

Land use and the economics of climate diplomacy

PhD Defense — Bertille Daran

February 20, 2026

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Land at the core of climate and livelihoods

Land plays a central role for **livelihood services** and **climate change**

- ▶ 69-76% of the global, ice-free land surface (IPCC, 2019)

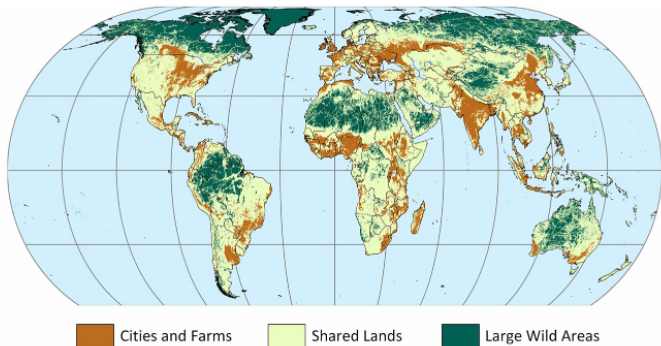


Figure: Land use practices (Ellis, 2019)

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Figure: Deforestation for agriculture along the border of Bwindi Impenetrable Forest National Park, Uganda
Credit: Nature Picture Library / Alamy Stock Photo

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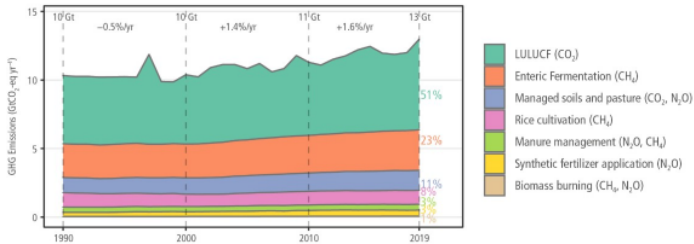


Figure: AFOLU emissions (IPCC, 2022)

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- ▶ 21% of total anthropogenic emissions (IPCC, 2022)
- ▶ 10-30% of all planned emissions reductions globally within the NDCs in 2030 (Roe et al., 2019)

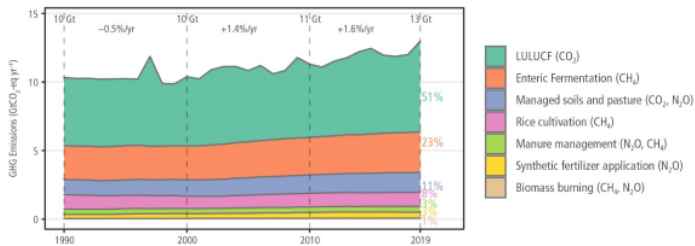


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Heterogeneous land structures, heterogeneous climate preferences

- ▶ Difficult to integrate into **international climate policy**

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- ▶ Mismatch between **local** land use practices and **global** land use outcomes
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RESEARCH QUESTION

How does heterogeneity in domestic land structures shape climate diplomacy—and how does climate diplomacy reshape land outcomes?

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DEFINITION

Climate diplomacy refers to the set of discussions, institutions, and policy instruments through which countries attempt to coordinate climate action within an integrated global economy.

