Climate & Biodiversity Conference – Impact of climate risk and biodiversity loss on financial stability and monetary policy

Keynote:

Biodiversity Finance

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Grand Societal Challenge: Biodiversity Loss

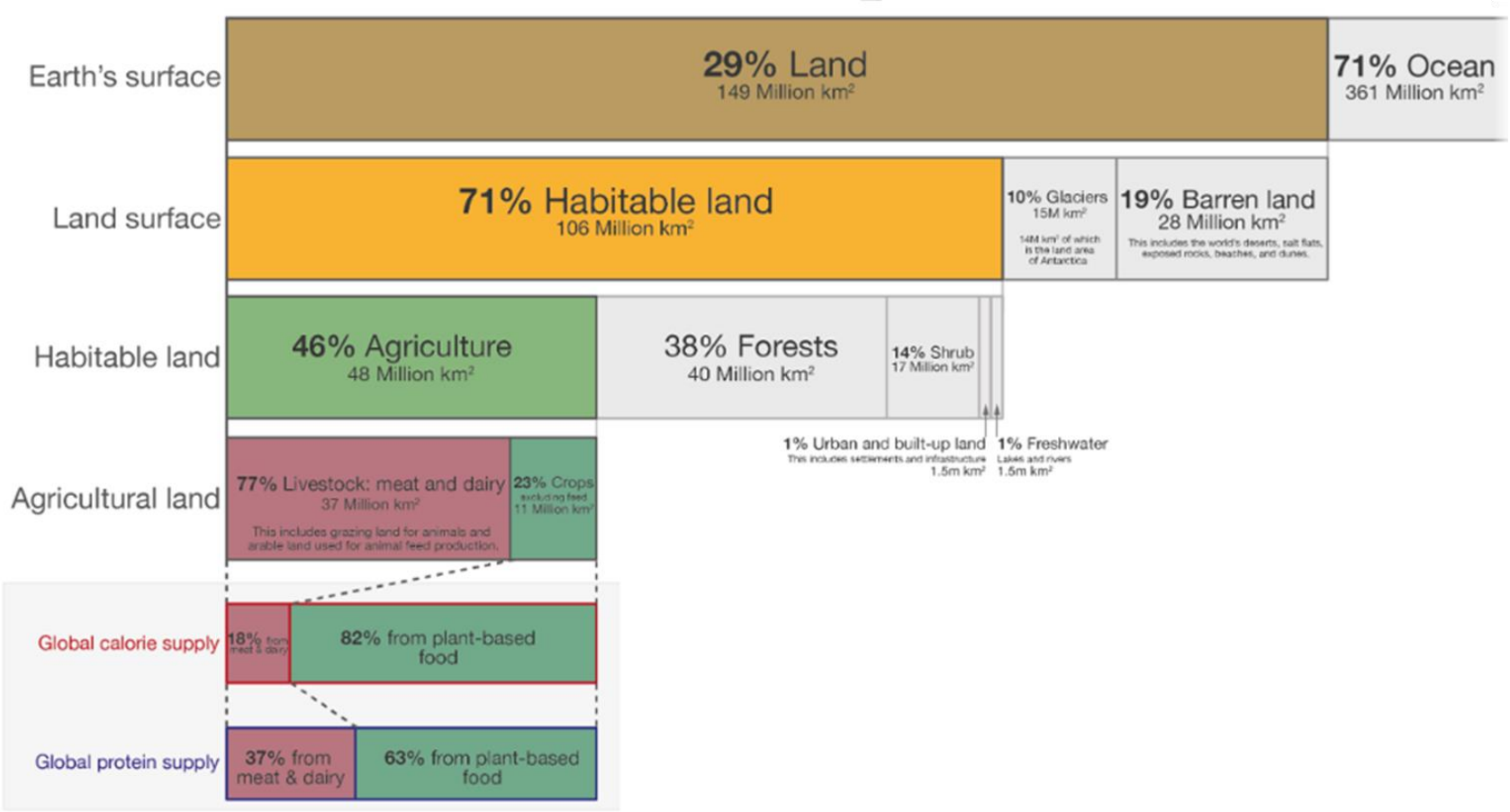
- Importance and urgency of mitigating biodiversity loss

