



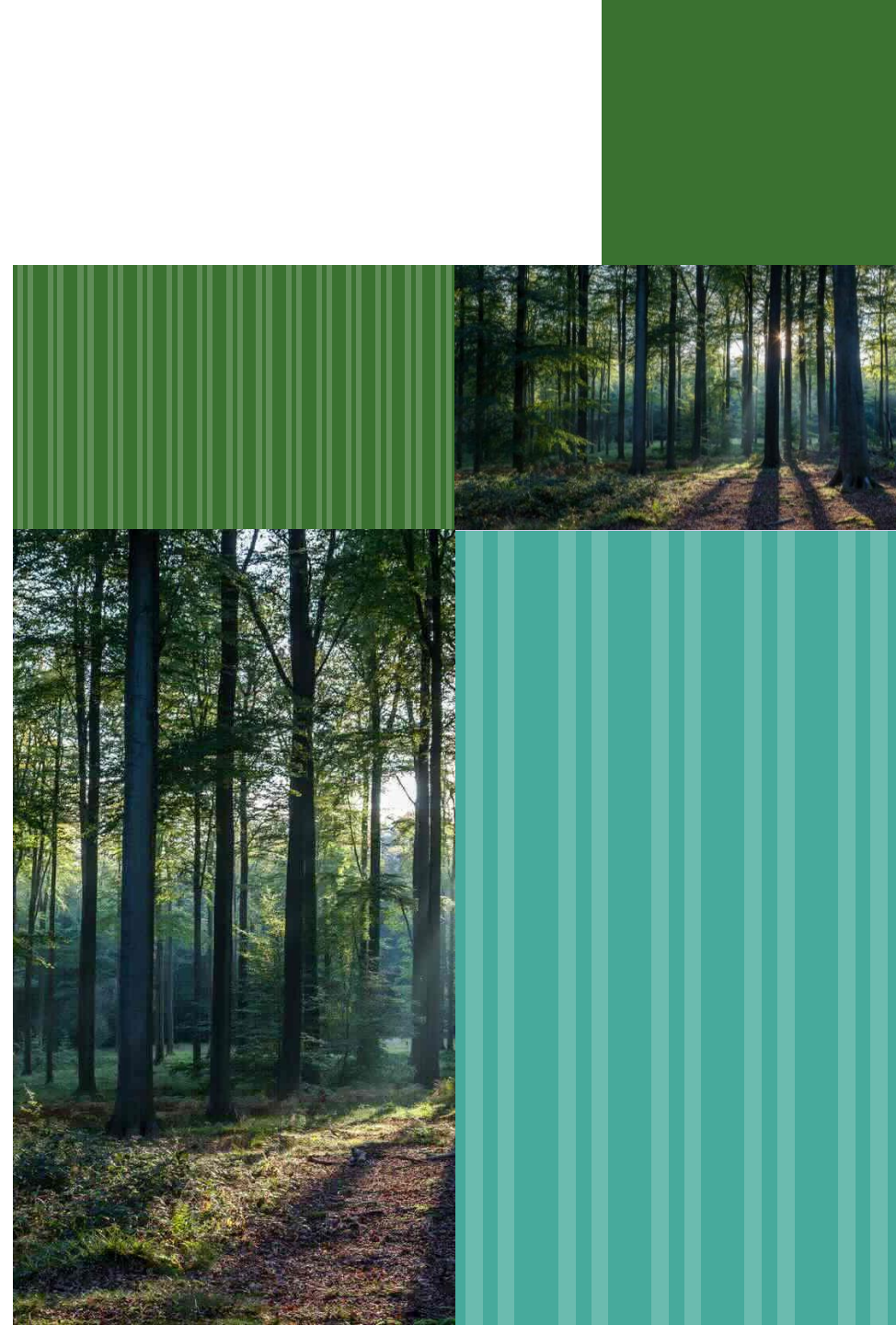
BANK OF ENGLAND

The macroeconomic implications of climate change and the transition

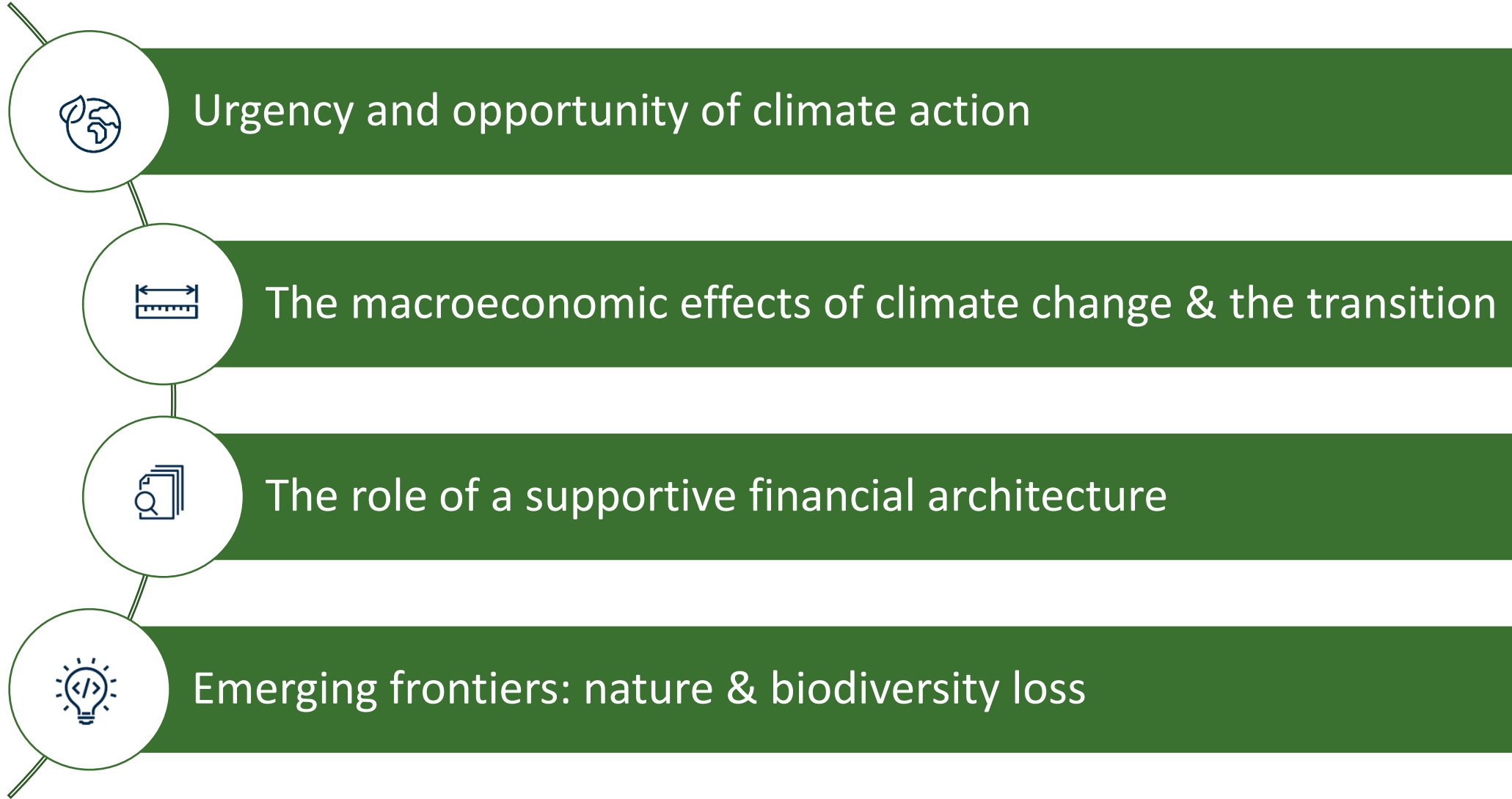
A central bank perspective

Danae Kyriakopoulou
Co-Head of the Climate Hub
Bank of England

OECD Global Forum on Productivity
Santiago de Chile, 27 September 2023



Focus of the presentation



Focus of the presentation



Urgency and opportunity of climate action



The macroeconomic effects of climate change & the transition



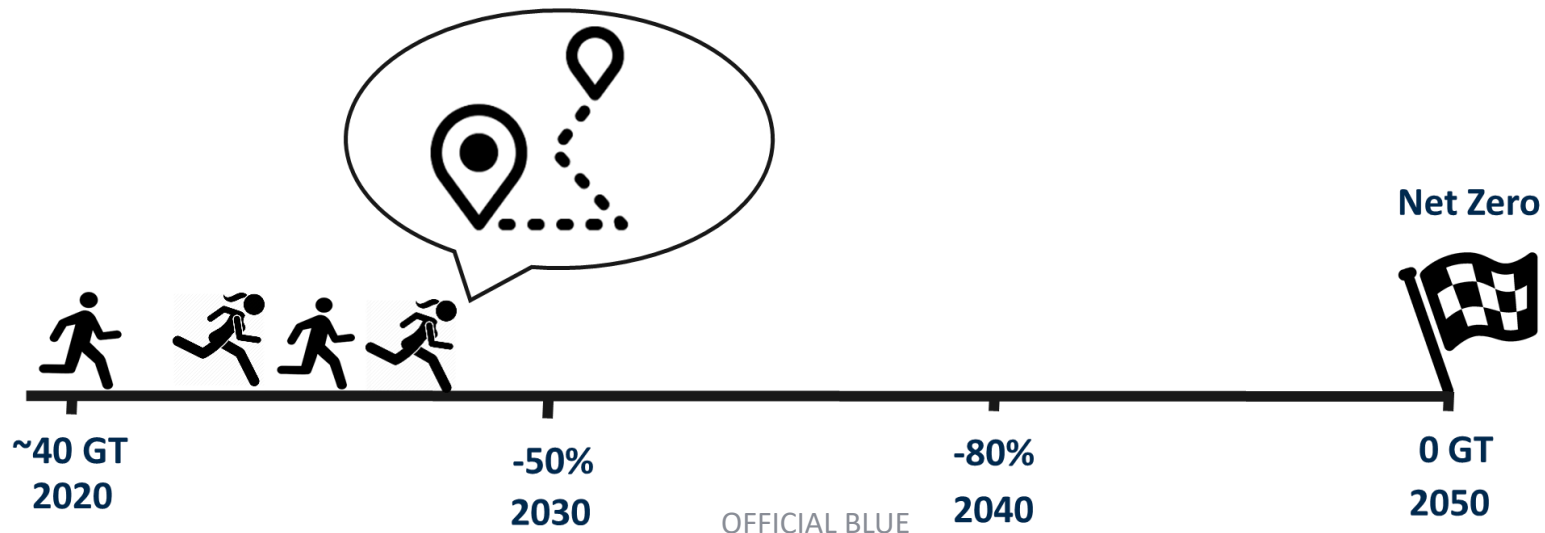
The role of a supportive financial architecture



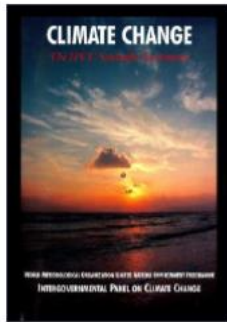
Emerging frontiers: nature & biodiversity loss

Clear science and policy signals for addressing climate change

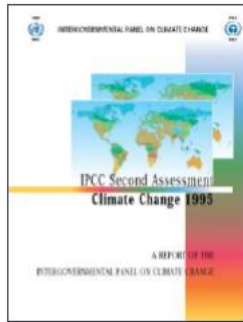
- Climate scientists have concluded that emissions of greenhouse gases such as carbon-dioxide are leading to global warming and broader changes in our climate.