This dissertation

1. NEGOTIATIONS

- ▶ Define commitments and collective rules

2. COOPERATION

- ▶ Use economic instruments to promote climate policies

3. FINANCE

- ▶ Fund mitigation and adaptation options

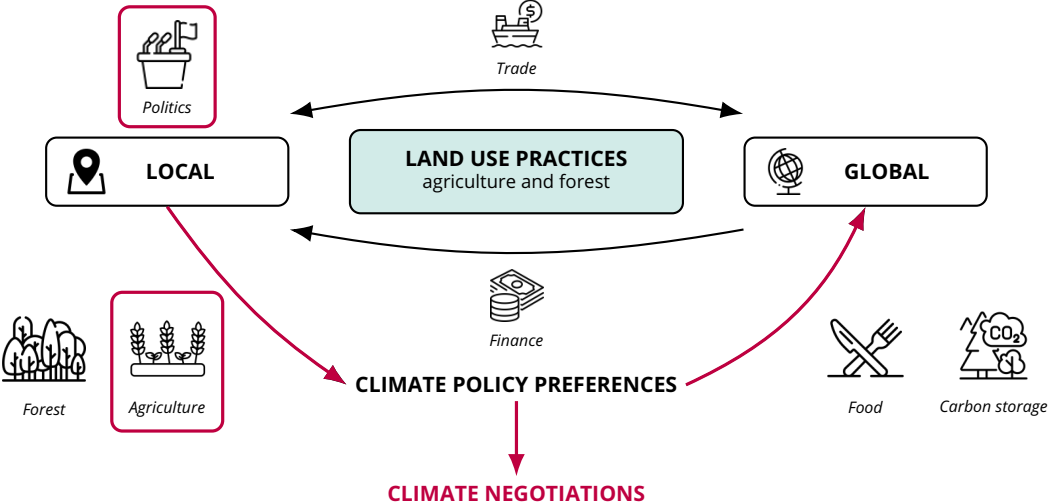
METHODS

- ▶ Textual analysis *via* natural language processing (NLP)
- ▶ Quantitative spatial models
- ▶ Empirical causal inference

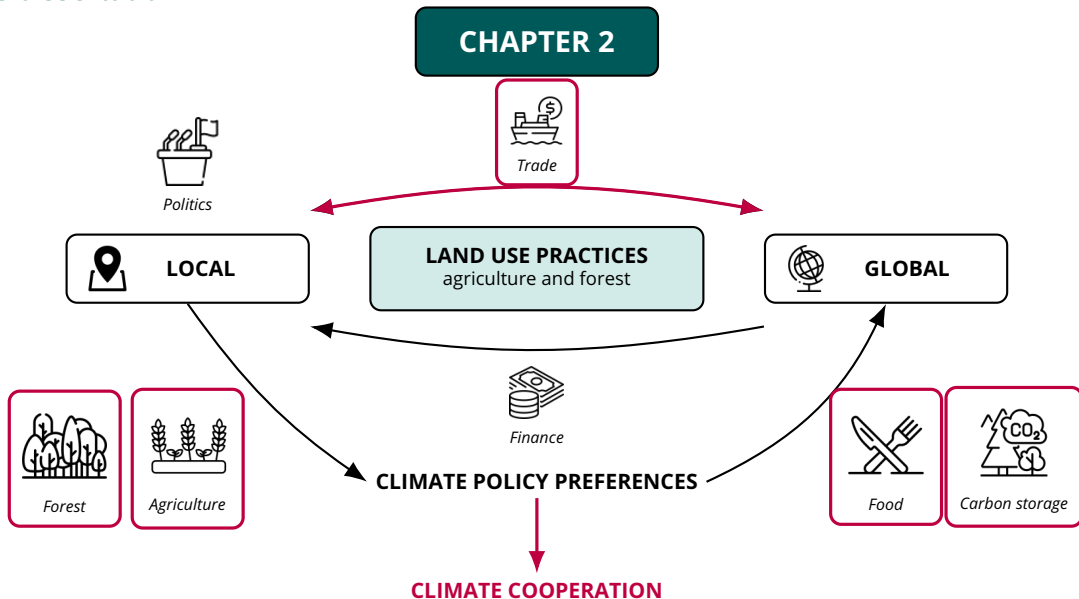
DATA

- ▶ Official documents and original survey
- ▶ Geocoded data
- ▶ Satellite-based data

