

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

I. What Role Can Institutions Play?

- We turn now to policies that support environmental protection in developing countries
- Of course, countries will do some on their own
 - For example, China's carbon markets began in 2017
- Our focus is on policies through which developed countries provide assistance for developing countries
 - Important for issues, such as climate change, where demand for emissions reductions comes primarily from richer countries.
- Climate change is an example where aid plays an important role
 - Developing countries particularly vulnerable to climate change
 - Also crucial to any mitigation plans
 - In 2010, traditional developed countries (OECD members in 1990) accounted for 28% of global emissions. International transport another 2%. Remaining 70% came from elsewhere.
 - Asia is the largest emitting region.
 - Mitigation in developing countries involves:
 - Energy
 - Agriculture
 - Forestry and land use

- Aid for climate change mitigation has largely come through institutional initiatives
 - Reducing Emissions from Deforestation and Forest Degradation (REDD+)
 - Compensates countries for emissions reductions achieved through reduced deforestation
 - Clean Development Mechanism (CDM)
 - Allows developed country agents to support emission reductions in developing countries
 - These developing countries (Annex B countries) were not otherwise required to reduce emissions under the Kyoto Protocol
 - Goals:
 - Increased flexibility
 - Buyers will purchase CDM credits for reductions they need to make if it is cheaper to make these reductions in the developing country than it is at home
 - Enables countries with binding commitments to lower costs
 - Sustainable development
 - The hope is that technologies provided help countries develop
 - This may involve technology transfer
 - Less relevant after Paris Agreement, which includes commitments for developing countries
 - Key principle: *Additionality*
 - Emission reductions must be “additional to any that would occur in the absence of the certified project.”
 - That is, we don’t want to give others credit for something that would have happened anyway.
 - However, how do we measure this? Requires knowing the no-intervention baseline.
 - How might CDM change after the Paris Agreement?
 - Article 6 says countries can partially meet their obligations through credits issued by another country.
 - But must avoid double-counting
 - We discussed how countries in Africa have used carbon markets and how the Paris Agreement might affect their choices?
 - Ghana doesn’t issue credits for low-cost reductions such as changing light bulbs or planting trees, so can claim those credits.
 - Looks for funding for harder to finance goals such as renewable energy or cooking fuel.

- Global Environmental Facility (GEF)
 - Began in 1992 before the Rio Earth Summit
 - More traditional aid vehicle
 - Financial contributions come from 40 donor countries, and are replenished every four years
 - Partner with other international agencies, including the UN and multilateral development banks
 - Provide grant funding and technical assistance for environmental project
 - Countries apply for funding.
 - Project must be driven by the country, rather than an external partner.
 - Project must be consistent with national priorities that support sustainable development.
- Green Climate Fund (GCF)
 - Emerged out of 2009 Copenhagen Conference of the Parties
 - Facilitates financial flows from developed to developing countries to assist with both climate mitigation and adaptation
 - Goal is to raise \$100 billion by 2020
 - However, only \$16 billion in pledges, mostly from developed countries, received as of April 2025
 - *The Economist* cites an OECD report saying the \$100 billion goal will be met in 2022.
 - This appears to include other sources, including loans
 - Background
 - Given an important role serving the Paris agreement
 - Began allocating resources in 2014
 - Pay particular attention to needs of countries particularly vulnerable to climate change
 - Funding aims
 - Aims for a 50:50 split on adaptation & mitigation
 - Using public investment to stimulate private finance
 - Engages with private sector through Private Sector Facility
 - OECD data suggests “crowding in” hasn’t been successful.

- Here we'll discuss the challenges faced raising private funds for adaptation projects.
 - Adaptation investments have large net benefits, but those benefits are avoided damages
 - It is cheaper to avoid damages than to repair damage after a storm, for example.
 - But private sector investors do not earn revenues from avoiding damages.
 - Compare to investing new technology (e.g. installing new renewable energy), where the investor earns money by selling energy produced.
 - How does this relate to the arguments on “loss and damage” compensation? Is such funding appropriate? If so, how would you implement a “loss and damage” fund?