Protecting biodiversity is critically **important and urgent**—it is important for the planet, our health and well-being, as well as the world's economy

- **"Code Red" alert for humanity**: global populations of mammals, fish, birds, reptiles, and amphibians declined by 69% since 1970 (WWF, 2022)
- **Climate and biodiversity crises are deeply intertwined**: Meeting the Paris Climate Agreement goals depends on the successful conservation, restoration, and management of biodiversity (UN 2022)

Grand Societal Challenge: Biodiversity Loss

- Global land use for food production



Source: Steve Lydenberg (2014)

Grand Societal Challenge: Biodiversity Loss

- Importance and urgency of mitigating biodiversity loss

Protecting biodiversity is critically **important and urgent**—it is important for the planet, our health and well-being, as well as the world's economy

- **"Code Red" alert for humanity**: global populations of mammals, fish, birds, reptiles, and amphibians declined by 69% since 1970 (WWF, 2022)
- **Climate and biodiversity crises are deeply intertwined**: Meeting the Paris Climate Agreement goals depends on the successful conservation, restoration, and management of biodiversity (UN 2022)
- **Biodiversity crisis is deeply intertwined with other crises:** food security, poverty, conflict and forced migration, geopolitical tensions, etc.
- **Existential threat to global economy and financial stability**: over 50% of world's GDP is dependent on nature and the services it provides (UN 2022)

Natural Capital: A Public Good

- Biodiversity provides many services to humans
  - For example:
    - Stabilizes climate, food supplies, water, plants used for medicine, natural flood defenses, carbon storage, pollination of crops, recreational enjoyment, provides spiritual sustenance, etc. (e.g., Heal 2020)
  - These services are typically provided as **public good**
    - Their **consumption is non-rival**: available to everyone and those unwilling to pay cannot be excluded from consuming the public good
    - Long-standing literature in public economics: their **efficient provision is challenging** due to free-rider and preference revelation problems (e.g., Dasgupta 2021, Heal 2020, 2003, 2004)

➔ Implication: Biodiversity is likely **undervalued and underprovided**

Potential Solutions to Mitigate Challenge

- Potential solutions to enhance biodiversity protection

1) **Intergovernmental measures**
   - E.g., Convention on Biological Diversity (CBD) and other global treaties
2) **Government measures** that aim to regulate
   - **Quantity** of natural capital
     - E.g., establishing protected areas, technology standards, cap-and-trade programs
   - **Price** of natural capital
     - E.g., through tax incentives and subsidies that encourage more sustainable production or consumption patterns
3) **Biodiversity finance**
   - Relatively recent phenomenon gaining momentum in practice
   - Yet, not well understood; investors feel underinformed about the risks and opportunities related to biodiversity finance (WEF 2023)

Important role, yet implementation challenging (Barrett 2022, Dasgupta 2021)

Financing the Protection of Biodiversity

- **Evolution of biodiversity finance**
  - Historically, biodiversity protection financed through:
    - **Public funding**
      - E.g., debt-for-nature swaps, official development assistance (ODA), sovereign biodiversity bonds (e.g., sovereign ocean bonds, rhino bonds), payments for ecosystems services (PES), biodiversity offsets, etc.
    - **Philanthropic giving**
      - E.g., Environmental Defense Fund (EDF), The Nature Conservancy (TNC), World Wildlife Fund (WWF), etc.
  - **Financing gap**: Additional capital (estimated $722-967 bn/year) needed to address biodiversity crisis (TNC, 2021)

Focus of this presentation

  - Relatively recent phenomena: **private investing in natural capital**
    - **Pure private capital investing**
    - **Blended finance** (i.e. blending concessionary funding with private capital)

Financing the Protection of Biodiversity

- **Gap in academic research**
  - In practice, private investing in natural capital rapidly growing but not well-understood
  - In academia, to date, **glaring research gap** in biodiversity finance (Karolyi & Tobin-de la Puente 2023, Starks 2023, Garel, Romec, Sautner, & Wagner 2023, Giglio, Kuchler, Stroebel, & Zeng 2023)
    - Likely due to:
      - **Lack of awareness** on how private capital can contribute to biodiversity conservation and restoration
      - **Lack of data** on biodiversity finance

Biodiversity Finance

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Agenda

1. Introduction
2. Private Investing in Natural Capital — A Conceptual Framework
   a) Asset types and monetization mechanisms
   b) Types of financing
3. Private Investing in Natural Capital — 1st Empirical Evidence
   a) Data
   b) In-portfolio Deals
   c) Discarded Deals
4. Discussion and Conclusion

Financing the Protection of Biodiversity

- Intriguing question: How can the **conservation and restoration** of biodiversity **yield financial returns** for investors?

