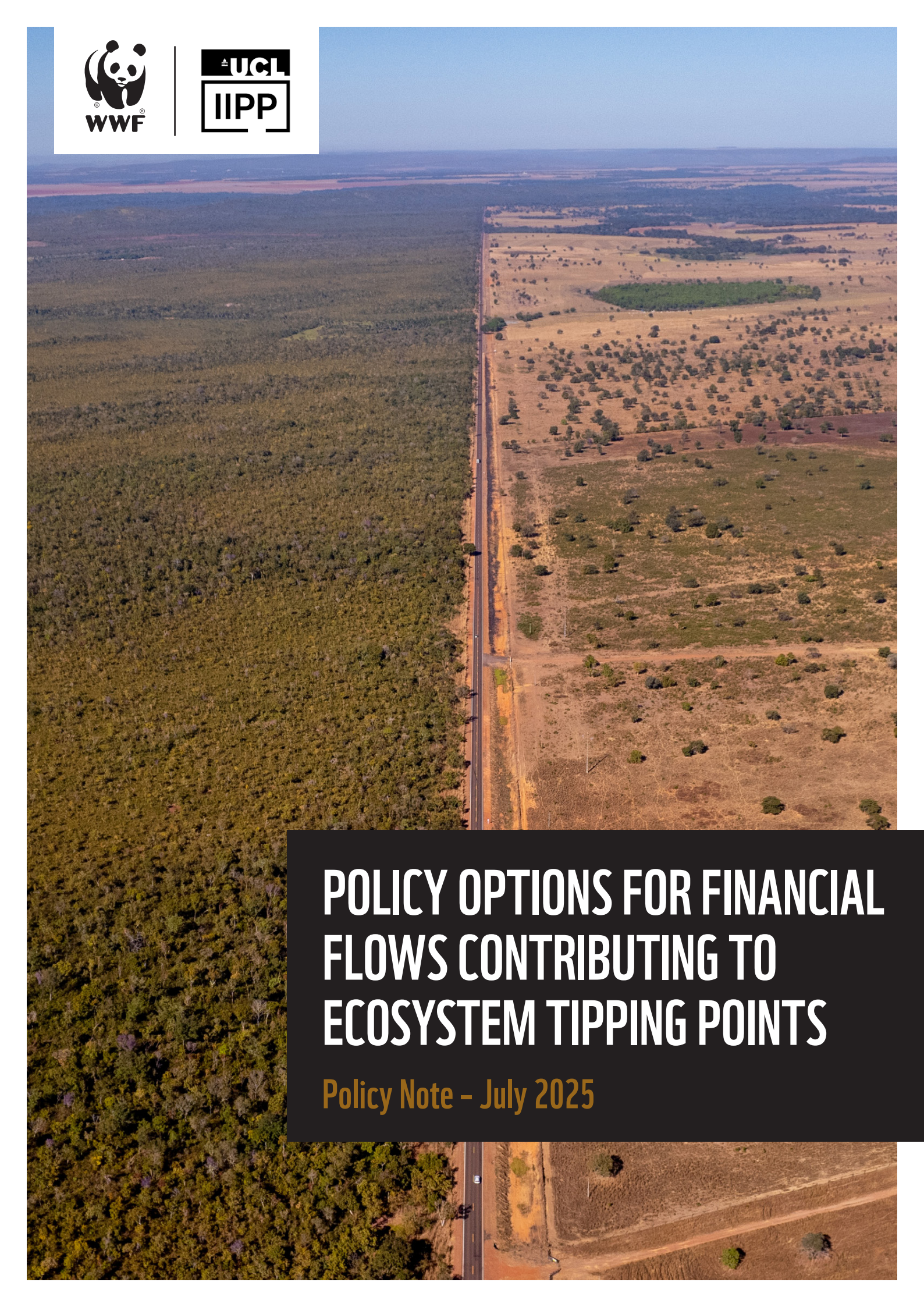


An aerial photograph showing a landscape with a road and forest. The road runs vertically through the center of the image, separating a dense green forest on the left from a dry, brownish landscape with scattered trees on the right. The sky is clear and blue.

POLICY OPTIONS FOR FINANCIAL FLOWS CONTRIBUTING TO ECOSYSTEM TIPPING POINTS

Policy Note – July 2025

ACKNOWLEDGEMENTS

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About WWF's Greening Financial Regulation Initiative (GFRI)

WWF's Greening Financial Regulation Initiative seeks to put climate and environmental risk at the heart of the financial system. Through this initiative, WWF wants to evidence the link between financial risks and environmental risks like climate change, water scarcity and biodiversity decline, and engage policymakers, central banks and financial supervisors on the need to integrate those risks into their mandates and operations. In doing so, WWF provides the necessary tools, scientific research, assessments, training and assistance to help enhance ambitions on the sustainable finance global policy agenda.

About UCL Institute for Innovation and Public Purpose (IIPP)

The [Institute for Innovation and Public Purpose \(IIPP\) at University College London](#) rethinks the role of the state in driving innovation and shaping markets to tackle global challenges. Through cutting-edge research, teaching and policy partnerships, IIPP challenges traditional economic thinking and defines new interactions between theory and practice. Working with governments and public institutions around the world, IIPP helps shape the design of outcomes-oriented policies that create inclusive, sustainable and innovation-led growth.

Front cover photo:

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A vertical photograph of a forest floor. In the foreground, there is a large, dark brown, textured piece of tree bark. Above it, several fallen leaves are visible, some green and some brown. The background is a soft-focus view of more forest floor with green leaves and brown debris.

SUMMARY

Ecosystem degradation poses escalating systemic risks to economic and financial systems that fall within the mandates of central banks, financial regulators and supervisors (CBFRs). Of particular concern is the potential crossing of large-scale tipping points in ecosystems such as the Amazon rainforest and boreal forests. These tipping points, driven by interacting drivers such as land-use change and global warming, involve abrupt, non-linear, and potentially irreversible changes to ecosystem states with cascading effects on economic stability and climate trajectories. Their impacts are very likely to exceed the absorptive capacity of financial and economic systems and would severely undermine long-term price and financial stability, requiring a more precautionary stance from CBFRs.

The prevailing approach by CBFRs – quantifying environmental risks to manage them as measurable financial risks – struggles to capture the economic and financial consequences of large-scale environmental degradation, particularly when tipping points are reached. In particular, it fails to capture how financial flows enabling ongoing ecosystem degradation endogenously contribute to long-term physical risks for the economy and the financial sector itself. This note summarizes recent research on such financial flows and proposes that, alongside government-led climate and nature protection efforts, CBFRs should deploy their policy instruments to steer financial flows away from economic activities driving nature loss in specific ecosystems. While all ecosystems are ultimately important to this effort, those that play a critical role in supporting earth system stability and that are facing tipping dynamics are an analytically and operationally tractable starting point given their uncertainty, potential irreversibility, and systemic consequences.

This note outlines how macroprudential, monetary, and microprudential policymakers could adapt their tools to target the financial flows that contribute to one key direct driver of nature loss – land-use change and degradation – in five ecosystem-based case studies encompassing the Amazon rainforest, boreal forests, mangroves, and tropical peatlands. Enhancing international and institutional coordination will be critical to fully maximize the effectiveness of these policies and ensure they support, and do not undermine, a broader economic policy agenda to equitably address the direct and underlying drivers of nature loss in ecosystem-hosting countries.

