

Climate  
Change  
Committee

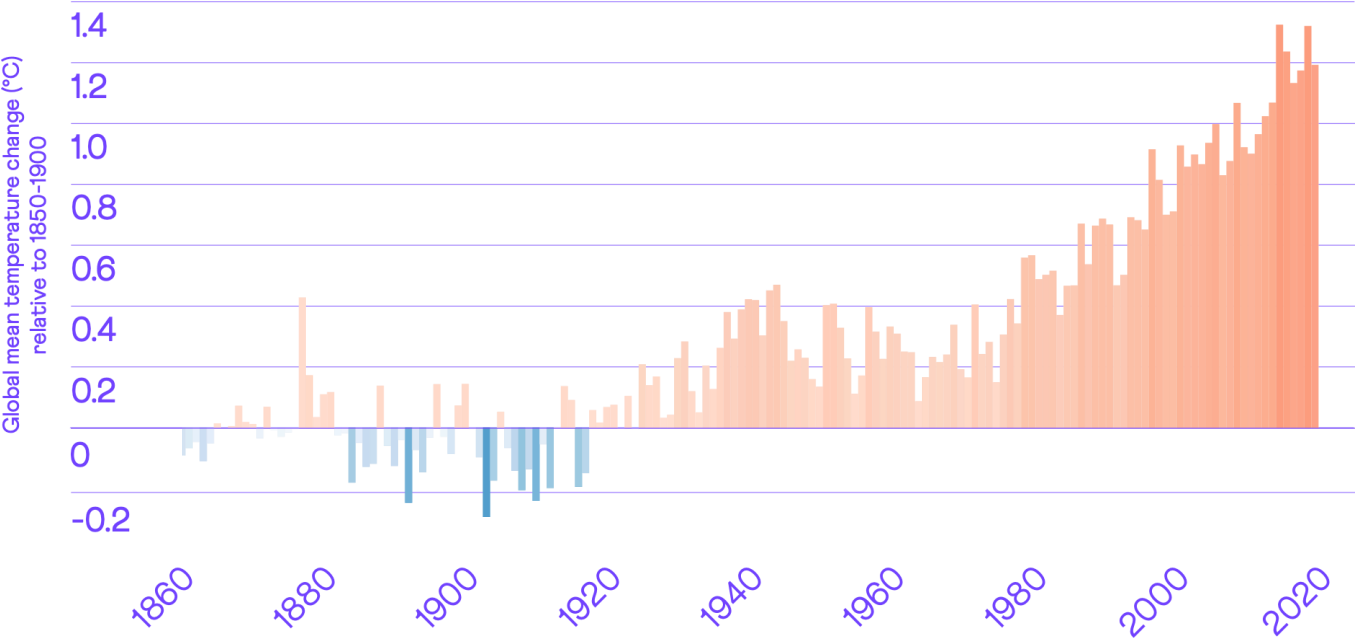
# Adaptation and Resilience: The UK approach

Julia King, Baroness Brown of Cambridge FREng FRS  
Chair, Adaptation Committee, UK Climate Change Committee

# The climate is changing

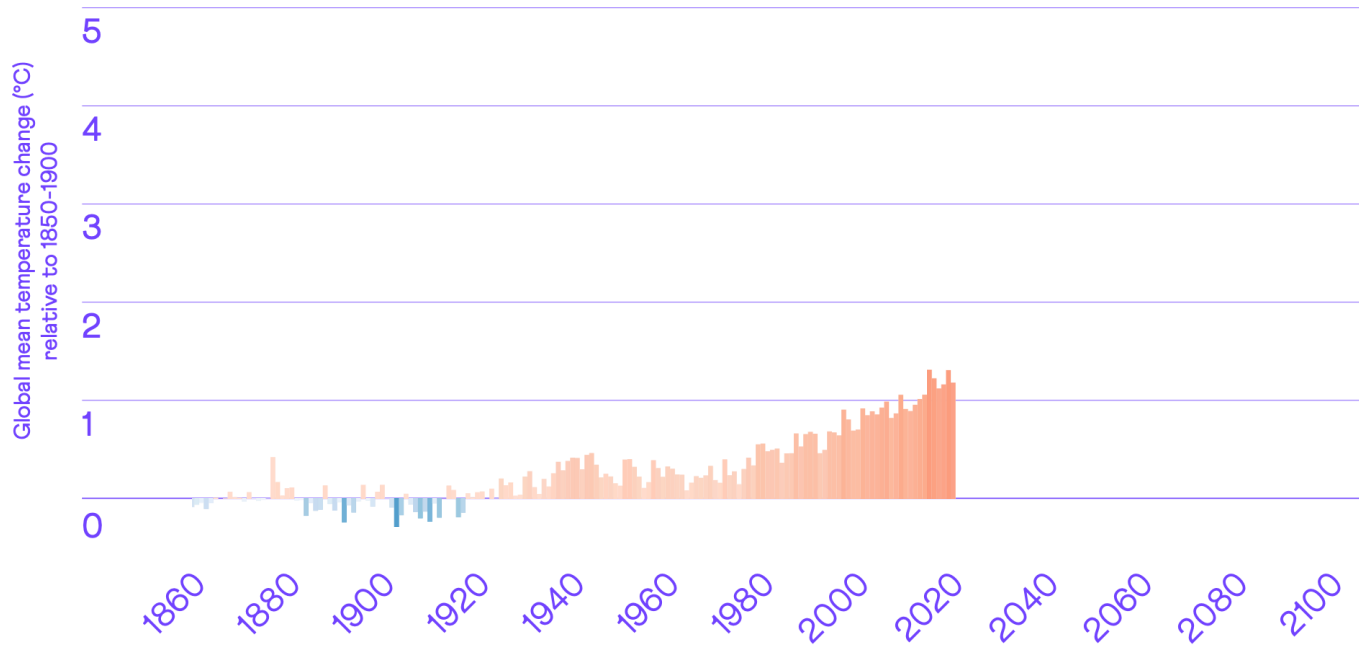
# Our changing climate

## Global temperature changes since 1860



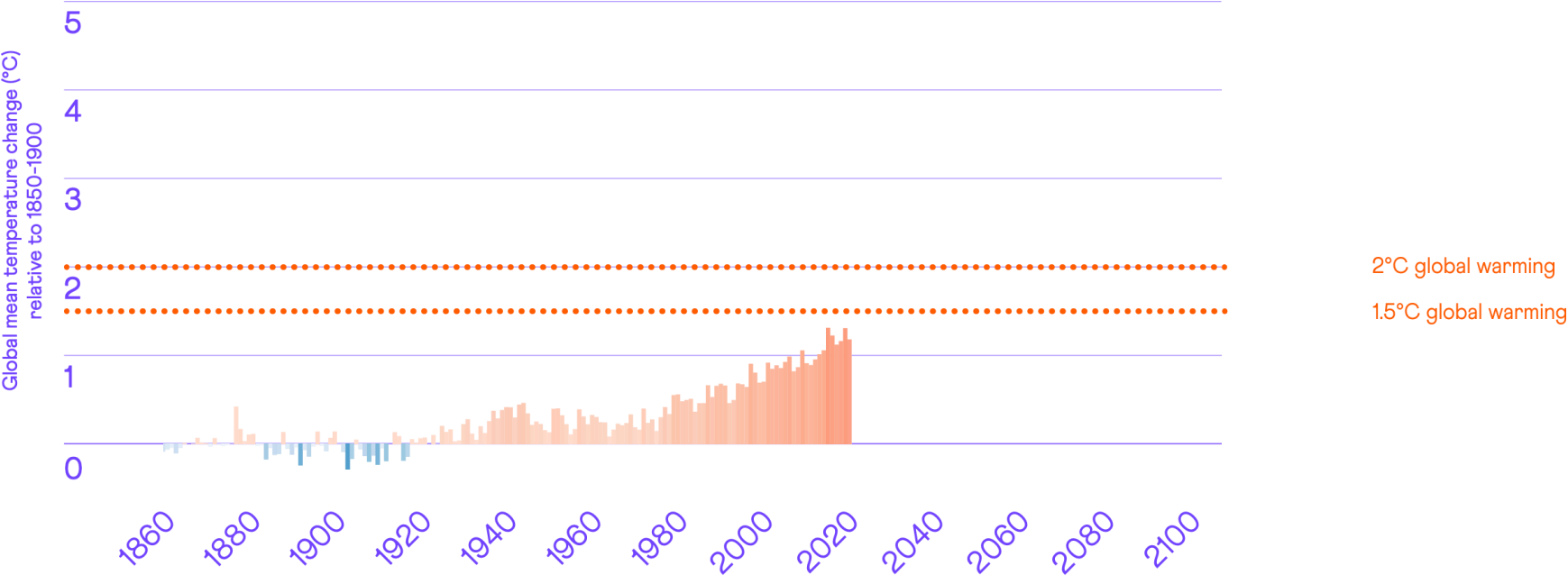
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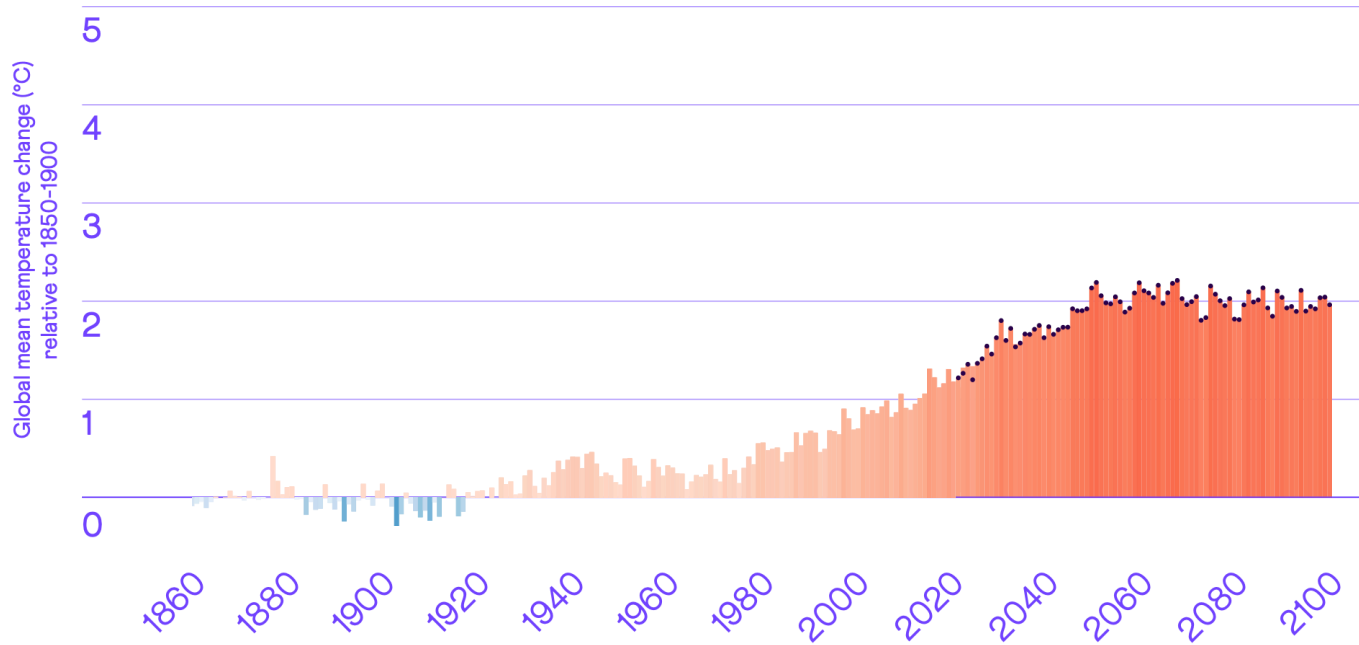
# Our changing climate

