

14th September 2021

Climate risk and adaptation: The importance of nature and land use

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Panellists:

- **Pam Berry**, University of Oxford, **Iain Brown**, Research Councils UK Land Use Catalyst & University of Dundee (Technical Report authors)
- **Brendan Freeman**, Climate Change Committee
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Climate Change Risk Assessment 3

Chapter 3 – Natural Environment and Assets

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‘Exam question’

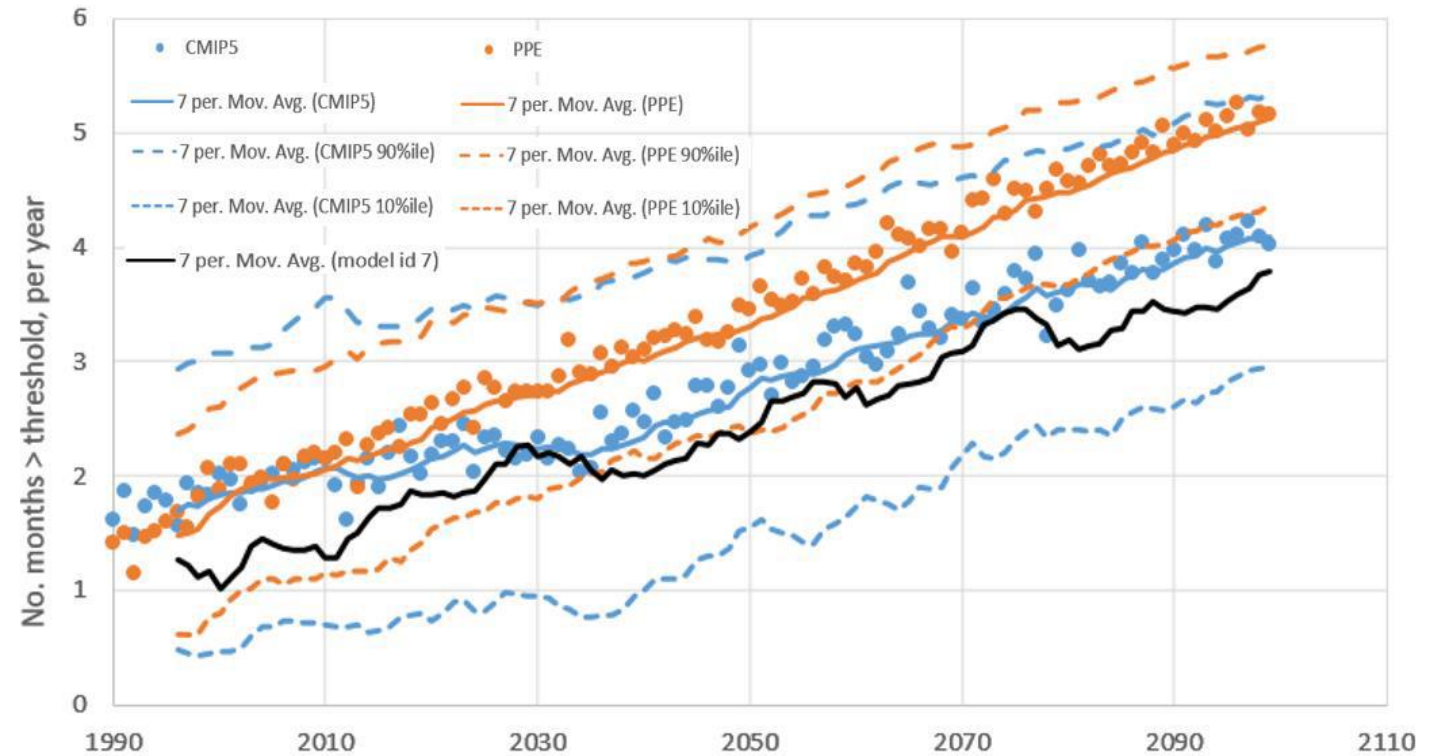
‘based on the latest understanding of current, and future, climate risks/opportunities, vulnerability and adaptation, what should the priorities be for the next UK National Adaptation Programme and adaptation programmes of the Devolved Administrations?’

- Urgency scoring framework – 3-step process

Steps

1. *What is the current and future level of risk/opportunity?*
2. *Is the risk/opportunity going to be managed, taking into account government commitments and non-government adaptation?*
3. *Are there benefits to further action in the next five years, over and above what is already planned?*

- Calls for evidence
- Stakeholder workshops
- CCRA3 Research projects
- External review



Time course of exceedance of water temperature threshold of 17 °C for algal blooms in lakes, under RCP8.5 pathway.
(from Thresholds project, Jones et al., 2020)

- Interacting risks
- Net Zero
- Notable events
- Greater emphasis on assessment at country-level