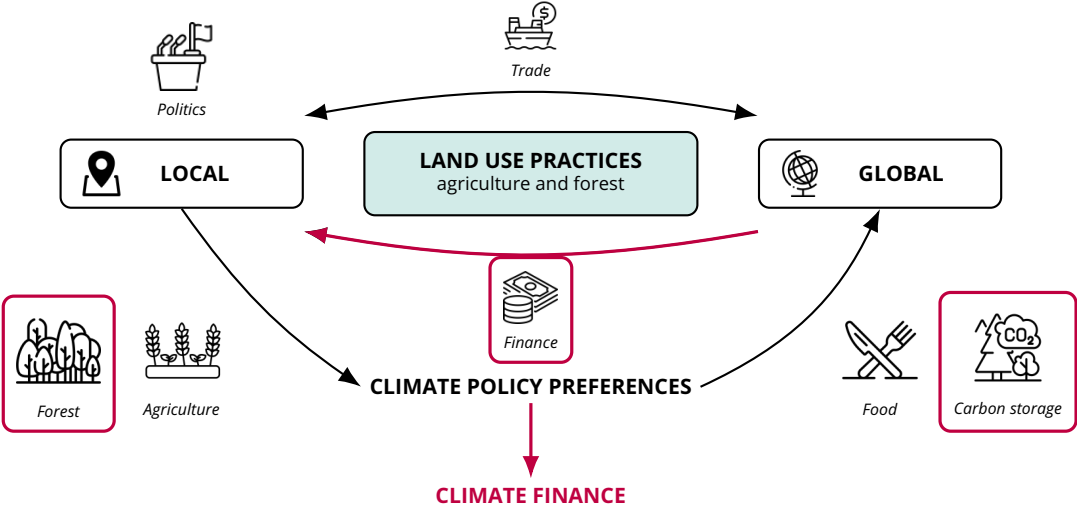
CHAPTER 1



CHAPTER 2



CHAPTER 3



On climate negotiations

Bargaining clubs?
Survey-based and UNFCCC text clusterings on
agriculture-climate issues

Development of a methodology to uncover bargaining clubs

Context

- ▶ UNFCCC Conference of the Parties as the arena of **complex multilateral negotiations**
- ▶ Involving numerous stakeholders from all countries
- ▶ Producing a large volume of official documentation

Development of a methodology to uncover bargaining clubs

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Main contribution

- ▶ Develop a **descriptive, process-oriented methodology** to analyze negotiation outputs
- ▶ Conceptual framework: **bargaining clubs** (Falkner et al., 2022)
 - Group of countries involving fewer participants
 - Reduced number of national interests, increasing compromise-seeking behavior

↔ *Can negotiation outputs reveal areas of convergence in countries' positions?*

Application: agriculture in climate negotiations

What areas of convergence?

▶ Application to **agriculture**:

- Five **responses options**, including supply-based options (agroforestry, BECCS, etc.) and demand-based (plant-based diet)
- Four **international cooperation mechanisms**, on monetary (financial transfer, etc.) or non-monetary (technology transfer and capacity-building, etc.) cooperation

Application: agriculture in climate negotiations

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What negotiation outputs?

- ▶ Independant analysis of **UNFCCC official documents** and **original survey responses**, conducted with co-authors
- ▶ **UNFCCC documents**:
 - Agriculture workstream and the Sharm-el-Sheikh online portal
 - 21 COP decisions and workshop reports (Mar 2012–Sep 2025)
- ▶ **Survey responses**:
 - Climate experts (negotiators)
 - Interlinkages between agriculture, climate policy, and negotiations
 - 752 individual responses from 134 countries (Oct 2024–May 2025)

Application of the methodology

Methodology

UNFCCC documents

NLP techniques
(semi-supervised)

Survey responses

Normalization

Creation of **actor-idea matrices**

Hierarchical clustering
(Stephenson et al., 2019;
Costantini et al., 2016)

Application of the methodology

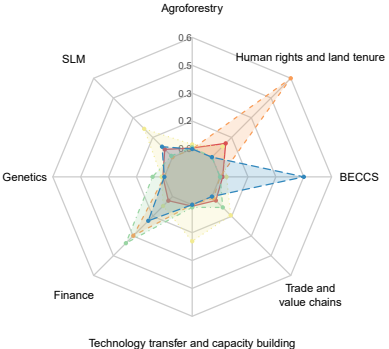


Figure: Radar plot for clustering on official documents

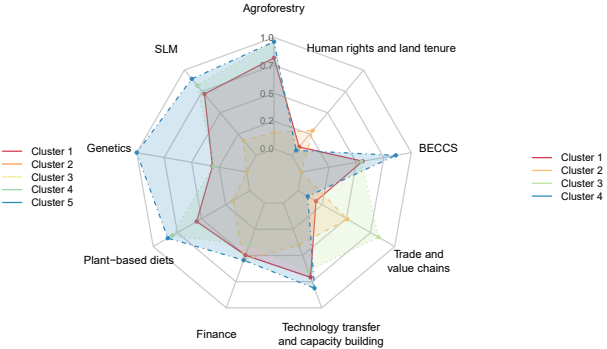
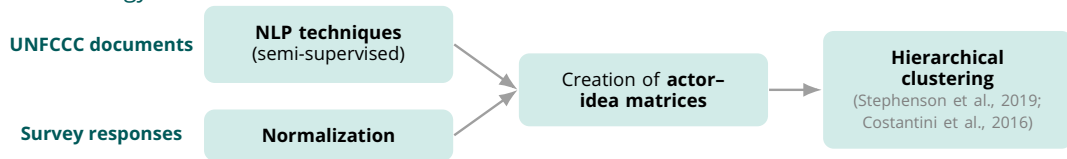