- Under the 2015 **Paris agreement**, signatory nations committed to ensure global average temperatures stay **well below 2°C, and preferably 1.5°C**, above pre-industrial era levels. Several countries, including the UK, have made further commitments to achieve “**net-zero**” emissions consistent with this outcome. This will require significant change across our economy in this decade alone.



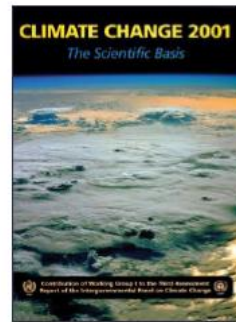
Urgency and opportunity of climate action clearer than ever



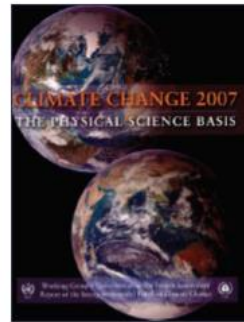
1990



1995



2001



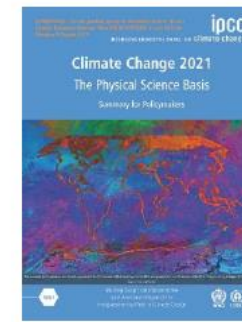
2007



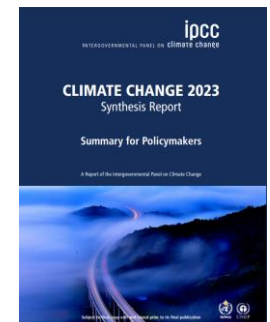
2013



2018



2021



2023

“There is *new and stronger evidence* that most of the warming observed over the last 50 years is attributable to human activities.”

“An increasing body of observations gives a collective picture of a *warming world and other changes* in the climate system.”

– *Third IPCC Assessment Report, 2001*

“It is *unequivocal* that human influence has warmed the atmosphere, ocean and land.”

“Human-induced climate change is *already affecting* many weather and *climate extremes* in every region across the globe.”