II. Deforestation

- I use forest and land use credits as an example of payments for ecosystem services (PES) programs designed to protect resources in developing and emerging economies.
 - One challenge is that many of the benefits of preserving forests, such as serving as climate sinks and providing biodiversity, are global public goods.
 - Roughly 25% of global emissions come from land use
 - Rich countries benefit as well as developing countries.
 - In contrast, other land uses, such as agriculture, pasture land, mining, or urban development offer greater private economic returns.
 - Problem: there are few mechanisms to reward developing countries for preserving forests.
 - For example, Kyoto's Clean Development Mechanisms provide compensation for *new* forests, but not for preserving existing forests.
 - Consider the example of Gabon.
 - Its forests sequester about 140m tons of carbon, the equivalent of 1/3 of France's carbon emissions each year
 - Its forests lead to rain in other countries (Ethiopia, Nile valley)
 - Since they are already protecting their forests, it is difficult to claim additionality. But should they be compensated for the benefits these forests provide?

- To understand how international policies can help protect forests, we first need to understand why deforestation occurs.
- 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
- Progress on protecting forests
 - Globally, deforestation in 2000s was 2/5 below what it was in the 1990s
 - Reasons for decline
 - Easing population pressures
 - Improvements in agricultural productivity
 - Many of these improvements took place away from forests
 - However, recent satellite data suggests deforestation increasing
 - As an example, deforestation in Brazil has increased significantly under President Jair Bolsonaro

- Busch and Ferretti-Gallon provide a meta-analysis of econometric analyses of deforestation causes.
 - 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
 - Studies including econometric analyses of the causes of deforestation were selected for inclusion
 - These studies all map potential causes of deforestation to specific locations.
 - Original meta-analysis included 172 studies published between 1996-2013.
 - Updated analysis adds 199 studies published from 2014-2019, for a total of 320 studies.
 - Trends in the literature
 - More studies using global annual data
 - Improved spatial resolution
 - Broader geographic coverage, such as more studies in Africa
 - Results of each study reviewed to include counts of significant positive and negative drivers of deforestation
 - Include results by both analysis of individual regression results and for entire studies.
 - 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
 - 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.
- Reforestation
 - Now 35 studies consider reforestation. Factors increasing reforestation include:
 - Steeper slopes
 - Greater distance from cities
 - Larger population reduces reforestation
- A few studies also consider forest degradation, but not enough to make definitive statements.
- Potential limitations
 - Paper discusses how they rule out sample bias and publication bias
 - Compare findings in different fields
 - Most studies only on a single country, although the new meta-analysis includes more multi-country studies
 - In the original meta-analysis, more than half from one of just six countries: Mexico, Brazil, Costa Rica, China, Indonesia, and Thailand
 - Newer studies cover more areas, but the tropical countries of Latin America, Africa, and Asia are still overrepresented, as are middle-income countries
- Potential 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

III. Reducing Emissions from Deforestation and Degradation (REDD)

- How to include carbon credits for protecting forest was a major issue during the 2021 climate summit in Glasgow.
 - The 2015 Paris agreement calls for the amount of carbon sequestered in carbon sinks each year to equal or exceed emissions “in the second half of this century.”
 - Discussions in Glasgow considered how to meet this goal
 - Many key nations, such as Brazil and Indonesia, are part of the agreement.
 - Rich countries pledged \$12 billion at Glasgow to protect and restore forests.
 - Challenges for appropriate accounting of the contribution of carbon sequestration made by forests.
 - Additionality: credits should only be given for new protection efforts, not things that are being done anyway
 - Permanence: If the forest is cleared or burned a decade later, the emissions have just been shifted to a different point in time
 - Leakage: Some deforestation may simply shift elsewhere, as demand for timber products still exist
 - For example, California assumes 20% market shifting. But this is based on old data.