Figure: Radar plot for clustering on survey responses

Application of the methodology

Methodology



Results and limitations

- ▶ Creation of a **taxonomy** of bargaining clubs (cooperative, innovation-led, etc.)
- ▶ **Comparison with existing coalitions:** medium alignment for UNFCCC documents (EU, Umbrella Group, etc.), weak for survey responses
- ▶ Weak results due to the **sparse coverage** of some ideas ⇒ extend the set of negotiation outputs used

On climate cooperation

Can agricultural trade integration promote international climate cooperation?

Geography as a lever for climate cooperation: application to land use

Context

- ▶ **Trade measures** foster “race-to-the-top” incentives (S. Barrett, 1997; Nordhaus, 2015; Farrokhi and Lashkaripour, 2025)
- ▶ **Geography** shapes countries’ strategic behavior (Desmet and Rossi-Hansberg, 2024)
- ▶ **Land use and agriculture** combines geography, climate, and trade specificities
 - Dependence of agriculture on geography, due to spatial heterogeneity
 - Land services are essential, difficult to replace, and generate tradeoffs (IPCC, 2019)
 - Particularly high tariffs (WTO, 2023)

↔ *Can liberalizing agricultural trade be an effective incentive to foster climate cooperation?*
↔ *What are the climate and socio-economic impacts of resulting coalitions?*

Geography as a lever for climate cooperation: application to land use

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Intuition

- ▶ Incentives based on individual **gains from trade** conditional on being part or not of the coalition
- ▶ **Agricultural trade liberalization**: “Club effect” (agri-exporters), “food effect” (import-dependent countries) (Morin et al., 2024; Smith and Glauber, 2020)

Two-step method

1. Designing a static **general equilibrium model of spatial land use** and taking it to the data
 - Including land heterogeneity within 8,798 fields around the world
 - Integrating energy, agricultural, and climate-related features
 - Applying policy instruments:
 - ▶ **Climate policy:** carbon tax on energy
 - ▶ **Trade policies:** standard tariff, carbon border adjustment, mirroring tariffs (retaliation)

Two-step method

1. Designing a static **general equilibrium model of spatial land use** and taking it to the data
2. Implementing a **coalition formation game**
 - Open membership, myopic best-response game
 - Focusing on three trade scenarios:

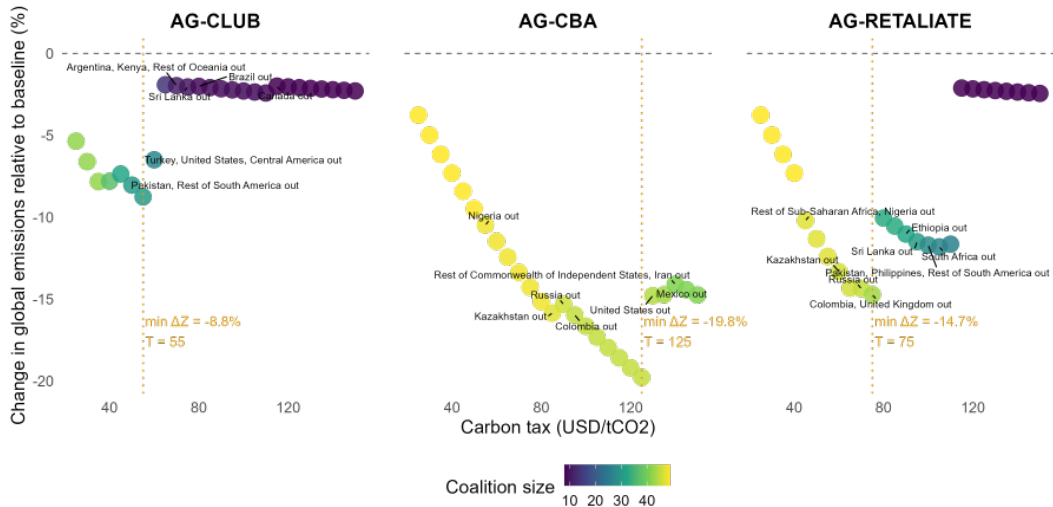
	Scenario		
	AG-CLUB	AG-CBA	AG-RETALIATE
Fixed core	EU countries	EU countries	EU countries
Domestic climate policy	Climate coalition	Climate coalition	Climate coalition
Zero agricultural tariffs	Climate coalition	Climate coalition	Climate coalition
Carbon border adjustment		✓	✓
Retaliation from outsiders			✓