– *Sixth IPCC Assessment Report, 2021*

“The world faces *unavoidable* multiple climate hazards over the next two decades with global warming of 1.5°C. Even temporarily exceeding this warming level will result in *additional severe impacts*, some of which will be *irreversible*.”

“People and ecosystems *least able* to cope are being *hardest hit*.”

– *IPCC, February 2022*

2023 headlines: the economic & financial effects are intensifying...

☰ **CNN BUSINESS** Markets Tech Media Calculators Videos Audio Live TV

Climate event El Niño could hit the economy from food prices to clothing sales this year

By Samantha Delouya, CNN

☰ **CNBC** MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV INVEST

Global rice prices could surge higher as flood risks loom over China

PUBLISHED SUN, AUG 13 2023-11:14 PM EDT

Lee Ying Shan
@LEEYINGSHAN

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22 May 2023 | **Climate and Environment**

Over two million deaths and \$4.3 trillion in economic losses; that's the impact of a half-century of extreme weather events turbo-charged by man-made global warming, the World Meteorological Organization ([WMO](#)) said on Monday.

Breakingviews

Breakingviews: El Niño will brew up potent new economic storm

By Antony Currie

July 4, 2023 2:04 AM GMT+1 · Updated 2

ECONOMY
TOURISM

AP ☰ U.S. WORLD POLITICS VIDEO SPOTLIGHT ENTERTAINMENT SPORTS BUS

WORLD NEWS

The cost of damage from the record floods in Greece's breadbasket is estimated to be in the billions

Greek tourism's new worries

Extreme weather conditions and crisis management to determine the choice of many tourists

REUTERS World Business Markets Sustainability Legal Breakingviews Technology Inv

Americas

In Argentina's drought-hit fields, billion dollar losses and farmers going under

By Lucila Sigal

February 17, 2023 10:01 PM GMT · Updated 7 months ago

🔖 Aa ↻

...while the growth & investment opportunities becoming clearer...

Pressing the accelerator on green growth could earn up to £57 billion for the UK economy by 2030

17 JULY 2023

[New analysis](#) from the CBI has shown that making the most of 27 green growth opportunities could earn up to £57 billion boost to GDP by 2030, equivalent to between 1.6% and 2.4%

B U.S. Economy | U.S. Government & Politics

COMMENTARY **OP-ED**

The Inflation Reduction Act could energize the economy

John Bistline, Neil R. Mehrotra, and Catherine Wolfram
May 1, 2023



OECD

GROWTH2023

The future of jobs is green: How climate change is changing labour markets

May 1, 2023

REUTERS®

World | Business | Markets

Energy | Grid & Infrastructure | Nuclear

US scientists repeat fusion ignition breakthrough for 2nd time

Reuters

August 7, 2023 8:07 AM GMT+1 - Updated a month ago



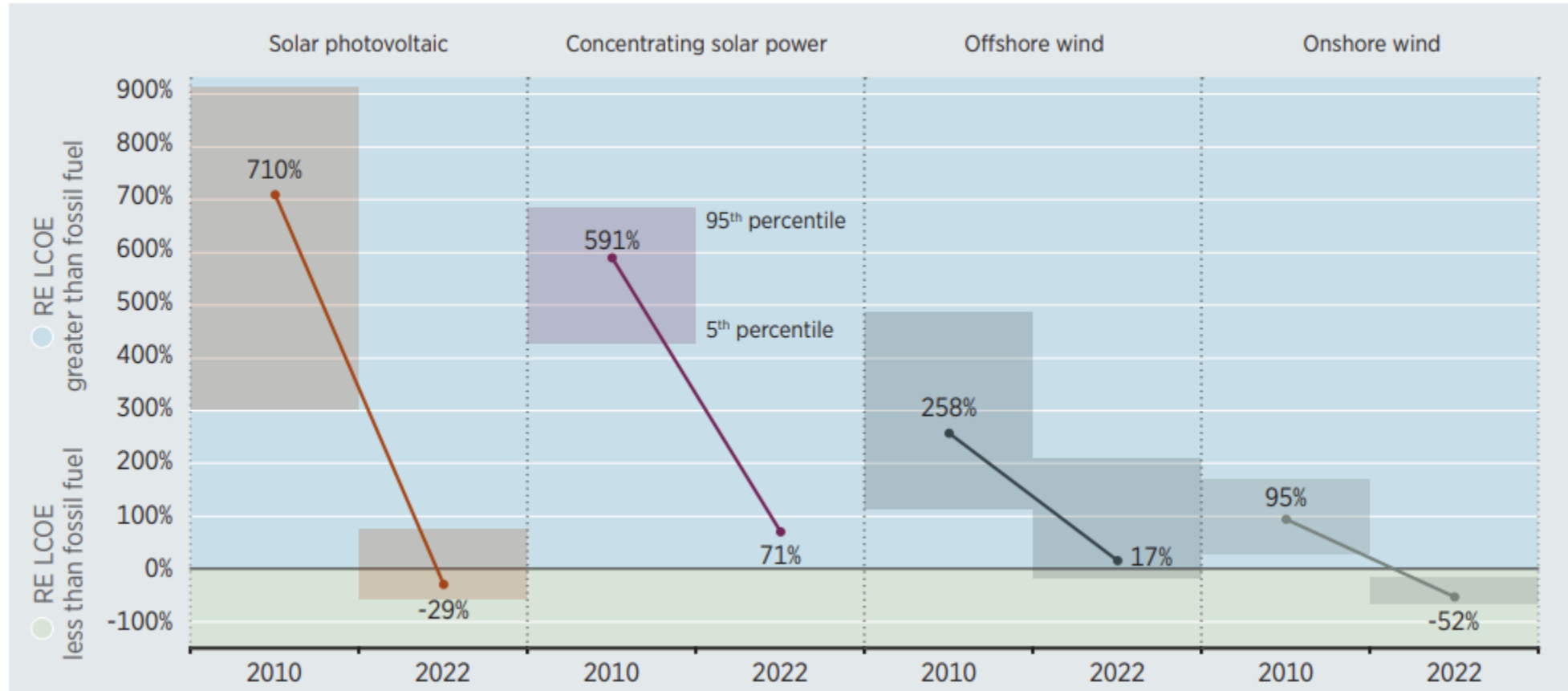
Business education + Add to myFT

Growing green awareness gives eco-innovation a competitive edge

Shifting attitudes make investment in cleaner technologies more viable, academics argue

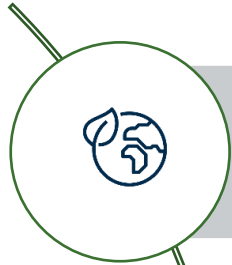
...driven by technology & policy factors

Change in competitiveness of solar and wind by country based on global weighted average LCOE, 2010-2022



Source: [Renewable power generation costs in 2022](#) IRENA (2023)

Focus of the presentation



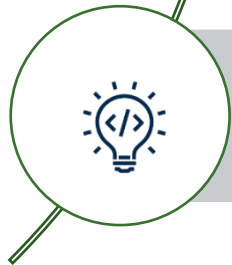
Urgency and opportunity of climate action