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# Our changing climate

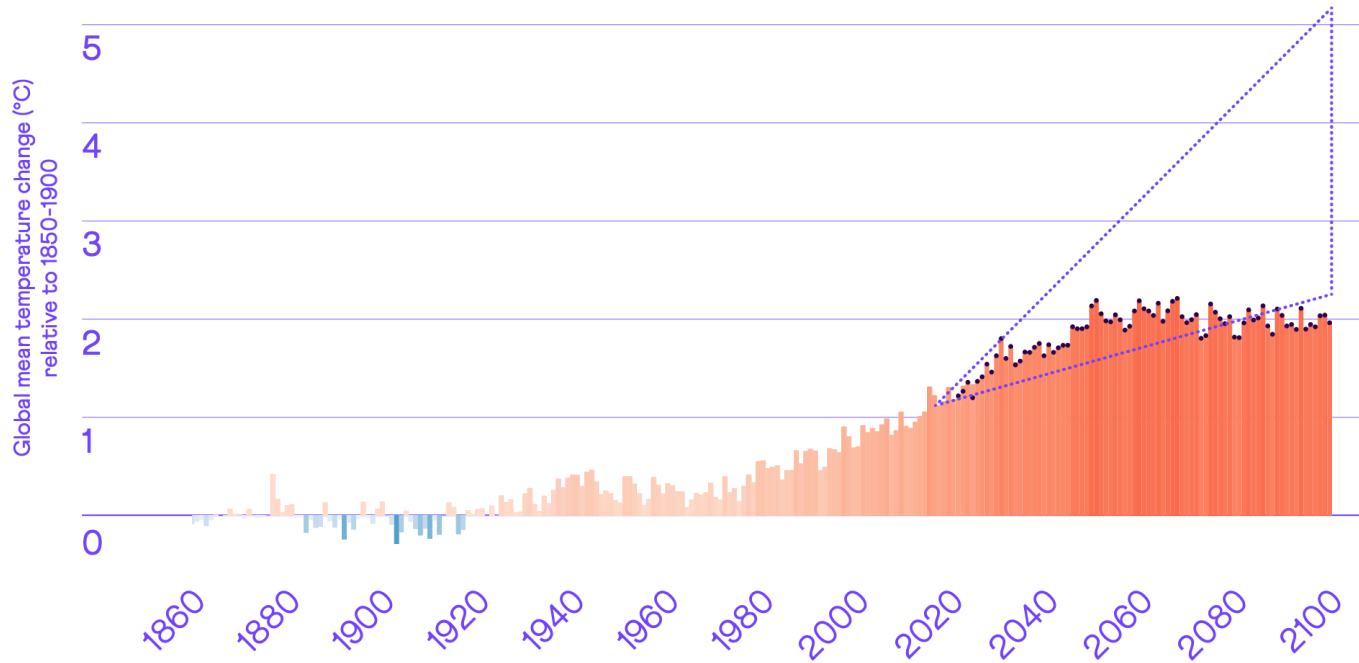
## Global temperature changes since 1860



Example climate future  
with global warming  
limited to 2°C by 2100

# Our changing climate

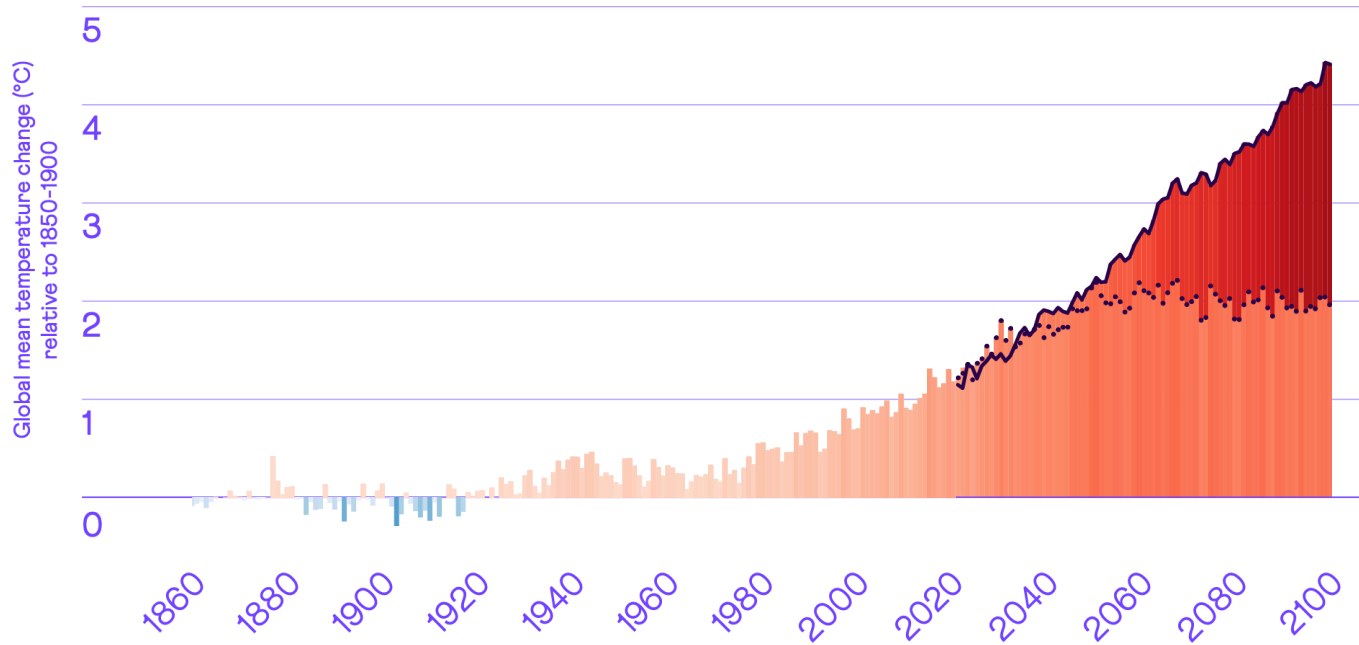
## Global temperature changes since 1860





