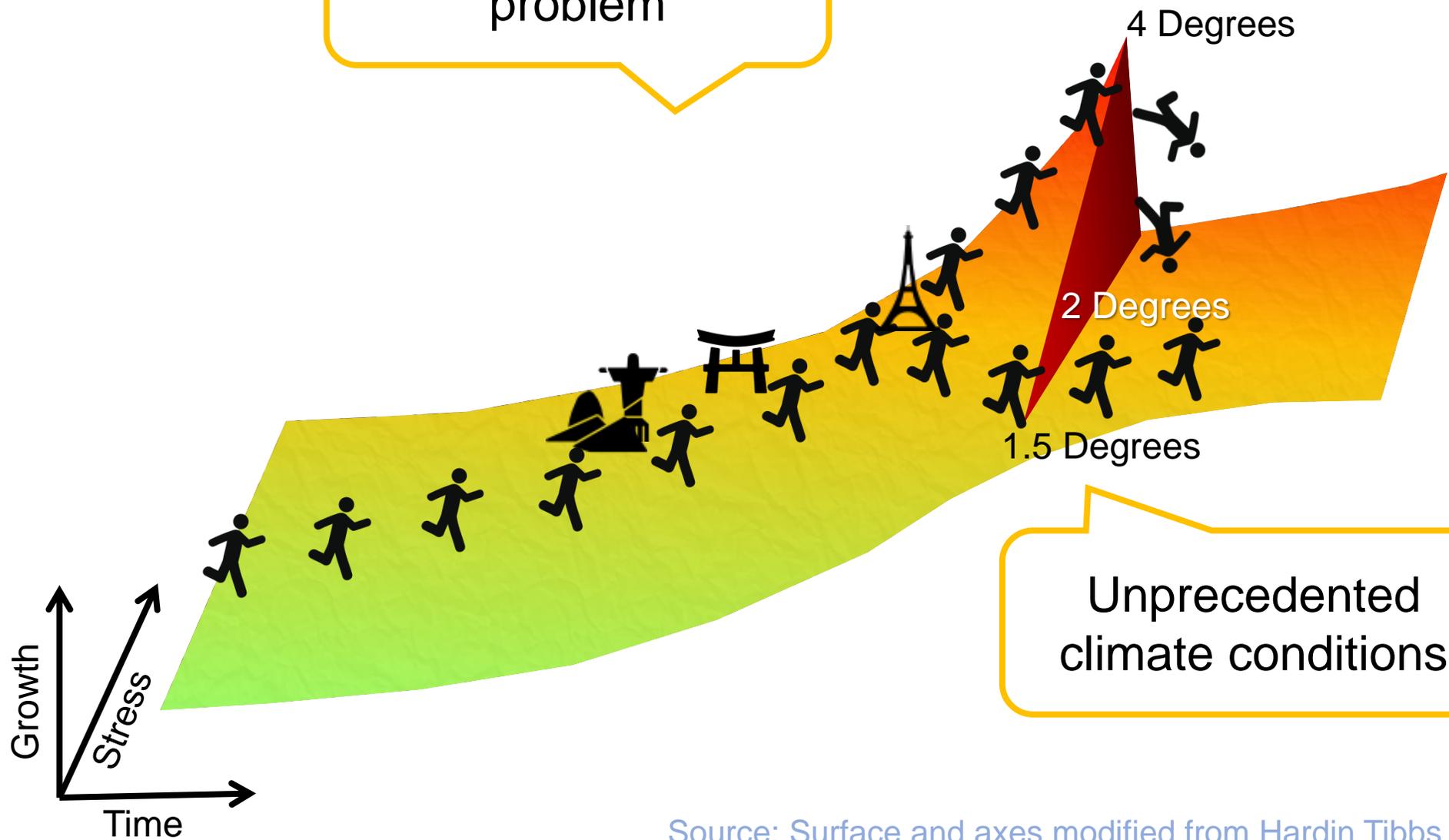


PHOTO: UN Photo/Rick Bajornas

Who could implement these solutions?

Under what conditions?

Collective action
problem



Unprecedented
climate conditions

Research questions

What are the preconditions for effective global responses to climate change?

Under what conditions would actors act on effective response options?

What influence might climate change have on actors and the global response to climate change?

What are the preconditions for actors to remove greenhouse gas from the atmosphere at a scale required to limit climate change to safe levels?

What are the preconditions for effective international cooperation on climate change?

Scenarios

Ramirez et al have shown that, when using appropriate methods, scenarios can “... produce ‘interesting research’ that is both usable and rigorous.” (page 82, Ramirez et al 2015).

The IPCC has assessed Integrated Assessment Models (IAMs), Representative Concentration Pathways (RCPs) and Shared Socio-economic Pathways (SSPs)

“The models use economics as the basis for decision making.” (page 422, Clarke et al 2014)

What about security or other decision criteria driving the global response to climate change?

Decisions in these “...models tend toward the goal of minimizing the aggregate economic costs of achieving mitigation outcomes...” (page 422, Clarke et al 2014)

It is not clear whether incentive structures for actors, including oil and gas companies or so called “petro-states”, would actually result in “minimizing aggregate costs”

“The models do not structurally represent many social and political forces that can influence the way the world evolves (e.g., shocks such as the oil crisis of the 1970s).” (page 422, Clarke et al 2014).

These shocks can drive systemic change and affect GHG emissions

IPCC noted that “Omitting climate impacts and adaptation responses from scenarios is likely to lead to biased results for three main reasons.” (page 442, Clarke et al 2014)

“...climate impacts could influence the effectiveness of mitigation options”

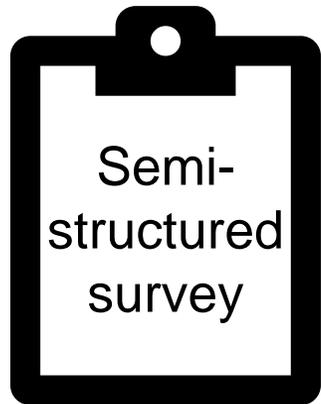
“...adaptation responses to climate change could themselves alter emissions from human activities, either increasing or decreasing the emissions reductions required to reach GHG-concentration goals.”

“...mitigation strategies will need to compete with adaptation strategies for scarce investment and R&D resources, assuming these occur contemporaneously.” (page 442, Clarke et al 2014)

The possibility of climate change impacts influencing ambition levels of actors and their responses does not appear to have been acknowledged as a possibility



Data collection



1. Current climate change situation
2. Failure scenario
3. Success scenario
4. Other scenarios that affect climate or the global response to climate change

Backcasting – reverse stress testing methods

Success = fulfilling the UNFCCC objective

UNFCCC objective

Stabilise atmospheric GHG concentrations

at levels that allow...

Ecosystems to adapt naturally

Food production not to be threatened

Economic development to proceed in a sustainable manner



Data processing



27 interviews

People from around the world
with experience in climate
change and related issues

238,000 words of transcript, from which 176 scenarios were identified and thematically analysed forming a “**searchable sample of possible futures**”

Theory of change analysis (looking for if-then statements)

“multiverse” of possibilities

Plotting scenarios

Global

Theory of change analysis (looking for if-then statements)

Strengthen targets

Success

Catastrophic events

"...there may be an incentive to strengthen the targets." (5616)

Muddle along

"...if there's some catastrophic, a series of certain catastrophic events" (5616)

"...they'll muddle along, they'll do some, some will do a lot, some will do not much but I don't see, think there's any incentives for anyone to change the target." (5618)

Might relax targets

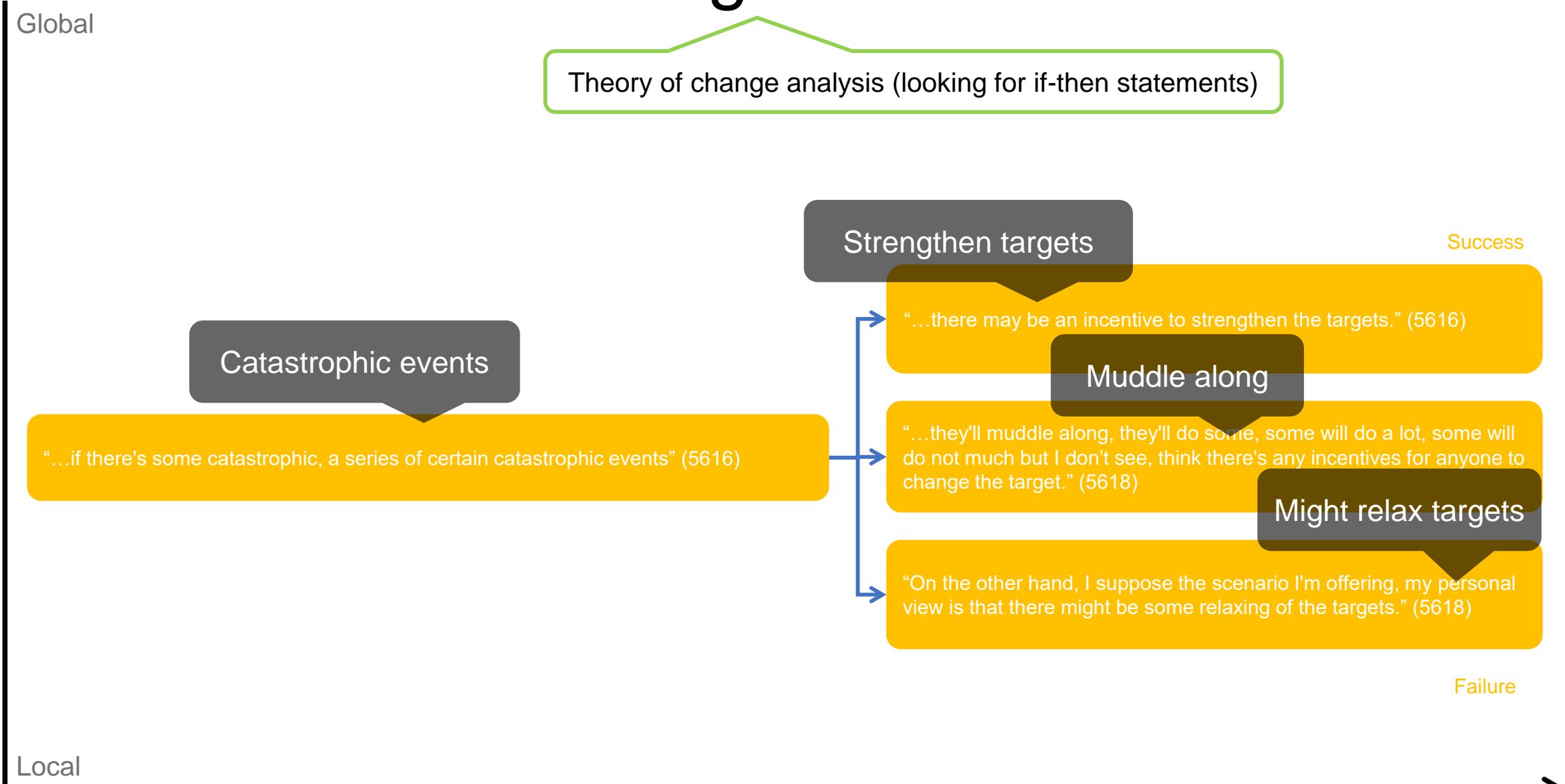
"On the other hand, I suppose the scenario I'm offering, my personal view is that there might be some relaxing of the targets." (5618)