SECTION 1: INTRODUCTION

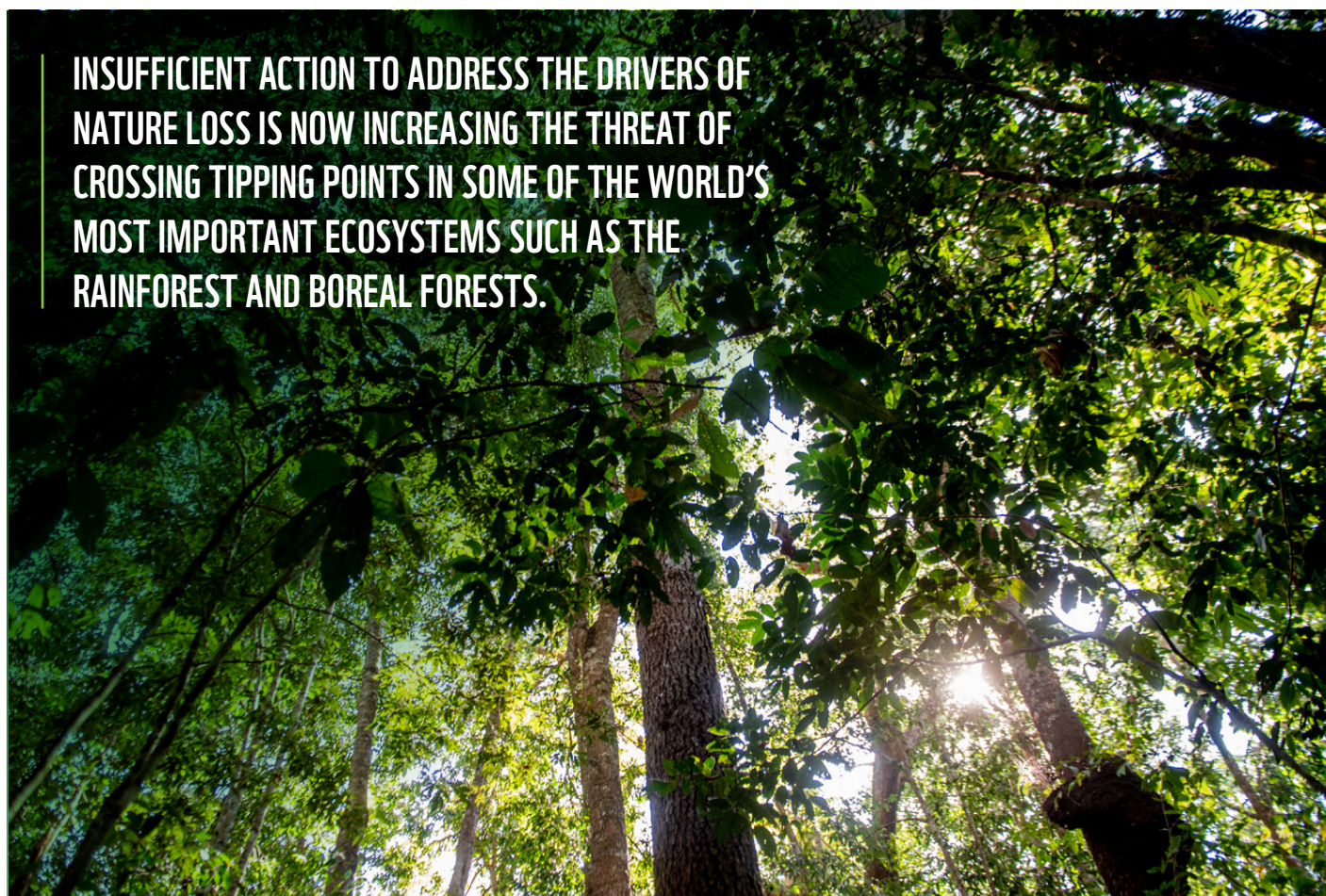
1.1. NATURE-RELATED RISKS AND THE SYSTEMIC THREAT OF ECOSYSTEM COLLAPSE

Interacting human pressures – climate change, land-use change, pollution, overexploitation, and invasive alien species – are driving unprecedented stresses on natural systems. Ongoing degradation of the ecosystems on which economic activity fully relies is already causing physical risks for economic and financial actors, while unexpected or disorderly actions taken to protect and restore nature could lead to transition risks.¹ Insufficient action to address the direct and indirect drivers of nature loss is now increasing the threat of tipping points in some of the world's most important ecosystems such as the Amazon rainforest and boreal forests.

Tipping points are non-linear, self-amplifying, and likely irreversible physical changes in ecosystem state that can occur relatively rapidly but remain very challenging to predict.²

Crossing tipping points in some ecosystems would cause the loss of interacting ecosystem services that will be difficult (if not impossible) to substitute for or adapt to through technology or trade.³ While all pressures on ecosystems pose potentially severe economic consequences through losses to local and regional ecosystem services, these dynamics are a key source of systemic nature-related risks that would have cascading impacts across multiple geographies and sectors simultaneously. Critically, crossing ecosystem tipping points would substantially intensify physical climate risks, via feedback effects on the global carbon cycle and the removal of natural protections from climate hazards.³ Major macroeconomic policy institutions acknowledge that the collapse of key “systemically important ecosystems” is likely to lead to systemic and irreversible impacts.^{4–8}

INSUFFICIENT ACTION TO ADDRESS THE DRIVERS OF NATURE LOSS IS NOW INCREASING THE THREAT OF CROSSING TIPPING POINTS IN SOME OF THE WORLD'S MOST IMPORTANT ECOSYSTEMS SUCH AS THE RAINFOREST AND BOREAL FORESTS.



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1.2. THE CHALLENGE FOR CENTRAL BANKS, FINANCIAL REGULATORS, AND SUPERVISORS

In recent years, CBFRs have made significant progress in identifying potential exposures to climate- and nature-related economic and financial risks.⁶ However, both remain less amenable to meaningful quantification of measurable financial risks to firms or financial assets.⁹ This is particularly true for nature-related risks, due to their additional complexity.^a Given their abrupt, non-linear and historically unprecedented nature, risk metrics calibrated on backwards-looking data (such as many Value-at-Risk calculations) are unsuitable for capturing them.¹⁰ Forward-looking risk assessments through scenario analysis and stress-testing are designed to deal with these issues but are typically accepted to be underestimates, especially when it comes to severe physical risk scenarios.^{3,11,12} This arises from genuine modelling difficulties, including around time horizons and particularly when it comes to representing tipping points.¹² As a result, calibrating financial policies solely based on these analyses – for example, applying

macroprudential capital buffers based on the results of climate stress tests¹³ – are unlikely to ensure sufficient resilience to or mitigate these systemic risks.

Ultimately, it is in the interests of CBFRs to act proactively to mitigate sources of systemic climate and nature-related risks in a precautionary manner.¹⁴ Ecosystem tipping points, in particular, are likely to overwhelm resilience capabilities; it is unlikely that economic and financial systems would be able to ‘absorb’ these types of large-scale, irreversible environmental-economic shocks. It is unclear how CBFRs can achieve their primary mandates of price and financial stability in a regime characterized by ecological collapse.⁸ Avoiding this requires CBFRs to shift towards an approach that steers financial activities away from contributing to the build-up of systemic risk, rather than relying solely on more and better risk quantification and disclosure to shift capital allocation at the necessary speed and scale.^{10,15}

1.3. OPERATIONALIZING A COMPLEMENTARY APPROACH: MAPPING FINANCIAL FLOWS TO ECOSYSTEMS FACING TIPPING POINTS

While continued scenario analyses are essential for understanding the potential future dynamics of nature-related risks, focusing on where new sources of funding are being channelled towards the direct drivers of nature loss in the world’s ecosystems can provide a complementary basis for action by CBFRs. This could build on the Network of Central Banks and Financial supervisors for Greening the Financial System (NGFS) ‘ecosystem-based’ approach to prioritization – looking at key ecosystems on which economy activity depends.¹ While not precluding other crucial ecosystems that must be included within climate and nature risk management efforts, those globally important ecosystems facing large-scale tipping points are an analytically and operationally useful starting point for CBFRs to operationalize this approach, given that they pose highly uncertain, non-linear, and potentially irreversible impacts with globally systemic consequences.

Climate change is a key driver of these tipping dynamics³ and has received substantial research and policy focus. However, there has been less attention on the financial services – including bank lending, capital markets facilitation, and insurance – that enable companies contributing to ongoing, more direct drivers of nature loss in these ecosystems, such as

deforestation and forest degradation. With voluntary policies by financial institutions remaining weak and fragmented,¹⁶ there is a clear need for more coordinated action by CBFRs in this area.

For CBFRs, these financial flows are most relevant to their macroprudential policies, since they contribute to the build-up of systemic risks from climate change and nature loss.^{1,14,17} In parallel, monetary policies should not undermine macroprudential policies by indirectly supporting such activities, whereas for microprudential policymakers these financial flows indicate potentially risky business models and future sources of transition risks that could threaten individual financial institutions.⁹ Since financial and monetary policies can have allocative and signalling effects on the price and directionality of borrowing in the economy,^{18,19} they are potentially powerful levers for redirecting these financial flows in line with a credible net-zero and nature-positive transition (see Box 1). Complementing government and international efforts to address core underlying drivers of nature loss,²⁰ CBFRs can support the delivery of their primary mandates in the long term by using their policies to target financial flows that enable ongoing nature loss in these and other ecosystems.

a. Due to distinct characteristics such as multidimensionality (inability to be captured in a single driver such as carbon emissions or single impact metric such as global temperature change) and a ‘local-to-global’ trade-off when analysing risks.

SECTION 2: CASE STUDIES

2.1. SUMMARY OF METHODOLOGY

Recent research by the UCL Institute for Innovation and Public Purpose (UCL IIPP) and the University of Exeter's Global Systems Institute (GSI) maps financial flows across multiple asset classes to companies linked to drivers of nature loss in specific ecosystems.^{21,22} This research focuses on four types of ecosystems across five case studies – the **Amazon rainforest** (Brazil), **boreal forests** (Russia, Canada), **tropical peatlands** (Indonesia), and **mangroves** (Indonesia). These cases were chosen for the following reasons: (i) scientific evidence of threshold behaviour or 'tipping points' that would lead to declines in important ecosystem services resulting in severe regional and global consequences and systemic nature-related risks; (ii) their degradation would have critical implications for climate change; and (iii) these specific jurisdictions host the largest remaining extent of each ecosystem. This choice is not intended to preclude other ecosystems from future focus from financial policymakers, but rather illustrates a starting point

for analysis – prioritizing those ecosystems posing highly uncertain and high-magnitude, global impacts – that could be extended to other areas.