# Our changing climate

## Global temperature changes since 1860



Example climate future  
possible with current  
worldwide policies

# The UK's changing climate

Further climate change is inevitable

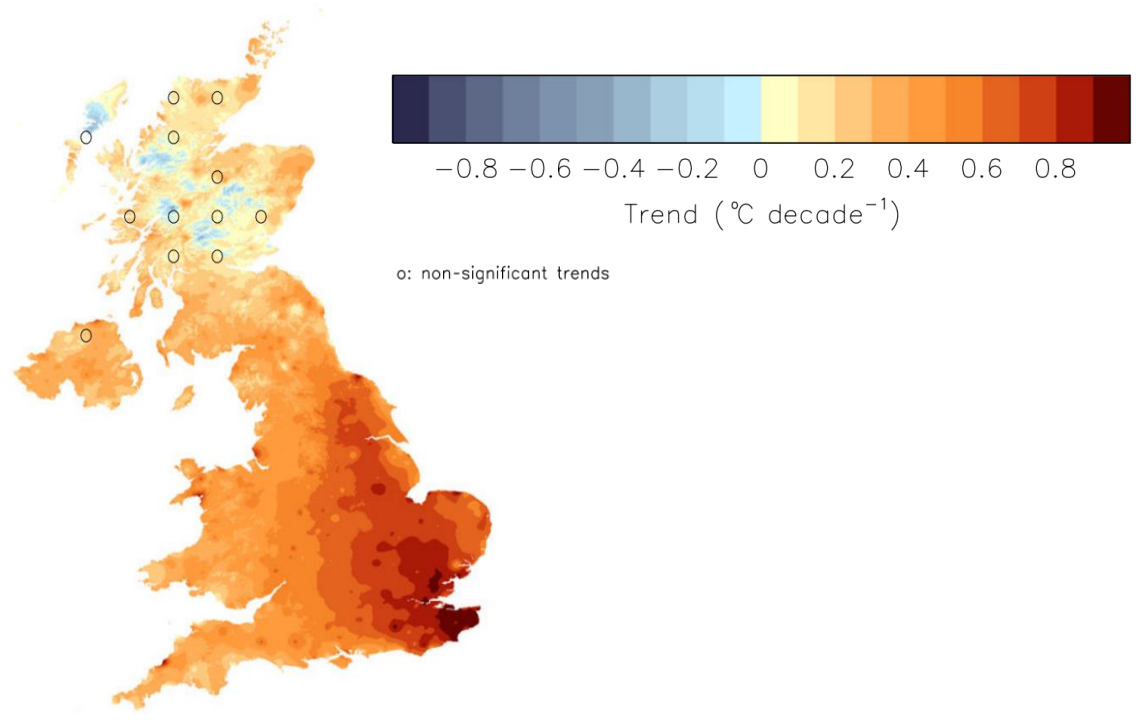
	Observed change to date	Inevitable change by mid-century	2°C by 2100C	4°C by 2100
Average annual UK temperature	~1.2°C above pre-industrial levels	~0.6°C from present	~0.7°C from present by mid-2080s	~3.0°C from present by mid-2080s
'Hot summer' occurrence	10 – 25% chance of a '2018 summer'	50% chance each year	50% chance each year	90% chance each year
Average summer rainfall	No significant long-term trend	-11% (to -24%)	-15% (to -28%)	-29% (-53%)
Average winter rainfall	No significant long-term trend	+5 % (+16%)	+6% (+18%)	+18% (+41%)
Heavy rainfall	No significant long-term trend	10% from present	20% from present	50% to 70% from present
Sea level rise	~16cm since 1900	3 - 37 cm from present by 2060	5 - 67cm from present	27 - 112cm from present

## Recent UK experience

Hottest 10 years.....

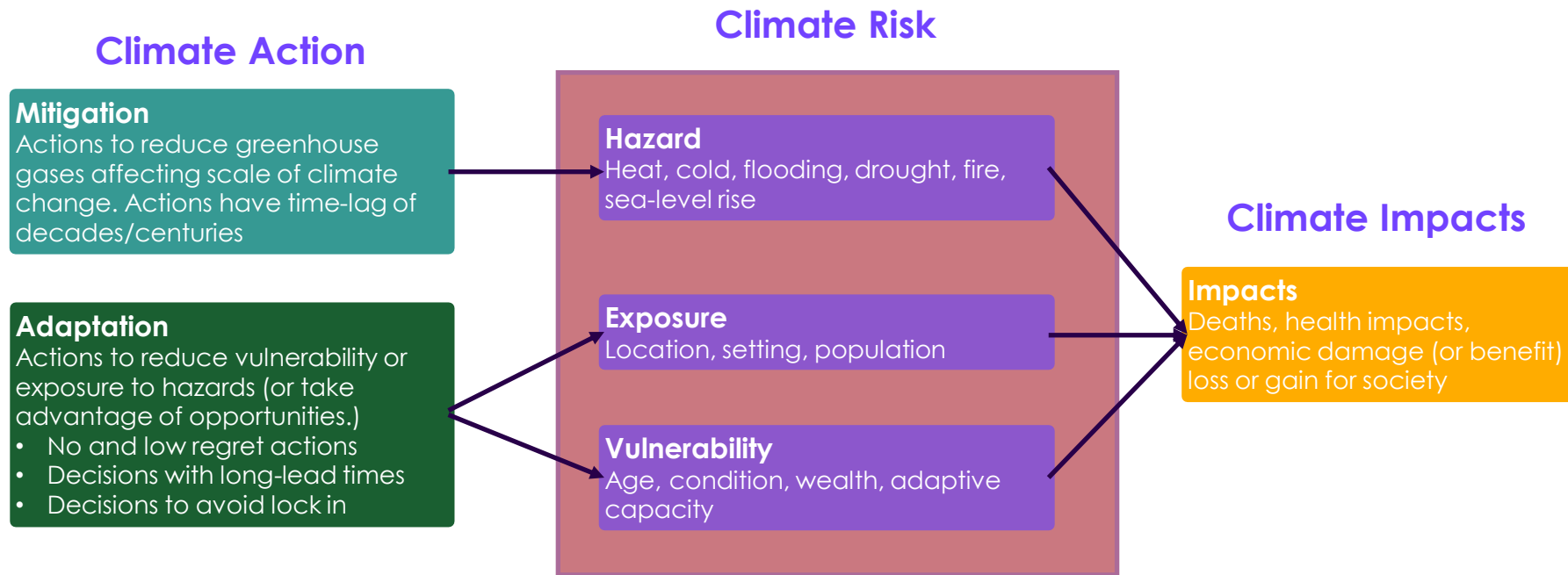
- 2018 heatwave summer typical by 2050
- Record UK temperature in Cambridge 38.7° July 2019
- 40°C temperatures by 2050

Rate of increase in hottest daytime temperatures (1960 to 2019)



# Action to reduce climate impacts

Both mitigation and adaptation are needed



# The UK's legislative framework

# Climate Change Act 2008



## Climate Change Act 2008

### CHAPTER 27

### CONTENTS

#### PART 1

#### CARBON TARGET AND BUDGETING

##### *The target for 2050*

- 1 The target for 2050
- 2 Amendment of 2050 target or baseline year
- 3 Consultation on order amending 2050 target or baseline year

##### *Carbon budgeting*

- 4 Carbon budgets
- 5 Level of carbon budgets
- 6 Amendment of target percentages
- 7 Consultation on order setting or amending target percentages
- 8 Setting of carbon budgets for budgetary periods
- 9 Consultation on carbon budgets
- 10 Matters to be taken into account in connection with carbon budgets

##### *Limit on use of carbon units*

- 11 Limit on use of carbon units

##### *Indicative annual ranges*

- 12 Duty to provide indicative annual ranges for net UK carbon account

##### *Proposals and policies for meeting carbon budgets*

- 13 Duty to prepare proposals and policies for meeting carbon budgets
- 14 Duty to report on proposals and policies for meeting carbon budgets
- 15 Duty to have regard to need for UK domestic action on climate change

# The UK Climate Change Act 2008

## Mitigation:

- Legal target to reduce UK greenhouse gas emissions by 80% from 1990 levels by 2050
- Government must legislate 5 year carbon budgets as a pathway to the 2050 target (six so far, up to 2037)