Failure

Local

Time

Issues



Issues

"I'd describe it as dire. Do you want me to expand on that? I believe and associated trapping of heat in the earth's system. we are approximating, previous interglacial periods. Where sea levels were many meters higher than today, and I believe, that it is an inevitability for [us] as civilization now and I believe that our descendent will be in perpetual retreat from the coasts. I also believe, that food security and that the drought and flood, pose severe hazards to the viability of our agricultural systems as they are now. But I'm hopeful that, that mitigation can occur, as in a switch away from fossil fuels. However, I don't believe it'll come soon enough to prevent some of the worst consequences." (12950-12958)

Sea level change locked in

"...I believe this has already set us on a track to many meters of sea level rise and I think that's baked into the cake..." (13008-13010)

Best case: Slow sea level rise and political action, social economic adaptation

So the best case scenario is that sea level rise happens at a rate that is slow enough for our political and social economic systems to adapt to. With a few people losing their properties and their life savings and they rebuild their livelihoods as soon as possible... (13020)

Sea level rise over next few decades

"In the next several decades, we're going to be dealing with rising sea levels and I think that rising ground water, we are just going to exacerbate the flood issues we already have in coastal areas." (13014-13016)

Changes to coastlines

"...perhaps the most obvious manifestation of change is the changing of the coastlines, I think our decedents will have to deal with that..." (13012-13014)

Worst case: Political stagnation and rapid sea level rise

"And the worst case would be political stagnation and trying to deal with this at a policy level and those sorts of things." (13022) "In the worst case scenario, the rise is going to happen too quickly to avoid large swathes of our population are losing their properties and their livelihoods." (13024)

Influence of climate change when affects the wealthy

"...it will probably only have true political ramifications when it starts to impact wealthier parts of the community" (13026)

Countries will be vulnerable to political turmoil

"...in a western essentially liberal society like New Zealand, it could still lead to political turmoil..." (13026)

"...trying to understand how previous climate regimes influenced ecosystems and geomorphic systems and that is perhaps the most obvious manifestation of change is the changing of the coastlines..." (13008-13012) "...we already know that people that are wealthy and better educated, especially those people on the coast are very forceful in advocating for public money to be spent on coastal defences for example, like sea walls and installing pump stations and those sorts of things. Whereas people who are less educated and poorer are not very good advocates for themselves as far as that is concerned." (13030-13034) "...coastal areas being inundated and perhaps as we were talking before about, it would overwhelm the more drawn-out and complex societal policy responses" (13212)

Success

Failure

Time

Food crisis

“there's a big... a kind of mega, you know, food fuel crisis that we saw in the 2000s.... So, that's virtually bound to happen.” (5328)

Defensive response

Cooperative response

Defensive versus cooperative

“At least a couple of those are bound to happen... and whether they happen on a regional scale or again, I think if something affects the global food system that's the one we'd expect. We kinda expect to see one of those before 2025 again. A double bread basket failure type event.” (5329-5330)

“There's a real question though whether that would drive defensive... or actually more cooperation so it's a question of, you know, a big fuck off event, climate-driven event, and which way [it] drives actions...” (5328)
“...and the question is, "What's the response to it?" (5329)

Time

Issues

“So, where are we at? It seems in terms of the nature of the problem, the scale of the problem seems to be substantial because it appears to be like using too much of hysterical rhetoric with kind of a runaway train in some ways, our ability to... With emissions continually increasing and global efforts to reduce them, or even slow them, faltering and I guess not being as effective as need be according to what science tells us. It's a very worrying scenario, particularly for anyone who's thinking not just in the short term but in the longer term.” (3103-3104)

“They [business and finance] could be putting money into infrastructure investments that help us address and reduce emissions or not. And that's an issue, particularly [for] sub-national governments. Making sure we get that non-carbon infrastructure in place, so like, you know.” (3162)

Low greenhouse gas emissions infrastructure investment needed

Timing of investment is important

“If that's not done in the next decade now, that window's half-closing. Then we're locked into higher emissions in current infrastructure that's for another 30, 50 years and it's, you know, some might argue that it's game over in some ways and viability to cut emissions.” (3162-3164)

Investment response before 2030

Success

Investment response after 2030

Failure

Issues

“Climate change is real. It's gonna be a significant problem by the end of the century according to the UN. We're probably talking about an impact that's equivalent to about 2 to 4% of GDP. So, it's the equivalent of each person, on average, on the planet being 2 to 4% less well-off by the end of the century.” (1547)

“Overall and in the long run, global warming will be predominated by bad things which is why it's a problem. But, actually, right now, there's probably about equal good and bad stuff happening with global warming.” (1557)

“...the political solution is to dramatically increase spending on research... then UNFCCC should focus a lot more on getting nations to get to spend money on research and development. It's much cheaper, it's much easier, it's also much easier to validate 'cause you can do it. You know, you can, say, just at the end of this year, you can actually see in the budget for the next year how much money you're gonna spend.” (1641-1645)



“And so, the main part politicians have to do is to dramatically increase their investment in research and development. If we do that, we have a much greater chance. If we don't, we have a much lower chance.” (1615)

“What we need is the long shot things that'll actually work out over the next couple of decades. So that's much more about having government investment!” (1619)

With regards to the UNFCCC and GHG emissions, and success: “Now, they will all say we need to get rid of all of it whereas the reality is we'll get rid of most of it if we're good.” (1591-1593) “And also accept that you're not going to be able to fix all global warming, just like any of the policy probably will only fix part of it.” (1551)

Need to focus on long term research

The solution is not perfection, but partial

Governments should increase research spending

“Businesses don't want you to invest in something until it was close to market, they would already be investing in it... If we spend lots of the research and development money on companies, we're gonna get close to market technology perfected which is not really what this challenge asks for.” (1617-1619)

“...fundamentally, the only way I can imagine that we're gonna achieve some sort of stabilization on a fairly low temperature is if we manage to get technologies that are cheap and produce about the same benefits as fossil fuels do now.” (1575) “The fundamental point here is much more about getting green energy to be so cheap that it's close to taking over.” (1603) “...we need technology in order to solve this if you're gonna, if it's both gonna be politically realistic and if it's gonna be realistic economically to stabilize at a low level.” (1597) “But if we can make technology that's gonna be cheaper... that are green then we can get this takeover. If we don't, it won't happen.” (1579-1581)

“...adding a carbon tax that actually reflects what the damage cost is. Again, that will solve a little part of the problem, it'll make it a little, like, more likely to happen.” (1609-1611)

Avoid close to market research funding

“Now, of course, the argument in some ways is that a carbon tax could be the alternative to that. So, you know, carbon tax globally implemented could actually achieve the same thing by making fossil fuel so expensive that any eventually, all kinds of green energy would be cheaper than fossil fuels and some people would switch over. But, of course, that would very easily run into the problem with actually being more expensive than the original problem that it was intended to solve which is why, you know, some standard economic models showed that you should do some things, that you should have modern carbon tax growing over the century but it will only fix a smaller part of the problem...” (1581-1583)

Time

UNFCCC

Success

Failure



“We are getting to the time when the future becomes the present, and even the past. Climate change started as an issue that was about atmospheric chemistry and about impacts in the future, and then it began to be about we think that maybe it's going to begin to show up in some present. And now, it's pretty much irrefutable, then we have too many of the things that are happening are manifestation of a changed climate. And also, they are manifesting that, for those who are already on the edge of survival, this means catastrophic change. And for people who are pretty well off, like the middle in California, suddenly things are happening that are beyond the ability to cope, so it's bad. Extreme events combined with societal [impacts]. So, extreme weather events, temperature, wind, rainfall anomalies, both in terms of shocks and in terms of trends that [unintelligible] on accumulating tipping point... you know, it's the little, all the things that we knew from science are beginning to show up in very tangible ways.” (13280-13289)

Youth taking their own path

“The generation of our children is going to not give a damn what is expected of them, and is going to want to take what they want by taking it. And there's going to be two extreme caricatures of what may await.” (13604)

Enlightened response

“...the other is radical collective transformation for the wellbeing of people and planet.” (13606)

