Lecture # 26 – Policies to Promote Environmental Protection in Developing Countries

I. Introduction to Nature-Based Solutions (NbS)

- Nature-based solutions (NbS) for mitigating climate change are actions to conserve, sustainably manage, and restore natural or modified ecosystems. The primary goal of these actions is to enhance the ability of ecosystems to reduce or remove carbon emissions.
    - Examples of NbS activities include:
        - avoiding emissions through limiting deforestation or conversion of grasslands and shrublands
        - afforestation and reforestation
        - restoration or conservation of peatlands, mangroves, seagrass beds, and marsh
        - improved forest and agricultural land management.
    - Note that many of these benefits, such as serving as climate sinks and providing biodiversity, are global public goods.
        - NbS are an important component of international efforts to achieve net-zero greenhouse gas (GHG) emissions goals by 2050.
            - 105 countries have included NbS in their pledged nationally determined climate contributions to reduce emissions
        - NbS are important for low-income countries.
            - The greatest potential for NbS for climate change mitigation is likely to be in tropical developing countries where emissions from agriculture, forestry, and land-use change are significant.
    - In contrast, other land uses, such as agriculture, pasture land, mining, or urban development offer greater private economic returns.

- Demand for NbS carbon credits has risen as businesses offset emissions
    - Voluntary carbon markets are the main exchange for NbS offset credits
        - Most projects are for either afforestation/reforestation (38.2 percent) or improved forest management (32.6 percent).
        - More than half (55.6 percent) of the credits issued are for avoided-deforestation projects, followed by avoided land-use conversion (20.9 percent).
    - Key concern is accurately measuring the emission reductions that result

- Example: Reducing Emissions from Deforestation and Forest Degradation (REDD+)
    - Compensates countries for emissions reductions achieved through reduced deforestation
    - Included as part of climate agreements in Cancun (2010), Durban (2011), and Paris (2015)
        - However, did not receive funding commitments until Paris Agreement in 2015, and funding commitments are small
        - So, nearly all transactions are bilateral
    - Idea is to reward those who control forests for not deforesting or degrading them
        - Establishes a baseline level of carbon in forests
        - Provides payments for any carbon stored above this level
            - Funds come primarily from developed countries

II. Evaluating Nature Based-Solutions

- To quantify an NbS project's contribution to carbon storage capacity over time, a baseline must first be established.
    - This baseline represents what the carbon storage capacity of the land would have been if the NbS project had not been implemented.

- Developing a baseline
    - Project baselines traditionally created by extrapolating historical land- and resource-use averages or trends, often spatially projected over a reference region encompassing the project sites.
    - These may be unreliable. Potential concerns include:
        - subjective modeling choices
        - uncertainty
        - poor data
        - inappropriate location choice
        - opportunistic inflation to increase the number of offsets issued by a project, known as "baseline gaming".

- Economics can help better understand what makes a good baseline.
    - Deforestation is often a concern as countries begin to grow
        - Forest transition curve
            - Plots development against forest cover
            - As countries grow, initially exploit forest resources
            - At some point, this bottoms out, and begin to protect forest
            - However, only comes back part of the way
    - Busch and Ferretti-Gallon provide a meta-analysis of econometric analyses of deforestation causes.
        - This article is optional, and we'll focus on the main points in class.
        - Below I summarize the main results from this paper.
        - A meta-analysis begins with a search for relevant literature
            - Their 2023 paper updates a 2017 meta-analysis
                - Since then, better data on tree-cover loss and remote sensing allowed improved analysis

- Key findings
    - Economic returns matter
        - Either due to favorable biophysical conditions or costs
    - Biophysical characteristics
        - Agricultural productivity, accessibility, and clearing costs matter
        - Deforestation lower on steeper slopes and at higher elevations
            - Reduce accessibility and increase clearing costs
        - Deforestation higher on land more suitable for agriculture
    - Built infrastructure
        - Lands near roads and urban areas deforested more
            - Roads lower transportation costs and make more forests accessible.
            - Also make more areas suitable for agriculture (because can get food to markets)
            - Most important in middle-income countries
    - Market demand for commodities matters
        - Most clearing of forest land in developing world for agriculture and pasture
            - Key variables related to agriculture that increase deforestation include:
                - Greater agricultural activity
                - Greater proximity to agriculture
                - Higher agricultural prices
                - Livestock activity (although not livestock price)
                    - In some regions, cattle ranching helps solidify land claims
            - Interestingly, agricultural yield not consistently associated with higher or lower deforestation
        - Timber prices do not increase deforestation
            - Effect of timber activity is a change from earlier study
            - Examples of timber activity include logging and plantation conversion permits
            - Value of forest products may delay deforestation for other uses
        - Supply chain initiatives, such as companies pledging to reduce deforestation in supply chains, and certification programs reduce deforestation at regression level, but not study level.