Economic Value of Natural Capital – A New Asset Class

- Typical monetization mechanisms of natural capital
  - Include the **transformation** of natural capital (e.g., logging and mining)
- Monetization mechanisms in case of **biodiversity?**
  - Revenues need to be generated from **protecting as opposed to transforming** natural capital
  - Puzzling at first, yet generating financial returns from biodiversity conservation is feasible:
    - Monetization mechanisms of ecosystem services—**bundling** biodiversity with private goods whose value it enhances (Heal 2003, 2004)

Asset Types and Monetization Mechanisms

Natural capital asset types	Monetization mechanisms of ecosystem services
A. Land	
Agriculture: soil and pollinators	Agricultural productivity; price of farmland; certification as "biodiversity-friendly" agricultural products (higher prices); carbon credits; fire suppression; water quality
Forests	Ecotourism (hotel nights, tour guide services); carbon credits (carbon capture and storage); biodiversity credits; health; recreational value; bioprospecting for medicine; certification as "biodiversity-friendly" wood (higher prices); hydropower (pay for success)
Urban parks and other green infrastructures in urban areas	Value of real estate (proximity to park, green roofs provide heat isolation); prevention of flooding; carbon credits (carbon capture and storage); recreational value (e.g., birdwatching tours, sports activities, etc.)
Natural parks & wildlife protection	Ecotourism (hotel nights, tour guide services); value of real estate around the park; biodiversity credits
Genetic resources	Protection against diseases (humans, plants, food, animals); bioprospecting for medicine; biodiversity credits

Asset Types and Monetization Mechanisms

Natural capital asset types	Monetization mechanisms of ecosystem services
B. Sea	
Watersheds	Green infrastructure services; water purification
Coastal ecosystems	Ecotourism (hotel nights, tour guide services); value of real estate (prevention of coastal flooding); carbon credit (carbon capture and storage); biodiversity credits; food production
Fisheries	Food production; certification as "biodiversity-friendly" seafood products (higher prices)
Oceans (incl. coral reef)	Ecotourism (hotel nights, tour guide services); carbon credits; biodiversity credits; value of real estate (prevention of hurricanes and coastal flooding)

Types of Financing

- Two broad categories:
  - **Pure private capital**
    - Akin to investing private capital in traditional asset classes
  - **Blended finance**
    - Private capital blended with public or philanthropic capital, whose aim is to subsidize and de-risk private capital investments

Biodiversity Funds Structure

- Biodiversity Funds
  - Typically structured as **partnerships**
    - Partnerships with
      - One **general partner (GP)** making the investment and
      - Multiple **limited partners (LP)** investing capital
    - Each LP commits a specific amount to fund by closing date
    - Once closing date is reached, investment process begins
    - Payments made by LPs during life cycle of fund through drawdown notices that apply to all LPs at a pro rata of their capital contributions
    - If an LP defaults on one of the payments, GP can request additional drawdowns from other LPs
      - In such cases, the required capital contribution of each LP is increased on a pro-rata basis to cover the amount that remains to be funded

Returns and De-Risking Mechanisms

- **Returns** of Biodiversity Investments
  - **Direct financial** returns
    - Generated through the monetization mechanisms
  - **Indirect financial** returns
    - Biodiversity credits
    - Carbon credits
  - **Biodiversity** returns

Traditional investors

Impact investors

- For blended financing structures: Grants and concessional funding help
  - **Subsidize** investments from private capital investors
    - ➔ Increase their overall financial and biodiversity returns
  - **De-risk** such investments