Committee on Climate Change

**INTERACTING RISKS IN
INFRASTRUCTURE AND THE BUILT
AND NATURAL ENVIRONMENTS**

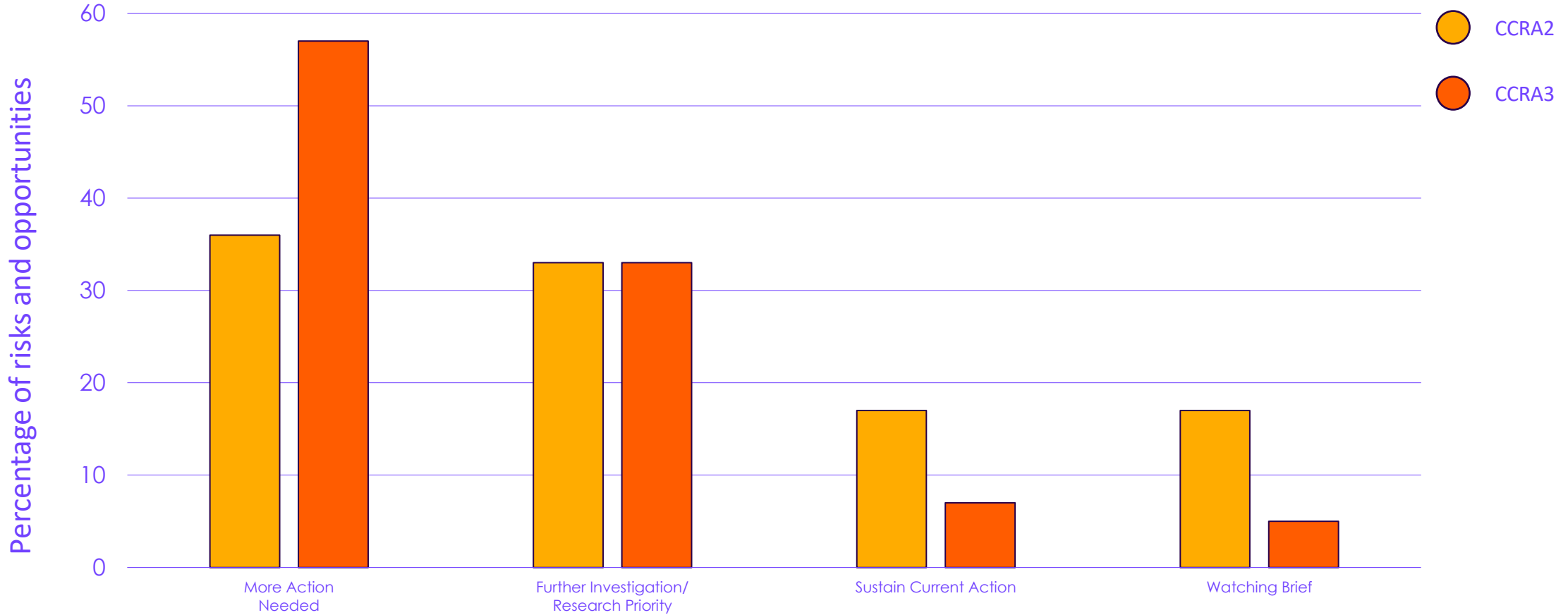
Research in support of the UK's Third Climate
Change Risk Assessment Evidence Report



| | | | | | | | |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| N1 Risks to terrestrial species and habitats | N2 Risks to terrestrial species and habitats from pests, pathogens and INNS | N4 Risk to soils from changing conditions, including seasonal aridity and wetness | N5 Risks to natural carbon stores and sequestration from changing conditions | N6 Risks to and opportunities for agricultural and forestry productivity | N7 Risks to agriculture from pests, pathogens and INNS | N8 Risks to forestry from pests, pathogens and INNS | N11 Risks to freshwater species and habitats |
| N12 Risks to freshwater species and habitats from pests, pathogens and INNS | N14 Risks to marine species, habitats and fisheries | N16 Risks to marine species and habitats from pests, pathogens and INNS | N17 Risks and opportunities to coastal species and habitats | I1 Risks to infrastructure networks from cascading failures | I2 Risks to infrastructure services from river and surface water flooding | I5 Risks to transport networks from slope and embankment failure | N1 Risks to terrestrial species and habitats |
| I12 Risks to transport from high and low temperatures, high winds, lightning | H1 Risks to health and wellbeing from high temperatures | H3 Risks to people, communities and buildings from flooding | H4 Risks to people, communities and buildings from sea level rise | H6 Risks and opportunities from summer and winter household energy demand | H8 Risks to health from vector-borne diseases | H11 Risks to cultural heritage | H12 Risks to public water supplies from reduced water availability |
| H13 Risks to education and prison services | B1 Risks to business sites from flooding | B2 Risks to business locations and infrastructure from coastal change | B6 Risks to business from disruption to supply chains and distribution networks | ID1 Risks to UK food availability, safety, and quality from climate change overseas | ID5 Risks to international law and governance from climate change overseas that will impact the UK | ID4 Risks to the UK from international violent conflict resulting from climate change | ID9 Risk to UK public health from climate change overseas |
| ID7 Risks from climate change on international trade routes | ID10 Risk multiplication from the interactions and cascades of named risks across systems and geographies | N3 Opportunities from new species colonisations in terrestrial habitats | N9 Opportunities for agricultural and forestry productivity from new species | N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion | N15 Opportunities for marine species, habitats and fisheries | N18 Risks and opportunities from climate change to landscape character | I3 Risks to infrastructure services from coastal flooding and erosion |
| I4 Risks to bridges and pipelines from flooding and erosion | I6 Risks to hydroelectric generation from low or high river flows | I7 Risks to subterranean and surface infrastructure from subsidence | I9 Risks to energy generation from reduced water availability | I10 Risks to energy from high and low temperatures, high winds, lightning | I13 Risks to digital from high and low temperatures, high winds, lightning | H2 Opportunities for health and wellbeing from higher temperatures | H5 Risks to building fabric |
| H7 Risks to health and wellbeing from changes in air quality | H9 Risks to food safety and food security | H10 Risks to health from poor water quality and household water supply interruptions | B3 Risks to businesses from water scarcity | B5 Risks to business from reduced employee productivity – infrastructure disruption and higher temperatures | B7 Opportunities for business – changing demand for goods and services | N13 Opportunities to freshwater species and, habitats | I11 Risks to offshore infrastructure from storms and high waves |
| B4 Risks to finance, investment, insurance, access to capital | ID8 Risk to the UK finance sector from climate change overseas | ID2 Opportunities for UK food availability and exports | ID3 Risks to the UK from climate-related international human mobility | ID6 Opportunities (including Arctic ice melt) for international trade routes | | | |