“One is the selfish, "I want to succeed and have, you know, the most expensive vehicle“ ” (13604)

Selfishness

Youth a driving force

“...socially-oriented youth, becoming a force of nature...” (13610)

Success

Failure

“What we are seeing know in certain, you know, parts of Europe and North America with youth storming in and saying, "You know what? I have a right to this. I'm gonna show up. I'm beginning to do this successful." Fingers crossed.” (13612)



Issues

Globalism versus nationalism

“...scientists have made it clear, and the meteorologists are, now some of them are starting to be able to feel confident enough to say that this particular hurricane hitting USA or Philippines, or Japan, is result of climate change in so far as the frequency and severity.... there's more than a few organizations that are already assessing the damage to the economy. Like in terms of individual extreme weather events, one-off extreme weather events, so many billion dollars or whatever...” (1790-1796)

“Catastrophic is the term used as you know, as well. And we've got, you know, the general gathering wisdom is we've got about 10 years left to turn that around.” (1780-1782)

“...you've got to, gotta step back from climate and sustainability issues for the moment and see what's happening in the world politically and you've got massive movements going on. One is more of an intellectual realization that we have to cohere together as a species and however we structure ourselves politically for decision making. So, I just call that the globalist approach. And then you've got the nationalist-populist backlash against the migratory flows especially, and so you have it in the United States and in Venezuela and quite possibly Brazil, ...you do have spots of populist backlash and for that matter inside Europe and the UK. So, it begs the question as to how those competing, and they are conflicting forces, play out to make decision making on anything whether it's military but also on sustainability and climate...” (2183-2187)

“I would anticipate that at some stage and there's going to be emergency powers kicking in at international level and on the question is do they kick in somehow the global level Security Council whatever. Because of, humanity will suddenly start baying and saying, "Enough [is] enough we got to change some things very fast.” (2196)

“Does that occur before 2030 or after 2030? By definition if it is after 2030 it is too late...” (2197)

Emergency powers United Nations Security Council

“Now we've got a global commons problem that makes it intellectually, patently clear you do, but whether you politically succeed, even under stress, is another. You know, it's a defining moment.” (2240-2242)

“So, yeah, because you know the UN negotiated machinery would've become, the political and military], and social instability would've become so fraught that your ability to negotiate a coherent single proactive response is minimized.” (2246)

“Maybe I'm just optimistic enough to think that the multilevel machinery will never collapse. But it doesn't follow from that, that it will, that the circumstances will allow that continuing multilevel machinery that will be under severe stress, to find that, create a problem unless you get some kind of emergency agreement with enforcement of the global element.” (2236)

Concerted response on time

Concerted global response before 2030

Success

Concerted global response after 2030

Failure

Concerted response too late

Time



Issues

“Well, as I understand it's, changes have already taken place that cannot be reversed and we're on track for, at the moment for, 2.7 degrees which is disastrous. So, I see it in just in terms of, where we're at is, beyond urgent really.” (9699)
“Severe weather events. the also, the rise in sea levels the, as I said the impact on the food production we see. So, the impact on agriculture and the interests that people might have or have not in pursuing that as a career you know.” (9922-9928)

“it would [affect] markets, it would affect politics...” (10396)

Global pandemic (i.e. bug causing population decline)

Pandemic

International cooperation shown to be useful

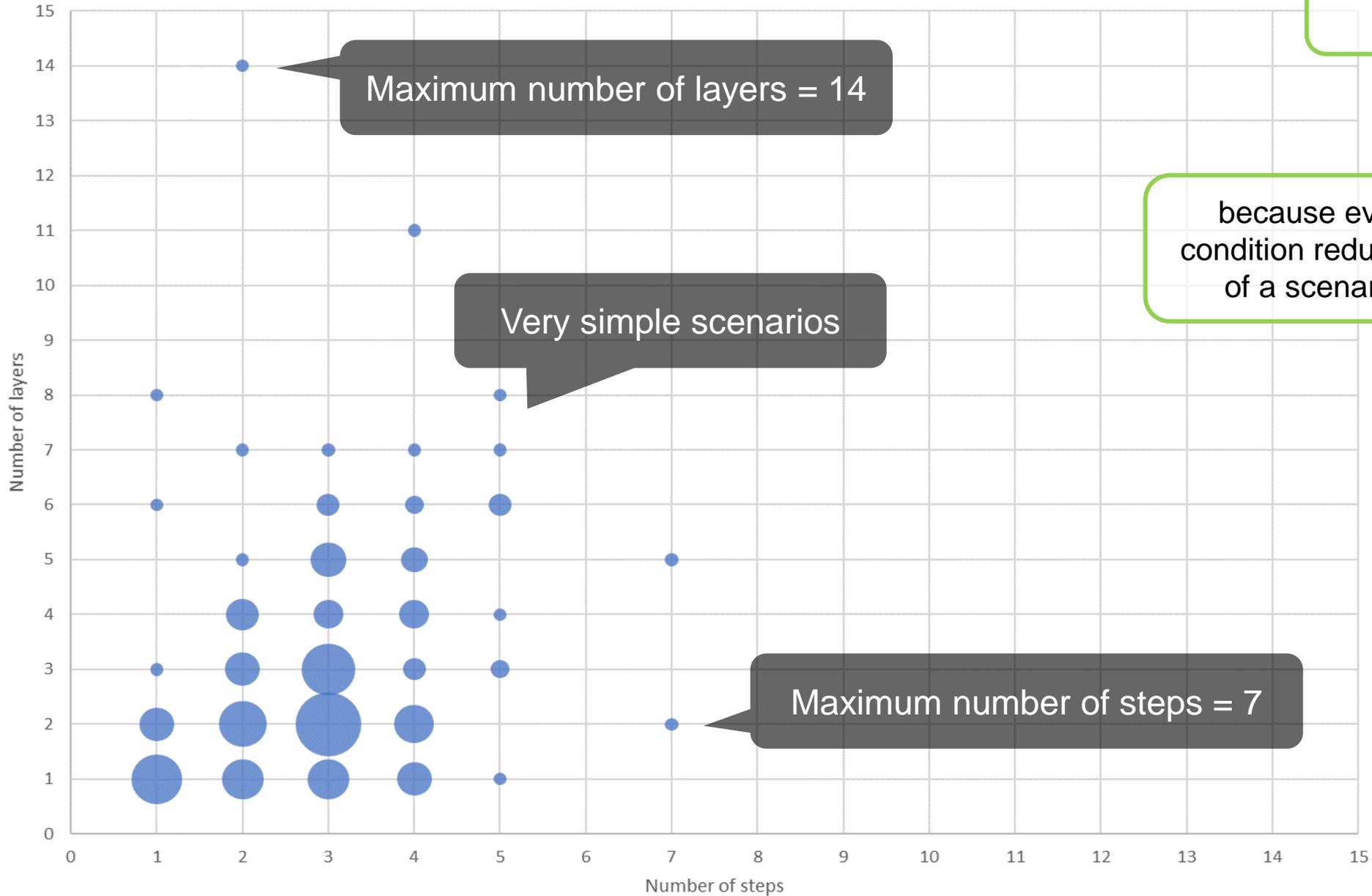
“...demonstrate the value of global cooperation...” (10402)

“It may it may enhance global cooperation to deal with it. You know, it might bolster the strength of the UN to, you know, the WHO, you know, UN too.” (10398-10402)

Strengthens faith in international cooperation

Time

Number of steps and layers in the scenarios compiled



Maximum number of layers = 14

Very simple scenarios

Maximum number of steps = 7

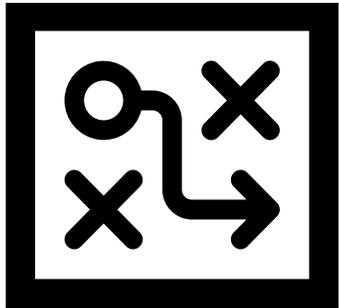
Scenarios were restricted to essential details

because every additional condition reduces the chances of a scenario happening



Data analysis

All scenarios and scenario elements were accepted as being “possible futures”



176 scenarios

The “searchable sample of possible futures” consisted of 7 branching scenarios, 50 failure scenarios, 67 success scenarios and 52 other scenarios