Table: Considered scenarios

Coalition size, coalition composition and welfare



Coalition size, coalition composition and GHG emissions



Perspectives

Assessing climate and socio-economic impacts of resulting coalition

- ▶ Arising **tradeoffs**: best scenario in terms of GHG emissions comes at the expense of the **higher land-use conversion** (in tropical regions)
- ▶ **Agricultural consumption** may be hampered by trade measures

Perspectives

Assessing climate and socio-economic impacts of resulting coalition

- ▶ Arising **tradeoffs**: best scenario in terms of GHG emissions comes at the expense of the **higher land-use conversion** (in tropical regions)
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Conclusion

- ▶ Using spatial incentives to promote international climate cooperation may be **efficient**
- ▶ Agricultural trade liberalization supports cooperation, but **shifts environmental pressure** and can have harmful **redistributive consequences**

On climate finance

The deforestation effect of climate aid

with Clément Nedoncelle

Climate aid and forest conservation

Context

- ▶ **Forests** face intensifying pressures from land-use change and climate shocks (IPCC, 2022; Curtis et al., 2018)
- ▶ One climate finance instrument: **climate aid**
 - Funds from high-income to low- and lower-middle-income countries for climate objectives (Falconer and Buchner, 2022)
 - Grown since the 2009 Copenhagen pledge (100 billion USD annually) (OECD, 2024b)

Climate aid and forest conservation

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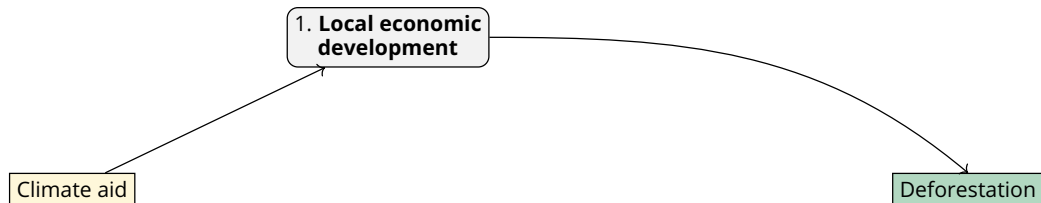
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Research gap

- ▶ **Limited evidence** on climate aid impacts, and particularly on forest cover
- ▶ Potential **tradeoffs** between projects addressing forest loss and development-related projects

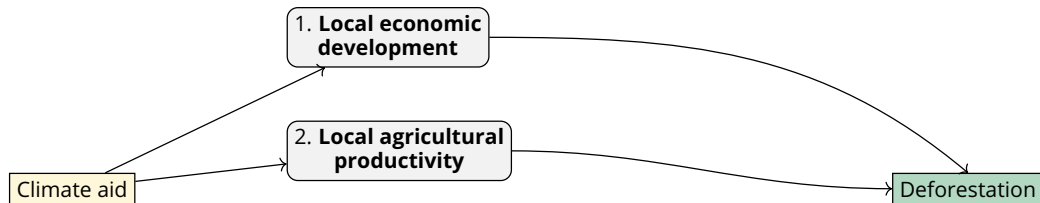
↔ *Does climate aid reduce or exacerbate deforestation in recipient countries?*

Mixed theoretical and empirical evidences regarding three channels



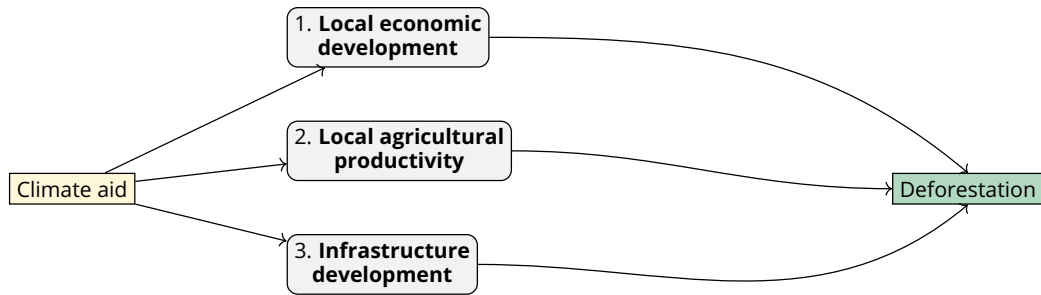
Involving structural transformation, or consumption expansion and dietary change
e.g., distribution of sun ray cookers to decrease the need for firewood next to a PA