Changes in urgency scores between CCRA2 and CCRA3

The level of urgency of adaptation has increased since CCRA2 was published in 2017



| Risk Descriptor | England | NI | Scotland | Wales |
|--------------------------------------------------------------------------------------------------------------------------------|---------|----|----------|-------|
| N1 Risks to species and habitats from changing climatic conditions and extreme events | | | | |
| N2 Risks to terrestrial species and habitats from pests, pathogens and invasive species | | | | |
| N3 Opportunities from new species colonisations in terrestrial habitats | | | | |
| N4 Risk to soils from changing climatic conditions, including seasonal aridity and wetness. | | | | |
| N5 Risks and opportunities for natural carbon stores, carbon sequestration and GHG emissions from changing climatic conditions | | | | |
| N6 Risks to and opportunities for agricultural and forestry productivity from extreme events and changing climatic conditions | | | | |
| N7 Risks to agriculture from pests, pathogens and invasive species | | | | |
| N8 Risks to forestry from pests, pathogens and invasive species | | | | |
| N9 Opportunities for agricultural and forestry productivity from new/alternative species becoming suitable. | | | | |
| N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion | | | | |
| N11 Risks to freshwater species and habitats from changing climatic conditions and extreme events | | | | |
| N12 Risks to freshwater species and habitats from pests, pathogens and invasive species | | | | |
| N13 Opportunities to freshwater species and habitats from new species colonisations | | | | |
| N14 Risks to marine species, habitats and fisheries from changing climatic conditions | | | | |
| N15 Opportunities to marine species, habitats and fisheries from changing climatic conditions | | | | |
| N16 Risks to marine species and habitats from pests, pathogens and invasive species | | | | |
| N17 Risks and opportunities to coastal species and habitats due to coastal flooding, erosion and climate factors | | | | |
| N18 Risks and opportunities from climate change to landscape character | | | | |

More Action Needed

Further Investigation

Sustain Current Action, Watching Brief

N1 Risks to terrestrial species and habitats from changing climatic conditions and extreme events

Risk magnitude - High

- no. of ecological processes (e.g. physiology, phenology, population dynamics) affected by climate change;
- no of species and habitats affected by climate change
- new evidence of the impact of extreme events, particularly droughts

Leading to changes in community and habitat composition and thus ecosystem services

Also opportunities - e.g. for population increase and range expansion (N3)

| | Magnitude score | | | | | Adaptation score | Urgency score |
|----------|-----------------|---------|---------|---------|---------|------------------|--------------------|
| | Present Day | 2050 2° | 2050 4° | 2080 2° | 2080 4° | | |
| England | | | | | | Partially | More action needed |
| NI | | | | | | Partially | More action needed |
| Scotland | | | | | | Partially | More action needed |
| Wales | | | | | | Partially | More action needed |

 More Action Needed

N11 Risks to freshwater species and habitats from changing climatic conditions and extreme events

Risk magnitude – Medium → High

- direct effects on species behavioural and physiological responses
- indirect effects of higher water temperatures on species interactions and habitat features
- higher water temperatures effects on water quality
- reduced water availability

Fewer opportunities for freshwater species from climate change

(and less evidence)

| | Magnitude score | | | | | Adaptation score | Urgency score |
|----------|-----------------|---------|---------|---------|---------|------------------|--------------------|
| | Present Day | 2050 2° | 2050 4° | 2080 2° | 2080 4° | | |
| England | | | | | | Partially | More action needed |
| NI | | | | | | Partially | More action needed |
| Scotland | | | | | | Partially | More action needed |
| Wales | | | | | | Partially | More action needed |

More Action Needed

Further Investigation

High for the 2080s with 4°C global warming, due to the likelihood of greater changes in temperature, river flows and water quality

- **Adaptation measures include:**
 - reducing other pressures on biodiversity / improving water quality
 - increasing the number and size of protected sites
 - improving the functional connectivity between sites / maintaining river flows and water bodies
 - maintaining or increasing habitat heterogeneity
 - protecting or creating cool microclimates and potential refugia for species / reducing water temperatures
 - species translocation and assisted colonisation
- **There are a range of initiatives, policies and measures aimed at facilitating adaptation to climate change, there is still limited, but growing, evidence of their effectiveness**

* at least

Risk Magnitude: MED* (present) → HIGH (future)

- Climate change interacting with other stressors, especially land use
- Natural resilience of soils degraded in many areas (erosion, compaction, OM loss etc.)
- Severe implications for ecosystems & ecosystem services

Adaptation: VERY LIMITED (specific soils/sites e.g. deep peat)

- Examples of maladaptation (land drainage; planting on organic soils etc.)