The macroeconomic effects of climate change & the transition



The role of a supportive financial architecture



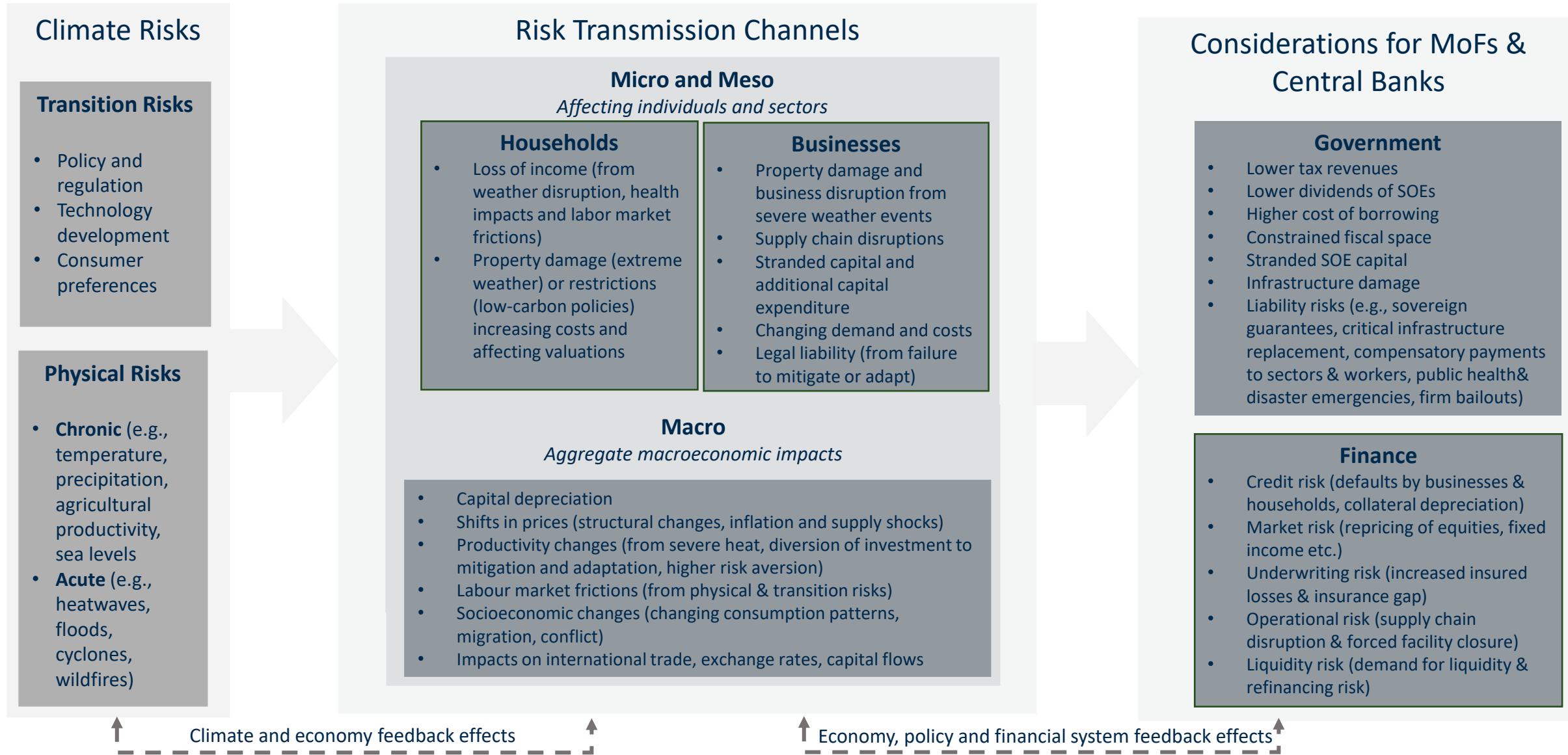
Emerging frontiers: nature & biodiversity loss

The effects of climate change aren't just environmental

- Climate change does not just raise environmental questions. **We all have a role to play in driving the change that is needed because it affects all of us.** As the central bank and financial regulator, our primary concern is the impact of climate change to the **UK economy and financial system.**
- Climate change leads to “**physical risks**” such as more frequent severe weather events (floods, wildfires etc.) and longer-term changes in the environment such as sea-level rises. But addressing climate change by taking action to reduce emissions can create “**transition risks**” such as changes in government policy, technology and consumer preferences. These physical and transition risks can lead to **financial and economic risks** for individuals, businesses and governments.



...in turn affecting economic & financial outcomes...



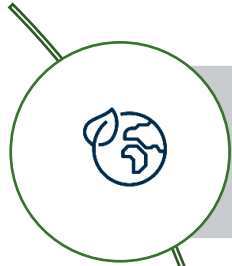
Source: Adapted from Network for Greening the Financial System & Coalition of Finance Ministers for Climate Action

...in turn affecting central banks

These risks affect central banks in a number of ways:

- **Risks to macroeconomic variables:** Physical and transition risks (i.e. from climate shocks and climate policies) can affect key macroeconomic variables relevant for central bank decision-making, including output, consumption, investment, productivity, employment, wages, international trade, exchange rates, inflation and inflation expectations.
- **Risks to the transmission of monetary policy:** Climate change may affect the balance sheets of financial intermediaries, asset valuations, and the expectations of economic agents. Risks in the form of stranded assets, increased credit risks and shifts in expectations among economic agents may all impair the transmission of monetary policy.
- **Risks to balance sheets:** Climate change could increase the riskiness of assets held on central banks' balance sheets, potentially leading to financial losses (Boneva et al, 2021, NGFS, 2020 and 2021)