In each case, the research identifies key drivers of nature loss which are making the ecosystem less resilient. In all cases, land-use change and degradation is the most important direct driver, alongside global climate change.^b It then identifies the key sectors associated with this direct driver in each case, and constructs firm-level proxies^c for land-use pressures to identify the most important companies within these sectors, prioritizing location-specific data that links^d firm activities to the specific ecosystem wherever possible. Availability of this type of data varied across ecosystems, meaning that the companies included: (i) do not represent an exhaustive list; (ii) operate at different stages of the value chain (e.g. production versus export); and consequently (iii) may be more or less involved in on-the-ground land-use change and degradation.



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b. We do not focus on companies linked to climate change drivers (i.e. greenhouse gas emissions) since this has been the subject of significant policy and academic research.

c. For example, data from Trase Supply Chains linking trade in agricultural commodities to on-the-ground environmental impacts and land tenure data from Global Forest Watch.

d. We refer to this collectively as companies "linked to" land-use change and degradation in the case studies.

The research used data from the London Stock Exchange Group (LSEG) to trace financial flows to these companies and their subsidiaries over the past decade (2014–2023/24), covering bank lending and capital markets facilitation (equity and bond issuances).^e It mapped the financial institutions (predominantly commercial and investment banks) that originated these deals and analysed their individual contributions as well as the geography (i.e. headquarters) and ownership of the ultimate parents of these financial institutions.^f

These financial flows are sources of new funding to companies linked to land-use change and degradation in these ecosystems, contributing to systemic nature-related risks; this contrasts with financial stocks, which track existing exposures in parts of the financial system. For capital markets deals, the research does not identify the actors (e.g. insurance companies, pension funds and investment firms) that provide the primary funding (as opposed to banks, which underwrite these deals). This is an important future research area, alongside other financial transmission channels such as insurance provision, private debt, and public finance.

2.2. HEADLINE FINDINGS

The case studies identified a wide range of financial institutions that originated financial flows to companies linked to land-use change and degradation in the respective ecosystems. These financial institutions were often headquartered in jurisdictions far from where ecosystems are located, indicating potential cross-border transmission channels of transition and endogenous risks. While bank lending was the most important source of financial flows, bond issuances were also a key channel. Most financial

flows were provided for general corporate purposes. When it comes to diversified companies, this leads to a challenge for CBFRs in pinpointing specific assets or transactions most linked to drivers of nature loss within policy frameworks. Global systemically important banks (G-SIBs) were central to financial flows, particularly in boreal forests and the Amazon rainforest (Figure 1 and case studies). Domestic systemically important banks (D-SIBs) also played a major role in all jurisdictions.

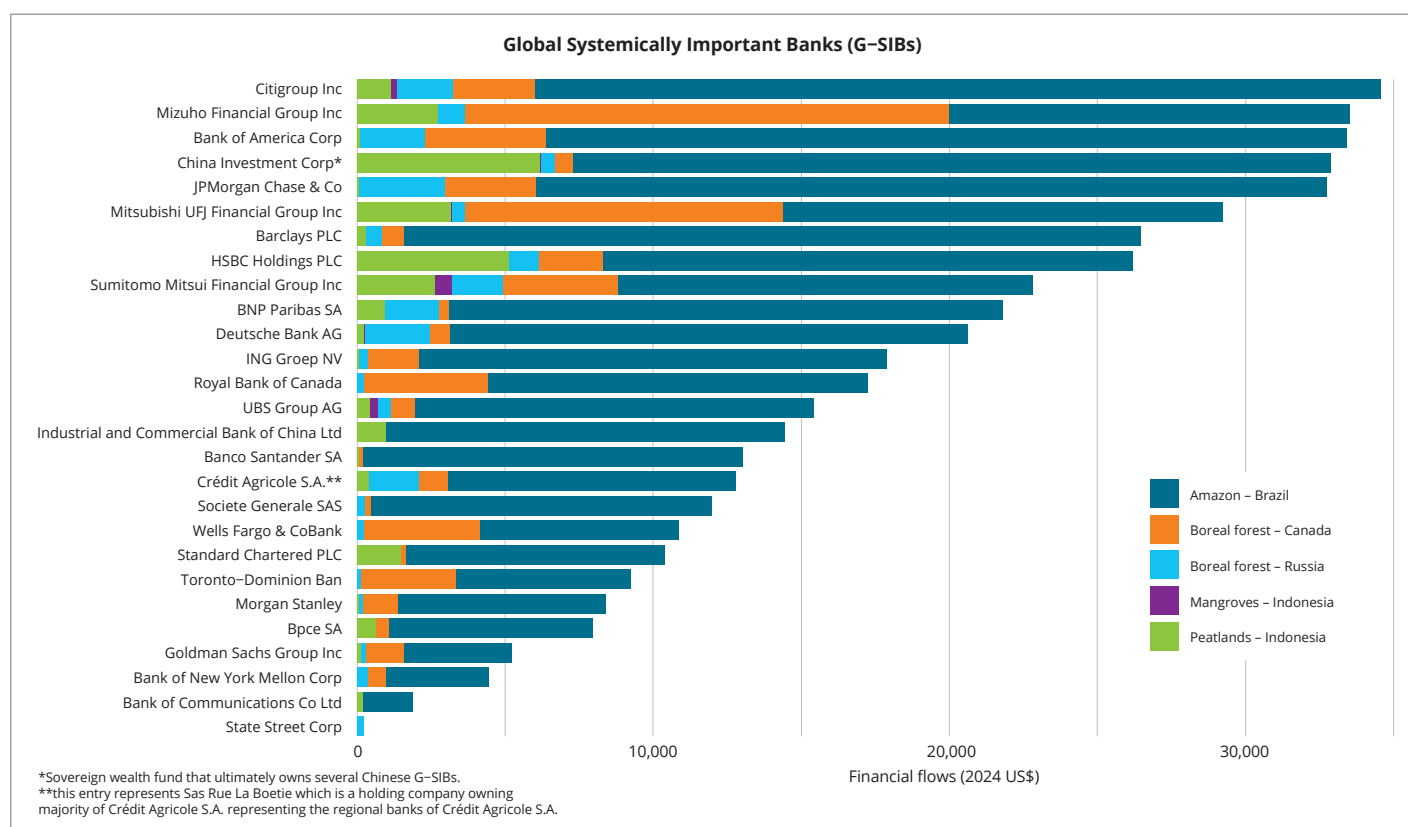


Figure 1: Financial flows provided and facilitated by G-SIBs to companies linked to the Amazon rainforest, boreal forests, mangroves, and peatlands across the five case studies.

e. All financial amounts are inflated to 2024 US dollars using the US Consumer Price Index sourced from LSEG.

f. For a detailed methodology, see Marsden et al. (2024) for the Brazilian Amazon and Indonesian peatlands, and Marsden et al. (2025) for boreal forests in Canada/Russia and mangroves in Indonesia.

2.3. CASE STUDY: AMAZON RAINFOREST – BRAZIL



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Parts of the Amazon rainforest could collapse to a non-forested state as soon as 2050 due to water stress driven by land-use change and climate change,²³ impacting global climate regulation, moisture cycling and biodiversity, as well as regional temperatures and rainfall patterns.³ Approximately 60% of the Amazon is in Brazil. The key direct drivers^g of land-use change in the Brazilian Amazon are pastureland for beef, followed by soy production.²¹

Financial flows between 2014 and 2023 to companies potentially linked to land-use change and degradation from beef and soy in the Brazilian Amazon totalled US\$614.6 billion (adjusted to 2024 US dollars). Financial institutions originating these flows were primarily headquartered in countries far from the Brazilian Amazon, including the United States (US), the European Union (EU) and the United Kingdom (UK) (Figure 2).