Urgency: MORE ACTION NEEDED

- Changes in land use / land mgmt. required
- Spatially targeted support schemes & advice
- More investment in large-scale monitoring data/indicators linked to actions & functions
- Recognise that soils are complex and variable
- Integrate adaptation / mitigation

* at least

Risk Magnitude: MED* (present) → HIGH (future)

- Risks predominate but they are also opportunities (incl. new species/cultivars)
- Changes in unit production (yield), land capability & other parameters (e.g. protein)
- Likely greater seasonal/yearly variability ('good/bad' years)
- Issues can affect wider supply chains (food, drink, bioenergy)

Adaptation: VERY LIMITED

- Reactive responses dominate at farm level. Also examples of path dependency & maladaptation
- Information on adaptations occurring (where & when) very limited (often anecdotal)
- Especially limited information on uptake of new crops/cultivars

Urgency: MORE ACTION NEEDED

- Incorporate adaptation into systematic national surveys of attitudes/practices etc.
- Better advice and outreach on evolving risks/opportunities – spatially targeted
- Use strategic planning tools such as Land Capability assessment (e.g. Wales CSC Prog)
- Shorten lead times from R&D to implementation. Encourage innovation/diversification
- Recognise and plan for key dependencies – soil structure/fertility, water availability etc.

* With Agric

Risk Magnitude*: MED (present) → HIGH (future)

- Increased risks, esp. from increased drought frequency (esp. in South)
- Opportunities for new species in new areas
- As with agriculture, interacting effects of increased CO2 on yield are a key uncertainty

Adaptation: LIMITED

- Often more emphasis on long-term planning & multifunctionality
- But also examples of path dependency & maladaptation
- Information on adaptation occurring remains limited

Urgency: MORE ACTION NEEDED

- Targeted advice & outreach on evolving risks/opportunities
- Encourage innovation/diversification
- Dissipate agric/forestry sector boundaries & develop integrated strategies, incl. agroforestry etc

Risk Magnitude: MED (present) → HIGH (future)

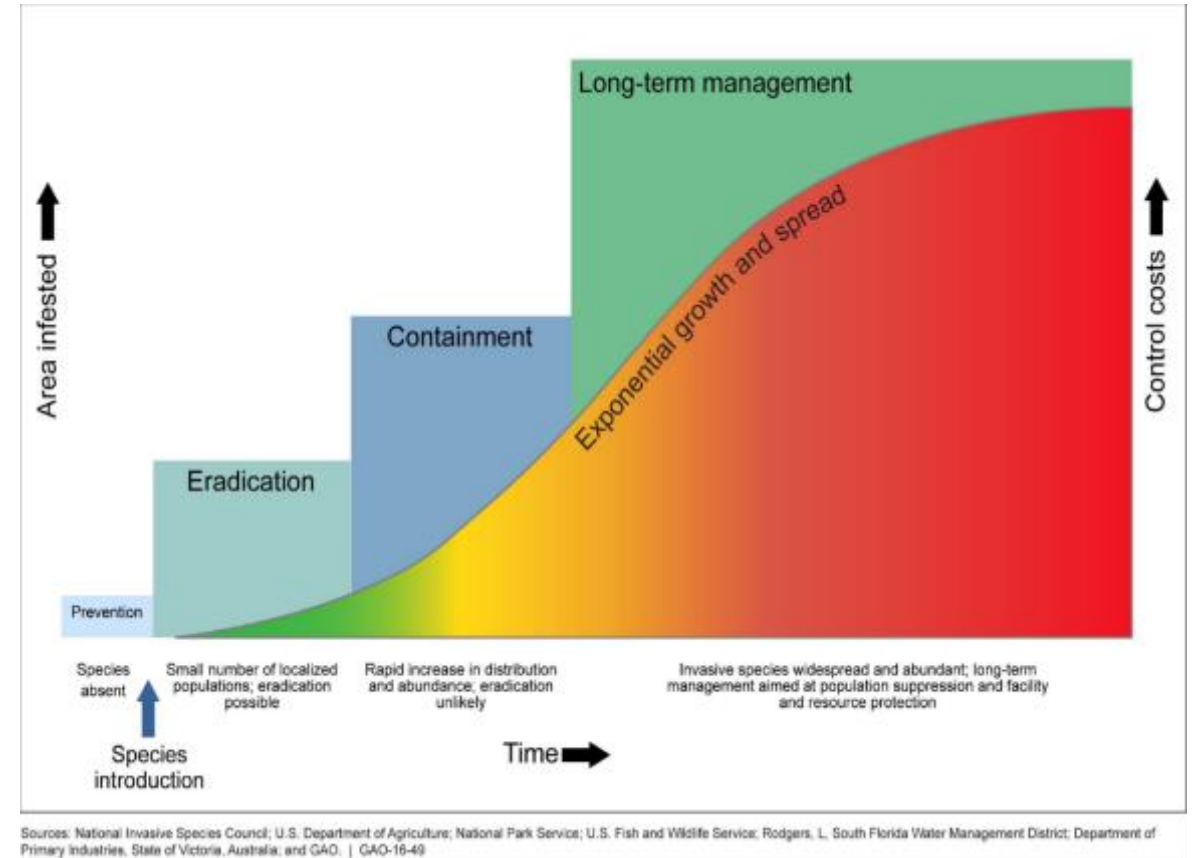
- Increased risk from known threats;
- Emergent risks likely
- Can interact with other climate stressors e.g. drought
- CC also acts with changing socioeconomic drivers e.g. trade & globalisation

