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REDD+ in Cambodia: A Case Study of Deforestation and Opportunity Costs in Koh Kong Province

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Center for Clean Air Policy (CCAP)

- Washington DC and Brussels-based environmental think tank
- A leader on climate change, air quality policy since 1985
- Promotes innovative, market-based solutions that balance environmental and economic interests
- Holds the semi-annual *Future Actions Dialogue* (FAD) for climate negotiators to help move post-2012 climate policy
- Developing Country Project from 2005: work with Brazil, Cambodia, China, India, Indonesia, Mexico on national climate strategies, NAMA development, REDD
- Launched new Mitigation Action Implementation Network (MAIN) in 2011 to support the design and implementation of Low-Carbon Development Strategies (LCDS) and NAMAs in developing countries through regional dialogues

CCAP's Forestry and Climate Change Program

- Launched in 2008 with support from Norwegian Agency for Development Cooperation (Norad)
- REDD+ policy analysis and design at international, national and sub-national levels
- Work on REDD+ policy in Indonesia, Cambodia, Mexico
- International work includes design of REDD+ policy structures for financing, carbon accounting, etc.
 - » Current work includes designs to elaborate three-phase approach
- Key papers on use of Payments for Environmental Services (PES) and NAMAs for REDD released 2009

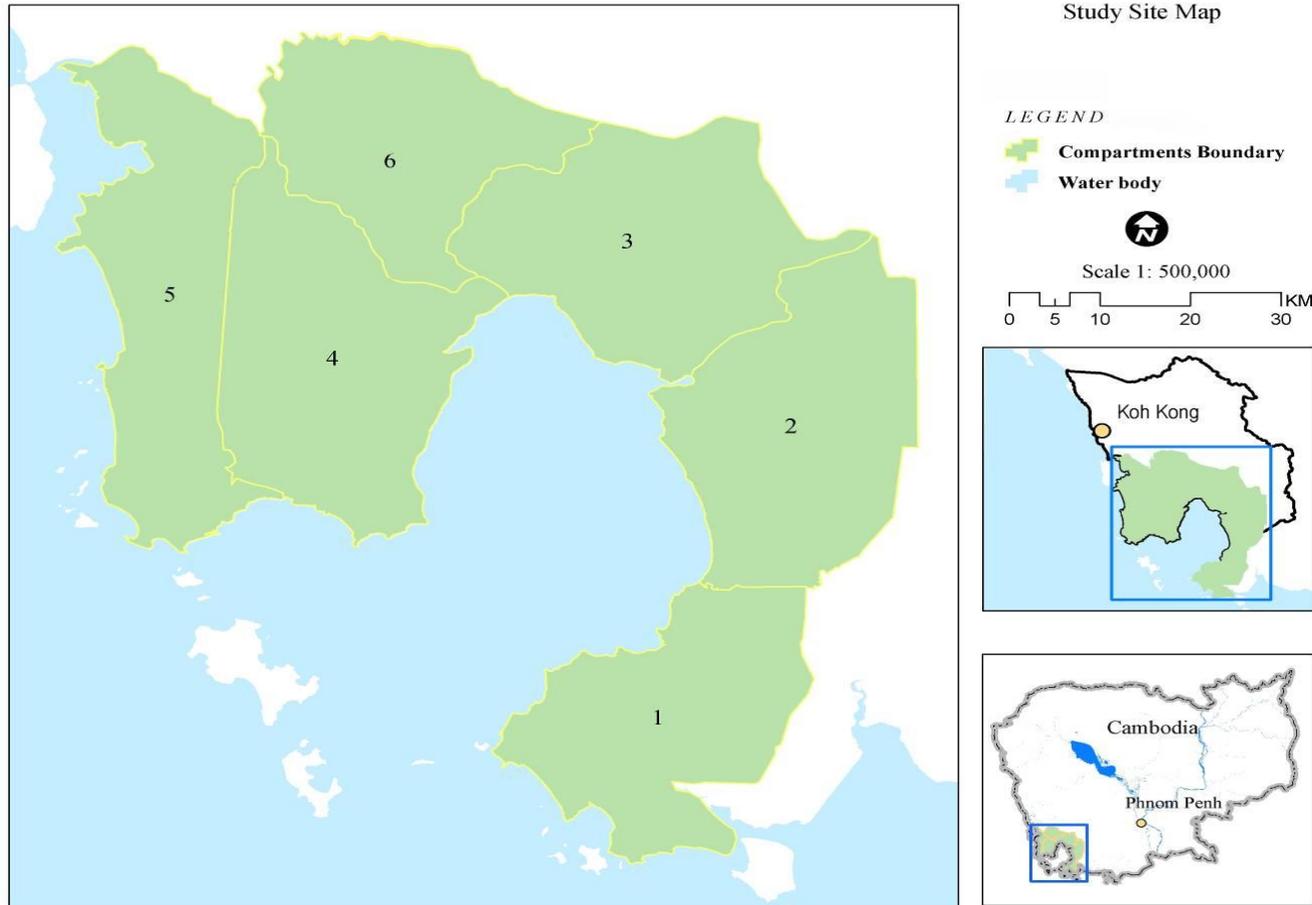
Cambodia REDD+ Overview

- High forest cover (11 million ha), about 60 percent of Cambodia's land area
- Large network of Protected Areas (25% of land area)
- Forest areas under threat from illegal logging, population expansion, migration, agriculture, infrastructure development, mining, etc.
 - » Annual deforestation rate 0.8% 2002-2006
- Strong government commitment to national REDD (REDD+ Roadmap, UN-REDD, FCPF R-PP)
- Pilot projects already testing REDD (Oddar Meanchey, Seima)