## Adaptation:

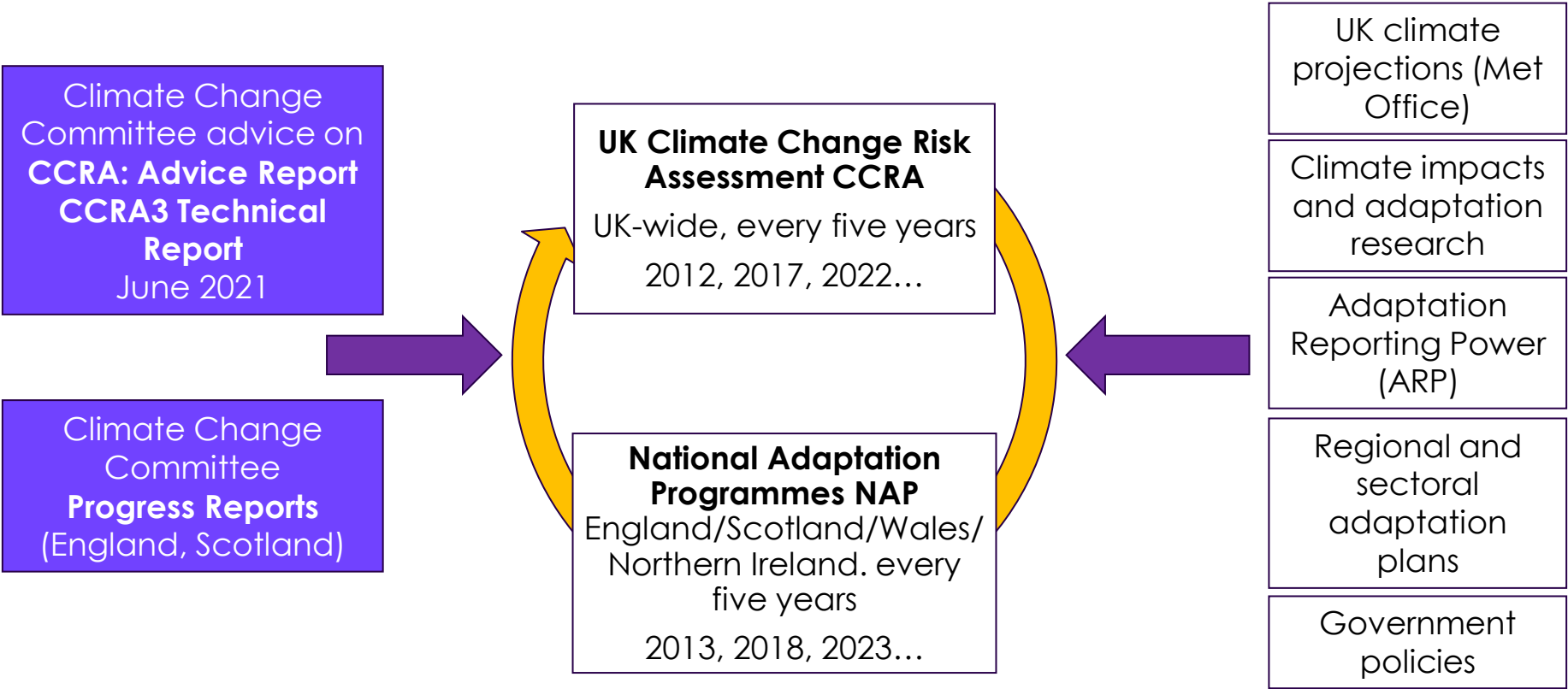
- Government must publish a UK climate change risk assessment (CCRA) every five years
- Followed by a National Adaptation Programme (NAP) to address the risks
- Establishes Adaptation Reporting Power (ARP)

## The Act sets up the Climate Change Committee and the Adaptation Committee

- **The CCC** advises Government on the level of carbon budgets, and scrutinises progress towards meeting the 2050 target
- **The AC** advises Government on the Climate Change Risk Assessment, and scrutinises progress in delivering the National Adaptation Programme

# Adapting to climate change

The Climate Change Act 2008 introduces a robust reporting framework





# The Adaptation Committee

An independent expert committee



Baroness Brown of Cambridge  
Chair  
Engineer: climate change



Prof Richard Dawson  
Civil engineer, flooding



Ece Ozdemiroglu  
Environmental economist



Rosalyn Schofield  
Company lawyer, sustainability head



Prof Mike Davies,  
Physicist: building performance



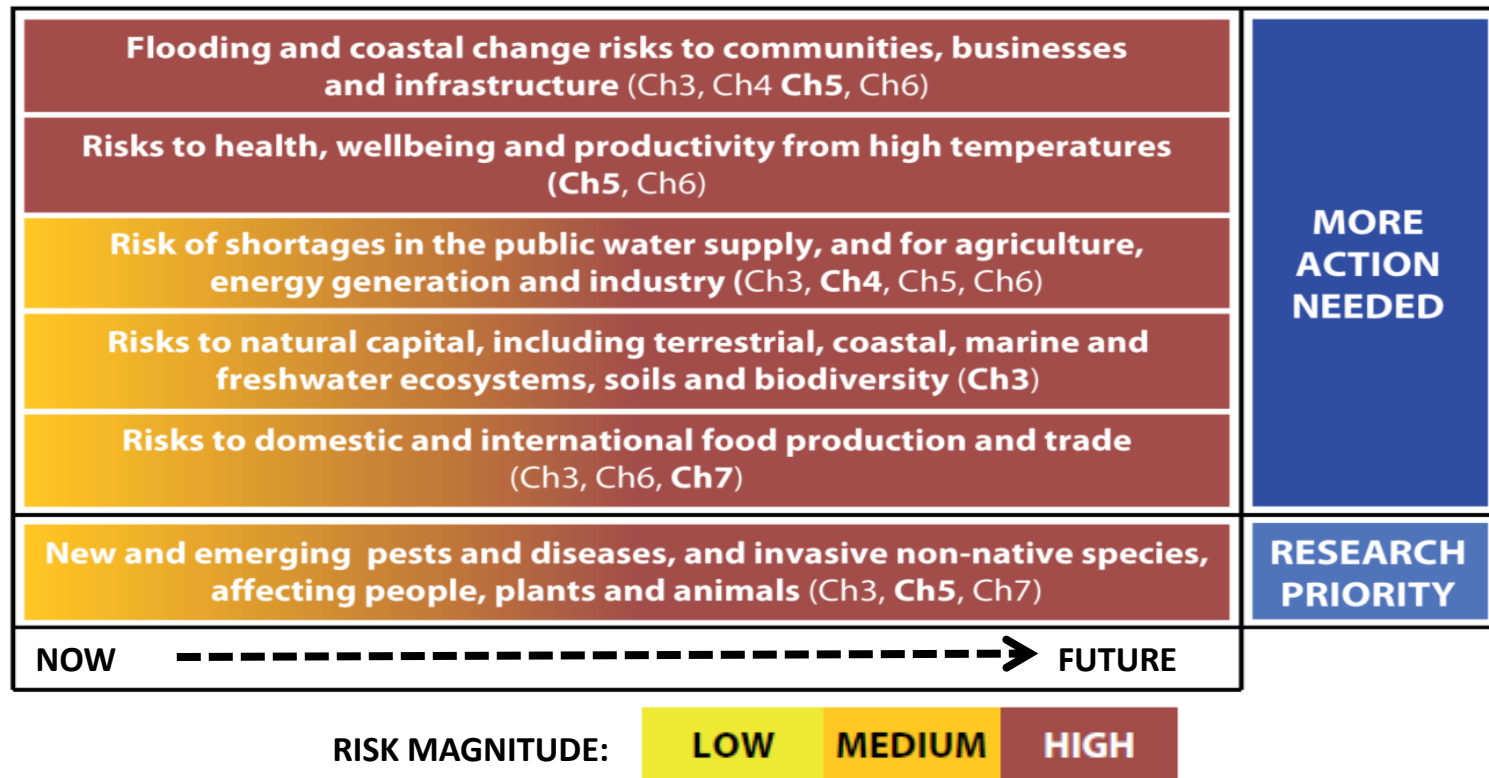
Prof Kate Jones (expert adviser)  
Biologist

Secretariat:

Biologist, meteorologist, 2 economists, climate scientist, environmental scientist