Adaptation: PARTIAL

- Established risk assessment procedures
- Climate change can blur PPI distinctions & responsibilities

Urgency: MORE ACTION NEEDED

- Surveillance / horizon scanning
- Cross-sectoral contingency planning
- Land use decisions crucial – e.g. diversification (variety/species → plot/stand → landscape)
- Expand Use and Uptake of Integrated Pest Management (IPM) & natural resistance strategies



Risk Magnitude: MED (present) → HIGH (future)

- Flooding/erosion risks already for habitats and agric land; some localised saline intrusion
- CC risks interact with socioeconomic factors, esp. land use decisions - Coastal squeeze effects
- SLR projections now being revised upwards

Adaptation: VARIABLE, GENERALLY V. LIMITED

- Emphasis often on business as usual putting off difficult decisions
- Many examples of Lock-in and Maladaptation (increase/transfer risk elsewhere)
- Some positive local examples with long-term strategy, some including Managed Realignment

Urgency: MORE ACTION NEEDED

- Ongoing developments – SMPs etc. better inclusion of nature-based solutions?
- Land use decisions need to be more adaptable & balance local & regional
- Current plans primarily use 1 SLR scenario – need a more robust approach and to include Higher SLR scenarios
- Integrate coastal with other land use plans (incl. coastal habitat evolution with terrestrial/freshwater)
- Investigate/trial/implement adaptive management and adaptation pathways approaches

Risk Magnitude: MED (present) → HIGH (future)

- Warming/moisture changes interacting with land use decisions
- Also pests/pathogens, wildfire risks etc
- Also CC risks to agric/forestry yields and proposed Net Zero 'land sparing' pathways
- Risks dominate but also important opportunities

Adaptation: VERY LIMITED

- Most mitigation/Net Zero assessments apparently assume a stationary climate!
- Some examples of maladaptation, notably with offsetting schemes

Urgency: MORE ACTION NEEDED

- Stress-test actions against different cc scenarios and don't hide uncertainties
- Collate and pool data on What Works, Where, and When
- Use more meaningful indicators (rather than just 'area planted / restored')
- Spatially targeted support schemes/advice based upon a long-term strategy
- All land uses / soils / habitats, not just peat/woodland, so intensive agriculture too!

Risk Magnitude: MED (present) → HIGH (future)

- Aggregated effect of multiple risks relative to local contexts
- Includes less tangible issues that still influence land use decisions
- Potential opportunities also
- CC also acts with changing socioeconomic drivers
- Important interactions with decarbonisation agenda

Adaptation: **GENERALLY LIMITED**

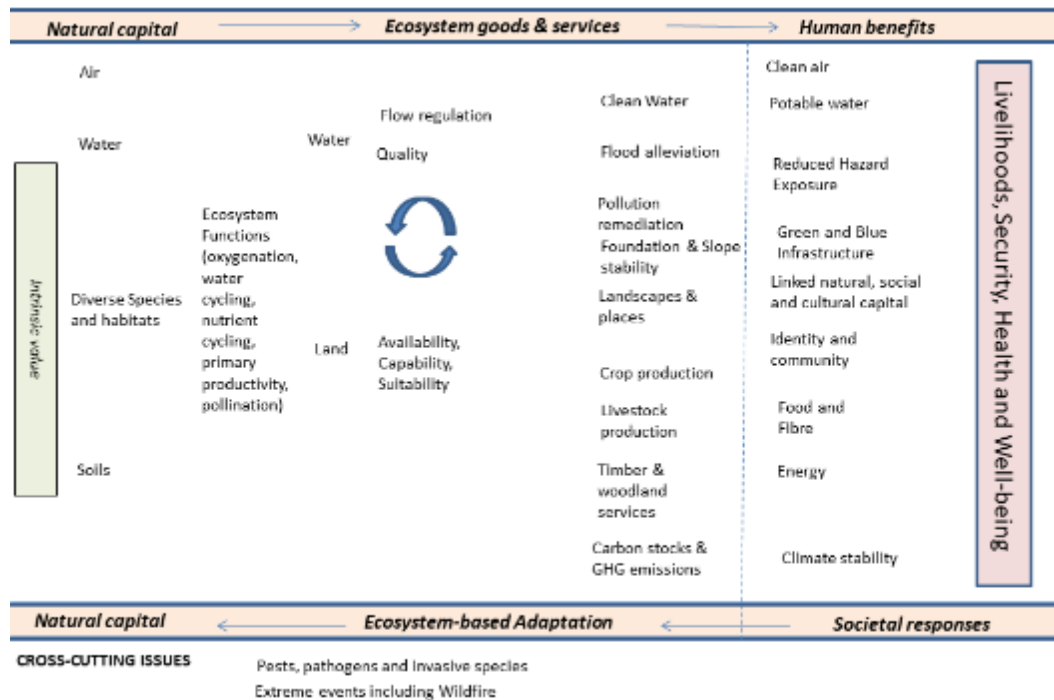
Urgency: **MORE ACTION NEEDED**

- Expand on good existing landscape assessments
- Link with 'place-building' / green recovery agenda etc.
- Integrate adaptation with Net Zero agenda
- Assess proposed outcomes based upon multiple scenarios



Landscape Characteristics (Natural England, 2014)