Mixed theoretical and empirical evidences regarding three channels



Increased agricultural productivity: Borlaug hypothesis or Jevons paradox
e.g., establishment of seed banks and introduction of crop diversification

Mixed theoretical and empirical evidences regarding three channels



Provides alternative energy resources and markets, or facilitates resource extraction
e.g., construction of a hydropower dam and associated transmission lines

Data

- ▶ 5,756 cells, over the African continent, between 2001 and 2021



Figure: Cells included in the study

Data

- ▶ 5,756 cells, over the African continent, between 2001 and 2021
- ▶ Disbursement levels of **geocoded climate aid projects** (adaptation and mitigation) from 19 OECD countries and the World Bank at the cell-year level, classified from ODA using an NLP model (Bomprezzi et al., 2024; Toetzke et al., 2022)

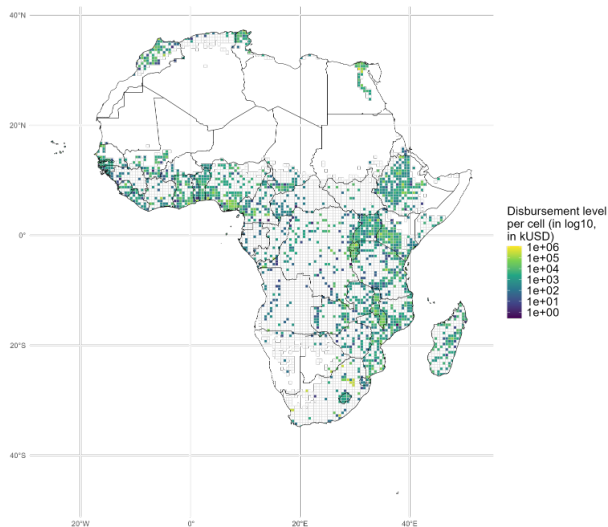


Figure: Cumulative climate aid disbursements per cell (2001-2021)

Data

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- ▶ **Area deforested** at the cell-year level (Hansen et al., 2013)

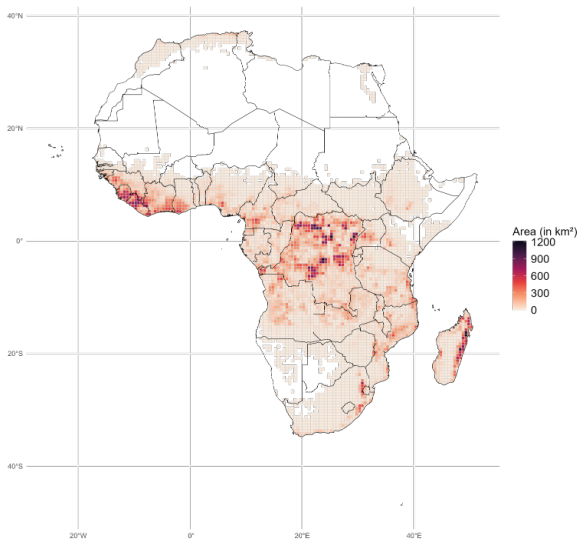


Figure: Cumulative deforested area per cell (2001-2021)

Method: Bartik instrument

Empirical strategy

- ▶ Panel data model with FE
- ▶ Causal effect \Rightarrow **endogeneity concerns**