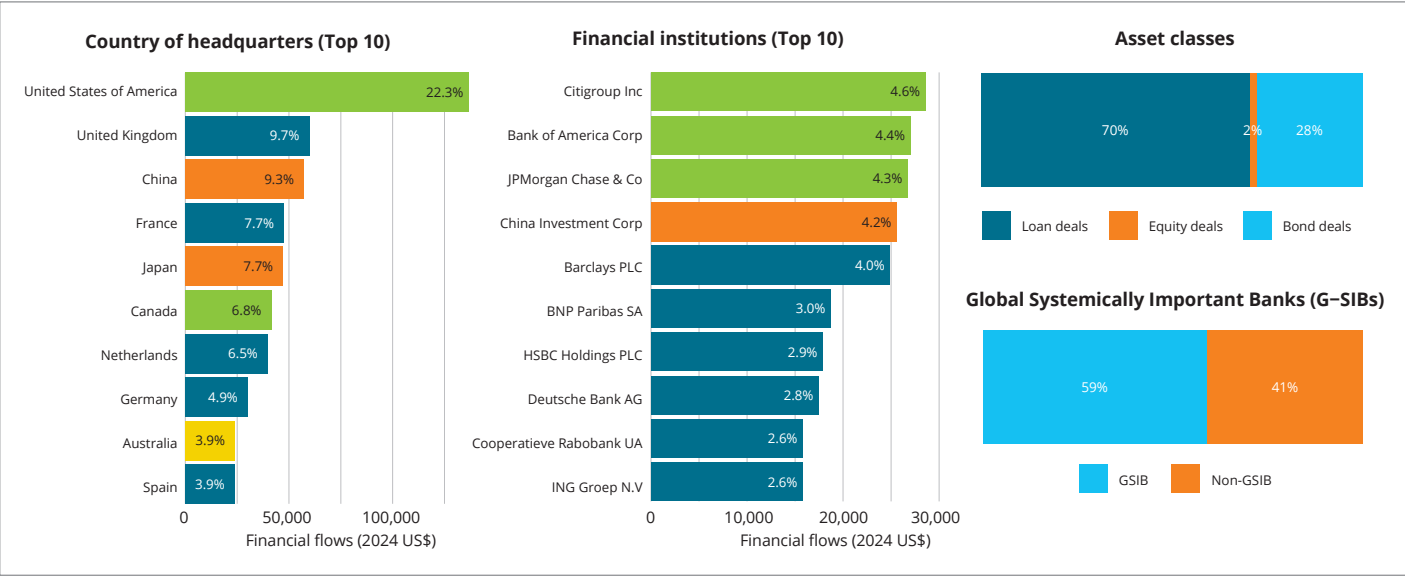


Figure 2: Brazilian Amazon – Financial flows (2014–2023) to companies linked to drivers of nature loss, by a) country of headquarters of financial institutions originating flows; b) individual financial institutions originating flows; c) asset class; and d) GSIB status of financial institutions originating flows. In (a) and (b), the top ten are shown – colours indicate region of headquarters and percentages indicate portion of overall flows (as such the percentages of the top ten will sum to less than 100%). For capital markets deals (equity and bond issuances), the data identified the financial institution facilitating the deal (through underwriting and other services) rather than the institutions (e.g. investment firms) providing the primary capital.

g. While beef and soy production are the largest historical contributors to deforestation in the Amazon, deforestation rates linked to these important commodities have declined in recent years (although they remain too high). Last year Brazil also saw a [major spike in forest loss](#) due to wildfires, reinforcing the importance of tackling climate change alongside other direct drivers of nature loss.

2.4. CASE STUDY: BOREAL FORESTS – CANADA



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Boreal forests, found in the northern hemisphere, could die back to a treeless state at their southern margins due to increasing disturbances – such as fire and invasive species – driven by climate change and forest degradation.^{3,22} Canada accounts for 26% of global boreal forest area. In Canada, industrial logging has been the largest economic contributor to intact forest loss and forest degradation in recent years.²²

Financial flows between 2014 and 2024 to companies potentially linked to land-use change and degradation from forestry in the Canadian boreal forest totalled US\$98.8 billion (adjusted to 2024 US dollars). Financial institutions originating these flows were primarily headquartered in Japan and the US, followed by Canada itself (Figure 3).

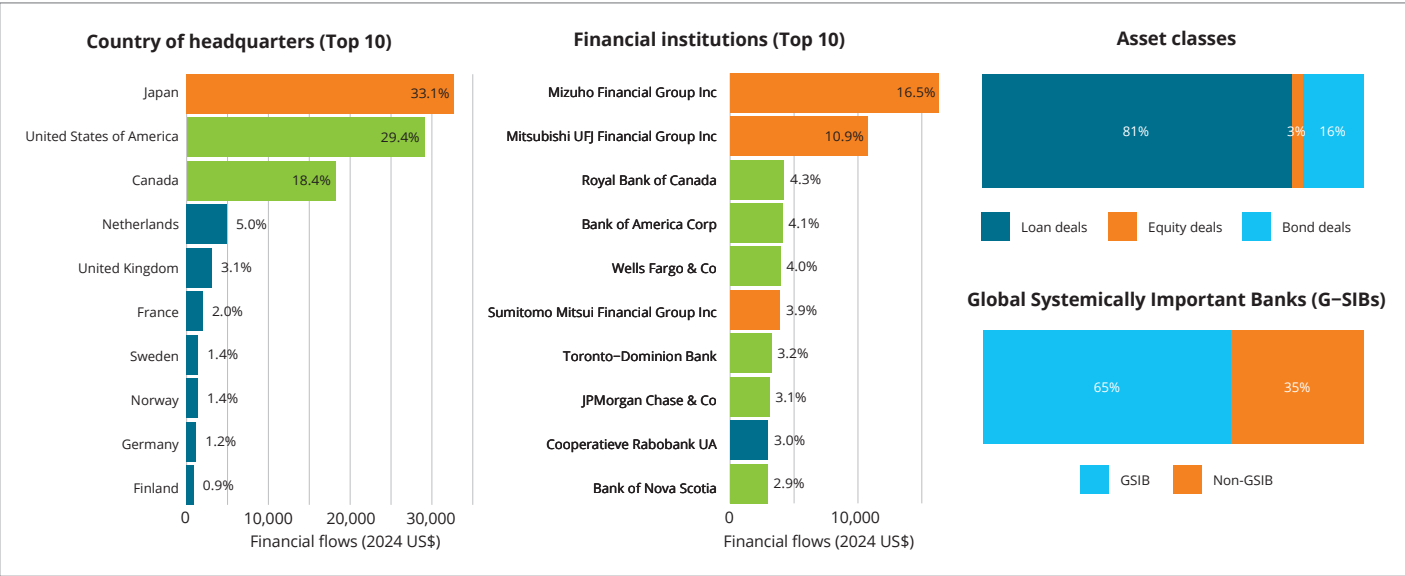


Figure 3. Boreal forests (Canada) – Financial flows (2014–2024) to companies linked to drivers of nature loss, by a) country of headquarters of financial institutions originating flows; b) individual financial institutions originating flows; c) asset class; and d) GSIB status of financial institutions originating flows. In (a) and (b), the top ten are shown – colours indicate region of headquarters and percentages indicate portion of overall flows (as such the percentages of the top ten will sum to less than 100%). For capital markets deals (equity and bond issuances), the data identified the financial institution facilitating the deal (through underwriting and other services) rather than the institutions (e.g. investment firms) providing the primary capital.

2.5. CASE STUDY: BOREAL FORESTS – RUSSIA



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Russia accounts for 60% of the world’s boreal forest area. Similarly to Canada, industrial logging has been the largest contributor to intact forest loss and forest degradation in Russian boreal forests over recent years, followed by mining and energy extraction.²² Financial flows between 2014 and

2024 to companies potentially linked to land-use change and degradation from forestry in Russia totalled US\$37.9 billion (adjusted to 2024 US dollars). Financial institutions originating these flows were primarily headquartered in the US, Russia itself, and the EU^h (Figure 4).

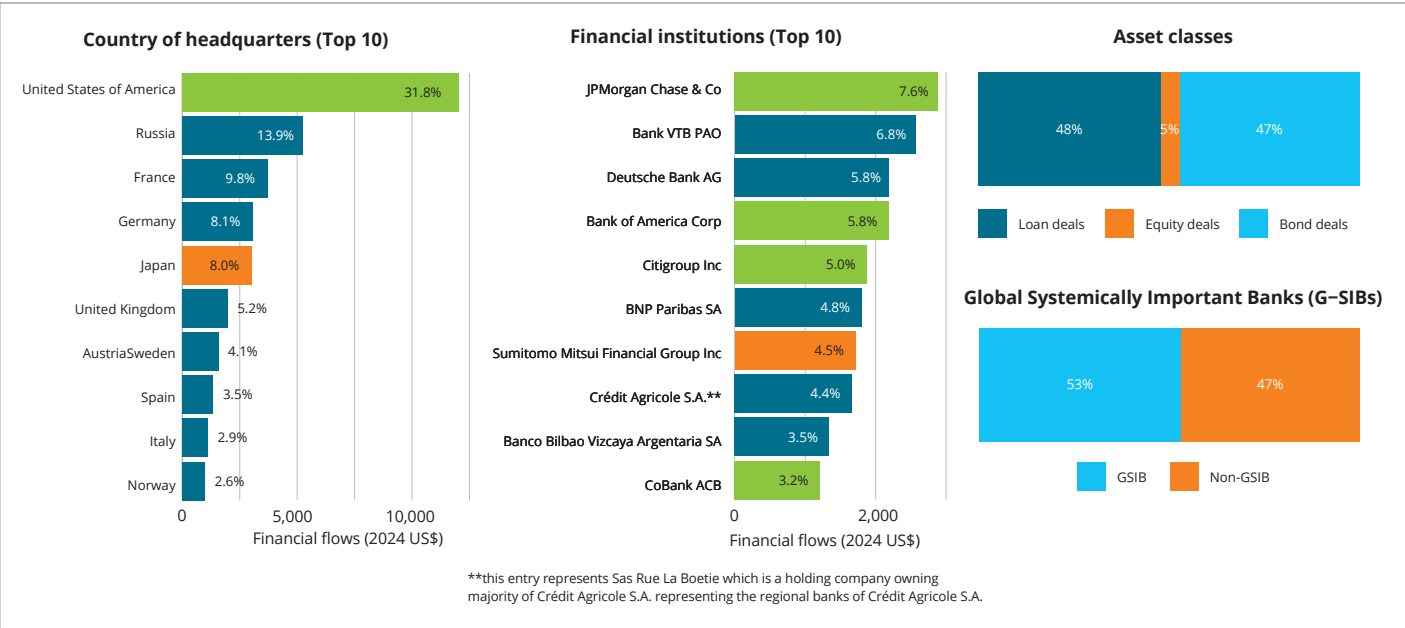


Figure 4. Boreal forests (Russia) – Financial flows (2014–2024) to companies linked to drivers of nature loss, by a) country of headquarters of financial institutions originating flows; b) individual financial institutions originating flows; c) asset class; and d) GSIB status of financial institutions originating flows. In (a) and (b), the top ten are shown – colours indicate region of headquarters and percentages indicate portion of overall flows (as such the percentages of the top ten will sum to less than 100%). For capital markets deals (equity and bond issuances), the data identified the financial institution facilitating the deal (through underwriting and other services) rather than the institutions (e.g. investment firms) providing the primary capital.

h. This is over the period 2014–2024 – the contributions to and exposures of European and US financial institutions to these companies is likely to have substantially shifted since 2022, in the aftermath of the Russia-Ukraine war, because of sanctions and divestments.