- Land use decisions affect all CCRA Risks in Ch.3 (incl. marine...& other chapters – esp. 5,6)
- Land use is often slow to change yet major transformation reqd. Also need to better understand current position
- Need a systems-based approach to avoid moving risk elsewhere or other negative trade-offs in space/time
- Need an integrated cross-scale strategy rather than piecemeal interventions
- Need to integrate land use adaptation with Net Zero agenda
- Be wary of illusory certainties (e.g. fixed targets)



The Challenge



Framework -> Strategy & Practice
(cross-scale, temporal, adaptable/robust)

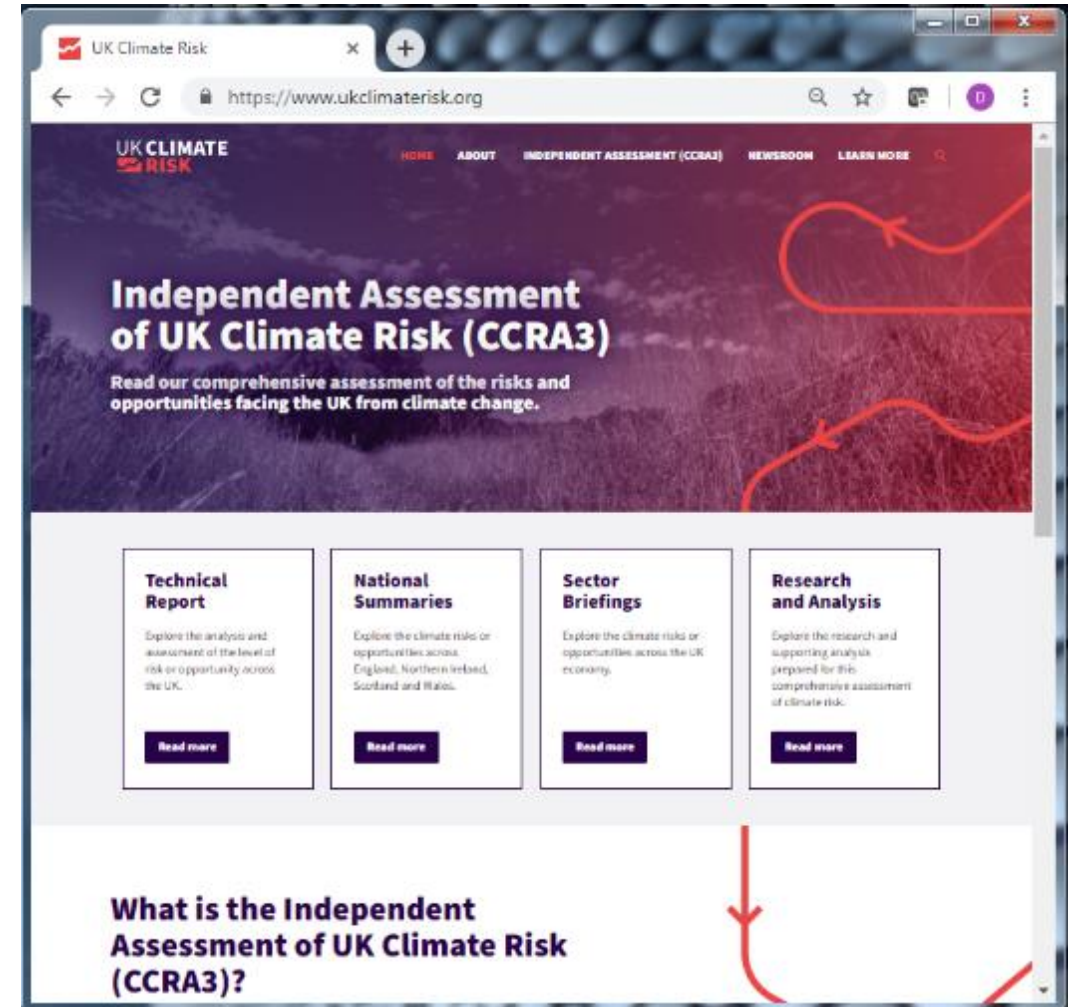


UK Climate Risk Website

- Technical Report
- National summaries
- Sector briefings
- Research and supporting analysis
- CCC's advice report

Infrastructure event

- Provisionally 22nd September



UK Climate Risk website (<https://www.ukclimaterisk.org/>)