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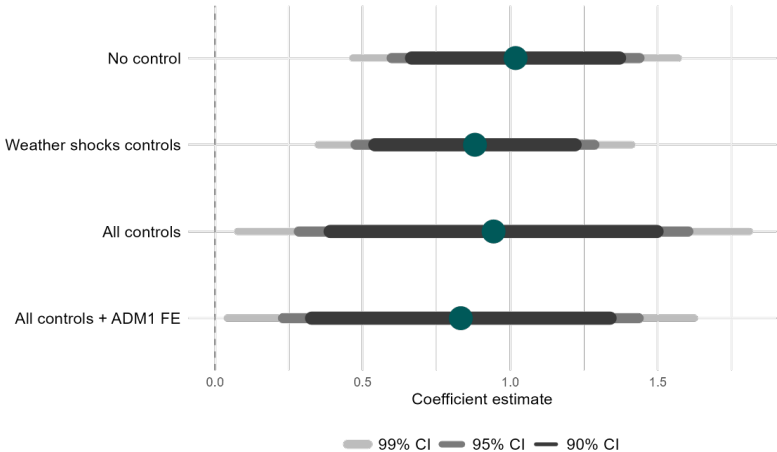
Empirical strategy

- ▶ Panel data model with FE
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Endogeneity

- ▶ Endogeneity concerns addressed using a **Bartik instrument**
- ▶ Combining exogenous global shifts with local exposure (Nunn and Qian, 2014)
- ▶ Shift: annual change in each donor's climate aid disbursement outside Africa
- ▶ Leveraging exogenous variations in **how donor countries allocate their climate aid budget** (Moscona, 2025)

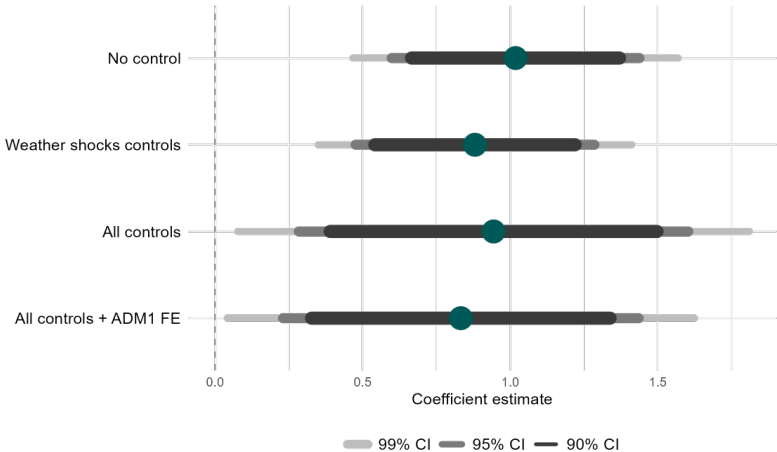
Climate aid increases deforestation



► Over the period, about **5% of deforestation** is driven by climate aid disbursement across the continent

Figure: Benchmark estimation

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- ▶ Heterogeneity:
 - Denser forest (Q4-Q5)

Figure: Benchmark estimation

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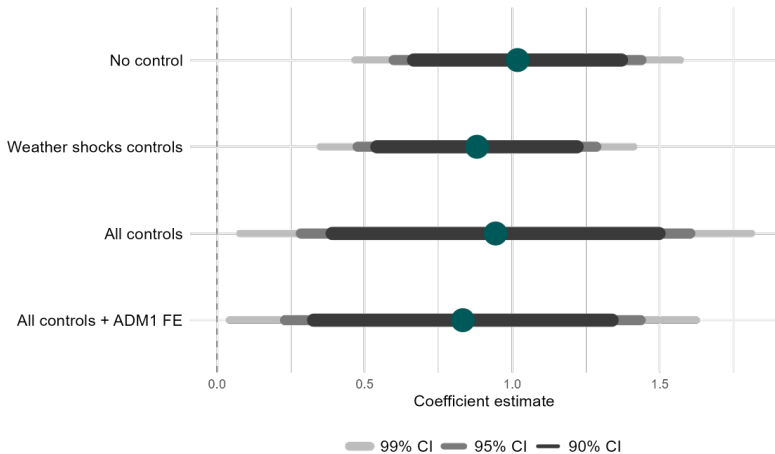