2.6. CASE STUDY: MANGROVES – INDONESIA



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Mangroves face possible tipping points due to a variety of interacting pressures that greatly increase the uncertainty of their future. Combating land-use change – the primary historical driver of mangrove loss – is key to building the resilience of this ecosystem to the threat of climate change.²² Over one-fifth of global mangrove cover is in Indonesia (more than double any other country), where land-use change for aquaculture (primarily shrimp cultivation) and oil

palm plantations has caused extensive mangrove loss since 2000.²² Financial flows between 2014 and 2024 to companies potentially linked to land-use change and degradation from palm oil and shrimp in Indonesia totalled US\$10.3 billion (adjusted to 2024 US dollars). These flows were primarily originated by Indonesian financial institutions, including state-owned banks, as well as ‘self-arranged’ by the companies themselves, followed by the US (Figure 5).

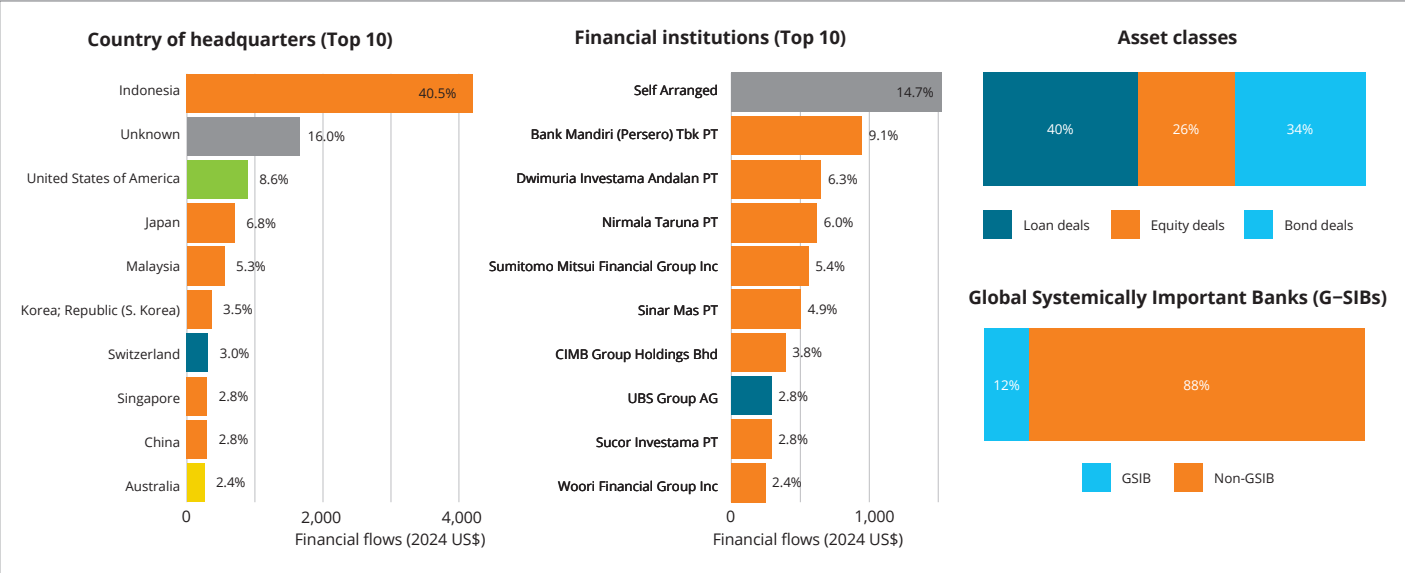


Figure 5. Mangroves (Indonesia) – Financial flows (2014–2024) to companies linked to drivers of nature loss, by a) country of headquarters of financial institutions originating flows; b) individual financial institutions originating flows; c) asset class; and d) GSIB status of financial institutions originating flows. In (a) and (b), the top ten are shown – colours indicate region of headquarters and percentages indicate portion of overall flows (as such the percentages of the top ten will sum to less than 100%). For capital markets deals (equity and bond issuances), the data identified the financial institution facilitating the deal (through underwriting and other services) rather than the institutions (e.g. investment firms) providing the primary capital. “Self-Arranged” indicates the company did not use financial services to issue the transaction and instead arranged this itself. These account for most of the flows from “Unknown” countries.

2.7. CASE STUDY: PEATLANDS – INDONESIA



© WWF-Pacific / Tom Vierus

Tropical peatlands can rapidly decompose through drying and repeated fires should water levels be reduced past critical levels, largely driven by land-use dynamics such as drainage, deforestation and conversion.²¹ Southeast Asia hosts the largest known area of tropical peatlands, concentrated in Indonesia. Plantation agriculture for oil palm and wood pulp are most associated with continued land use and associated historical deforestation on peatlands

in Indonesia.²¹ Financial flows between 2014 and 2023 to companies potentially linked to land-use change and degradation from oil palm and wood pulp on peatlands in Indonesia totalled US\$82.3 billion (adjusted to 2024 US dollars). Financial institutions originating these flows were primarily headquartered in Indonesia itself, followed by China, Japan and Singapore – although the second-largest contributor was UK-headquartered HSBC (Figure 6).

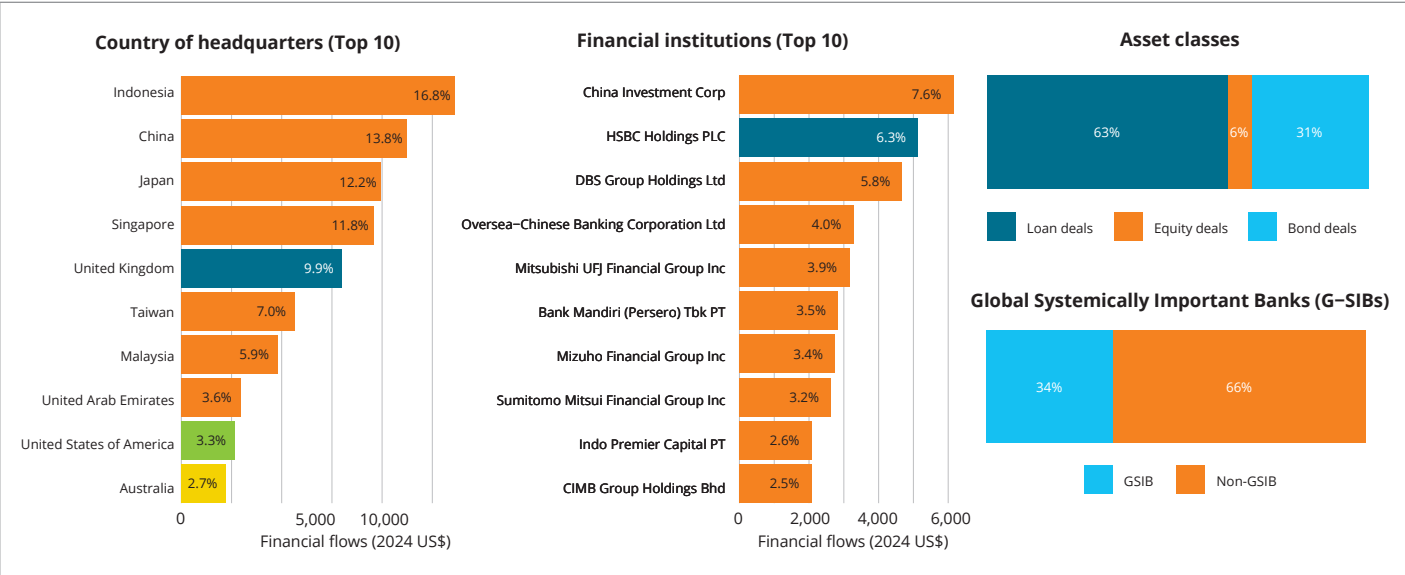


Figure 6. Peatlands (Indonesia) – Financial flows (2014–2023) to companies linked to drivers of nature loss, by a) country of headquarters of financial institutions originating flows; b) individual financial institutions originating flows; c) asset class; and d) GSIB status of financial institutions originating flows. In (a) and (b), the top ten are shown – colours indicate region of headquarters and percentages indicate portion of overall flows (as such the percentages of the top ten will sum to less than 100%). For capital markets deals (equity and bond issuances), the data identified the financial institution facilitating the deal (through underwriting and other services) rather than the institutions (e.g. investment firms) providing the primary capital.