Instead of restricting the study to four or five reference scenarios

The analysis focused on conditions found in success scenarios

The study mapped multiple possible pathways between scenario elements and themes

Common conditions in success scenarios are preconditions for effective responses



Results

Climate change

National interests

International cooperation

Impact and risk signals

Responses

Key concepts

Physical systems

Biological systems

Human and managed systems

Social change and behaviour

Political will and policies

Technology and practices

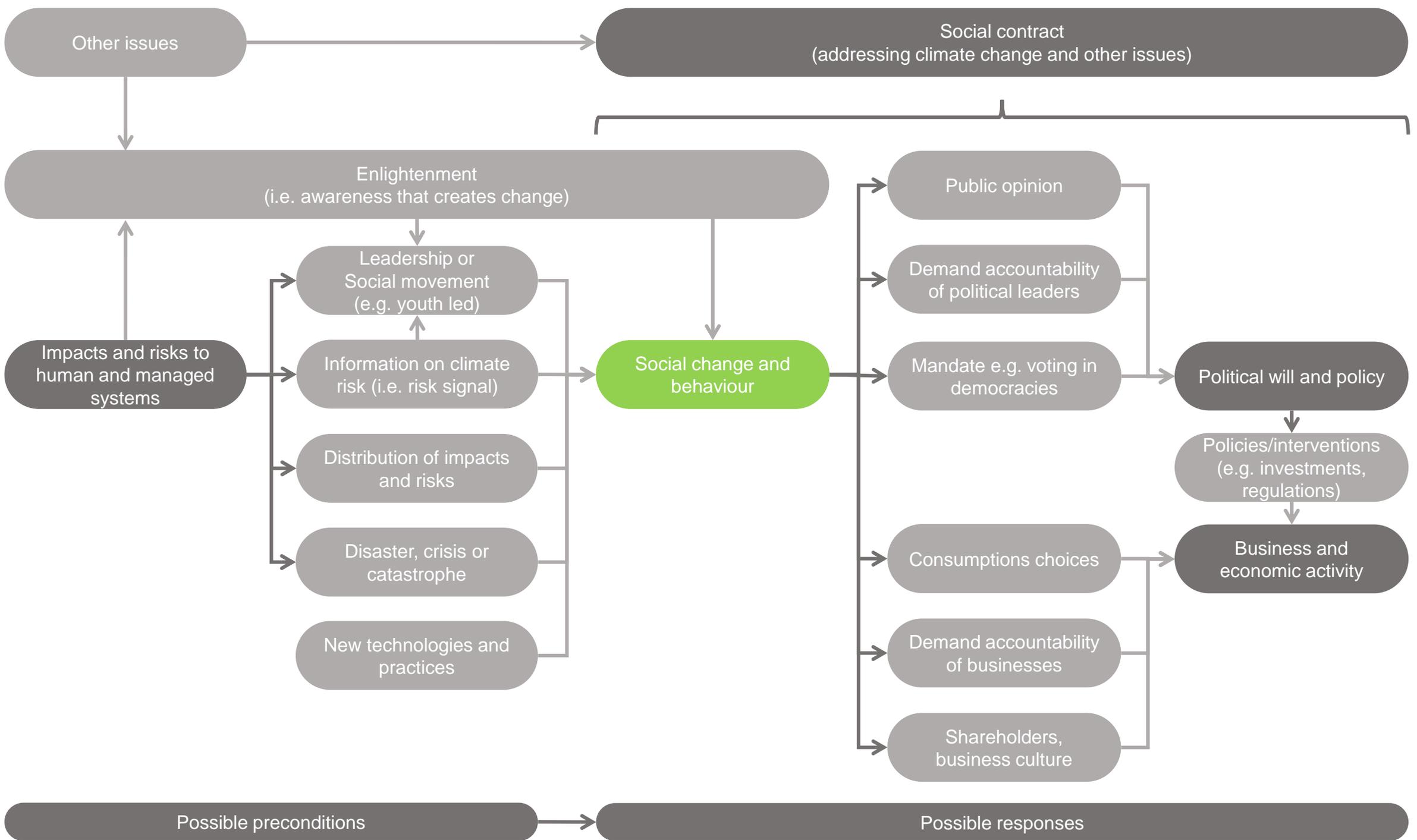