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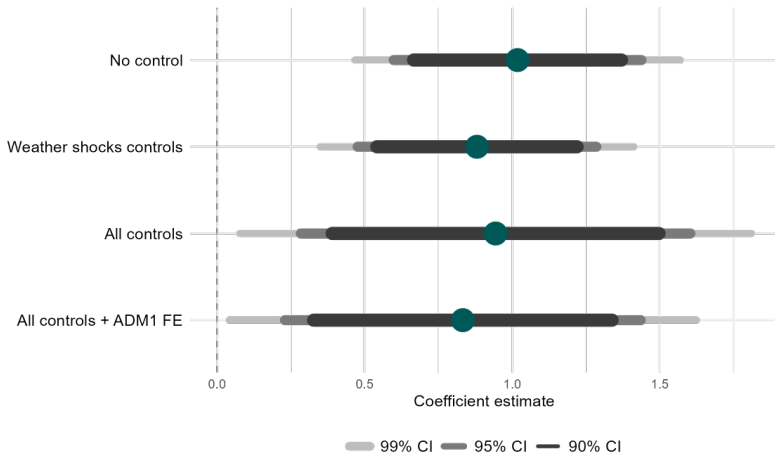


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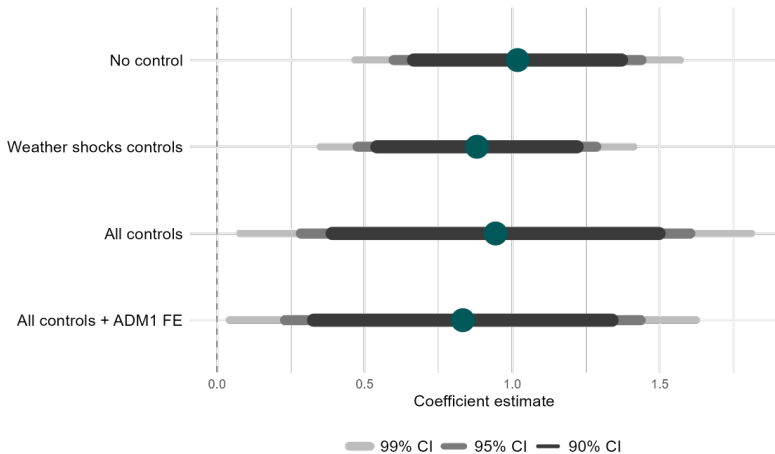


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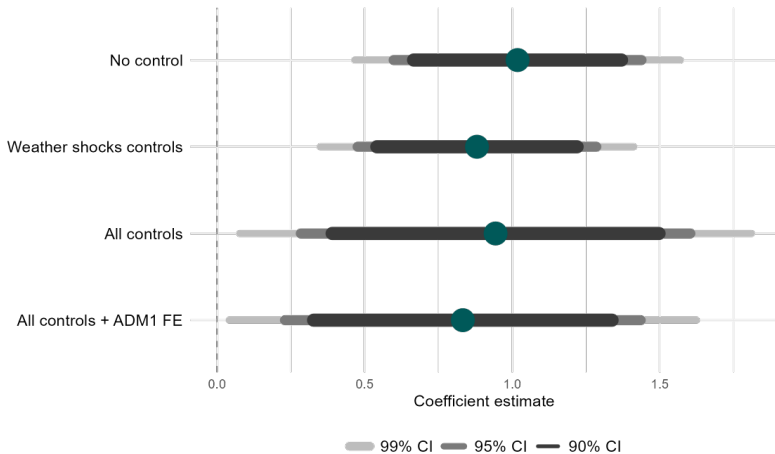


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 - Mitigation-related objective
- ▶ **Agricultural expansion** as the most likely channel
(Berman et al., 2023)

Perspectives

Conclusion

- ▶ Highlights **unintended environmental costs** of climate aid, rather than rejection of bilateral funding
- ▶ “Development” label attached to climate finance, generating these unintended costs
- ▶ Ignoring other climate/socio-economics benefits (adaptation, co-benefits)

Opportunities

- ▶ **Scaling up** programs with safeguards and co-benefits (REDD+)
- ▶ Funding economy-wide structural transformation supported by **local government** (budget-support operation)

General conclusions

Main results

- ▶ Spatial heterogeneities between countries may participate in **building coalitions** and **incentivizing climate cooperation**
- ▶ International climate policies generate **trade-offs**, due to policy spillover and economic adjustments
 - Unintended consequences of international flows of goods and capital
 - Adverse redistributive impacts

Research avenues

- ▶ Including **dynamics**, to allow political and socio-economic evolution and commitment failures in climate diplomacy
- ▶ Shifting the focus to citizens and consumers on analyzing **demand-side measures**

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