Focus of the presentation



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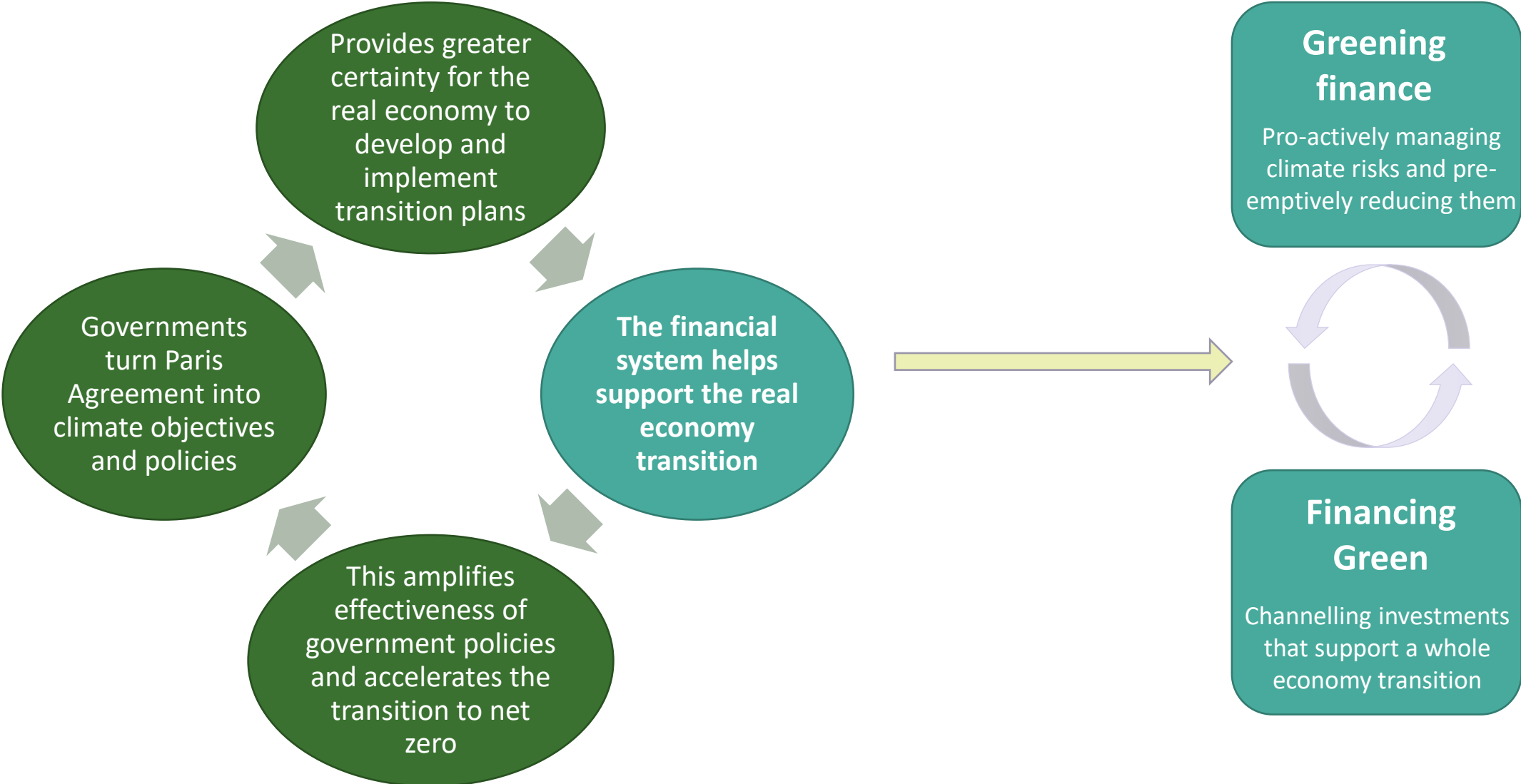


The role of a supportive financial architecture



Emerging frontiers: nature & biodiversity loss

Financial system as an engine to allocate capital & mobilise finance



Supported by transparency of information (labels & standards)

1) Innovation in instruments and investment strategies

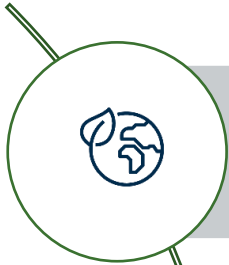
Measuring alignment – e.g. portfolio metrics that measure implied warming from investments and future climate ambition

Mobilising finance to deal with real problems – e.g. retrofit homes

2) Identify and reward investments that support the transition

- Role of **capital markets** – an implied price for carbon
- **Labels** – e.g. marker for investments in companies with credible transition plan
- **Sustainability reporting standards** – e.g. IFRS Foundation Consultation to establish new body

Focus of the presentation



Urgency and opportunity of climate action



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The role of a supportive financial architecture

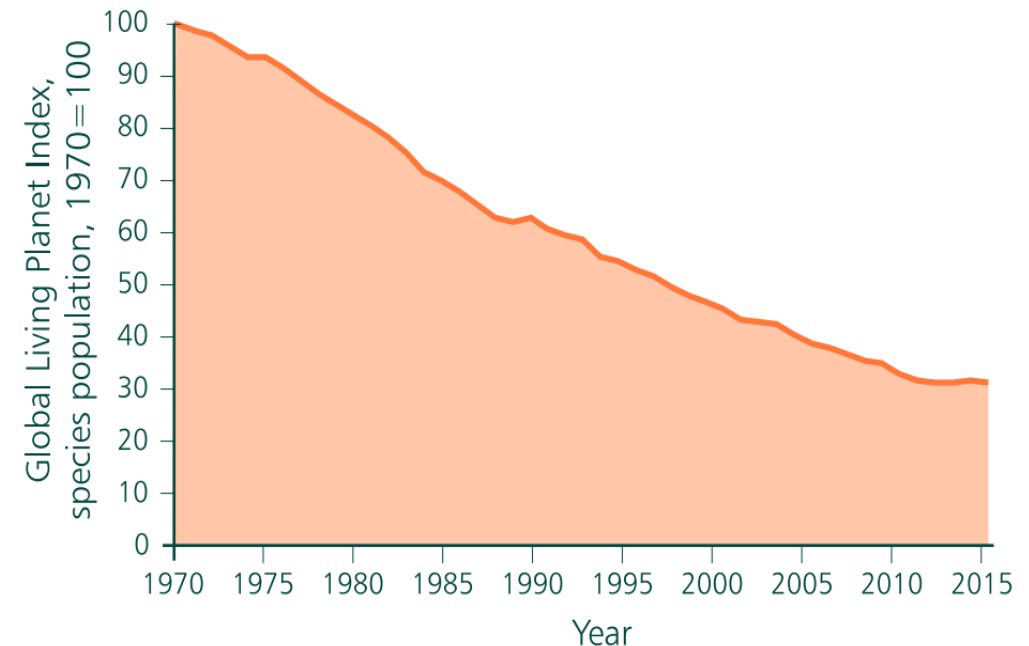


Emerging frontiers: nature & biodiversity loss

The science: nature is declining rapidly...