Business and economic activity

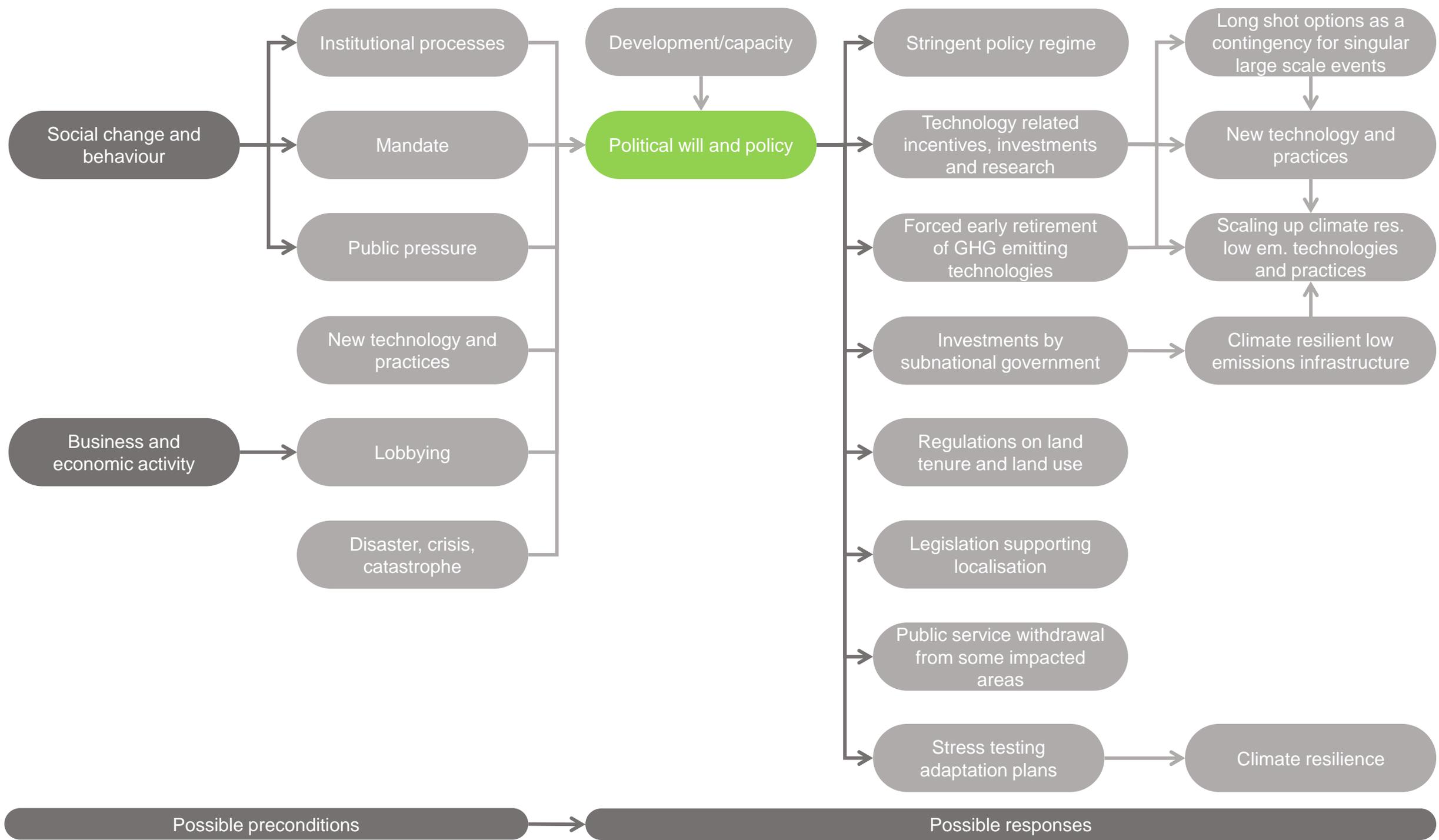
Other factors

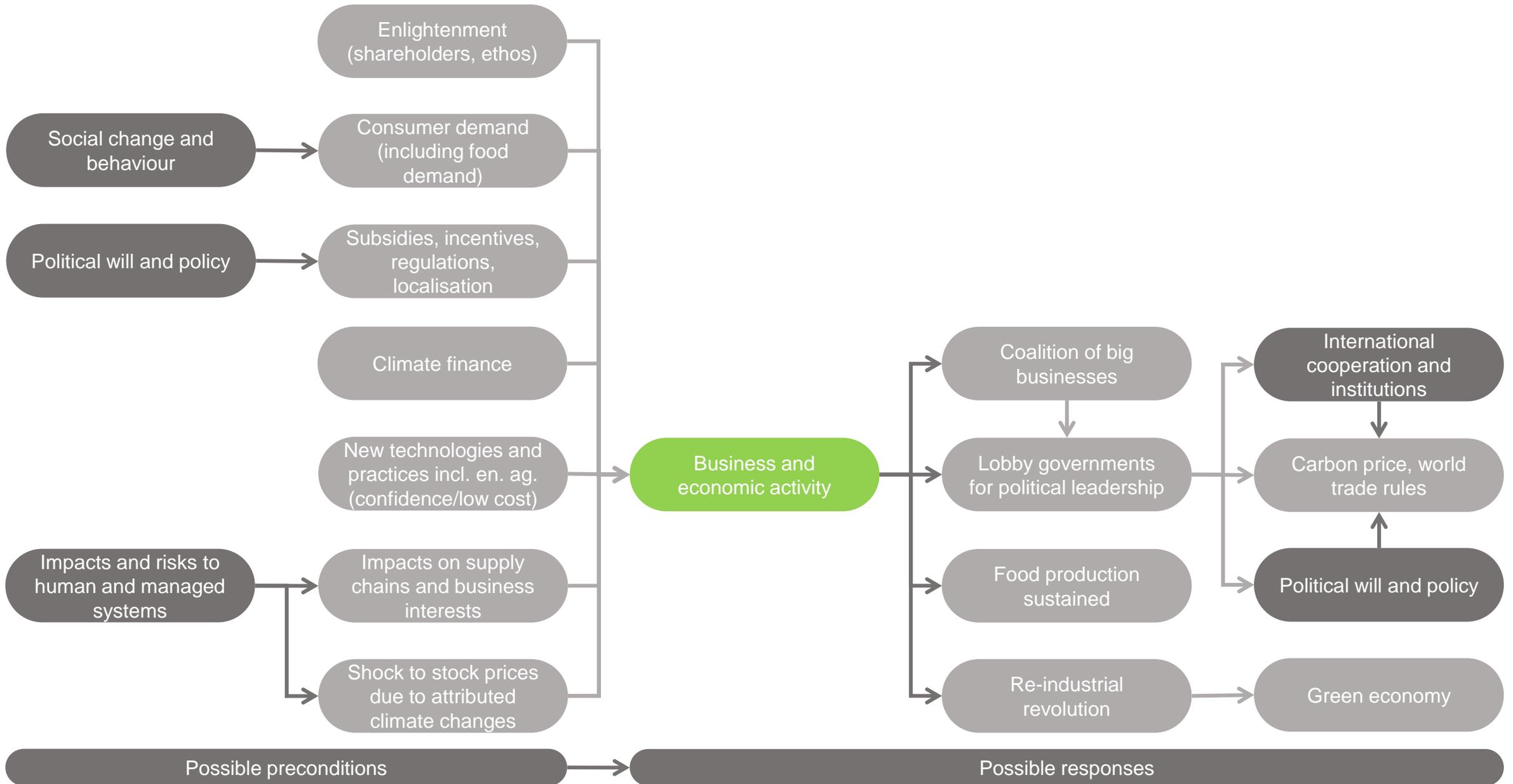
International regime

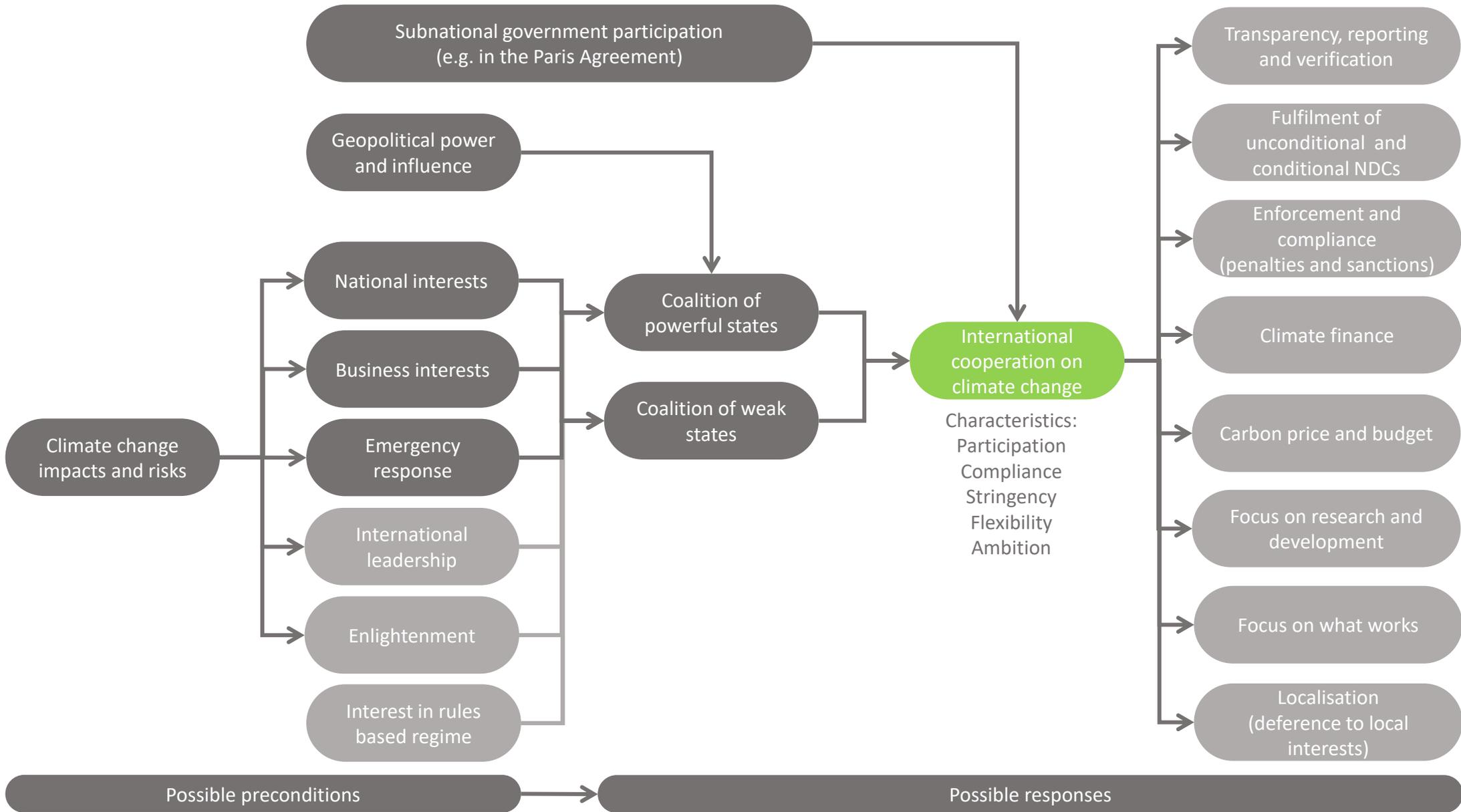
International cooperation on climate change

Overarching themes









Climate change

National interests

International cooperation

Impact and risk signals

Responses

Physical systems

Biological systems

Human and managed systems

Social change and behaviour

Political will and policies

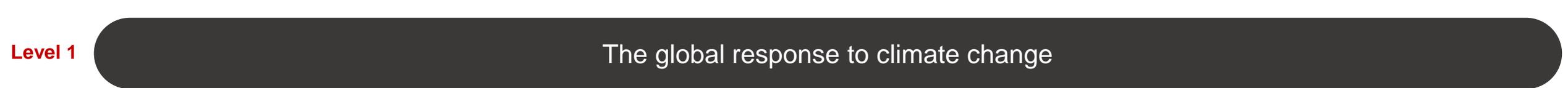
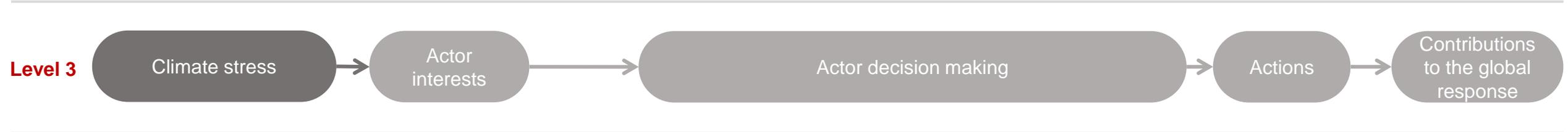
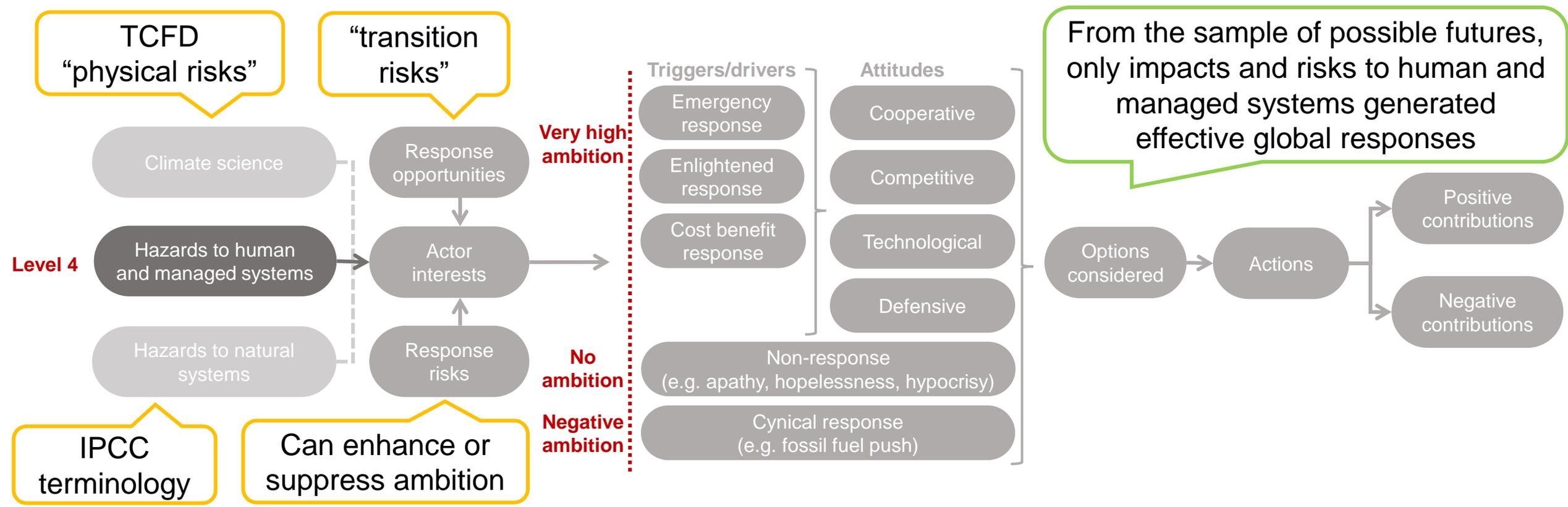
Technology and practices