- Key decisions at Glasgow
 - Article 6 of the Paris Agreement regulates carbon markets. The accounting framework was agreed upon in Glasgow.
 - Two carbon markets created
 - One only open to states
 - One open to both the private and public sectors
 - Many forest credits will fall here (e.g. offsets)
 - Avoids double counting. A country cannot take credit for carbon reduced in both an offset sold and as part of its Nationally Determined Commitment (NDC)
 - “Additionality shall be demonstrated using a robust assessment, that shows the activity would not have occurred in the absence of the incentives from the mechanism, taking into account all relevant national policies, including legislation, and representing mitigation that exceeds any mitigation that is required by law or regulation...”
 - This wasn’t the case before, as there were concerns that it would penalize developing countries for enacting their own climate policies.
- History of REDD
 - Reducing Emissions from Deforestation and Degradation
 - A large example of a payment for ecosystem services system
 - 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
 - Estimates of cost of REDD per ton carbon saved vary from \$30-50/ton

- REDD is a results-based agreement
 - An agreement in which a buyer country (BC) agrees to pay a developing country (DC) to control deforestation
 - Payment based on units of monitored carbon stock relative to an agreed upon baseline
 - Note that additionality is key – the goal is to protect forests that wouldn't otherwise be protected
- Principal-agent framework
 - A principal-agent framework provides a way to think about crafting an effective agreement
 - The goal is for the principal to provide sufficient incentives to the agent so that the agent follows through on a commitment.
 - Principal designs an agreement to maximize expected utility subject to:
 - A participation constraint
 - Agent's expected utility higher if he participates than if not
 - Incentive compatibility constraint
 - Agent must choose to comply with the agreement ex post
 - What defines utility for each participant in REDD?
 - Buyer: Additional climate mitigation benefit net of cost of participation
 - Developing country: Value of payments received plus its valuation of extra climate mitigation benefit created, net of mitigation cost
 - If don't have a single international market, resulting projects will be more like bilateral aid
 - Will the U.S. State Department have a say in which countries get support and which do not?
 - Comparing savings will be difficult, as each agreement will have different rules.
 - Components of an agreement
 1. Allocating risk
 - Risks to developing country require a more generous baseline to make them willing to participate. Examples of risks DC's face:
 - Payments depend on observed carbon. Cannot be fully controlled by the developing country
 - Future carbon prices are uncertain
 - If DC more risk averse than the buyer, the buyer may be willing to bear the risk
 - For example, changes in forest emissions in response to exogenous factors could be excluded from definition of observed effort to be rewarded
 - Challenge
 - The developing country has private information about its own effort. Leads to a moral hazard problem.
 - Thus, impossible to allocate risk efficiently and maintain efficient incentives

2. Private information about baselines

- Would the developing country have cleared the land in the future?
 - This is important, as we don't want to reward protection that would have occurred anyway
 - But only the developing country knows what it would have done
- Resulting market failure: adverse selection
 - Developing countries that volunteer to participate not the best partners for the buyer, since they were those least likely to develop their land anyway
- How to minimize adverse selection
 - Research
 - Increase scale of agreement
 - Design mechanisms to encourage revelation of private information
 - E.g. offer a series of potential contracts
 - The contract chosen reveals expectations of baseline carbon
 - Those DCs accepting a contract with more stringent baseline are rewarded with a higher price for protection achieved above the baseline
- Cannot be based on outdated data
 - E.g. Brazil has already started to reduce deforestation.
 - Savings based on old data will overestimate forest protected
- Some countries, such as Costa Rica, have already protected forests
 - Does this mean they cannot receive compensation?