SECTION 3: POLICY RECOMMENDATIONS

These case studies can provide an initial basis for policy action by CBFRs. Those in countries hosting financial institutions that originate these flows should adapt relevant prudential and monetary policy tools to limit the contribution of these entities (and CBFRs' own operations) to drivers of nature loss in these ecosystems.

The data can also partially inform microprudential authorities' assessment of transition and physical risks facing individual financial institutions. While this data provides a place to start, CBFRs could also conduct further analysis following this approach to fill remaining data gaps, as well as cover: a) other sectors contributing to land-use

change and degradation in these ecosystems; b) other drivers of nature loss in these ecosystems beyond land-use change and degradation; and c) other important ecosystems that are not highlighted here but nonetheless pose material nature-related risks relevant to mandates.



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BOX 1: SCRUTINIZING COMPANIES' CONTRIBUTIONS TO NATURE LOSS IN SPECIFIC ECOSYSTEMS



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The data set out in this policy note demonstrates that CBFRs must take a borrower/issuer-level, as well as an asset-level, approach to understanding the financial flows potentially contributing to nature loss in ecosystems such as the Brazilian Amazon and boreal forests. This is because most financial flows were provided as general purpose corporate finance to often diversified companies, as opposed to labelled or use of proceeds-restricted transactions such as project finance, where the intended activity is precisely known (Section 2.2). Moreover, CBFRs will also need to scrutinize the wider corporate groups connected to individual borrowers, to prevent measures being circumvented via intra-group lending.ⁱ One option could be to reverse the burden of proof on supervised entities (and borrowers/issuers) to prove their financing is not indirectly linked to these activities, following examples set within the European Union Deforestation Regulation and many financial crime regulations.

Since the data used to identify company impacts on nature is often backwards-looking and focuses on particular parts of the supply chain,^j there is a complementary need for forward-looking data to ensure measures do not inadvertently hinder access to capital for transition and adaptation.¹⁴ Climate and nature transition plans are key frameworks that could support this. There is some precedent for similar borrower/issuer-level analysis by CBFRs (e.g. the ECB's assessment of the climate performance of issuers held within its asset purchase portfolio). However, financial policymakers do

not necessarily have the appropriate expertise or authority to solely determine the credibility of transition plans (i.e. their alignment with robust net-zero and nature-positive pathways)^{9,24} of non-financial companies. They can, however, do so for financial institutions, and a critical link exists between the two²⁵ – since a credible financial sector transition plan includes robust plans for the managed phase-out of activities that have potentially irreversible negative impacts on nature.²⁶

Determining alignment with net-zero and nature-positive pathways remains an open question and certainly requires CBFRs to coordinate with others, include their own governments' climate and nature strategies and action plans.²⁷ However, the following points are worth noting: the UN High Level Expert Group on Net-Zero and other standard-setters set a 2025 target date for removing deforestation from agricultural and forestry supply chains as part of credible net-zero pathways.²⁸ This provides an indication that companies with connections to continued land-use change and deforestation in 2025 in key ecosystems, including those facing tipping points, may be potential candidates for managed phase-out within financial sector transition plans. Furthermore, distinguishing between 'always environmentally harmful' activities in comparison to those with potential to transition can also be a useful starting minimum safeguard to identify practices that require an accelerated phase-out.^k

i. Our research found some evidence of intra-firm lending;^{21,22} the literature elsewhere also highlights how companies may issue finance via their most creditworthy and least risky divisions and channel this to riskier subsidiaries elsewhere in the group (see discussion in Marsden et al., 2024).

j. See Marsden et al. (2024, 2025) for a discussion of this for these case studies.

k. See 'Always Environmentally Harmful Reference Points' in WWF (2022).

3.1. MACROPRUDENTIAL POLICY

For macroprudential policymakers, the financial flows shown in this note should be a key focus since they contribute to the build-up of national and global systemic risks. Macroprudential policy seeks both to build resilience to and constrain the build-up of systemic risk within the financial system.¹⁴ Since large-scale degradation of and tipping points in these ecosystems are likely to overwhelm financial resilience and adaptation capabilities,^{1,3} here policymakers need to focus even more closely on how they can contribute to mitigating the build-up of these systemic risks.

While they are not solely responsible for economic activities driving nature loss in these ecosystems, the identified financial institutions play an important enabling role that allows the activities to persist. Macroprudential policymakers can adjust the tools they have available to influence these financial flows, targeting these *endogenous* sources of systemic nature-related risks and incentivizing mitigation action.

RECOMMENDATION:

Design capital buffers that incentivize individual financial institutions to limit financial flows to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).

Ikeda and Monnin (2024)¹⁴ provide relevant principles for calibrating macroprudential capital buffers for climate-related systemic risks, including ‘prevention’, ‘individualization’ and ‘recalibration’ components that work to dynamically incentivize financial institutions to reduce their contribution to the build-up of systemic risk. Here, the buffer should reflect each individual financial institution’s changing contribution to financial flows to companies contributing to nature loss in these ecosystems, following the framework in Box 1. Capital buffers should be set on these narrowly targeted exposures at sufficiently high levels to materially impact the financing conditions of the targeted firms.¹⁵ Given their prominence in originating financial flows to companies contributing to nature loss in these ecosystems (Figure 1 and case studies), GSIBs could also receive a specific penalizing factor.

Incentive-based measures that seek to influence financial flows by altering the relative prices of finance to companies contributing to nature loss in these ecosystems may not sufficiently alter the price or quantity of finance provided to these actors.¹⁵ In light of this, CBRs can also place direct limits on the quantity of finance provided to these companies through borrower-based measures and outright limits on financial flows.

RECOMMENDATION:

Set borrower-based measures for companies contributing to nature loss in these ecosystems (based on the framework in Box 1).

Borrower-based measures – such as restrictive loan-to-value/debt-to-income ratios – are direct quantity-based policies¹⁵ that complement capital-based measures in current macroprudential frameworks and have the specific objective of reducing the contribution to systemic risks by reducing demand for credit in the targeted sectors.²⁹ While borrower-based measures tend to apply only to bank lending, there are ongoing discussions³⁰ on how to extend them to corporate lending by any financial institution, as well as to market-based sources of finance. These are highly relevant for financial flows linked to these ecosystems where bond issuances play an important role.

RECOMMENDATION:

Apply direct limits or exclusions on funding or underwriting by banks, and portfolio restrictions on capital markets funding by other financial institutions (including index funds), to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).

These outright limits operate as mandatory exclusions on specific borrowers and are the most direct means of managing these financial flows in line with climate and nature goals.¹⁵ There are several examples of successful quantity-based credit policies. For example, the Brazilian central bank’s experience with aligning the financing of agricultural activities with strict environmental requirements in certain ecological zones has been shown to have resulted in a material reduction in deforestation over the period 2003–2011, compared to locations not covered under the policy.³¹ China also made successful use of green ‘window guidance’ – informal guidance to direct the lending of both private and specialized public credit institutions towards green sectors and away from fossil fuels and other polluting sectors – from 2006–2014.³² Given the prominence of bond issuance within financial flows to these systems, it will be crucial that measures are extended to a) banks’ underwriting and arranging of these transactions, and b) the funding of these transactions by other financial institutions (e.g. insurance companies, pension funds).

3.2. MONETARY POLICY, BALANCE SHEET OPERATIONS AND OWN PORTFOLIOS

CBFRs should ensure they do not contribute to the build-up of systemic risk^l via their monetary policy and other operations by indirectly promoting financial flows to companies contributing to nature loss in these ecosystems.

RECOMMENDATION:

Apply haircuts and concentration limits within collateral frameworks to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).

RECOMMENDATION:

Adjust eligibility criteria in asset purchase, foreign reserve and own (e.g. pension fund) portfolios to limit exposure to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).

RECOMMENDATION:

Exclude financial flows to companies contributing to nature loss in these ecosystems (based on the framework in Box 1) from targeted refinancing operations.

When central banks accept assets as collateral during day-to-day liquidity support to commercial banks, this results in a premium for both the assets and their issuers, through higher prices and lower borrowing costs respectively.¹⁵ Similarly, use of central bank balance sheets, through asset purchase programmes and foreign reserves management, can influence the market demand and yields of assets included within these portfolios, including those companies that contribute to nature loss in these ecosystems. Adapting these tools can therefore have important allocative and signalling effects that can reduce the build-up of these systemic risks, also managing the exposure of central bank balance sheets to possible transition risks as part of prudent public policy. Aligning monetary policy with this approach also plays a crucial role in targeting non-bank sources of finance that currently lie outside many macroprudential policy tools but nonetheless contribute to these financial flows.