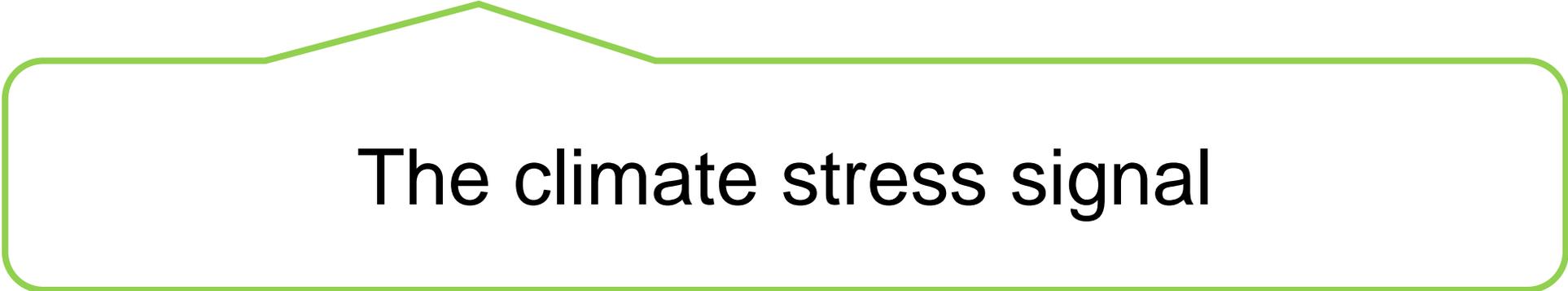
Business and economic activity

Other factors

International regime

International cooperation on climate change





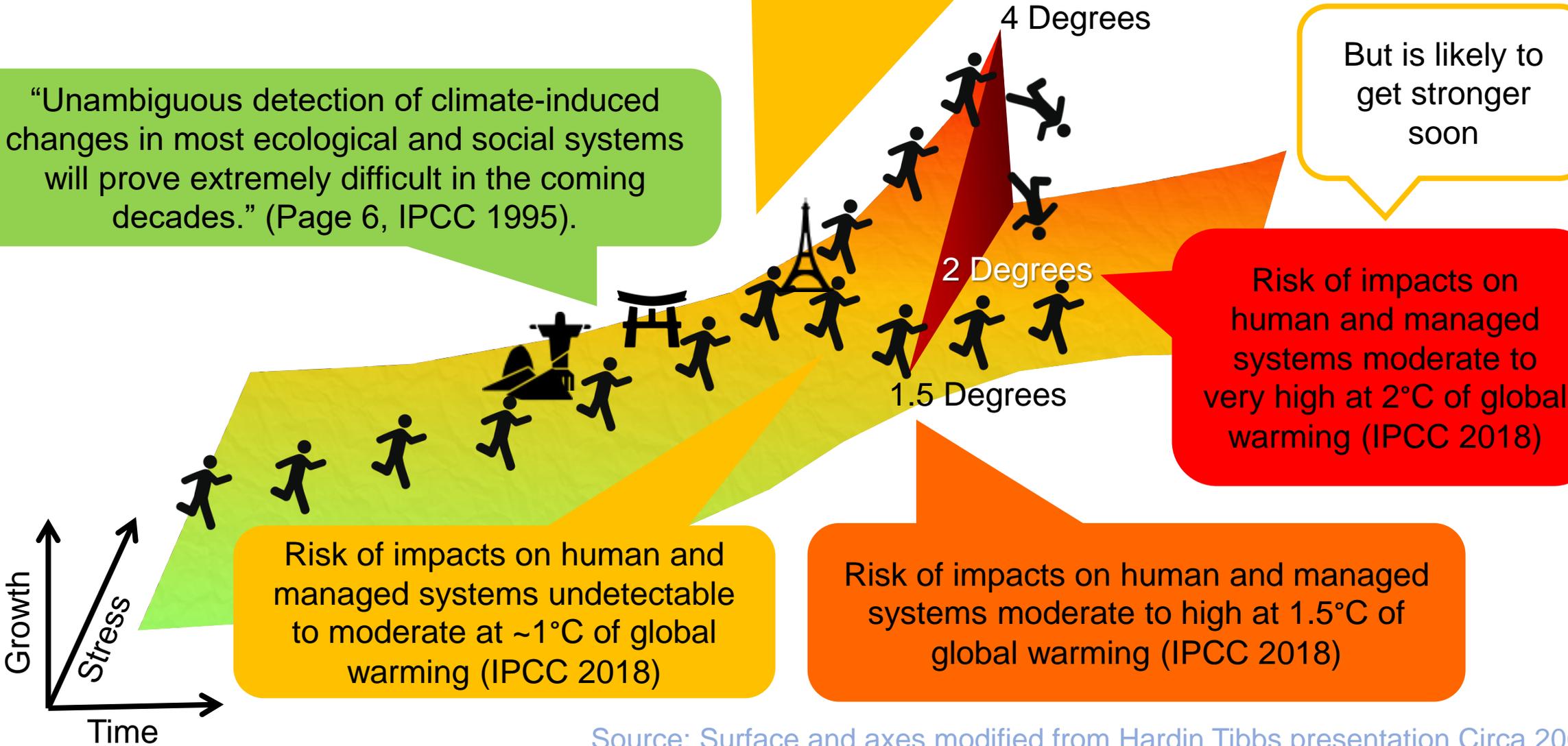
The climate stress signal

“Some impacts on human systems have also been attributed to climate change, with a major or minor contribution of climate change distinguishable from other influences.” (Page 6, IPCC 2014).

A climate stress signal has only just emerged

“Unambiguous detection of climate-induced changes in most ecological and social systems will prove extremely difficult in the coming decades.” (Page 6, IPCC 1995).

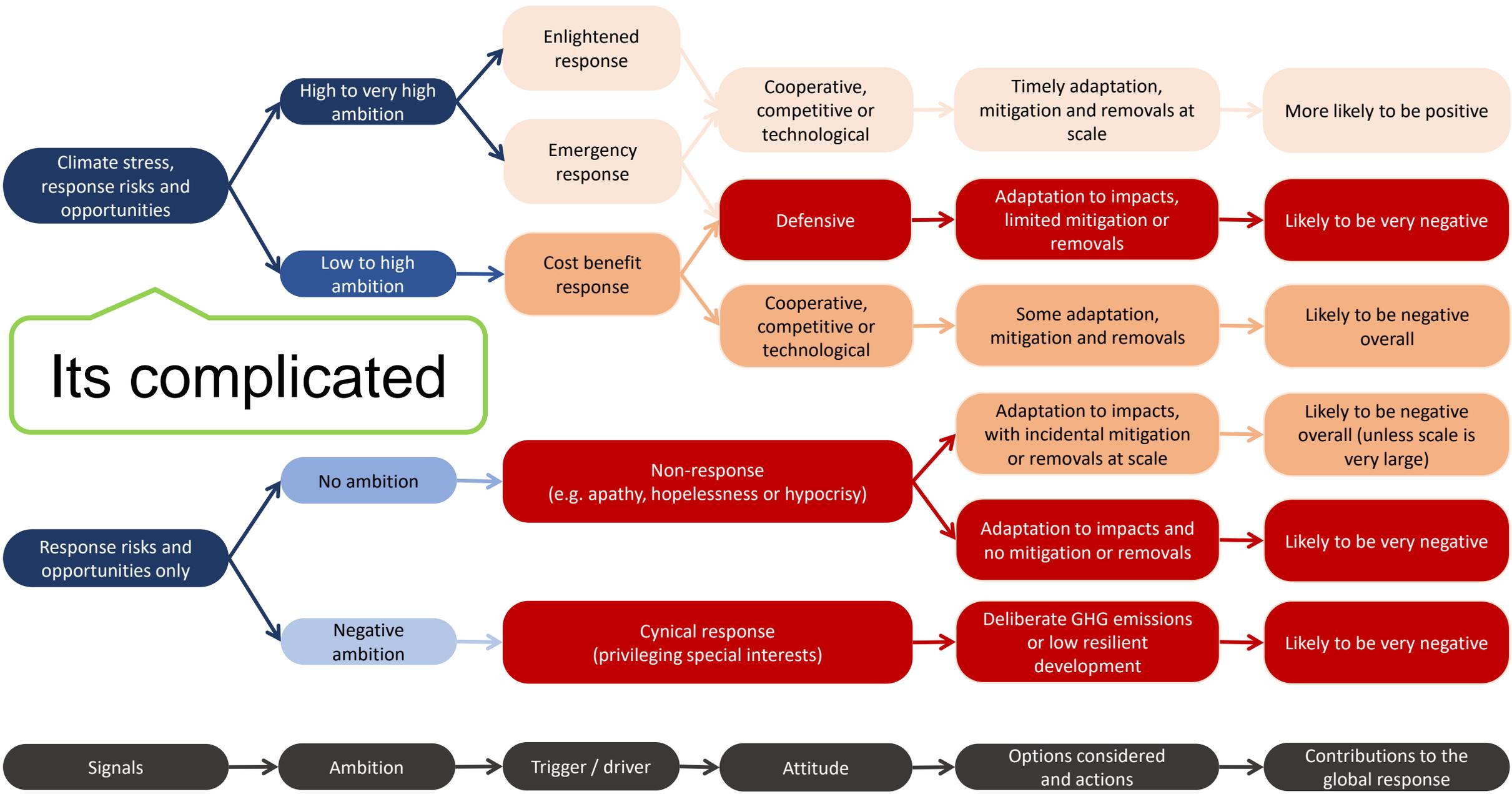
But is likely to get stronger soon



Source: Surface and axes modified from Hardin Tibbs presentation Circa 2003

Ambition	Trigger/driver (strategy)	Justification and framing	Actions
Negative	Cynical response (non-cooperation)	Special interests: the extent to which special interests benefit	Deliberate negative contributions, “burn baby burn”
None	Non-response (free riding and no cost contributions)	None: Denial*, apathy or hopelessness leading to inaction or incidental helpful contributions to the global response to climate change.	Incidental negative contributions to the global response, “ignorance is bliss”* Incidental positive contributions to the global response
Low to high	Cost benefit response (competition and cooperation)	Cost benefit analysis: Decisions to act on climate change are based on costs and benefits of the options being considered	“Act at costs up to social cost of carbon”*
High to very high	Enlightened response (cooperation)	Evidence of impacts, risks and need to limit climate change and its impacts	Collective action on adaptation and mitigation
Very high	Security response (cooperation and coercion)	Security: Climate change is a clear and present danger. It has been decided that climate change needs to be acted upon and now it is a question of what can be achieved with the resources available	“Containment and defence”* Containment and fix