## 2<sup>nd</sup> UK Climate Change Risk Assessment 2017

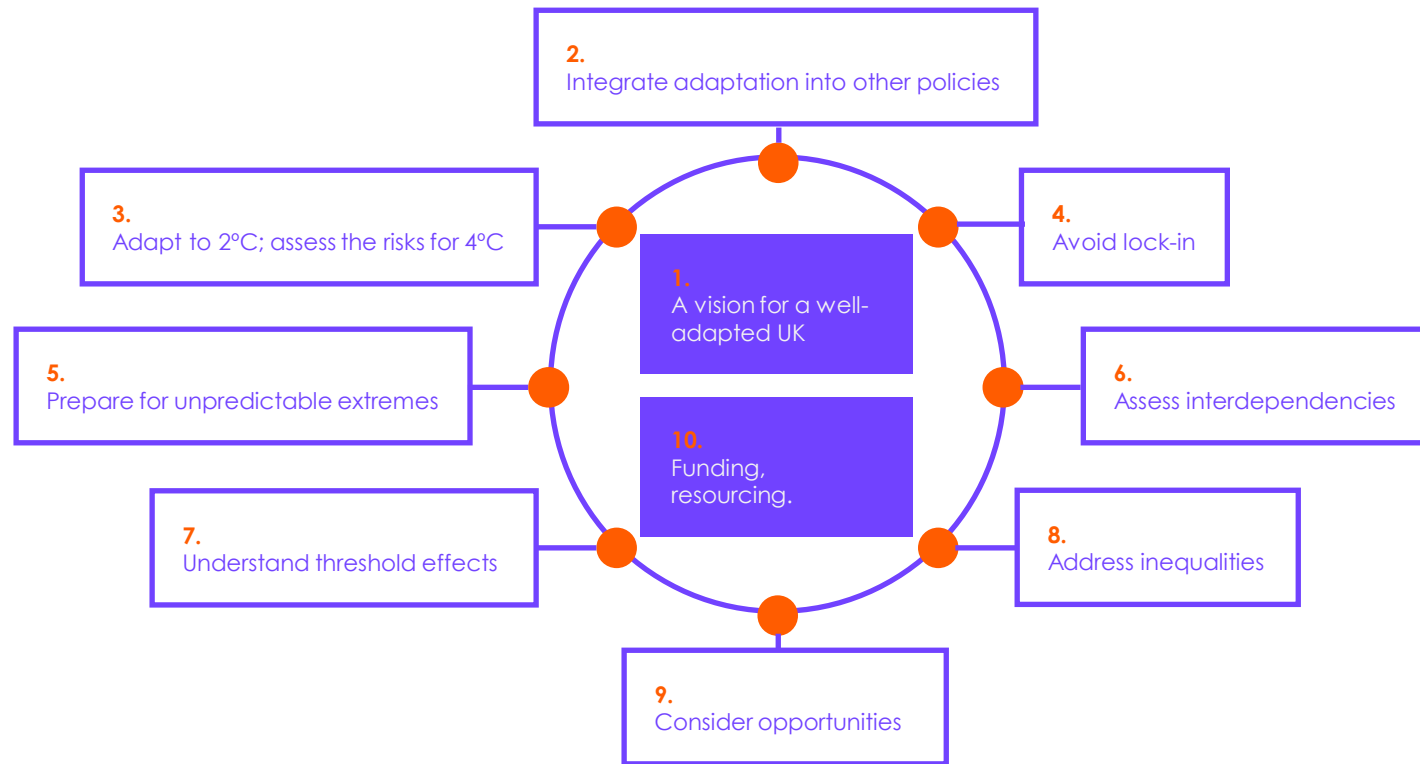
### Major risks to the UK



# Principles of good adaptation

# Ten principles for effective adaptation

Advice to UK Government for the Climate Change Committee 2021



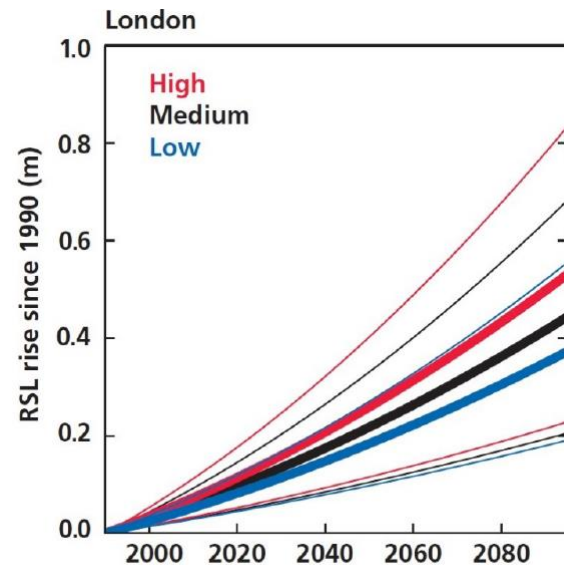
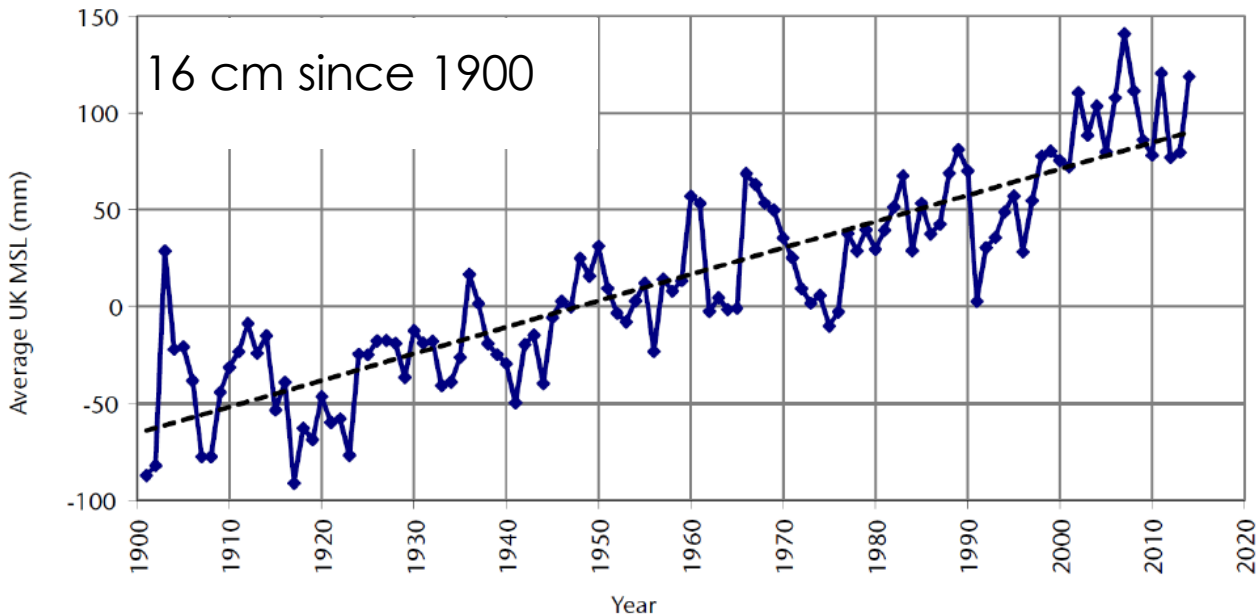
# Principles of good adaptation:

How are we doing at the coast?

# The impacts of climate change around the UK coast

## Sea level rise, flooding and coastal erosion

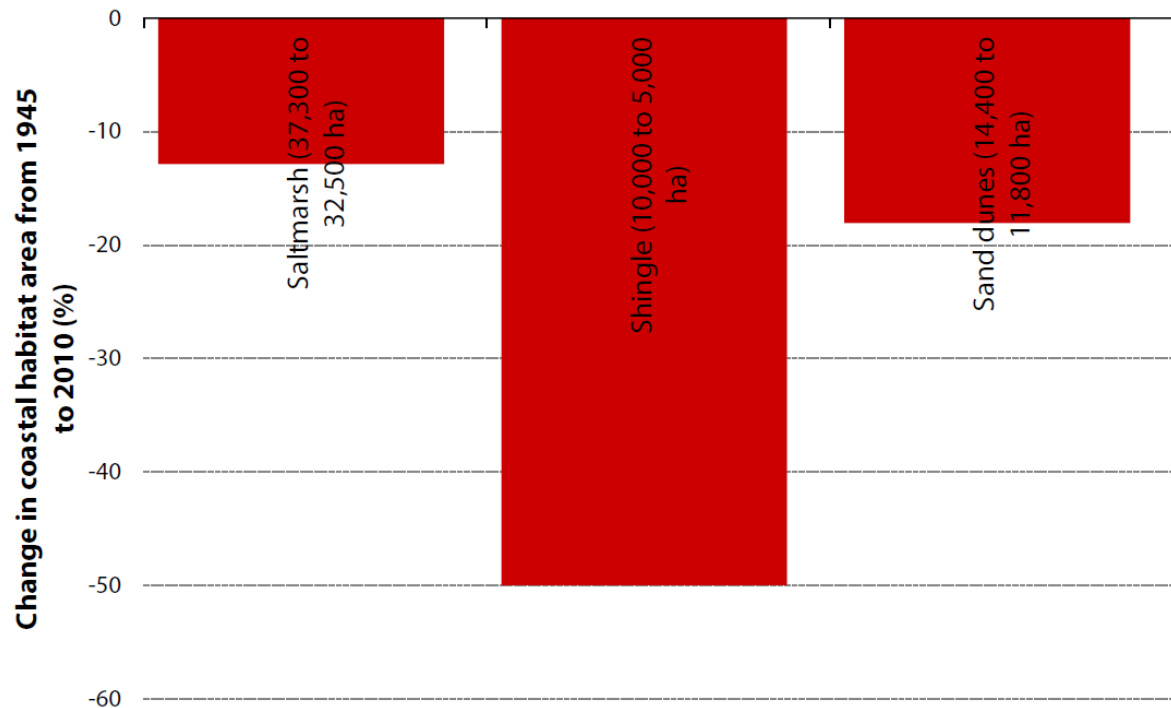
- The UK is likely to experience 1m of sea level rise, possibly by the end of the century
- Climate change threatens sustainability of coastal communities and environments



