Research Statement

1. Summary

Global climate change will create severe impacts on humanity during the 21st century. With land and natural resources becoming increasingly scarce, economic, environmental, and humanitarian crises seem inevitable. While the effect of economic activity on the climate is relatively well understood, we know little about how climate-induced crises will shape economic activities and political systems, which again accelerate environmental destruction. My core motivation is to *understand these interlinkages and feedback mechanisms of human-environmental interactions*. Focusing on land-use changes and forest losses, I investigate the determinants of effective forest conservation policies (Sec. 2), political and economic incentives for forest conservation (Sec. 3), land-use after natural and economic shocks (Sec. 4), and the human consequences of land-use change (Sec. 5).

My analytical approach heavily relies on the quasi-experimental econometrics toolkit. In most of my work, I create large panel data sets using micro-level surveys, census data, administrative statistics, and high-resolution remotely sensed land-use data. Developing innovative indices based on exogenous geo-climatical local conditions enables me to causally identify the effects of location-based interventions, economic shocks, and political incentives. (Across this statement, I highlight my published work in *blue* and available working papers in *green*.)

2. Determinants of effective forest conservation policies

To understand the determinants of effective forest conservation policies, I analyze several incentive-based conservation instruments and their effect on deforestation in the Brazilian Amazon. My analyses of *Payments for Environmental Services* (Cisneros et al., 2022, *JEEM*; Giudice et al., 2019, *ERL*) and *Integrative Conservation Development Programs* (Correa et al., 2020, *FPE*; Rodríguez et al., 2018, *Sustain.*) show limited effects on forest outcomes.[7, 14, 29, 46] Positive impacts are generated only in areas of moderate deforestation pressure. These papers discuss the importance of localization, monitoring, and enforcement in incentive-based policy design in delivering conservation outcomes. In addition, they highlight the role of political incentives for targeting the low-hanging fruits of forest conservation. The lesson from these policy evaluations is that incentive-based conservation instruments can effectively reduce forest losses when coupled with monitoring and enforcing mechanisms.[53] Nonetheless, such programs often a have limited influence on aggregate deforestation trends.

3. Political and economic incentives for forest conservation

My research in this area highlight the importance of local governments for forest conservation. In multiple analyses I show that local political incentives are a significant driver of land-use change. Still, carefully designed public interventions can stir the political incentive structure and reduce environmental damages.

To understand the local political drivers of land-use change, I investigate politicians' incentives and how these can be shaped through adequate interventions. For example, I study the interaction between political and economic incentives driving deforestation dynamics in Indonesia (Cisneros et al., 2021, *JEEM*).[10] For this, I link high-resolution deforestation data in Indonesia to economic incentives to expand oil palm cultivation and political incentives arising before idiosyncratically-timed local mayoral elections (cf. Figure 1). Results show substantial increases in *deforestation in the year prior to local elections*. These incentives are amplified in geo-climatically best-suited locations for growing oil palm and when global market prices of palm oil are increasing.

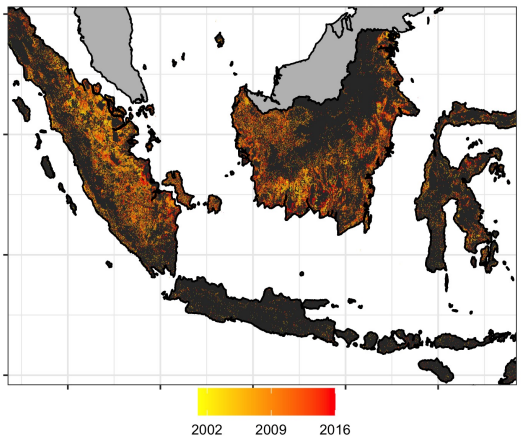

Figure 1: Forest losses in Indonesia (2001–2016). Based on Hansen et al. (2013).[32]

Collusions between politics and the agricultural industry can be observed in Indonesia as well as Brazil. Scrutinizing corrupt mayors via fiscal auditing has been shown to increase public service delivery in Brazil.[4, 13, 23, 25, 42, 43, 54] Nonetheless, I show that *deforestation—a non-audited outcome—can serve as an evasion strategy to maintain corruption* income (Cisneros and Kis-Katos, *forthcoming*, *JEEM*).[9] On the other hand, policy interventions can shape the local incentive structure of district mayors in forested regions. *"Naming and shaming"* districts with high deforestation rates proves to be a highly effective conservation instrument halting deforestation (Cisneros et al., 2015, *PLoS ONE*) and enabling a *sustainable*

agricultural transformation (Damm et al., 2024, *WD*). [12, 15] Decentralization has been promoted as another avenue to increase electoral control and protect forests. [3] . However, I show that *decentralization*, through splitting local administrations, leads to *temporal reductions in deforestation*. The slump can be linked to strategic divestment before splitting and an administrative incapacity after splitting (Cisneros et al., 2023).