Source: Author except when marked * which indicates the source as Grubb 2014



Contributions to the global response

Signals	Response		
	Trigger or driver	Attitude	Contribution to global response
Climate stress, response risks and opportunities	Enlightenment or emergency	Cooperative, competitive or technological	More likely to be positive
	Cost benefit	Cooperative, competitive or technological	Likely to be negative overall
	Cost benefit or emergency	Defensive	Likely to be very negative
Response risks and opportunities only	No trigger e.g. non-response or cynical		

Source: Jeremy Webb

Power and capacity are important

Effectiveness of global response

Signals	Actors and coalitions	Possible responses			Effectiveness of global response
		Trigger or driver	Attitude	Contribution	
Climate stress, response risks and opportunities	With power and capacity	Enlightenment or emergency	Cooperative, competitive or technological	More likely to be positive	More likely to be effective
		Cost benefit	Cooperative, competitive or technological	Likely to be negative overall	Unlikely to be effective
		Cost benefit or emergency	Defensive	Likely to be very negative	Very unlikely to be effective
	No trigger e.g. non-response or cynical				
	With limited power and capacity	Cost benefit, enlightenment or emergency	Cooperative, competitive, technological or defensive	Positive or negative contributions	Limited influence on effectiveness. Unlikely to be effective
		No trigger e.g. non-response or cynical			

Source: Jeremy Webb

Natural fluctuations in solar output

Global warming

Incoming shortwave radiation (SWR)

SWR reflected by the atmosphere

Outgoing longwave radiation

SWR absorbed by the atmosphere

Aerosol cloud interactions

Chemical reactions

Chemical reactions

Aerosols

Clouds

Ozone

Greenhouse gases and large aerosols

SWR

SWR, LWR

SWR, LWR

LWR

Chemical reactions

SWR reflected by the surface

Latent heat flux

Sensible heat flux

Back longwave radiation (LWR)

LWR radiation from the surface

Emissions of greenhouse gases and aerosols

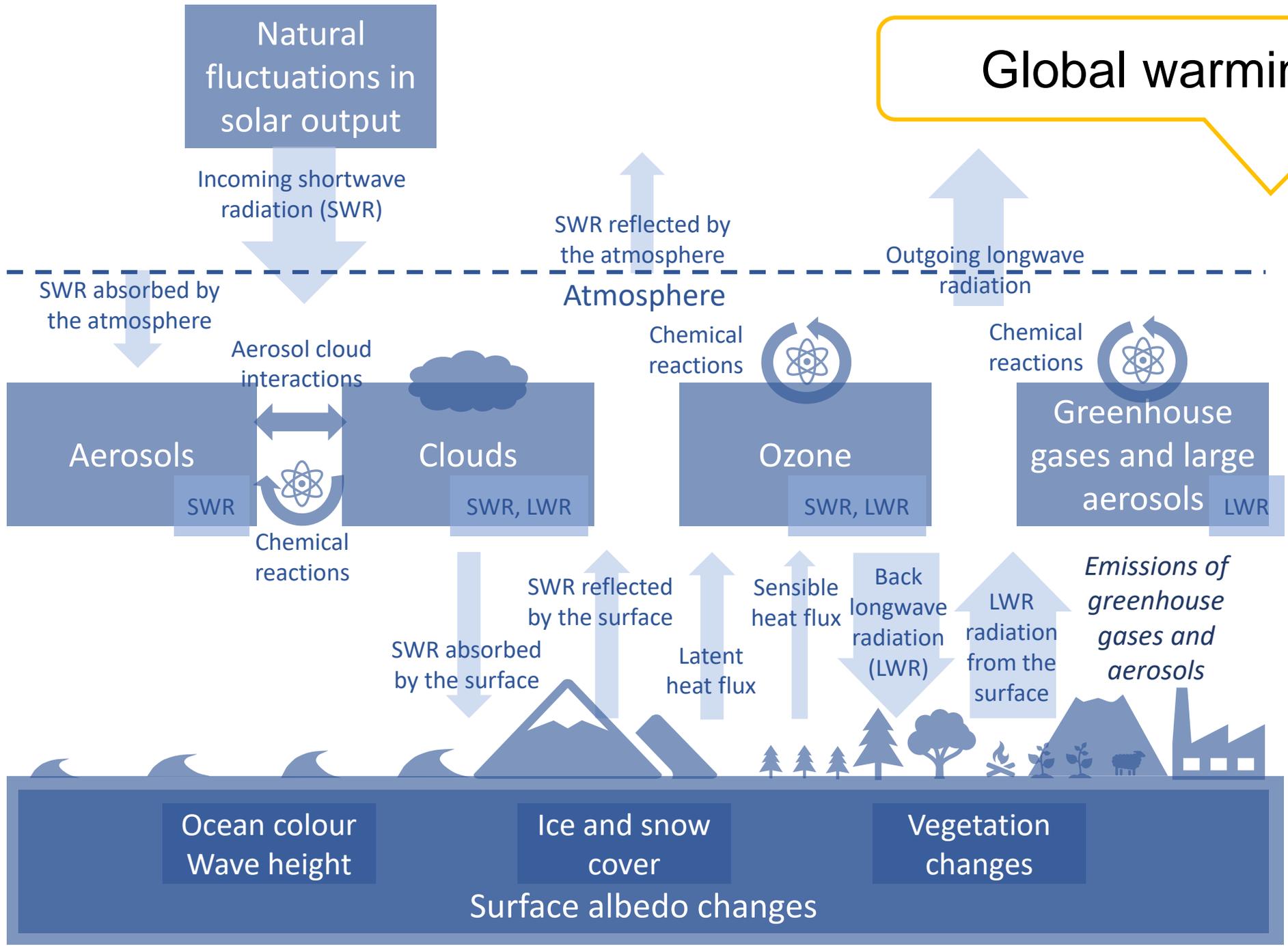
SWR absorbed by the surface

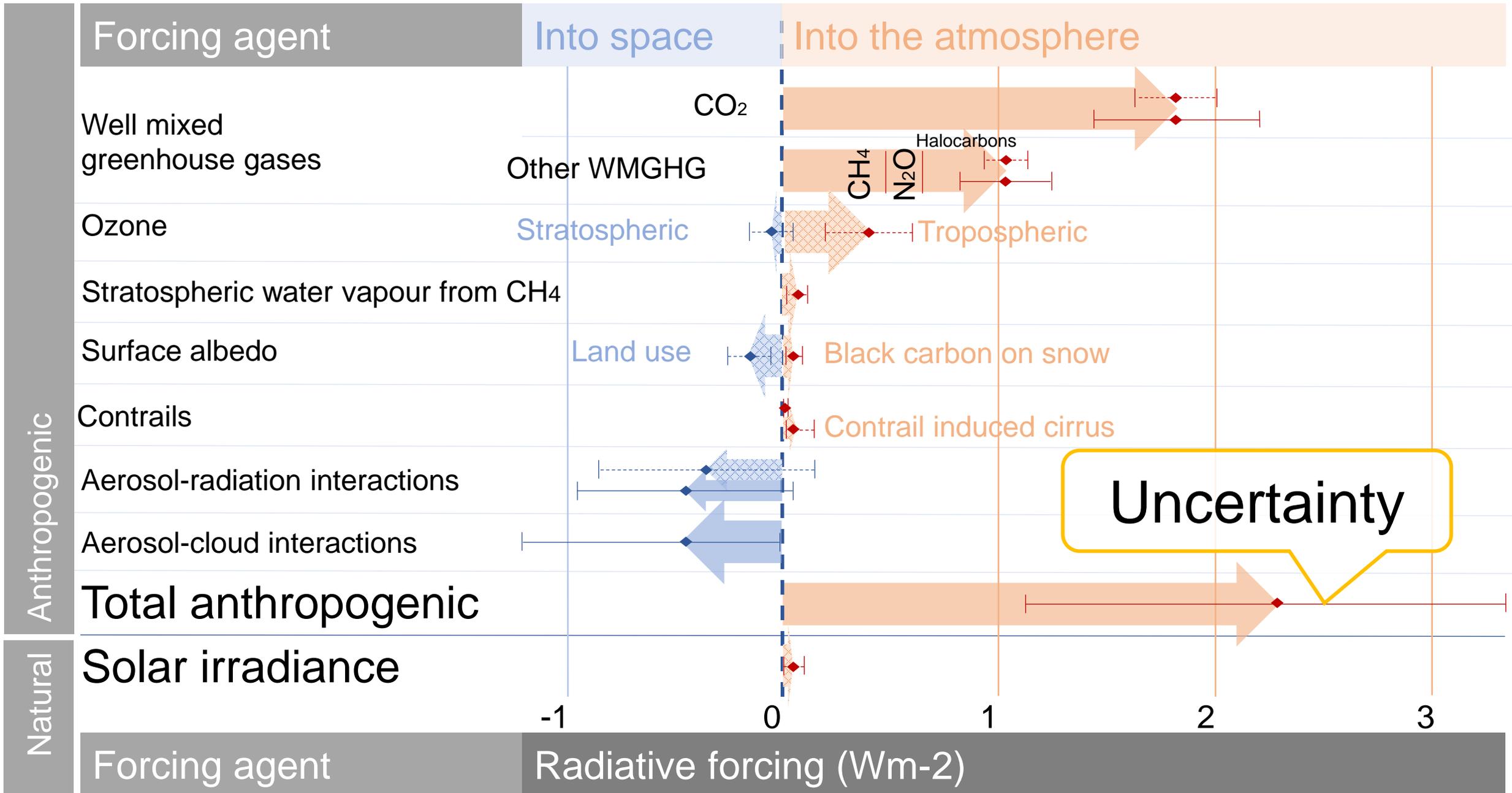
Ocean colour
Wave height

Ice and snow cover

Vegetation changes

Surface albedo changes





CO ₂ -eq Concentrations in 2100 (ppm CO ₂ -eq) Category label (conc. range)	Subcategories	Relative position of the RCPs	Change in CO ₂ -eq emissions compared to 2010 (in %)		Likelihood of staying below a specific temperature level over the 21 st century (relative to 1850-1900)			
			2050	2100	<1.5°C	<2°C	<3°C	<4°C
<430	Only a limited number of individual model studies have explored level below 430 ppm CO ₂ -eq							
450 (430 to 480)	Total range	RCP2.6	-72 to -41	-118 to -78	More unlikely than likely	Likely	Likely	Likely
500 (480-5300)	No overshoot of 530 ppm CO ₂ -eq		-57 to -42	-107 to -73	Unlikely	More likely than not		
	Overshoot of 530 ppm CO ₂ -eq		-55 to -25	-114 to -90		About as likely as not		
550 (530 to 580)	Total range	RCP4.5	-41 to -29	-90 to -59		More unlikely than likely		
						Unlikely		
(580 to 650)			-38 to -24	-134 to -50				
(650 to 720)	Total range		-11 to 17	-54 to -21		Unlikely	More likely than not	
(720 to 1000)	Total range	RCP6.0	18 to 54	-7 to 72	Unlikely		More unlikely than likely	
>1000	Total range	RCP8.5	52 to 95	74 to 178		Unlikely	Unlikely	More unlikely than likely