# The impacts of climate change around the UK coast

Increasingly damaging floods, increasing rates of coastal erosion

Loss of coastal habitats 1945 - 2010



# The impacts of climate change around the UK coast

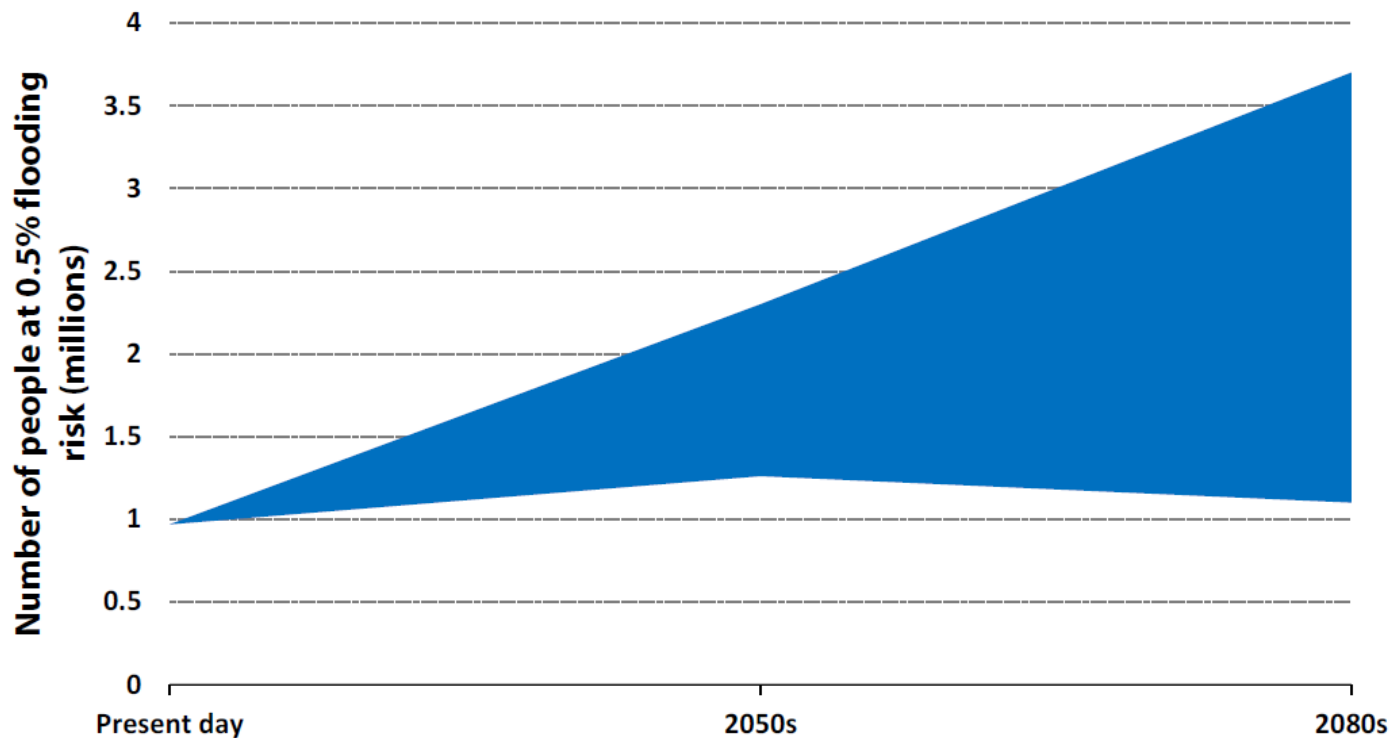
## Assets at risk

Asset category	Flood Zone 2 (0.1% or greater risk of flooding per year)	Flood Zone 3 (0.5% or greater risk of flooding per year)
Residential properties	445,000	374,000
Non-residential properties	173,000	145,000
Motorways and A-roads (km)	930	770
All other public roads (km)	6,550	5,720
Railways lines (km)	522	436
Railway stations	77	59
Historic Landfill (ha)	3,370	2,500
Grade 1, 2 and 3a agricultural land (ha)	205,000	187,000
Site of Special Scientific Interest (ha)	108,000	105,000



# The impacts of climate change around the UK coast

Population at 0.5% or greater risk of coastal flooding in England



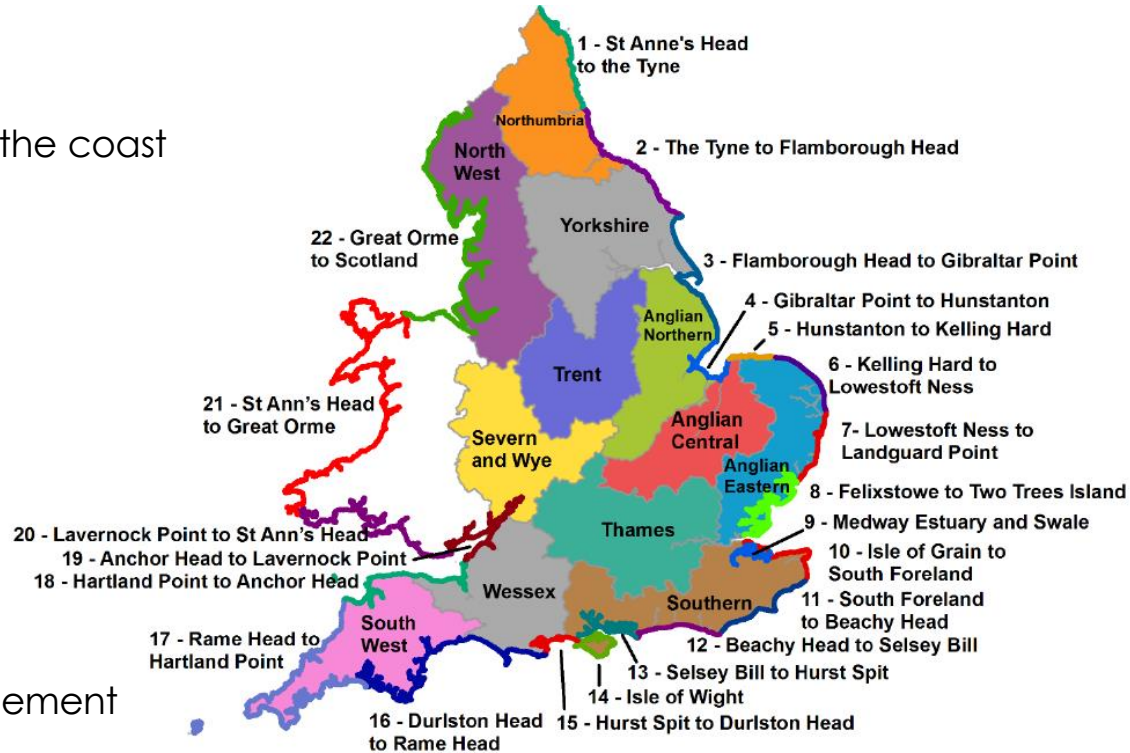
# 1. A vision of a well adapted coastline?

## Shoreline Management Plans: SMP

- Main vehicle for outlining strategy for the coast
- 100 year policy framework

### Coast of England and Wales:

- 22 Shoreline Management Plans
- Divided into smaller 'policy units'
  - Hold the Line HTL
  - Advance the Line ATL
  - Managed Realignment MR
  - No Active Intervention NAI
- 100 year policy framework for management



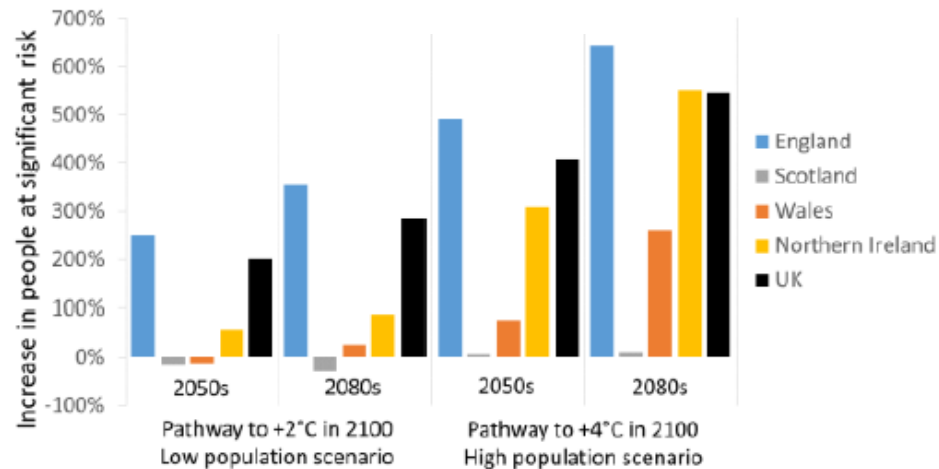
## 2. Integrate adaptation into other policies

### Shoreline Management Plans and Local Plans

- Shoreline Management Plans are not mandatory
- 30% of Local Plans do not mention Shoreline Management Plans
- Decisions with long time horizons versus local politics

### 3. Adapt to 2°, assess the risks of 4°

People at significant risk of coastal flooding

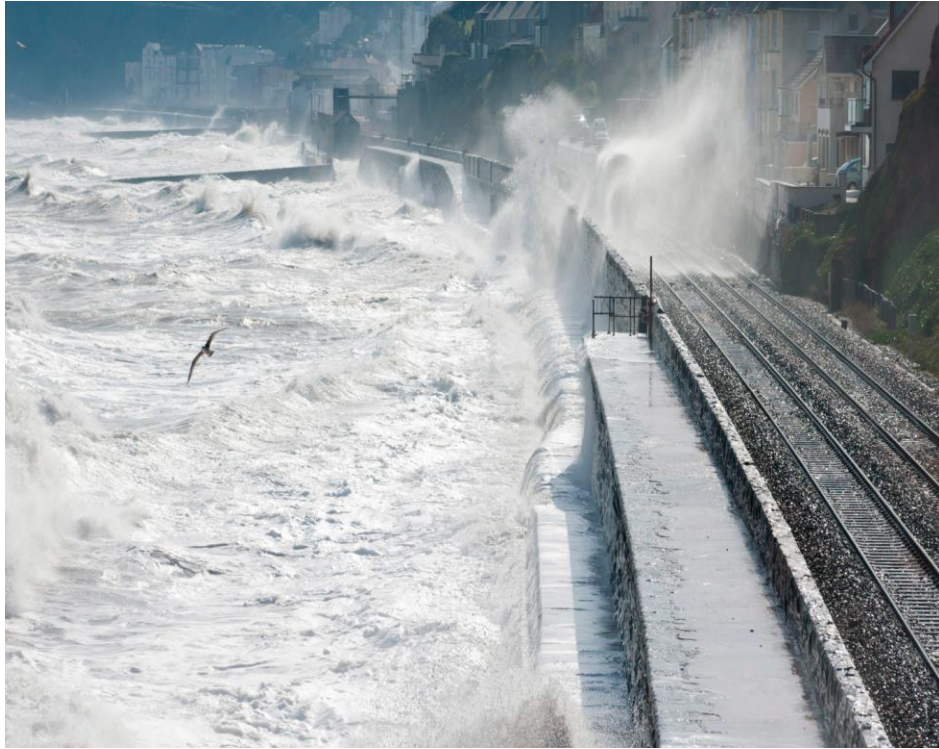


Identification of properties at risk



## 4. Avoid lock-in

### Coastal road and rail infrastructure in Devon, SW England



The railway line at Dawlish



The road at Slapton



## 5. Prepare for unpredictable extremes

Don't just assume the mean of the distribution

- Current approach
  - Likely range scenarios
  - Emergency response and incident management
- Need to consider
  - Extremes
  - Tipping points
  - 'What if scenarios'
- 'Tipping' into severe impacts
  - Successive storms where the second hampers recovery from the first: Ciara and Dennis in 2020