Political reforms and forest conservation interventions all depend on a credible threat of stricter environmental law enforcement and a potential loss of business opportunities. In a novel study (Magalhães de Oliveira et al. 2023), [41] I study the *political signals against forest conservation* via X (Twitter) of the Bolsonaro administration. These signals have likely eroded the credibility of environmental enforcement and led to higher deforestation rates during the first year of the presidency.

4. Land-use transformation after natural and economic shocks

To better understand the *vulnerability of natural habitats*, I study the dynamics of deforestation, forest fragmentation, and oil palm expansion after commodity booms, the COVID-19 pandemic, earthquakes, and climatic shocks. This research generates cutting-edge insights into the fragility of the human-environmental system and the adaptation strategies of the world's most vulnerable rural populations.

To better understand forest loss as a complex landscape change and ecological disruption, I study the *impact of economic incentives for agricultural expansion on forest fragmentation* in Southeast Asia (Cisneros et al., 2023). [8] I combine remotely sensed forest loss maps (2001–2019) to calculate yearly forest fragmentation metrics on a grid cell level. These outcomes are linked to global commodity price fluctuations in a shif-share design based on crop-specific local agricultural suitability. The results show that oil palm price incentives reduce forest fragmentation locally through a higher aggregation of remaining forest patches. Suggestive evidence links this process to industrial plantations rather than smallholder farming. The deforestation impacts of other crops are mixed.

I causally identify *the global impacts of the COVID-19 pandemic on deforestation* using using a global 5-by-5 km grid-cell panel on forest losses, fires, and spatio-temporal exposure indices. Exposure is approximated through combinations of time-varying pressure components (infection rates, global economic growth, and government lockdowns) and time-constant spatial shifters. As shifters, I use COVID-19 risk maps (Seufert et al., 2022, *JRSSSA*) [21, 48] and FAO's global crop suitability maps (cf. Figure 2). Multiplying both components provides shift-share measurements of the exposure to the COVID-19 crisis across time and space, allowing me to causally identify the effects of the different channels of the pandemic. Initial results show varying impacts on forest disturbances across space. Areas with higher potential agricultural profits and with lower levels of governmental control are most affected.

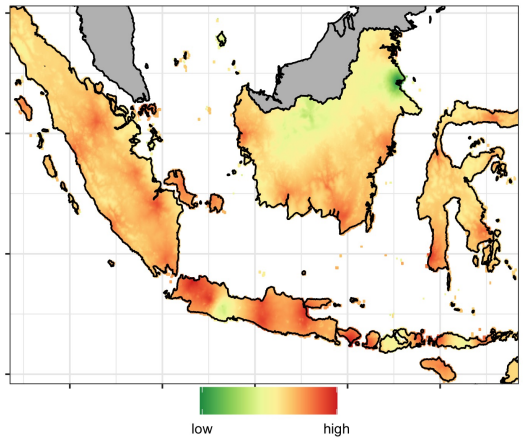

Figure 2: Ex-ante COVID-19 risk. Based on own preparatory work. [48]

Continuing the analysis of natural hazards, I investigate the *impact of earthquakes on land-use transformation dynamics in Indonesia*. Geo-localizing over 1300 earthquakes to Indonesian villages provides a large panel across 27 years that allows examining changes in forest losses and oil palm expansion (cf. Figure 3). Strong earthquakes take lives, destroy infrastructure, and diminish productive capital. [20, 28, 47] In the short term, people try to compensate for forgone income and mortality costs. [17, 27, 40] In the long term, the local economy recoups with intensified agriculture and new industrial oil palm plantations. [39] Initial results show a 2–5 percent increase in forest losses after earthquakes with a peak ground acceleration larger than 0.092 g (VI on the Modified Mercalli Intensity scale).

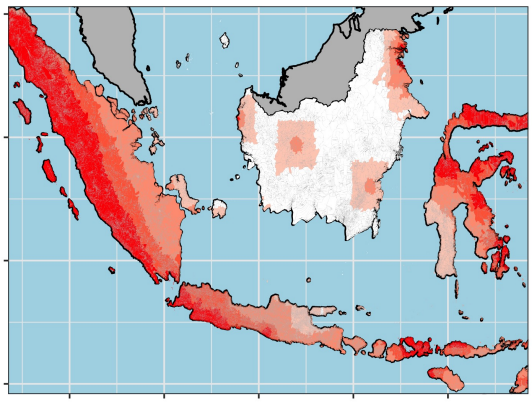

Figure 3: Earthquake intensity. Village level mean peak ground accelerations (2001–2014).