        - Brazil soy moratorium reduced deforestation in Amazon, but led to spillover deforestation of the Cerrado
        - Certified Sustainable Palm Oil is example of certification program
            - Trade openness associated with more deforestation at regression level only
- Ownership and management rights
    - Community forest management reduces deforestation at regression level, but not study level (change from last study)
    - Protected areas lower deforestation
        - But is this due to legal status or remote location?
        - In the first meta-analysis, this effect is smaller when controlling for land characteristics. This is not mentioned in the new meta-analysis.
    - Better law enforcement significant at regression level only
    - No consistent effect for land tenure security:
        - Can help, but also help encourage expansion of agriculture
- Governance
    - Good governance (e.g. rule of law, political stability, and control of corruption) not associated with more or less deforestation
- Demographics and Socioeconomic Characteristics
    - Most community demographics didn't matter. Exceptions:
        - Presence of indigenous peoples lower deforestation
    - Population associated with greater deforestation'
        - But clearly endogenous: what causes what?
        - Newer studies try to disentangle this by looking at outside causes of population growth, such as international migration or family planning. Results are mixed.
    - Greater poverty decreases deforestation
    - Increased income from rural support programs, including remittances set home by migrants, increase deforestation
    - Payment for ecosystem services reduce deforestation
        - More studies look at PES now than in earlier review.

    - Potential lessons for policy
        - Roads can be planned to minimize intrusion
        - Protected areas should target highly threatened areas
        - Because agriculture is important, policy could insulate forest frontier from influence of high commodity prices
        - Payments for preserving forests work if well-targeted
        - Suggests stronger enforcement and management of forests by indigenous peoples works

- Once the carbon storage capacity over the NbS project timeframe has been quantified, the value of this benefit ideally would reflect the social cost of carbon (SCC).
    - Because there is no single SCC estimate, its value can range considerably across countries and for different projects
    - In addition, the SCC should be adjusted for the temporary and risky nature of carbon storage under NbS investments.
        - NbS storage methods are susceptible to fire, floods, and other natural disasters, as well as disease outbreaks, project failure, climate change, or other environmental and social risks.

III. Key Challenges

- Additionality: Additionality measures how project outcomes, such as reducing land-use change or carbon emissions, compare with baselines.
    - For a project to truly be impactful, it must reduce emissions beyond what would have been done anyway.
    - If baseline scenarios are not correctly estimated, selecting project areas with low deforestation may generate spurious carbon credits unsupported by actual additionality.
    - Several studies provide examples where actual reductions of NbS projects are less than claimed.
        - West et al. (2023) study carbon offsets from voluntary avoided deforestation projects in 6 tropical countries.
            - The conclude that most did not significantly reduce deforestation and, when they did, reductions were less than claimed.
            - Differences are due to what served as the baseline.
        - Delacote et al. (2022) show that, for REDD+ projects in Brazil, if baseline scenarios are not correctly estimated, selecting project areas with low deforestation may generate spurious carbon credits unsupported by actual additionality.

- Leakage: Leakage is the risk of causing environmentally harmful activities to either move to or expand in other locations.
    - For example, if demand for timber still exists, restrictions on deforestation may simply move forest activity elsewhere.
    - The correct measure of a project's potential carbon credit is the additional carbon it sequesters minus the leakage it creates elsewhere.
        - To account for this, California's offset programs assumes that 20% of reduced deforestation will shift elsewhere.
        - However, 82 percent of the credits issued for California's forest carbon-offset program were found not to represent true emissions reductions due to poorly constructed leakage assumptions (Haya et al. 2023).
    - To reduce leakage, national or regional policies are more important than local policies.
        - In tropical developing countries, widespread leakage of NbS may also be tied to the failure to instigate adequate policies to control deforestation and land-use change at regional and national levels.

- Permanence: Permanence concerns whether carbon will remain sequestered by an offset project for a long period, usually 30 to 100 years.
    - If a forest is clearer or burned a decade later, the emissions have just been shifted to a different point in time
    - Most NbS do not permanently reduce carbon but only temporarily store it in vegetation and soils.
    - Once the project ends, there is no guarantee it will continue to deliver carbon mitigation and other benefits.
        - Barbier and Burgess cite evidence of forest loss recurring after REDD+ and PES projects end.
    - Impermanence undermines the credibility of credits issued by NbS in carbon-offset markets.
        - Buyers view credits from NbS as being too risky and have difficulty comparing them with credits issued for other carbon offsets that offer more certain removal or reduction.
    - Possible solutions:
        - "Rental" units
            - Were allowed under the Clean Development Mechanism
            - Must be replaced with a permanent unit (or a sequence of temporary units) at a later date
            - Because of the risk involved, EU, Australia, and New Zealand all refused to accept these units in their emission trading schemes
        - Flexible system
            - Provide credit when emissions reduced, as if the emissions were permanent
            - Add penalties if emissions later increase
                - Challenge: if payments are large, compliance will be non-credible

- Finally, consider distributional issues
    - *Question*: Should countries limit who can take credit for emission reductions?