## 5. Prepare for unpredictable extremes

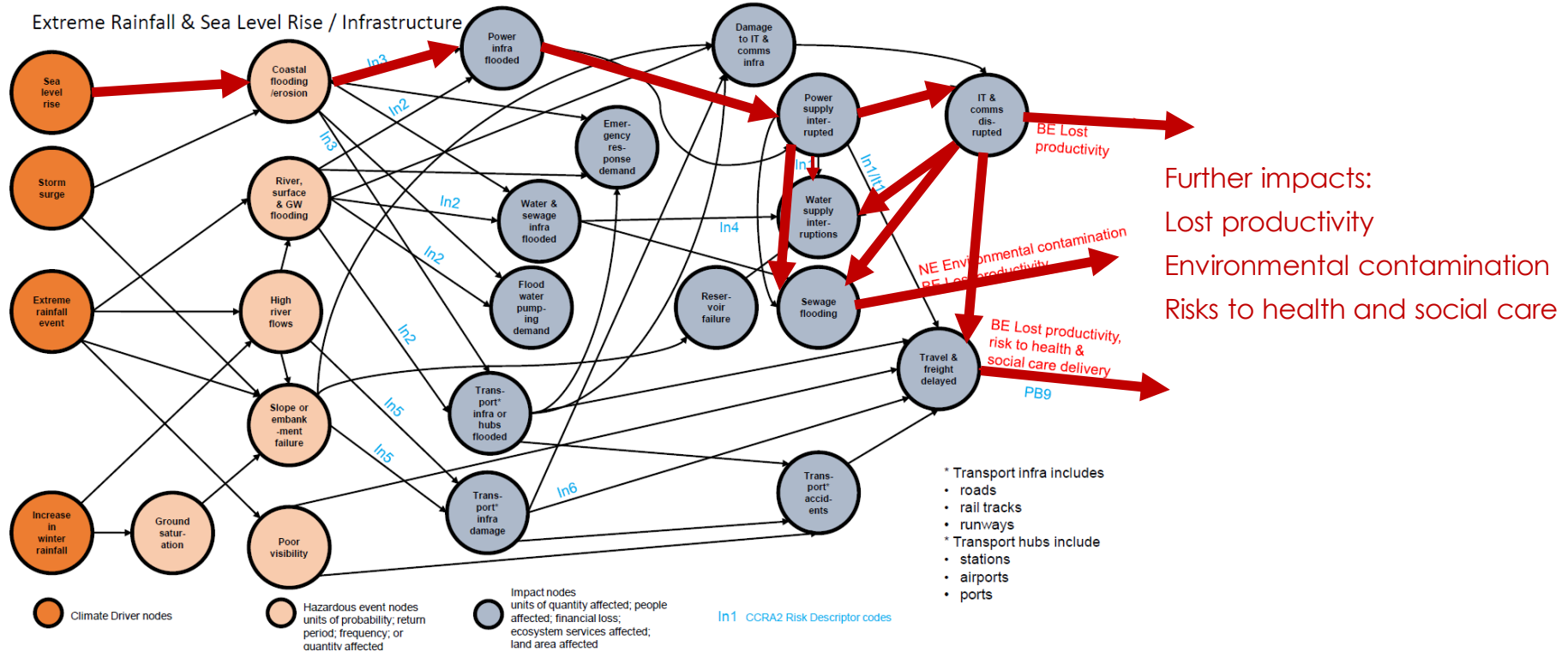
### Earth system changes

	Types of climate change that could occur	Resulting risks
<b>Extreme changes to regional and UK climate</b>	<ul style="list-style-type: none"><li>• Abrupt collapse of the Atlantic Meridional Overturning Circulation (AMOC), leading to reduced European warming, reduced summer rainfall, increased winter storminess over and above projected trends in Europe</li><li>• Changes to the Jet Stream due to Arctic warming, leading to persistent and amplified 'waviness', leading to changes to UK weather patterns</li></ul>	<ul style="list-style-type: none"><li>• Widespread and large reductions in arable farming output</li><li>• Severe depletion of groundwater reserves and severe summer drought</li></ul>
<b>Land ice melt-accelerated sea level rise</b>	<ul style="list-style-type: none"><li>• Accelerated loss of Antarctic and Greenland Ice Sheets, leading to sea level rise of over 1 m and up to 2 m by 2100 (and much more beyond)</li></ul>	<ul style="list-style-type: none"><li>• Extreme coastal flooding and widespread loss of viable coastal communities</li></ul>
<b>Carbon and biogeochemical feedback cycles – accelerated global warming</b>	<ul style="list-style-type: none"><li>• Large and rapid release of carbon from permafrost thawing significantly amplifying the level of global warming so that it reaches above 4°C from preindustrial levels by 2100</li><li>• Large reduction in the carbon uptake by the biosphere (oceans, Amazon, northern boreal forests), leading to abrupt ecosystem collapse and accelerated warming</li></ul>	<ul style="list-style-type: none"><li>• Major increases in heat-related deaths and losses to well-being and productivity</li><li>• Major increases in cooling demand</li></ul>

Need for early warning process

## 6. Assess interdependencies

Interacting and cascading risks - one of the biggest challenges in assessing climate impacts





## 7. Understand threshold effects

### The challenge of non-linear changes

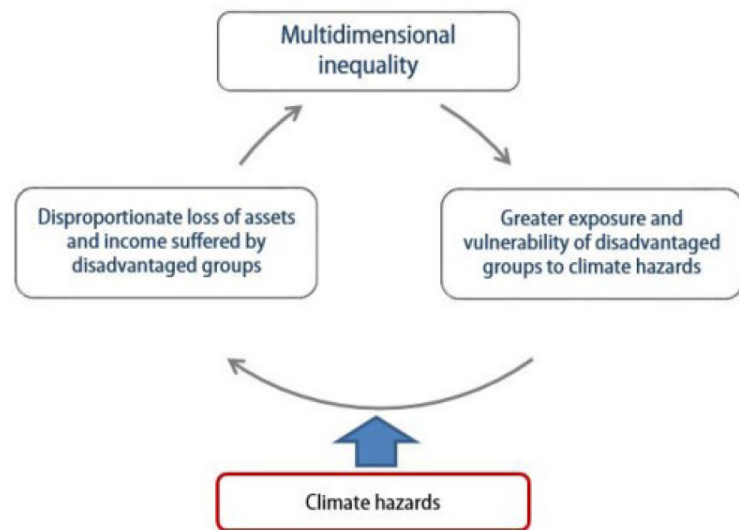
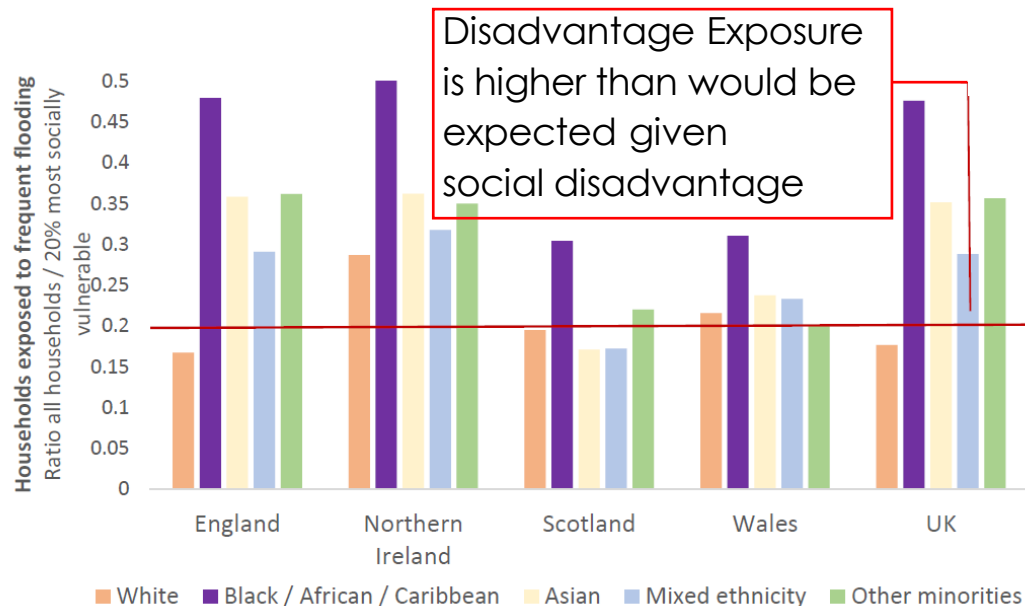
- Risk assessments that look at average changes over time assume a gradual, usually linear, increase in risk
- Algal blooms appear when water temperatures exceed  $17^{\circ}$
- When the Thames flood barrier remaining fatigue life is 30 years a new barrier is needed
- There is little research on thresholds in adaptation