3.3. MICROPRUDENTIAL POLICY

The case studies in Section 2 can also support microprudential authorities in their efforts to assess and manage the exposure of individual financial institutions to nature-related risks. On transition risks, these ecosystems will be key targets for future nature transition policies (e.g. by area-based conservation measures or the development of alternative industries) which could transmit to traditional financial risk categories by threatening the financial positions of companies contributing to nature loss in these areas.²² On physical risks, many of the companies impacting these ecosystems also depend on their ecosystem services for their business activities. Finally, these companies are increasingly subject to litigation and reputational risks, including on grounds of financial crime.^m

However, the academic research showed that, for most of the financial institutions originating the greatest volume of flows, these activities made up a very small proportion of

their overall activities.^{21,n} This further underscores the need for macroprudential policymakers to target these financial flows, since individual financial institutions may not perceive these activities as sufficiently material transition risks and act in a timely fashion to mitigate them in line with systemic environmental stability concerns.¹⁷ Microprudential policymakers should still recognize the transition and potential physical risks posed by exposures to these ecosystems by starting to include how financial institutions address these risks within supervisory review and evaluation processes, prudential transition plans,³⁴ and exclusion criteria within due diligence requirements (see Box 1). Capital measures, such as increasing risk-weights for exposures linked to drivers of nature loss in these ecosystems, would be complementary to the tools laid out in previous sections but would likely require more supervisor discretion compared to current methods of calibrating microprudential capital requirements based on established risk differentials.

l. Degradation of these ecosystems would also have major implications for price stability mandates, including through supply shocks to sectors that depend on these ecosystems and are strongly linked to core and headline inflation.^{3,33} While new inflation targeting and management frameworks are likely needed to fully manage these effects, aligning monetary policy operations with the approach in this note can play a complementary role by seeking to reduce contributions from within the financial sector to these dynamics.

m See, for example, calls to [prosecute French financial institutions](#) on these grounds for the Amazon rainforest.

n. Note that further analysis – for example, accounting for securitization dynamics and maturity periods – may be required to understand how financial flows evidenced here translate to on-balance-sheet exposures. Flow data can, however, directly indicate the extent to which a financial institution's business model is linked to supporting companies contributing to nature loss.

3.4. FURTHER ANALYSIS

By tracking the origination of *new* financial flows to companies linked to drivers of nature loss, the case studies provide useful grounds for CBFRs to scope and prioritize policy measures. However – as discussed in Section 2.1 – there are gaps in the data available for academic research, on both the financial side (e.g. bilateral transactions, insurance underwriting, primary market securities purchases) and on the counterparty side (e.g. asset-level data to identify ETP risk companies).

CBFRs could expand on this ecosystem-based approach to nature-related financial risks by taking advantage of significantly more granular data that is available to them across different sectors of the financial system, such as credit registries, securities holding statistics, and insurance underwriting data. Where firm-level data available to CBFRs is in the form of financial *stocks* or balance sheet exposures,^p this is suitable for microprudential policymakers aiming to identify sources of risk to individual financial institutions. However, macroprudential policymakers may need to analyse

changes in stocks over multiple years as a proxy for new financial flows contributing to the build-up of systemic risk.

Alongside their own analysis, CBFRs could also achieve greater visibility by requiring regulated entities to disclose financial flows to companies with activities linked to drivers of nature loss in specific ecosystems – for example, as part of TNFD-aligned disclosures on ‘sensitive locations’.^q This could also support the identification of companies across other drivers of nature loss and a greater portion of the supply chain in these ecosystems, since the companies studied within the academic research were not an exhaustive list (Section 2.1).

Finally, this approach could be extended to other ecosystems beyond those identified as possible tipping elements. Many provide regionally and globally important ecosystem services and face multiple drivers of nature loss; focusing too heavily on those ecosystems outlined in this note without addressing wider pressures on ecosystems could lead to leakage of impacts to neighbouring areas.



**CBFRs COULD ACHIEVE GREATER VISIBILITY BY
REQUIRING REGULATED ENTITIES TO DISCLOSE FINANCIAL
FLOWS TO COMPANIES WITH ACTIVITIES LINKED TO
DRIVERS OF NATURE LOSS IN SPECIFIC ECOSYSTEMS.**

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p. For example, the EU credit registry AnaCredit.

q. The TNFD asks participants to assess any ‘sensitive locations’ (regardless of material financial risks), defined as areas of biodiversity importance, ecosystem integrity (rapid decline or high intensity), and ecosystem service delivery importance (including cultural importance to Indigenous peoples and local communities) since these may present elevated reputational and liability risks as well as contribute to elevated systemic risks.³⁵ Within nature transition plans,²⁶ the TNFD considers these locations as candidates for ‘managed phase-out’ strategies.

SECTION 4: IMPLEMENTATION CONSIDERATIONS

First, financial and monetary policies to influence financial flows to these ecosystems remain complementary to national government and international policies, by ensuring that the financial system does not undermine wider efforts to address the many interacting drivers of nature loss in these areas. CBFRs should coordinate with national governments, since these must ultimately set the direction of the green transition to ensure measures are aligned with democratically defined economic and environmental policy objectives, such as emerging national climate and biodiversity plans.

Currently, however, some regulatory dynamics appear to be moving in the opposite direction, with the EU's potential retreat from sustainability disclosure and due diligence regulations a clear example. Effective coordination between CBFRs and governments is also important since risks are only partly endogenous to the private financial system. Uncoordinated government action – such as continued subsidies to sectors impacting critical ecosystems – equally undermines CBFRs' efforts to reduce systemic nature-related risks. For example, fiscal policies have a central

role in influencing companies driving nature loss in these ecosystems that have strong financial positions that insulate them from changes in financing conditions (e.g. driven by financial regulations) or that do not substantially engage with private financial institutions.^{21,22}

Second, the transmission of financial and monetary policies to real economy impacts on companies contributing to nature loss in these ecosystems can be limited by several factors. These include the availability of substitute pools of finance from other jurisdictions (e.g. if green financial policies are unevenly implemented geographically) and asset classes (e.g. if green financial policies are applied only to bank lending).^{15,36} This means that green financial and monetary policies must minimize possible arbitrage opportunities by targeting multiple types of financial institutions and asset classes. Addressing these leakage concerns requires coordination internationally and between central banks and supervisors/regulators across banking, insurance and securities, as well as for system-wide macroprudential policies.³⁰

TAKING PROACTIVE STEPS MUST BE CONDUCTED IN PARALLEL WITH ADDRESSING - AND NOT EXACERBATING - UNDERLYING STRUCTURAL ECONOMIC DRIVERS OF NATURE LOSS IN THESE ECOSYSTEMS.



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BOX 2: THE ROLE OF INTERNATIONAL STANDARD-SETTERS IN STRENGTHENING ALIGNMENT AND TRANSMISSION



International standard-setters can help to align responses across jurisdictions and institutions. The Financial Stability Board and the Basel Committee on Banking Supervision (BCBS) have a mandate to coordinate and set minimum standards for global banking regulations, including those of G-SIBs (Figure 6).³⁷ The International Association of Insurance Supervisors (IAIS) and the International Organisation of Securities Commissions (IOSCO) can support addressing leakage concerns between financial market segments. The International Monetary Fund, given its focus

on both macroeconomic and financial stability, is well placed to lead this effort to manage where the financial system enables nature loss in systemically important ecosystems. Within these fora, CBFRs should become active stewards advocating for ecosystem-based concerns – including on ecosystem tipping points – in other coordination work related to banking, insurance and capital markets supervision. Ultimately, it is also the role of CBFRs to push for coherence and consistency of (systemic) risk management approaches globally and ensure a level playing field.

Finally, taking proactive steps to influence the price and directionality of borrowing to direct economic drivers must be conducted in parallel with addressing – and not exacerbating – underlying structural economic drivers of nature loss in these ecosystems. For example, countries hosting these ecosystems face underlying macroeconomic constraints – such as relatively weak currencies, foreign-denominated sovereign debt burdens, exchange rate vulnerabilities and volatile borrowing conditions on international markets – that a) can incentivize extractive activities that degrade ecosystems, and b) are a result of highly unequal positions in the international monetary and financial system.³⁸ Without accounting for these factors, tackling financial flows may crystallize transition risks, lead to financial instability (e.g. exchange rate volatility) and fiscal stress (e.g. debt repayment concerns), given that many of these sectors are central to economic development within ecosystem-hosting countries.³⁹

It could also increase their cost of borrowing and ability to finance spending, including to fund a green transition and adapt to environmental impacts.