- **Nature is declining faster than any time in human history**
–extinction rates are around 100 to 1,000 times higher than average over the past several million years – **and is accelerating.**
- From 1970 to 2016, the [WWF's Living Planet Index](#) declined by around 70% on average in populations of mammals, birds, fish, reptiles and amphibians.
- The IPBES [2019 global assessment](#) reported a decline in 14 of 18 categories of ecosystem services since 1970, particularly regulating and maintenance services

Trends in Global Vertebrate Abundance as measured by the WWF's LPI

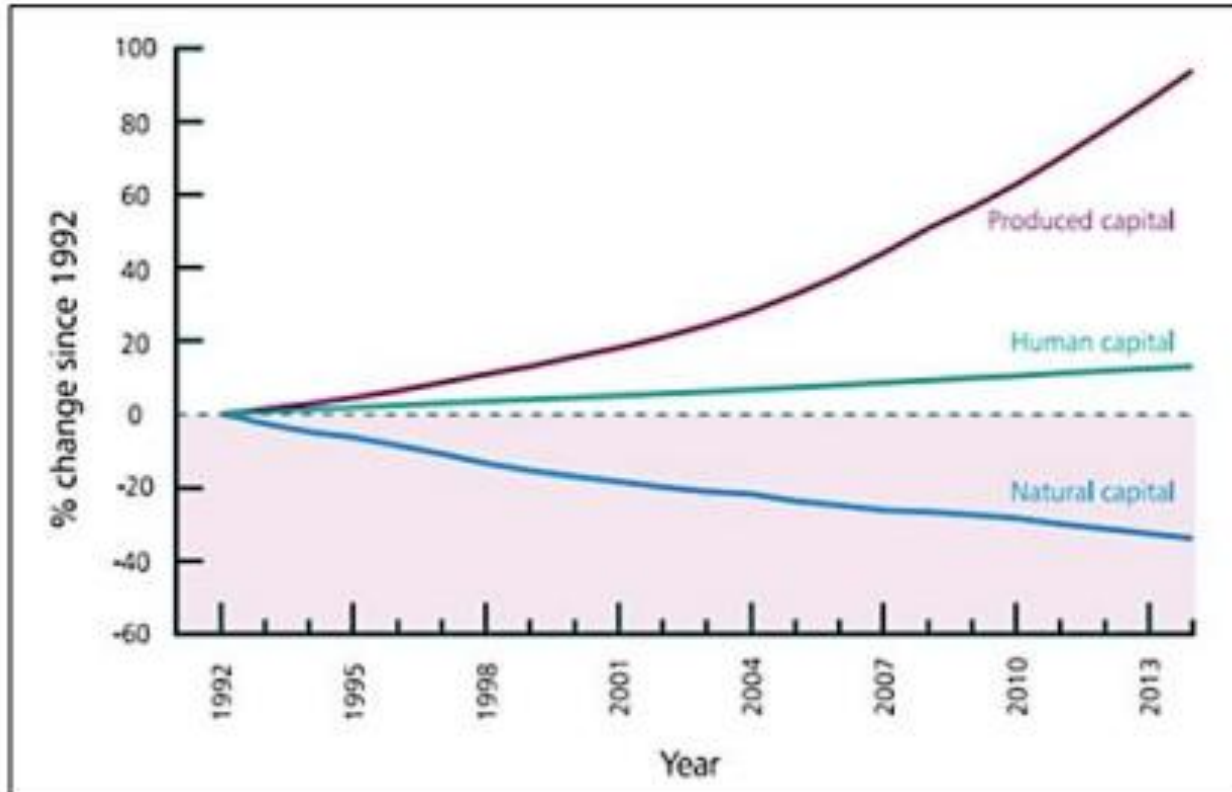


Source: WWF/ZSL (2020)

Note: Based on 20,811 populations of 4,392 vertebrate species

...putting at risk economic activity that depends on it...