Its conceivable that global warming might be less than expected (but unlikely)

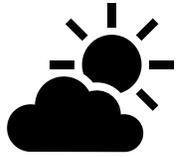
Source: IPCC 2014

Effective response scenarios

Signals	Types of global responses		Serendipity
	Trigger or driver	Attitude	
Climate science, risks and impacts	Leadership response		<p>Creating the preconditions for serendipity</p> <p>Leadership influencing social change and behaviour, policy, business, technologies, practices, and coalitions, can help generate social permissions, negotiate social contracts and create response options needed for effective global responses</p>
Climate stress, response risks and opportunities	Enlightenment or emergency	Cooperative, competitive or technological	<p>High levels of serendipity needed, including:</p> <ul style="list-style-type: none"> Climate sensitivity is no higher than anticipated Climate change and related impacts can be halted GHG removals can be done at scale if needed Other unexpected changes don't hinder the global response to climate change
	Cost benefit	Cooperative, competitive or technological	<p>Very high levels of serendipity needed, including:</p> <ul style="list-style-type: none"> Climate sensitivity is lower than anticipated Climate change and related impacts are reversible Climate resilient low emissions technologies and practices become cheap quicker than expected GHG removals technologies and practices are available and done at scale Other unexpected changes help the global response to climate change
	Cost benefit or emergency	Defensive	<p>Incredible levels of serendipity needed, including:</p> <ul style="list-style-type: none"> Climate sensitivity is much lower than anticipated Climate change and related impacts are reversible
Response risks and opportunities	Blind luck non-response		<p>Climate resilient low emissions technologies and practices become very cheap very quickly</p> <p>GHG removals technologies and practices are available and are eventually done at scale</p> <p>Other unexpected changes help the global response to climate change</p>
	Failed cynical response		

Source: Jeremy Webb

Preconditions for effective global responses to climate change



Climate related

Scale of climate change is limited

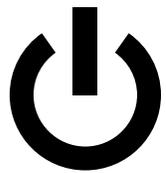
Climate change and related impacts are reversible or can be quickly stabilised

The scale of climate change can be addressed by technologies and practices

Atmospheric accumulation of GHGs is limited

Climate sensitivity much lower, or not much higher, than expected

Not passing thresholds e.g. tipping points



Response related

The global response is timely and at scale including adaptation, mitigation and atmospheric GHG removals

Contingencies are available for addressing extreme climate change or other scenarios

Leadership generating response opportunities

Social permissions for climate action

Domestic and international coalitions with capacity and power to ensure timely responses at scale

Research and development of technologies, practices and policies, so they can be deployed quickly and at scale if needed



Other scenario related

Other changes don't negatively influence climate or the global response to climate change at scale

The scale of other changes can be addressed by technologies, practices, institutions and policies

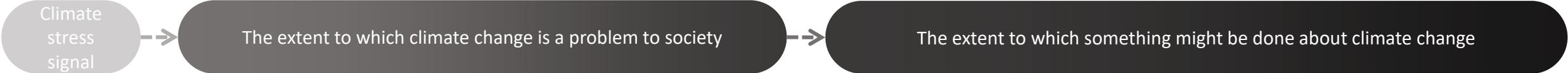
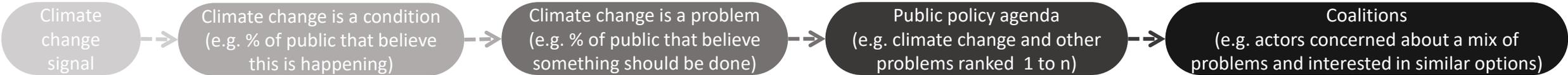
Other changes limit climate change or help the global response

Condition under which actors might
act on effective response options

Conditions versus problems

Conditions:
society lives with

Problems: society believe
need to be solved



Summary

From the sample of possible futures, only impacts and risks to human and managed systems (e.g. agriculture) were capable of driving effective global responses to climate change

The climate stress signal, in the form of impacts to human and managed systems, has only recently emerged

This represents a fundamental shift in the response system

How this will influence the global response is unclear

Serendipity is an important part of an effective global response to climate change

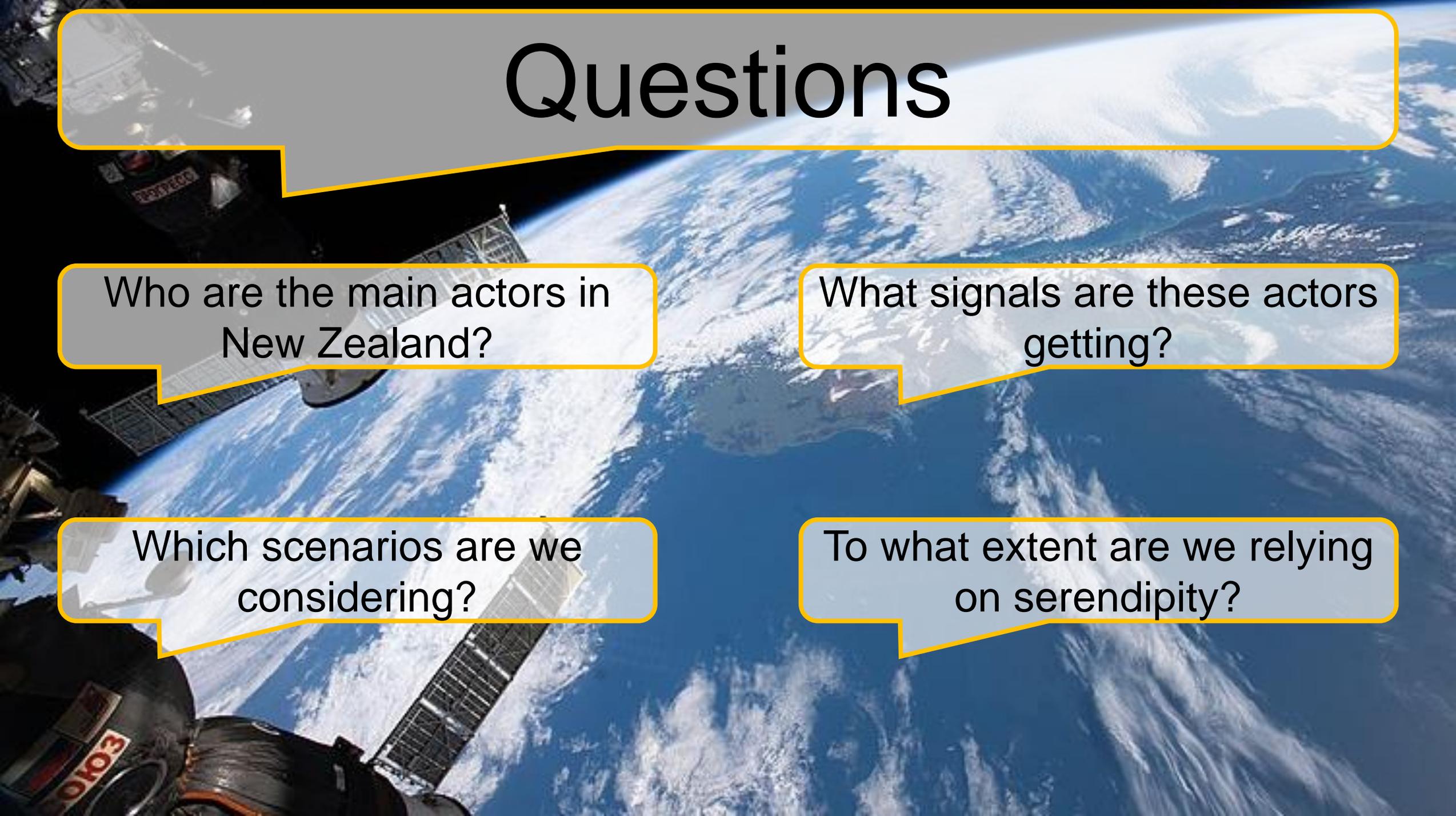
Leadership can create the conditions for serendipity

Creating options for the global response

The global response depends on the extent to which climate change is a problem that needs to be solved versus a condition that society lives with

It also depends upon how the climate change problem is defined

Questions

The background of the slide is a photograph taken from the International Space Station (ISS) looking down at the Earth. The planet's blue oceans, white clouds, and brown/green landmasses are clearly visible. The structure of the ISS, including solar panel arrays and various modules, is seen in the foreground and middle ground, extending across the frame.

Who are the main actors in New Zealand?

What signals are these actors getting?

Which scenarios are we considering?

To what extent are we relying on serendipity?



Thank you

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