All of these are questions of global justice.⁴⁰ In general, fiscal policies – as well as the alignment of central banking tools to ease financing conditions for green activities – can help to manage short-term financial stability and credit/finance provision effects of capital and other measures.^{14,18} In an international context, given the cross-border nature of many of the financial flows we traced, this implies fiscal support and debt relief from high-income governments and, from high-income CBFRs, the inclusion of climate/green bonds issued in and by ecosystem-hosting countries within collateral frameworks and asset purchase programmes, alongside using other central banking tools to improve financing conditions for mitigation and adaptation in these regions.⁴⁰

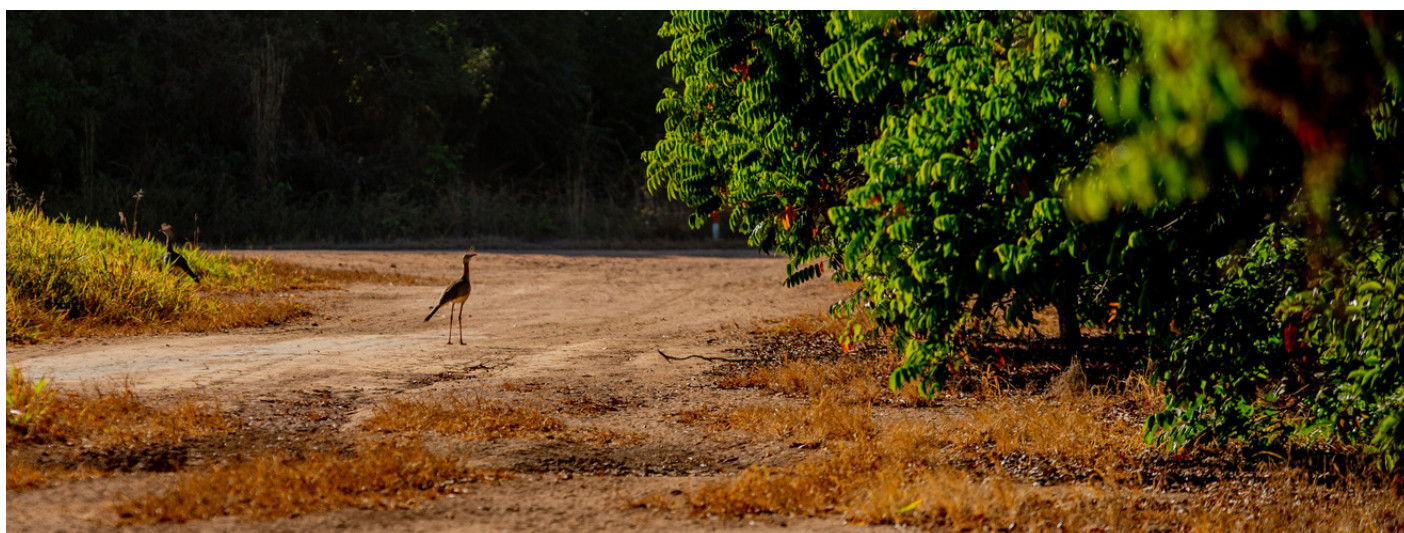
SECTION 5: CONCLUSION

This note has outlined how CBFRs can focus on new sources of funding to companies contributing to nature loss in specific ecosystems as a complementary approach to managing systemic environmental risks. Current efforts to quantify nature-related risks have a distinct bias towards underestimation for extreme physical risk scenarios, rendering them unsuitable as a sole means to *manage* risks. An alternative approach is required since the most severe physical nature-related risks – including those posed by tipping points – are likely to overwhelm absorption capabilities and hence require a much stronger focus by CBFRs on mitigating their build-up.

We use novel data from research by UCL IIPP and the University of Exeter's GSI – five case studies across four types of ecosystems facing tipping points that would have systemic impacts – to illustrate the analysis required to operationalize this approach and highlight key ecosystem-financing countries that should investigate it. In ecosystem-financing countries, CBFRs should deploy their policy tools to influence the price and availability of finance available to companies contributing to nature loss in these ecosystems, particularly under macroprudential rationales and aligning monetary and microprudential tools with this. These case studies also imply several important considerations for policy implementation, namely the need to: (i) target multiple types of financial institutions and asset classes beyond bank lending; (ii) recognize that the prevalence of intra-group lending and general corporate purpose financing requires a borrower-level approach incorporating corporate group structures; and (iii) address in parallel the important

global justice concerns raised by the international nature of financial flows and the structural macro-financial inequalities faced by many ecosystem-hosting countries (such as using tools from high-income economy CBFRs to support a fair green transition in ecosystem-hosting countries).

As emphasized throughout, focusing on the ecosystems facing large-scale tipping points should be viewed as a starting point for this ecosystem-based approach within a broader coordinated policy effort by CBFRs to assess and manage nature-related risks across *all* ecosystems, to prevent risks and impacts simply being displaced elsewhere. While the international and institutional coordination needed to fully deliver our recommendations will not be met by the current direction of travel in global cooperation, there are many steps that CBFRs can start taking already to contribute to safeguarding economic, financial and environmental stability in this era of interlocking crises.



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SECTION 6: APPENDIX

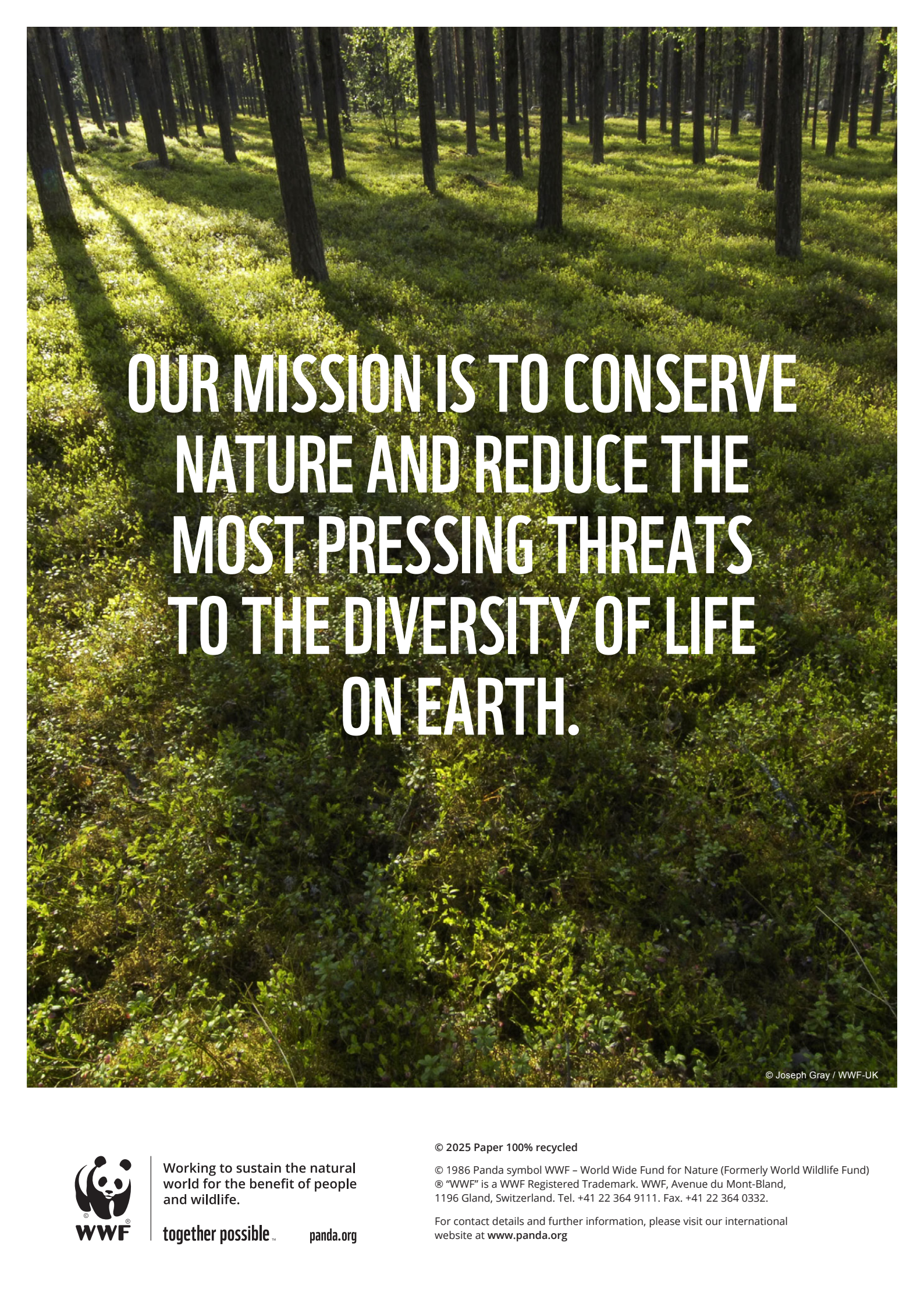
– SUMMARY OF RECOMMENDATIONS

AREA	POLICY RECOMMENDATIONS
Macroprudential policy <i>Rationale: Limit financial sector's contributions to the build-up of systemic risk</i>	Design capital buffers that incentivize individual financial institutions to limit financial flows to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).
	Set borrower-based measures for companies contributing to nature loss in these ecosystems (based on the framework in Box 1).
	Apply limits on funding or underwriting by banks, and portfolio restrictions on capital markets funding by other financial institutions (including index funds) to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).
Monetary policy, balance sheet operations and own portfolios <i>Rationale: Limit own contribution to the build-up of systemic risk</i>	Apply haircuts and concentration limits within collateral frameworks to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).
	Adjust eligibility criteria in asset purchase, foreign reserve, and own (e.g. pension fund) portfolios to limit exposure to companies contributing to nature loss in these ecosystems (based on the framework in Box 1).
	Exclude financial flows to companies contributing to nature loss from targeted refinancing operations (based on the framework in Box 1).
Microprudential policy <i>Rationale: Manage transition and physical risks associated with exposures to specific ecosystems and support the prevention of the build-up of systemic risk</i>	Include specific ecosystems within supervisory review and evaluation processes, prudential transition plans, ³⁴ and exclusion criteria within due diligence requirements and use contributions to nature loss in these ecosystems to adjust risk-weights in capital requirements frameworks.

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