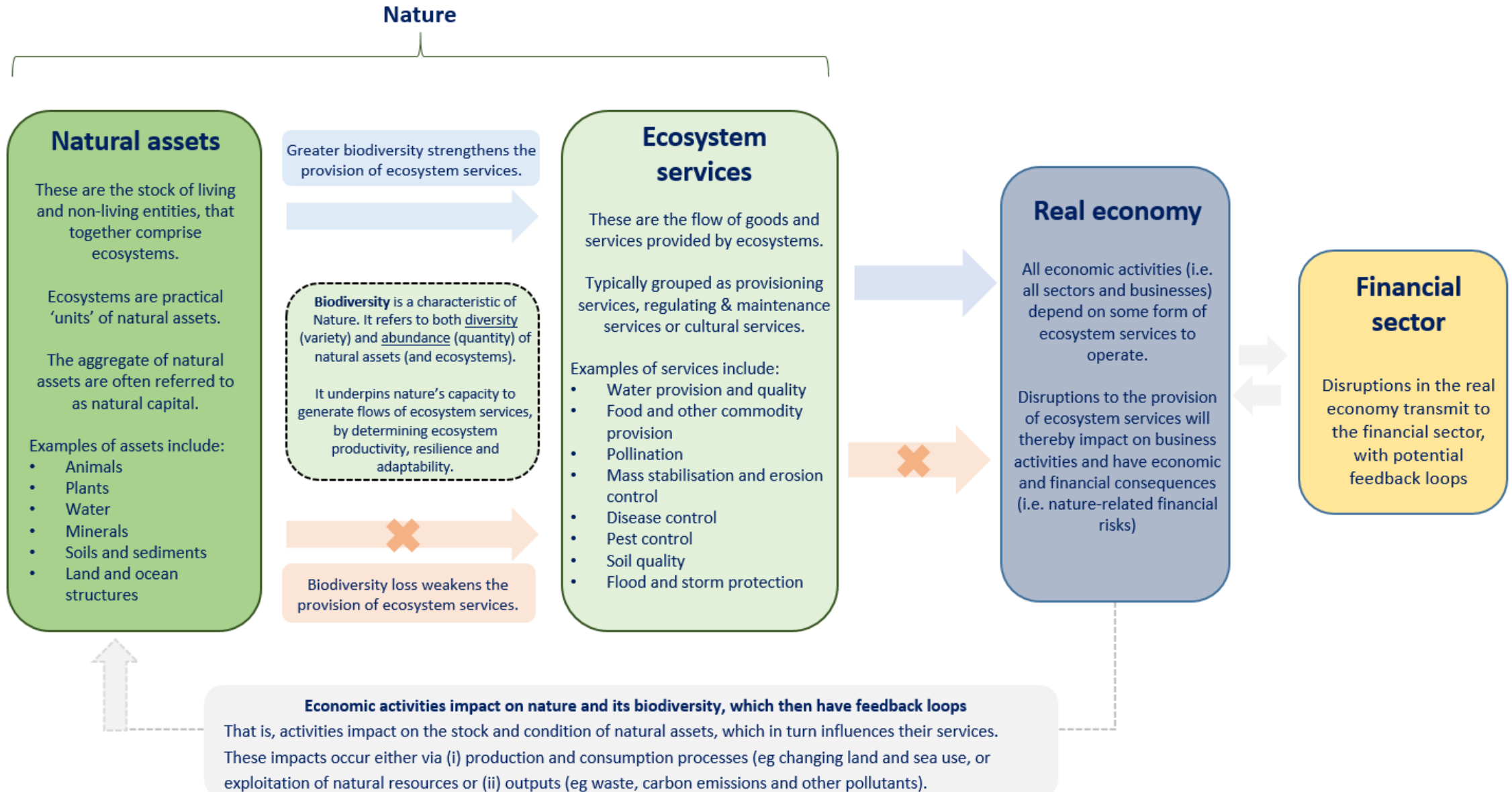
Global wealth per capita, 1992 - 2014



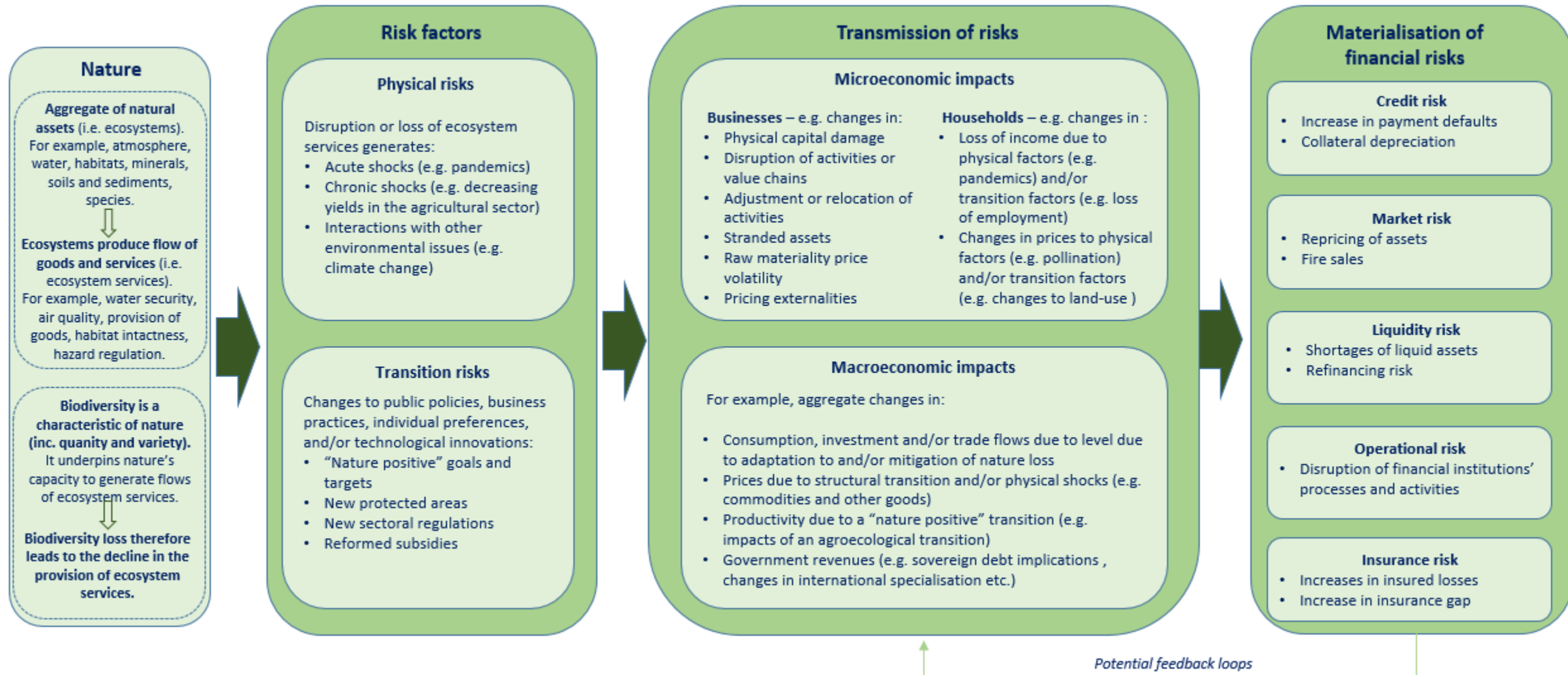
Source: Dasgupta, 2021

- UN global capital data highlight that while produced capital per person doubled between 1992 and 2014, natural capital per person declined by around 40% during the same time period.
- Conservative estimates suggest that \$44 trillion of global GDP (almost 50%) is generated in sectors that depend highly (\$13 trillion) or moderately (\$31 trillion) on ecosystem services i.e. the benefits that people derive from natural capital.
- The rapid global loss of biodiversity threatens continued provision of the critical ecosystem services that underpin economic activity

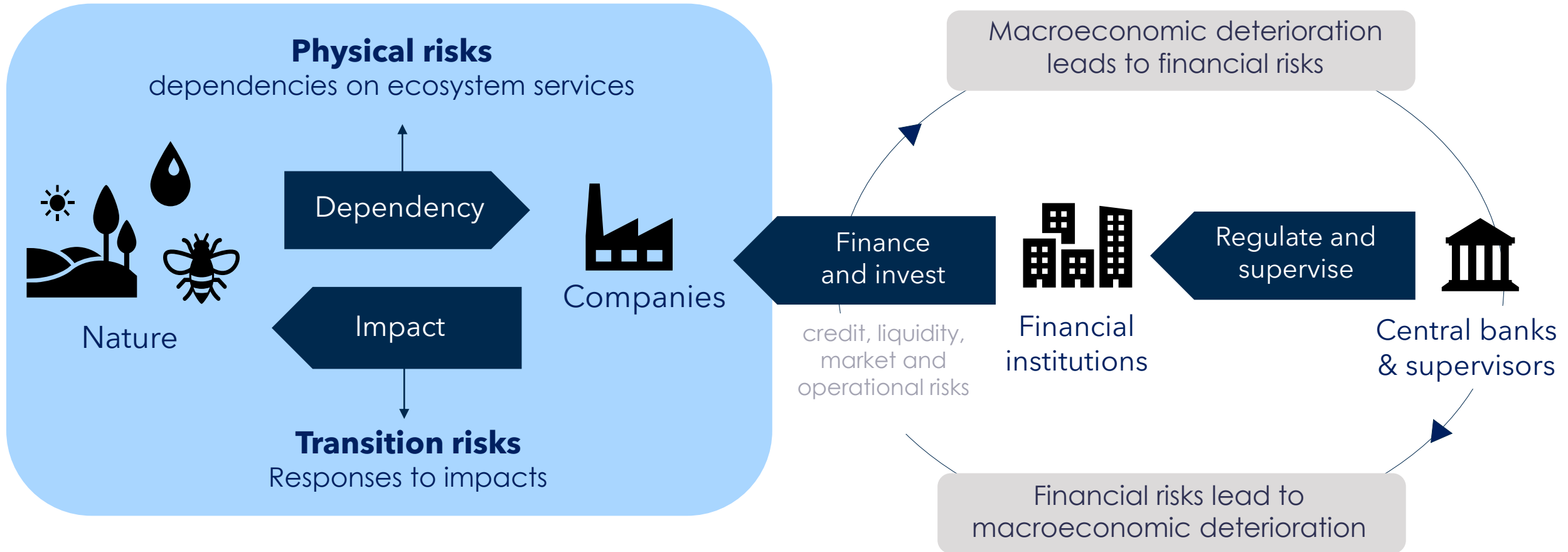
...and in turn creating financial risks



Risks can materialise through variety of channels...