De-Risking Mechanisms

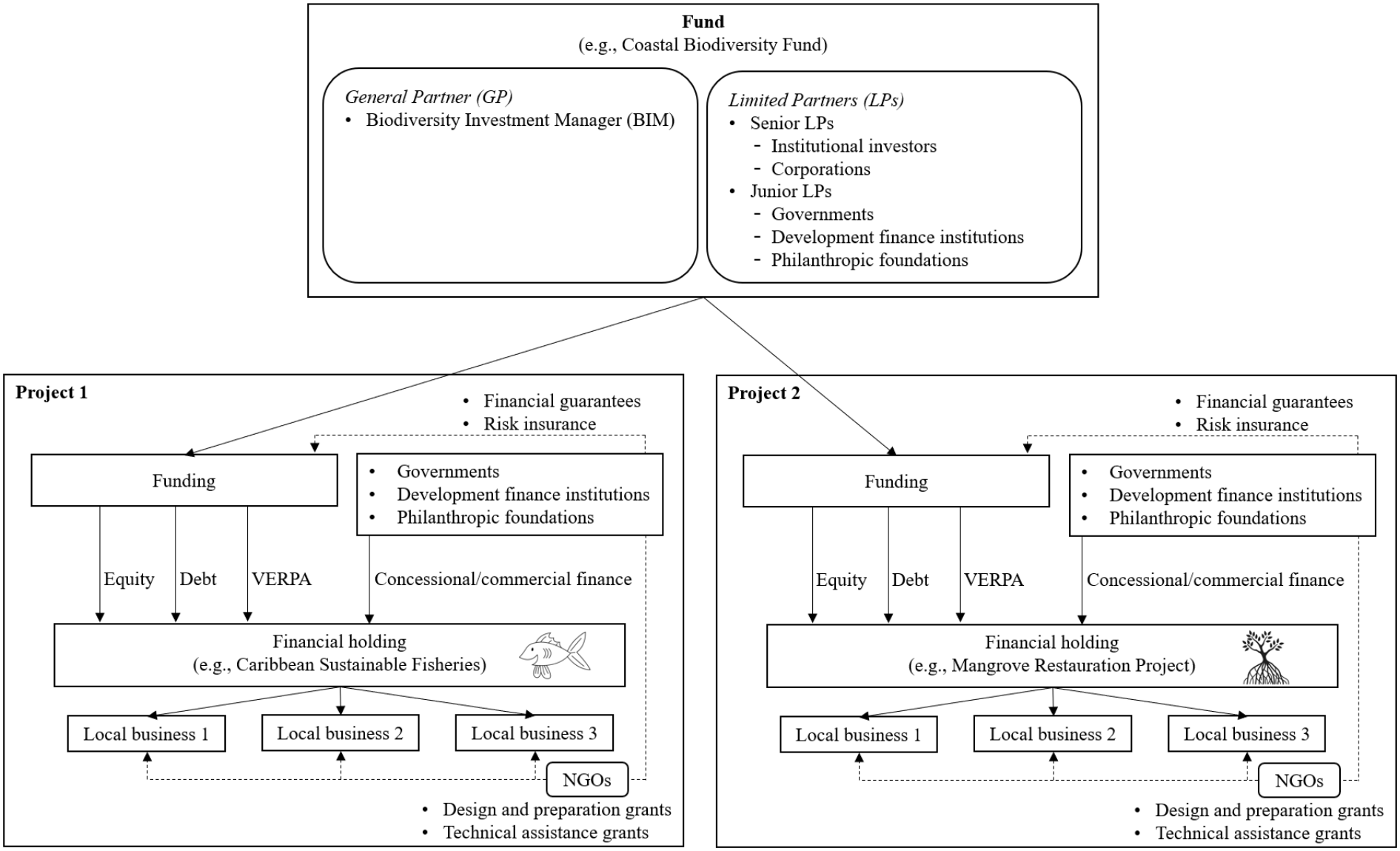
➔ **Objective** of de-risking mechanisms

- Various de-risking mechanisms
- Their objective is always the same: **act as a catalyst** in attracting private capital by **improving risk-return tradeoff** of biodiversity projects

De-Risking Mechanisms

- **De-risking Mechanisms** of Blended Finance
  - **Fund-level** de-risking mechanisms
    1) Seniority
    2) Preferred rate of return
    3) Financial guarantees
  - **Project-level** de-risking mechanisms
    1) Concessional finance
    2) Ex ante risk mitigation
       - Design and preparation grants
       - Technical assistance grants
    3) Ex post risk mitigation
       - Financial guarantees
       - Risk insurance