## 8. Address inequalities

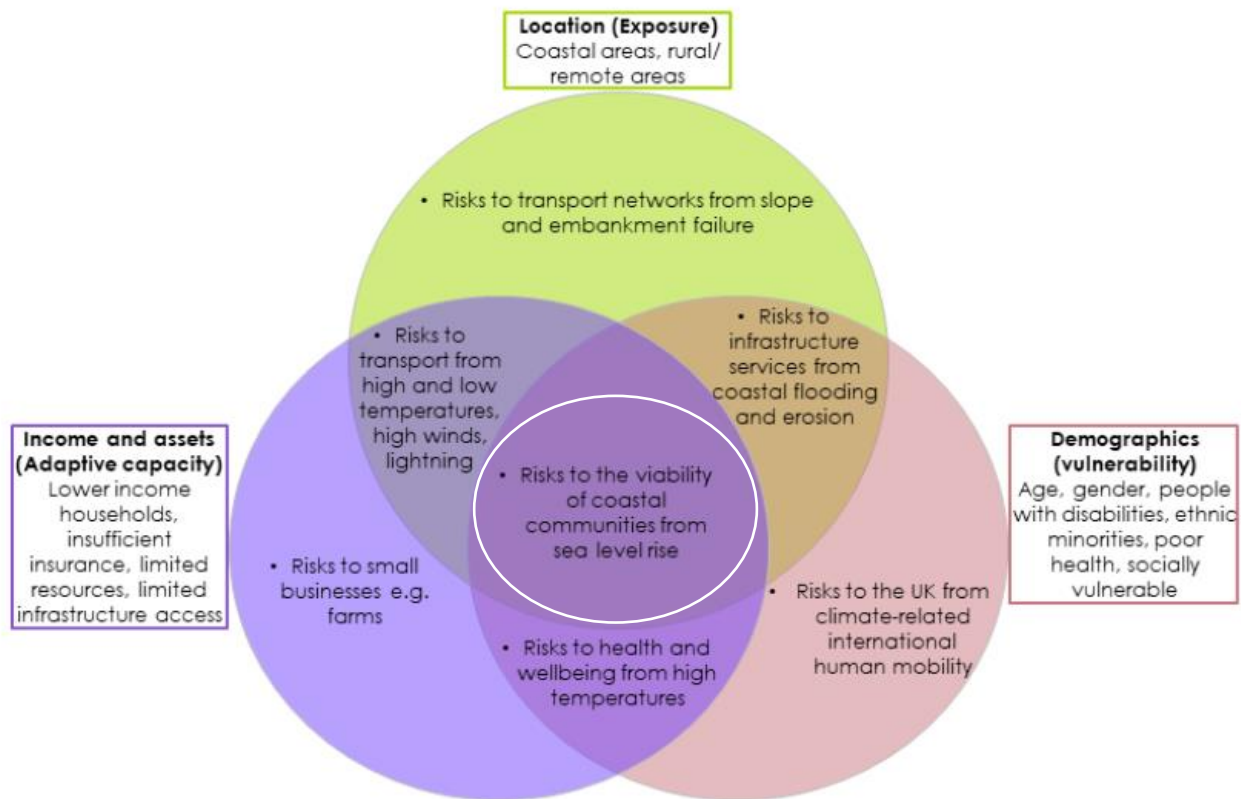
The disadvantaged are disproportionately affected by climate change

- Elderly and less affluent communities concentrated around the coast
- Disadvantaged households disproportionately exposed to flooding
- 2007 floods: lowest income groups 8x more likely to report mental health problems than highest



## 9. Address inequalities

Coastal areas are particularly challenged



## 9. Consider opportunities

### Carbon sequestration, health and well-being

- Creation of new wetland areas
  - >20% probability of saltmarsh stability or gain in some locations
    - low emissions
  - >80% probability of saltmarsh loss due to sea level rise
    - high emissions
- Recreation

Land use type	UK Carbon Stock	Annual net UK emissions or removals
Forest	459 MtC <sup>3</sup> (England)	Removals:18 MtCO <sub>2</sub> e <sup>2</sup>
Peatlands	3,200 ± 300 MtC <sup>1</sup> (UK)	Emissions:18.5 -23 MtCO <sub>2</sub> e <sup>2</sup>
Coastal wetlands (saltmarsh, coastal mudflats)	Unknown	Unknown: potentially higher removals for saltmarsh restoration than some types of peatland restoration

## 10. Funding and resourcing

### Valuing benefits and difficult conversations

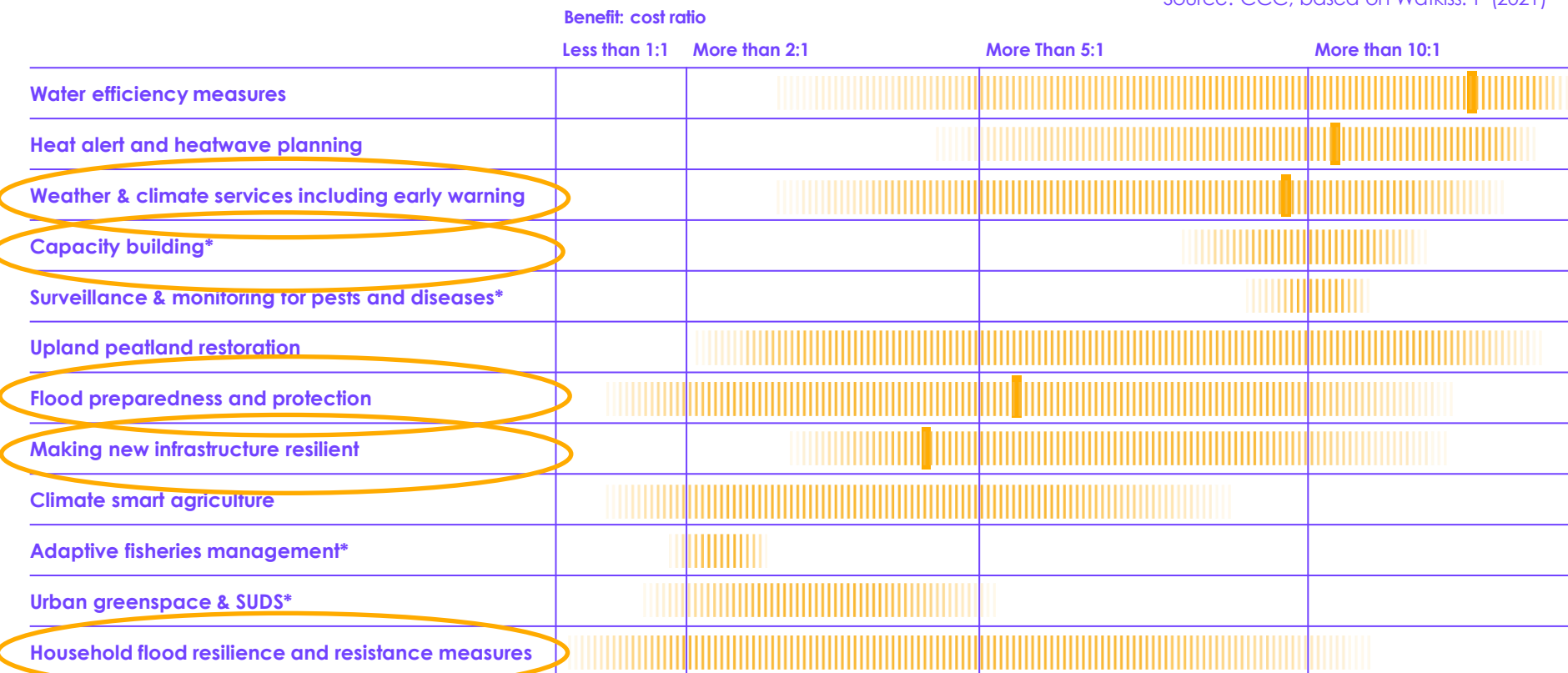
- Over 30% of England's coast has Shoreline Management Plans that are unlikely to meet the Government's benefit:cost threshold for funding
- 75% of the coast where the plan is to 'Hold the Line' – ie protection of the current coastline – is unlikely to be funded

# 10. Funding and resourcing

## Many adaptation actions are beneficial

\*Based on single, limited or indicative studies

Source: CCC, based on Watkiss. P (2021)



## Conclusions?

We are travelling hopefully

- Much of the UK's coast is not ready for the changes in climate that are already with us
- There is a 'Vision' in Shoreline Management Plans
- But it is unsupported
  - The plans are not statutory
  - In many areas they will be unfunded
  - Expectations are not being managed
- A complex patchwork of legislation
- A complex array of organisations involved
- Long term investment decisions do not align with political and election cycles

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