3. Commitment and enforcement
 - Difficult to make long-term agreements binding
 - Thus, buyers unwilling to pay for long-term protection in advance
 - Creates risk of holdup (e.g. buyer tries to renegotiate after meeting short term goals such as creating parkland), since the agreement is worthwhile only if protection extends long-term
 - Otherwise, the agreement has only delayed emissions, not reduced them
 - Need to address incentive compatibility for the developing country
 - Requires some upfront payments from the buyer
 - Institutional capacity matters
 - Does the state have the information necessary to implement effective policy?
 - Is its legal system sufficient to enforce policy?
- Once an agreement is reached, how is compliance assured?
 - Both sides have incentive not to comply. Thus, monitoring, reward, and sanctions must be strong
 - Monitoring
 - Remote sensing makes monitoring of forest cover easier
 - May not be accurate for small properties, but on a regional level law of large numbers should reduce variance
 - Remote sensing technology available to both buyers and sellers
 - Makes monitoring transparent and reduces opportunities for corruption
 - Forest degradation can be sensed remotely, but is costly
 - Requires linking estimates of changes in forest-cover to carbon values
 - Typically done using carbon tables for different ecological conditions
 - Ecological conditions identified using GIS data

- Rewards
 - Domestic benefits recognized by a stable government
 - E.g. improved environmental quality, preservation of livelihoods and cultures, flood protection, biodiversity
 - If these are large enough, the developing country only needs help with access to capability, risk sharing, and capital, as the country has incentive to protect forests on their own
 - Payments based on net reductions
 - Risk for DC is that the buyer will not follow through with payments after the DC has given up future development options
 - Benefits of international recognition
 - May lead to increased trade access, increased international cooperation
 - Note that these benefits are less tangible
 - Risk for DC: will protection now weaken its ability to negotiate for forest protection support in the future
 - E.g. will the buyer get credit for all the “low-hanging fruit”, making it difficult to agree to additional reductions in future climate agreements
- How are obligations defined in REDD?
 - A REDD agreement must have at least three dimensions of obligations:
 - Time (permanence)
 - How long do countries agree to store carbon?
 - Agreements can be reversed easily
 - May be unintentional (e.g. fire, wind damage, war)
 - This simply involves risk management through insurance or diversifying risk
 - May be deliberate clearing
 - Need sanctions for noncompliance
 - Compare to fossil fuels
 - Countries are rewarded for reducing the flow of fossil fuels (e.g. current emissions).
 - However, burning less coal now means more coal is available to burn in the future
 - In contrast, REDD requires direct protection of the forest stock
 - Countries may not want to make permanent agreements
 - Thus, temporary agreements may be more practical

- Options for temporary payments
 - “Rental” units
 - Such temporary units possible 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
- Baseline (reference levels)
 - Buyers don’t want to subsidize all carbon stored, as that would be expensive
 - If most forest is not under threat in a given year, most carbon would have been stored anyway
 - Thus, goal is to establish a baseline level of carbon and reward countries for protecting more than the baseline
 - Determining the baseline
 - Depends on:
 - the relative returns of forested and unforested land
 - cultural values
 - local institutions affecting land use
 - Note that current rates of deforestation are not sufficient
 - If lack of infrastructure (e.g. no roads) or institutions make forestry difficult now, deforestation may increase in the future
 - Similarly, high deforestation rates won’t continue once high-quality land is cleared
 - Relates to adverse selection: don’t want to reward the country for only protecting its marginal land
 - Challenge: the timing of the transition away from forestry is hard to predict
 - Challenge: if countries believe baselines depend on current levels, have perverse incentive to increase deforestation to get a favorable baseline.
 - Thus, want to base on behavior before an historical date
 - Requires good data

- Scope (deforestation, degradation, reforestation) and scale (overall area covered)
 - The wider the scope, less chance for leakage
 - Is an agreement with a community, a region, or a nation?
 - Payments for ecosystem services generally go to local actors
 - That approach doesn't necessarily work for REDD
 - What policies can address leakage?
 - Increase spatial and temporal coverage of REDD agreements
 - Requires more generous agreements to get more DC's on board
 - If agreement is large scale, leakage concern is international
 - Thus, need policies to reduce demand for timber
 - Could also estimate leakage and adjust price accordingly
 - But, difficult to estimate