Summary


Fund
(e.g., Coastal Biodiversity Fund)
General Partner (GP)
• Biodiversity Investment Manager (BIM)
Limited Partners (LPs)
• Senior LPs
- Institutional investors
- Corporations
• Junior LPs
- Governments
- Development finance institutions
- Philanthropic foundations
Project 1
• Financial guarantees
• Risk insurance
Funding
• Governments
• Development finance institutions
• Philanthropic foundations
Equity
Debt
VERPA
Concessional/commercial finance
Financial holding
(e.g., Caribbean Sustainable Fisheries)
Local business 1
Local business 2
Local business 3
NGOs
• Design and preparation grants
• Technical assistance grants
Project 2
• Financial guarantees
• Risk insurance
Funding
• Governments
• Development finance institutions
• Philanthropic foundations
Equity
Debt
VERPA
Concessional/commercial finance
Financial holding
(e.g., Mangrove Restauration Project)
Local business 1
Local business 2
Local business 3
NGOs
• Design and preparation grants
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Data: “Biodiversity Investment Manager” (BIM)

- **“Biodiversity Investment Manager” (BIM)**
  - Description of BIM:
    - Recognized leader in biodiversity finance (and sustainable finance more broadly)
    - Private equity firm fully dedicated to sustainable investing
    - $30 billion in assets under management (AUM) throughout the world
    - Clientele comprises individual and institutional investors
    - Offers equity and fixed income investment strategies
    - Finances projects and companies at any stage of their life cycle

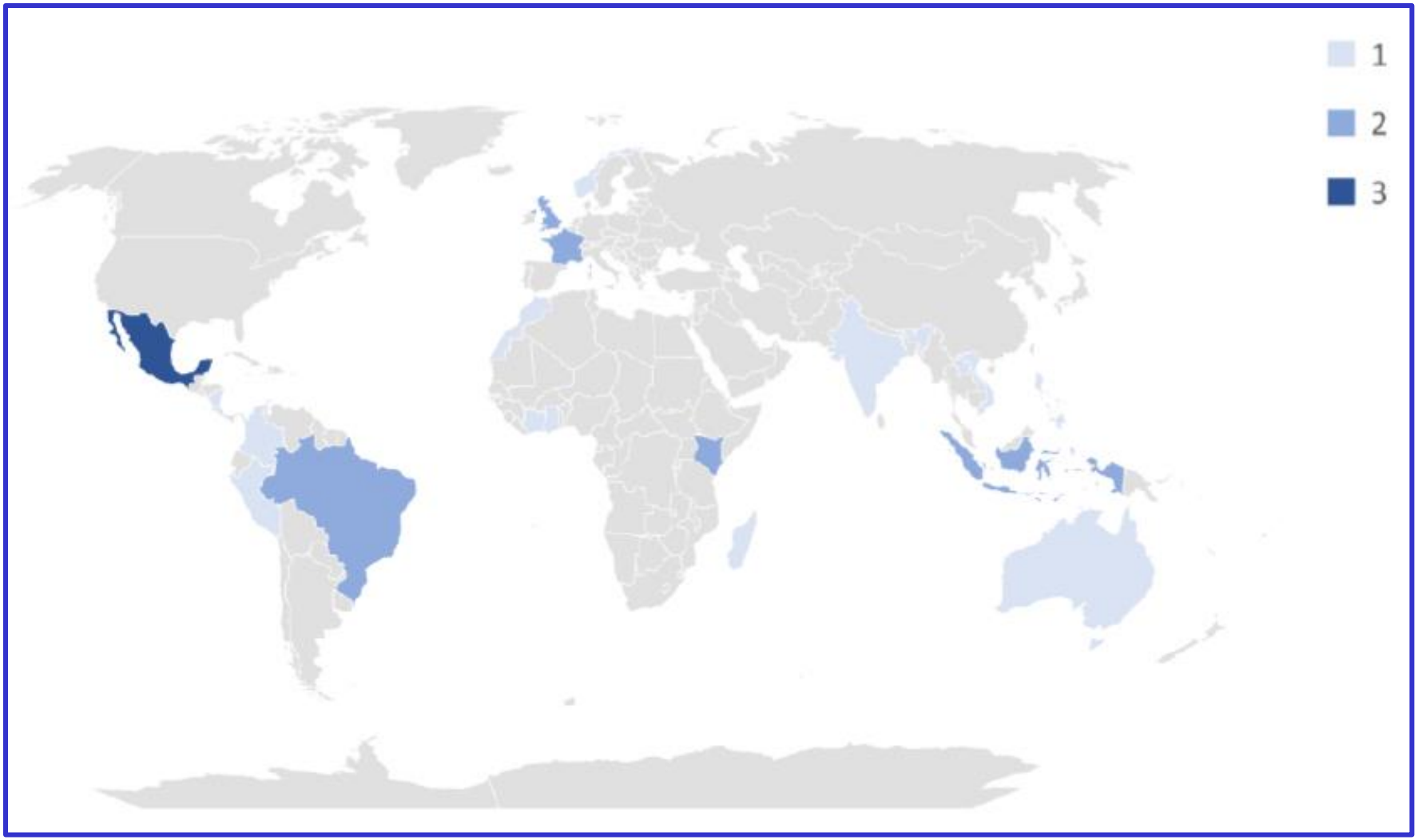
Data: "Biodiversity Investment Manager" (BIM)