...and feedback loops



Source: Almeida and Dikau (2022)

Examples of ecosystem service disruption that can lead to financial risk

Type	Link to financial risk
Air quality and local climate (e.g. the regulation of temperature, humidity and pollutants)	<p>Within the local climate, vegetation can modify temperatures, humidity, and wind speeds. For example, a lack of trees in urban areas increases the urban heat island effect, increasing air conditioning costs. For air quality, a range of organisms and natural structures (e.g. peat or forests) filter and absorb pollutants that could directly affect human health or infrastructure.</p> <p>Sovereign debt risk could increase if revenues from industries reliant on predictable rainfall, such as agricultural export-based economies, are impacted.</p>
Water security (e.g. availability and condition of freshwater)	<p>Reduced availability of water directly impacts the cost base of several sectors, such as utilities, consumer goods and agriculture, increasing operational expenditures and cost of living. This could lead to additional credit or market risk associated with the firms impacted, especially if significant investment is needed to adjust operations.</p> <p>Direct water consumption is not the only component of the water footprint of a country, business, industry or country. For several industries, indirect water use from upstream or downstream (i.e. supply chain, agriculture and consumer use) is generally a bigger component of the overall water footprint than their direct ones (from manufacturing and operations).</p>
Food and other goods provision (e.g. pollination enabling agricultural output)	<p>Lower production volumes from agricultural, forestry or fishery industries in certain locations could increase the credit and market risk of companies in those sectors, and it could also lead to a reduction the demand for associated services in across the supply chain, such as manufacturing & processing and distribution, induced similar credit and market risks.</p>
Habitat intactness (e.g. intactness reduces risk of zoonotic disease)	<p>Less habitat intactness can concentrate species and increase the number of interfaces between those species and humans. This increases the chance of zoonotic disease – where pathogens transmit from animals to humans – such as Covid-19. Furthermore, the loss of species due to the loss of habitat intactness is irreversible, with such extinction representing the loss of genetic material that may have held yet to be understood medicinal or other future value.</p>
Hazard regulation (e.g. regulation of the impact of extreme weather events)	<p>If the impact of hazards is not regulated, then infrastructure and real estate are put at greater risk of flood, storm, etc. and capital destruction can occur. That capital destruction poses credit risk where assets are offered as security, and market risk as balance sheets are impacted.</p>

Work on climate can provide a head start, but much more needed

SIMILARITIES TO CLIMATE RISK

Far reaching, non-linear & largely irreversible



Foreseeable yet uncertain



Delayed action brings greater risk



DIFFERENCES TO CLIMATE RISK

Broader in scope and source



Cannot be captured in a single metric



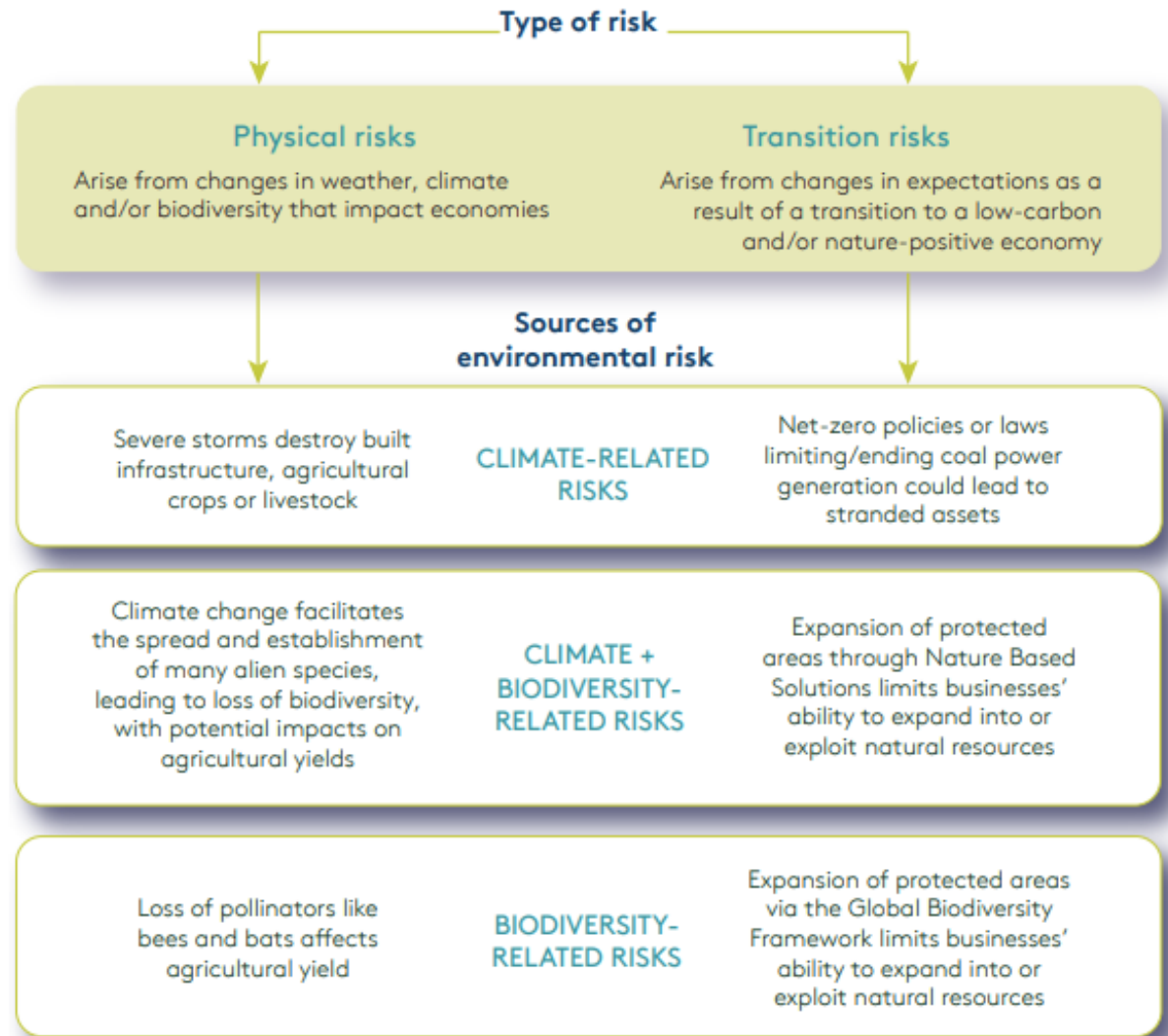
More local vs global



Climate & Nature: not just different, but related; risks of compounding

The interaction between climate and nature can lead to compounding risks, particularly if not addressed together.

- Climate change as a driver of nature risk
- Nature degradation as a driver of climate risk
- Climate change mitigation and adaptation strategies as a potential driver of nature risk
- Nature as a solution to decrease climate risk (i.e. nature based solutions) – e.g. Paris Agreement targets cannot be met without nature based solutions



Source: Almeida (2021)