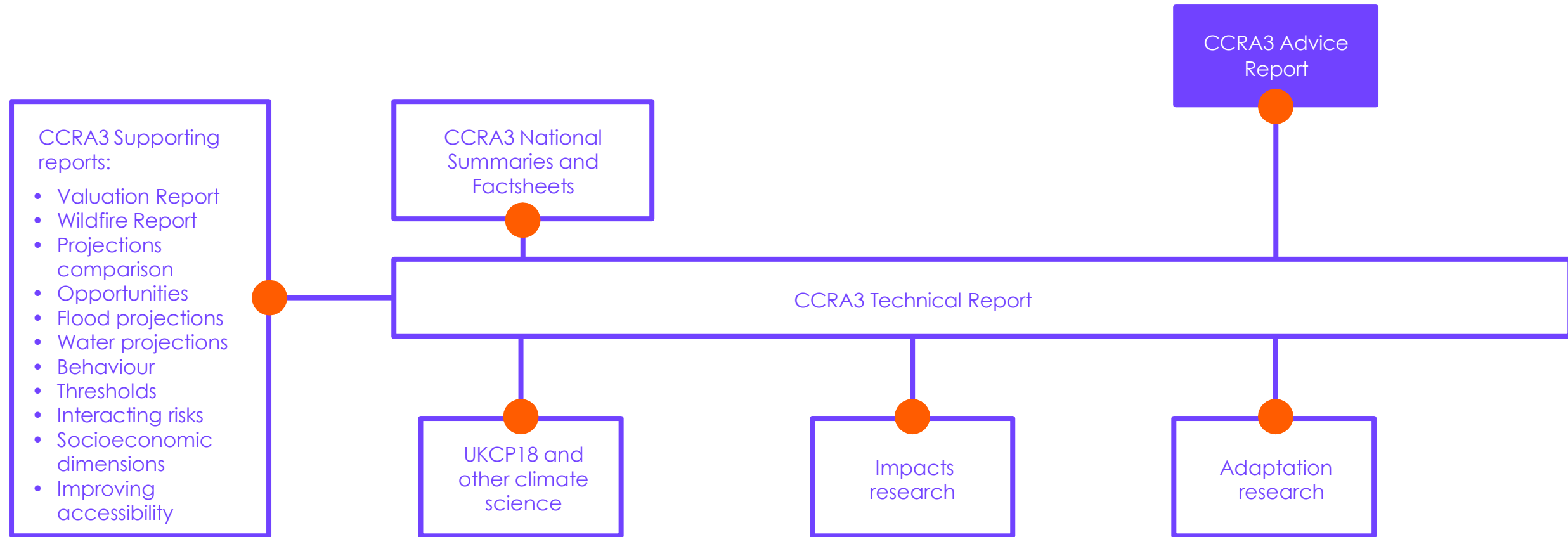
CCC's Independent Assessment

Brendan Freeman, Senior Analyst - adaptation

Climate Change Committee

Independent Assessment of UK Climate Risk

A comprehensive assessment of climate risks and opportunities

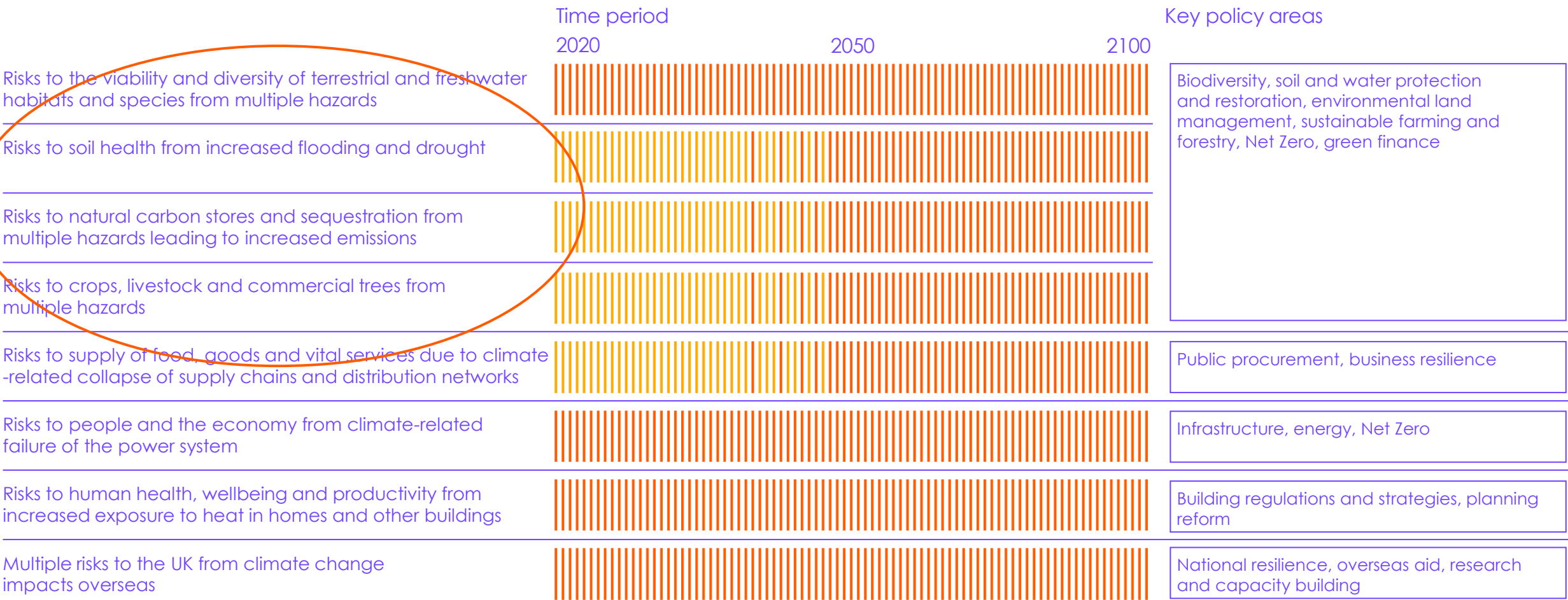


Independent Assessment of UK Climate Risk

Highest priorities for further adaptation in the next two years

Magnitude of risk

High Medium



Risks to delivery of Net Zero: soils, carbon stores and crops

- Nature will need to play a key role in supporting the UK to meet Net Zero.

However...