- Proprietary data
  - Coverage:
    - **All 33 in-portfolio** biodiversity finance **deals** that were closed by BIM between 2020 and 2022
    - Note: deals are still **ongoing** (their average maturity is 8 years) and hence information about realized performance unavailable
    - **Detailed data**: For each deal, we have access to BIM's internal documentation
      - Includes information about
        - underlying biodiversity project
        - deal structure
        - expected biodiversity impact
        - expected financial return
        - BIM's risk assessment
        - etc.
    - In addition, access to **32 discarded deals**
      - Deals that were under consideration for portfolio inclusion, but were ultimately discarded by BIM's management

Deals by Natural Capital Asset Types

	All (N = 33)		Blended finance (N = 14)		Pure private capital (N = 19)	
	# Deals	Percent	# Deals	Percent	# Deals	Percent
Land	16	48.5%	8	57.1%	8	42.1%
Agriculture: soil and pollinators	8	24.2%	3	21.4%	5	26.3%
Forests	6	18.2%	3	21.4%	3	15.8%
Natural parks & wildlife protection	1	3.0%	1	7.1%	0	0.0%
Genetic resources	1	3.0%	1	7.1%	0	0.0%
Sea	17	51.5%	6	42.9%	11	57.9%
Watersheds	1	3.0%	0	0.0%	1	5.3%
Coastal ecosystems	3	9.1%	0	0.0%	3	15.8%
Fisheries	10	30.3%	4	28.6%	6	31.6%
Oceans (incl. coral reef)	3	9.1%	2	14.3%	1	5.3%
Total	33	100.0%	14	100.0%	19	100.0%

Biodiversity Finance Deals by Country



Deals by Financing Structure

	All (N = 33)		Blended finance (N = 14)		Pure private capital (N = 19)	
	# deals	Percent	# deals	Percent	# deals	Percent
Equity	11	33.3%	4	28.6%	7	36.8%
Equity + Debt	8	24.2%	4	28.6%	4	21.1%
Equity + Debt with profit sharing	1	3.0%	0	0.0%	1	5.3%
Equity + VERPA	2	6.1%	2	14.3%	0	0.0%
Debt	1	3.0%	1	7.1%	0	0.0%
Debt with profit sharing	6	18.2%	3	21.4%	3	15.8%
VERPA	4	12.1%	0	0.0%	4	21.1%
Total	33	100.0%	14	100.0%	19	100.0%