5. Consequences of land-use change

Economic profits, political incentives, and natural shocks drive land-use change. Land transformations from forest to agriculture, from traditional crops to cash crops, from smallholder to industrial plantations, etc., all precede an economic and social transformation. While these transformation processes bring about economic growth, [26, 35, 36, 37] they can also lead to unforeseen social cleavages and health effects. [1, 19, 24, 44, 45]

I investigate the *effect of the global oil palm boom on violent community conflict* in rural Indonesia (Hellmundt, Kis-Katos, and Cisneros, 2024). [33] I combine rich data on sub-district-level conflict in Indonesia from 2005 to 2014 with remotely sensed data on oil palm plantation expansion to a yearly panel covering half of all rural sub-districts in Indonesia (cf. Figure 4). [16, 18, 31] I show that oil palm expansion pressure leads to more conflicts, especially at locations that experienced a high level of environmental destruction and where land is scarce. These effects are most prominent in conflicts linked to land disputes, elections, and working conditions. Similarly, market and climatic shocks also increase conflicts in oil palm-producing regions. These findings suggest that expansion is likely linked to local environmental and economic grievances, i.e., a land transformation process that incites violence through an economic transformation and possibly inequality.

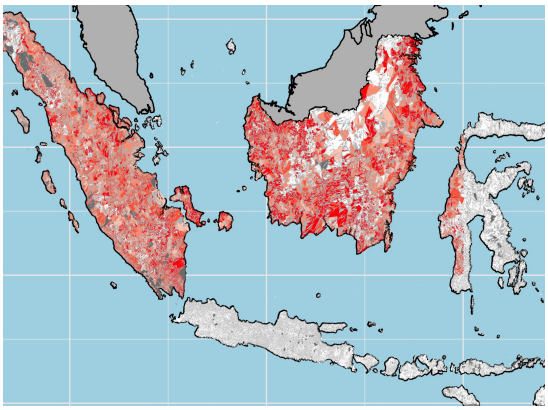

Figure 4: Oil palm expansion (2004–2015). Village data based on Danylo et al. (2021). [16]

Conditional cash transfers (CCT), have shown to significantly reduce people's vulnerability. In the context of large scale land-use changes, CCTs could mitage the negative effects to the losers of the the land-transformation process. [22] In a related study to the effects of Indonesia's oil palm boom, I investigate how a *CCT program affects local violent crime* (Cisneros et al., 2024). [11] Communities receiving the CCT program experienced an increase in violent crime. At the same time, idleness among non-targeted young men within beneficiary households increased, which can explain the rise in violent crime. The surge in violent crime is neither related to PKH increasing the rewards (monetary and non-monetary) for committing crime nor to reductions in the costs (material, psy- chic, punishment-related) of engaging in crimes.

6. Future research and impact

The economic and political priorities are shifting away from global environmental issues. Understanding, therefore, the environmental effects of non-environmental policies and shocks is becoming ever more important. In the *short run*, I want to first extend my work on economic and political shocks and understand the ambiguous role of migration, labor shortages, and demographic change on deforestation pressures. Relatedly, I want to analyze the effect of labor market and trade policies on land-use dynamics across the tropical forests of the world. Second, I want to analyze the resilience of protected areas to economic shocks and commodity booms. This work can potentially be conducted by graduate students through seminars. Third, to better understand the impacts of global shocks on local ecological functions, I want to integrate novel broad-scale remotely sensed data to investigate heterogeneous effects on CO_2 emissions, biodiversity, agricultural productivity, local climates, and reforestation. [34, 38, 50, 52] In the *medium run*, I aim to become a leader in the rapidly evolving field of *forest conservation impact evaluation*. The rising demand for carbon credit accreditation pushes the field to provide credible evaluations of avoided forest cover loss. [5, 49, 51] Setting up a University-linked institute will serve multiple (non-)governmental stakeholders and train students for the job market.

My research agenda is fundamentally *interdisciplinary*. It borrows from geography the techniques to precisely measure high-frequency and high-resolution spatial data, it adopts ecological concepts to draw conclusions about biodiversity dynamics, and it uses modern quasi-experimental estimation approaches of economics. [2, 6, 30] Through this unique combination, it pushes ecological analyses towards *a causal identification* of economic drivers and advances the economic science towards adopting *precisely measured biophysical functions*. My research agenda aims to inform conservation strategies by investigating the dynamic relationship between shocks, land-use decisions, the environment, and human well-being. Understanding the heterogeneous interlinkages generates valuable information for stakeholders to mitigate the environmental effects of future crises.

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