- Soils are increasingly impacted by climate including flooding and drought
- Degraded peat is emitting increasing amounts of CO₂
- Wetlands are being lost to coastal flooding and impacted by drought
- Trees are suffering from drought, heat, fire wind, new pests and diseases



Heath fire at Sway, Hampshire in 2020.

Acting on adaptation

What can be done?

| Action | Examples |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engineered solutions | Building design and retrofit, road resurfacing, flood defence investment, drainage |
| Nature-based solutions | Increasing plant diversity, habitat creation, soil conservation, increased blue carbon (coastal and marine vegetation), green sustainable urban drainage, urban greening, peatland restoration |
| New technologies | Precision farming, using new crop and livestock varieties, remote sensing, new designs for infrastructure assets, use of sensing, digitisation and big data for monitoring, evaluation and management |
| Behavioural | Changing timing of agricultural practices, information sharing, public engagement, skills development in adaptation actions |
| Institutional | Adaptation standards, supply chain diversification, regulation, advisory services |
| Financial | Insurance, risk disclosure, adaptation finance |
| Data, R&D | Monitoring and surveillance, inspections, forecasting, research, decision support tools |

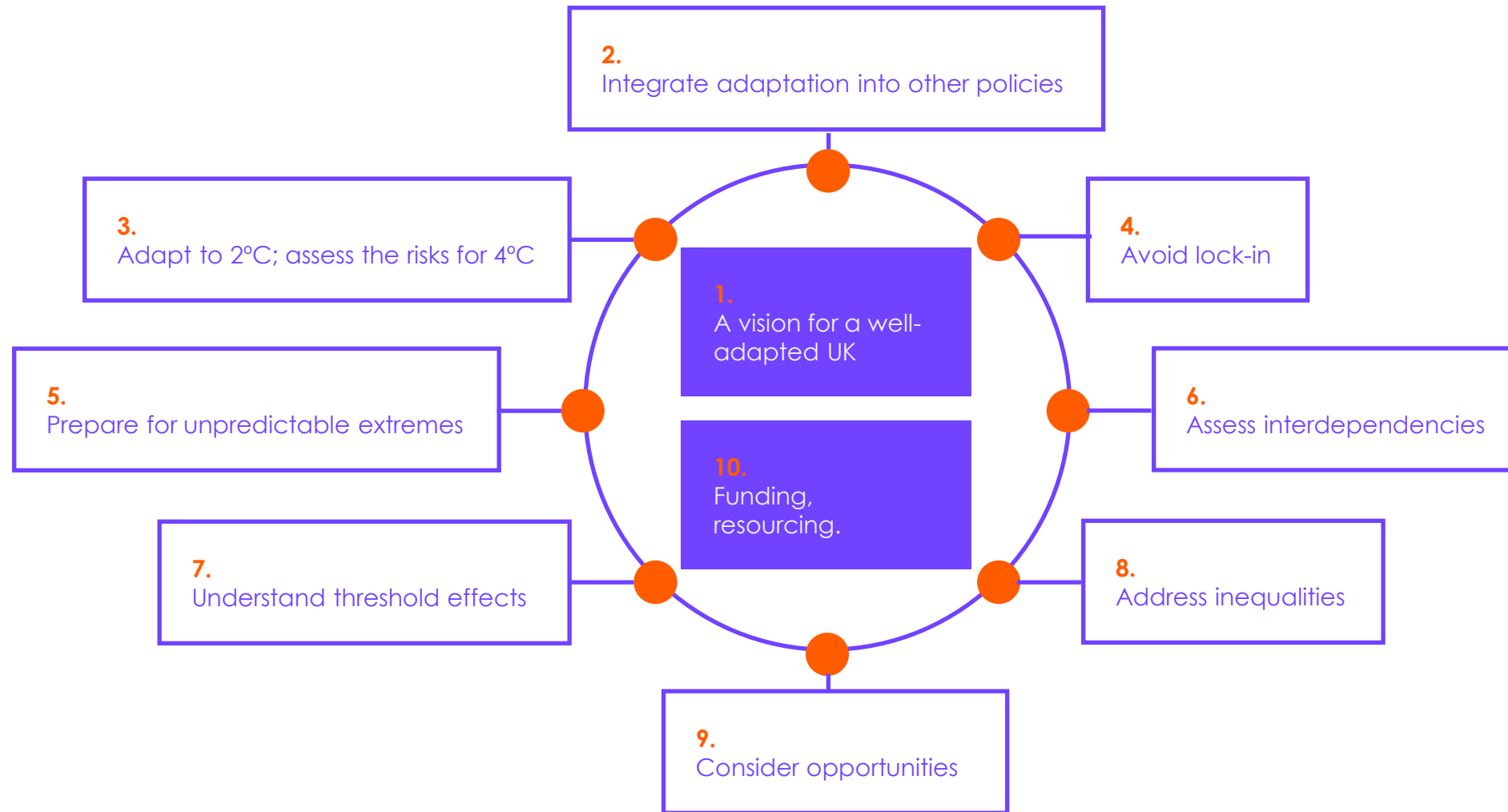
Adaptation must be given the level of attention it needs by the UK Government

- Adaptation action has failed to keep pace with the worsening reality of climate risk.
- Climate adaptation must be embedded in core environmental/land use policies if they are to succeed.
- There is a time-limited opportunity to build adaptation explicitly into policies to protect the UK's natural assets.



Independent Assessment of UK Climate Risk

Principles for effective adaptation policy



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