Deal Characteristics

	All			Blended finance			Pure private capital			Difference in means
	N	Mean	Std. dev.	N	Mean	Std. dev.	N	Mean	Std. dev.	*p*-value
A. Deal size and financing										
Maturity (years)	33	7.94	3.03	14	7.93	2.70	19	7.95	3.32	0.986
Deal size ($ million)	33	22.84	17.47	14	29.15	18.39	19	18.19	15.63	0.074*
Ticket size ($ million)	33	6.62	3.86	14	7.24	3.99	19	6.17	3.79	0.443
Equity ($ million)	33	3.21	4.00	14	3.44	4.45	19	3.04	3.74	0.781
Debt ($ million)	33	2.79	4.20	14	3.65	4.34	19	2.16	4.08	0.320
VERPA ($ million)	33	0.62	1.62	14	0.14	0.53	19	0.97	2.03	0.147
% Equity	33	0.52	0.44	14	0.50	0.44	19	0.53	0.46	0.881
% Debt	33	0.35	0.42	14	0.47	0.46	19	0.26	0.39	0.172
% VERPA	33	0.13	0.33	14	0.03	0.11	19	0.21	0.42	0.124

Deal Characteristics

	All			Blended finance			Pure private capital			Difference in means
	N	Mean	Std. dev.	N	Mean	Std. dev.	N	Mean	Std. dev.	*p*-value
B. Financial performance and risk										
Project return (target IRR)	33	13.52%	3.68%	14	11.88%	2.86%	19	14.72%	3.81%	0.026**
Project risk (deviation from target IRR)	20	7.18%	5.22%	8	6.94%	6.13%	12	7.34%	4.81%	0.872
Project return / project risk	20	2.51	1.32	8	2.44	1.54	12	2.56	1.22	0.846
C. Environmental and social impact										
Total impact area (ha, expected)	17	73,408	167,115	9	114,798	226,016	8	26,844	27,805	0.098*
GHG emis reduction (1,000tCO2e, expect)	18	5,665	8,649	8	9,469	11,900	10	2,622	2,824	0.096*
# Beneficiaries (expected)	13	11,623	11,779	6	19,133	13,812	7	5,185	3,710	0.025**
# New jobs created (expected)	15	1,846	4,273	6	3,358	6,693	9	838	1,050	0.279
Certification (1/0 dummy)	33	0.79	0.42	14	0.79	0.43	19	0.79	0.42	0.980

Deal Characteristics

- Results suggest
  - ➢ **Tradeoff between financial returns and biodiversity returns**, with implications for the type of financing
    - **Profitable projects** can be viably financed by pure private capital, but tend to have lower biodiversity impact
    - **Projects with higher biodiversity** return tend to be less profitable, but can nevertheless appeal to private investors through blending
  - ➔ Blending is important tool for improving risk-return tradeoff
  - ➔ Existence of a **three-dimensional "risk—financial return—biodiversity return frontier**"

Key Performance Indicators (KPIs)

A. Environmental

Certification

- Internationally recognized certifications achieved

Sustainable productive lands and seascapes

- Area of reforestation/afforestation (including agroforestry) [ha]
- Hectares of land under sustainable management (production or conservation/restoration) [ha]
- Hectares of land under sustainable productive management [ha]
- Carbon sequestration practices

Climate change mitigation

- Total GHG emissions avoided/reduced or sequestered [tCO2e]
- Avoided/reduced greenhouse gas emissions [tCO2e]
- Tons of GHG sequestered [tCO2e]
- Tons of GHG sequestered that led to the generation of verified tradable carbon units [tCO2e]
- Tons of GHG avoided/reduced that led to the generation of verified tradable carbon units [tCO2e]

Natural ecosystems

- Hectares of land under conservation or restoration [ha]
- Volume of waste treated or valued [metric tons]

Key Performance Indicators (KPIs)

B. Social

Community engagement

- Community engagement events held [#]
- Number of people attending community engagement events [#]

Livelihoods and decent work

- Number of employees [#]
- Employees expressed in full-time equivalent [#]
- People with their main source of income provided by the project (excluding direct employees), [#]
- People expected to benefit directly from the project (excluding employees) [#]
- Households benefitting directly from livelihoods generated by the project (excluding employees and individual beneficiaries) [#]

Inclusion

- Gender ratio for management roles [%]
- Gender ratio for senior executive roles [%]
- Gender ratio at board level [%]
- Ratio of female employees [%]

Discarded Deals ("Outside Group")

	In-portfolio deals			Discarded deals			Difference in means
	N	Mean	Std. dev.	N	Mean	Std. dev.	*p*-value
A. Financial performance							
Project return (target IRR)	33	13.52%	3.68%	32	11.29%	4.60%	0.035**
B. Environmental and social impact							
Total impact area (ha, expected)	17	73,408	167,115	28	19,684	43,148	0.006***
GHG emissions reduction (1,000 tCO2e, exp.)	18	5,665	8,649	12	1,253	2,094	0.096*
# Beneficiaries (expected)	13	11,623	11,779	11	3,727	3,899	0.045**
# New jobs created (expected)	15	1,846	4,273	12	1,192	2,813	0.652

Policy Implications

- Results from discarded deals suggest
  - **Only deals above** certain risk-return threshold appeal to private investors, and
  - **Biodiversity impact** needs to be sufficiently favorable for blended finance to be a viable option

➔ Private capital (as standalone or blended) is **unlikely to provide a silver bullet** against biodiversity crisis and needs to be **complemented with effective public policies**

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Urgency of Biodiversity Crisis

- Biodiversity crisis
  - A **critical threat** to the world economy
    - Collapse of ecosystem services provided by nature—such as wild pollination, the provision of food from marine fisheries and timber from native forests—could result in a decline in global GDP of $2.7 trillion annually by 2030 (World Bank 2021)
  - Ambitious goals have been set
    - E.g., "30 by 30" worldwide initiative (that is, the protection of 30% of land and 30% of oceans by 2030) at 2022 COP 15 meeting of the UN Convention on Biological Diversity
    - Public measures crucial in addressing biodiversity crisis, yet **unlikely sufficient**
  - **Financing gap**
    - Massive amounts of funding are required to effectively address biodiversity crisis (TNC 2020)

➔ As such, **biodiversity finance** could play an **important role** in mobilizing private funding for the protection and restoration of biodiversity

Key Findings and Implications for Policy

- Key Findings:
  - **Blending** is important tool for improving risk-return tradeoff of these projects to appeal to private investors
  - Existence of a **three-dimensional "risk—financial return—biodiversity return frontier"**
    - **Only deals above** certain risk-return threshold **appeal to private investors**
    - **Biodiversity return** needs to be **sufficiently favorable for blended** finance to be used

➔ Implications: Private capital (as standalone or blended)

- Useful addition to the toolbox**:** Can **help close financing gap** and contribute to conservation and restoration of biodiversity
- Yet, **unlikely a substitute** for the implementation of **effective public policies** in addressing biodiversity crisis

Concluding Remarks and Implications for Policy

- SDGs, Financing Gap, and Blended Finance
  - A large financing gap remains, especially in the Global South, to effectively finance the mitigation of climate change, biodiversity loss, and other grand societal challenges.
  - **The question:**
    - How can we crowd in more private capital to finance innovative solutions in climate tech, renewable energy, nature-based solutions, social inclusion, and others, especially in the Global South?
  - **Blended finance**
    - Private capital blended with public or philanthropic capital, whose aim is to subsidize and de-risk private capital investments
    - As such, the blending can serve as a catalyst for private capital investments in projects that create societal value but would otherwise not be financed (Flammer, Giroux, Heal, "Blended Finance", NBER WP 2024)

Concluding Remarks and Implications for Policy

- Critical factors that need to be addressed to scale up blended finance and close the financing gap

1) Current global prudential and regulatory framework for financial system was established before the Paris Agreement and has not been revised with the Paris Agreement; **global financial regulation needs to be aligned with climate goals**.

2) Blended finance is not **recognized as a distinct category** under the current global financial and prudential regulatory framework.
   - As a result, supervisors and regulators typically view blended finance similarly to securitization (which requires a lot of liquidity and capital to protect against risk).
   - Since risk-mitigation mechanisms (e.g., first loss guarantees from DFIs and others) used in blended finance are not properly recognized, financial institutions using blended finance get unnecessarily penalized, making such investments less attractive for private investors.

3) Blended finance is highly dependent on **credit ratings**.
   - Credit rating agencies often don't differentiate between country risk and project risk. As a result, credit rating agencies may overestimate the risk of these projects.

➔ Making progress on this front would likely help enhance the environmental, economic, and financial resilience of our planet

Thank You!

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Research papers: http://www.columbia.edu/~cf2870/

Sustainable Investing Research Initiative (SIRI):

https://www.sipa.columbia.edu/global-research-impact/initiatives/sustainable-investing-research-initiative-siri