CCAP Cambodia Study

- Designed and carried out with regular government input, consultation
- Kick-off workshop in Phnom Penh with Ministry of Environment (MoE), Forestry Administration (FA), others (March 2009), final workshop June 2010
- Interdisciplinary team included
 - » CCAP: Management, REDD+ and economic policy analysis
 - » David Ashwell: Coordination, forest and carbon analysis
 - » Economic Institute of Cambodia (EIC): Econometric analysis
 - » Partnership with MoE, with input from other stakeholders

Case Study Area: Koh Kong Coastal Lowlands



Forest and Carbon Stock Analysis

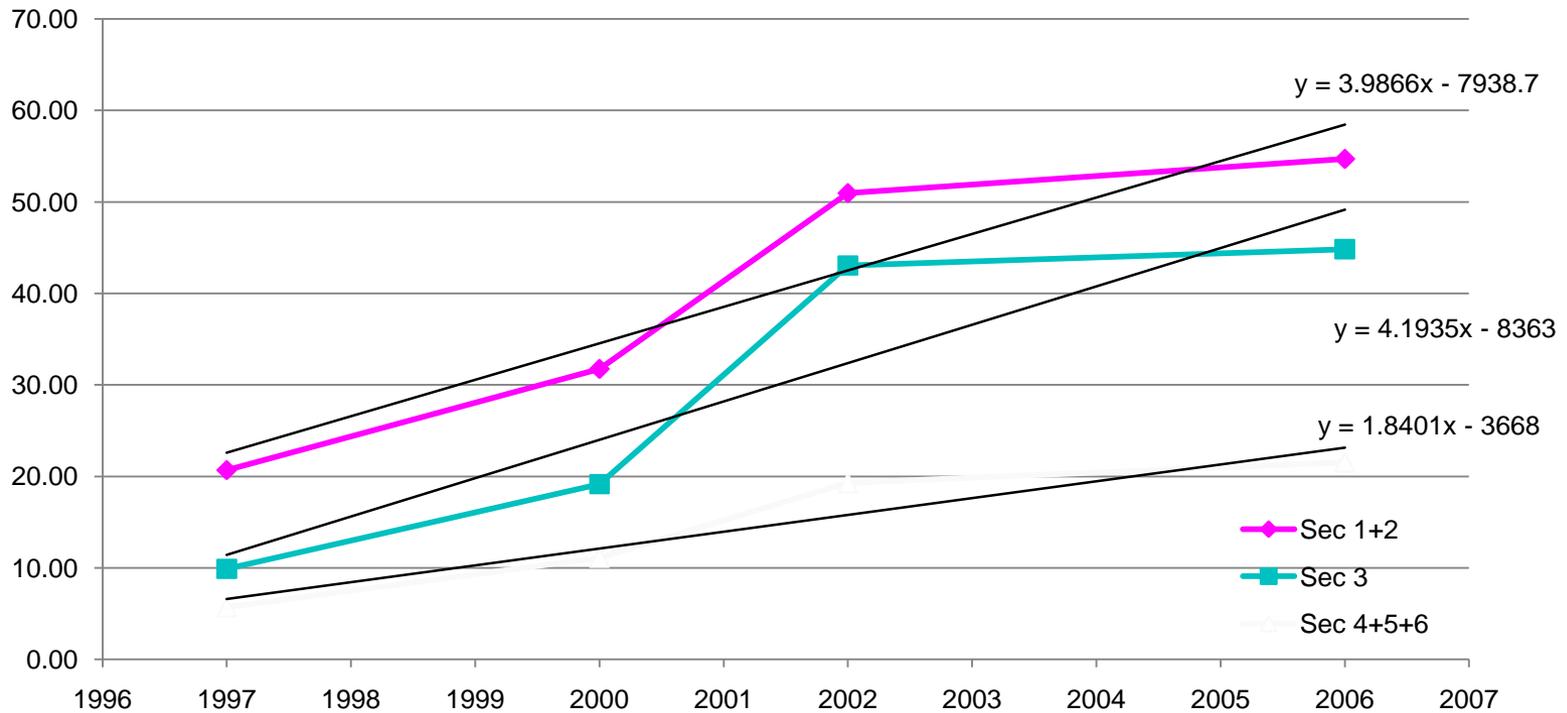
- Team estimated forest cover and carbon stocks using pre-war inventories from the 1960s for this region
 - » FAO Forest Survey (1965-1969): 487,000 ha inventoried
 - » Other studies incl. Hozumi *et al* (1968) – biomass
- Four major forest types (337,000 ha total forest)
- All commercially viable timber from trees larger than the legal limit assumed to have been logged in line with historical observations
- Historical deforestation rates from 1997 to 2006 estimated from inventories
 - » Sources included datasets from 1997, 2000, 2002 and 2006 from Mekong River Commission, MoE, FA

Carbon Stock and Deforestation Results

- Carbon stocks across the entire case study area have declined 45% from pre-war levels
 - » From 145 tons to 80 tons Carbon per ha
- Total forest cover decline was lower: 11% through 2006
- Annual average deforestation rate 1997 – 2006: 3.2 % of 1997 cover
 - » Much higher than current national rate
- The deforestation rate slowed significantly after 2002, was higher in the eastern section of the area

Deforestation Trend

Non-forest Cover (Percent of Area)



Opportunity Cost Study: Framework

- Analyze the opportunity costs for select land uses for the case study area
- Compare the opportunity costs for select land uses to that of both the current stocks and potential value of forests as carbon sinks
- Seeks to answer the question: Can the carbon values of a forest compete with the opportunity costs of alternative land uses in Cambodia? If so, in what context?

Opportunity Cost Study: Assumptions

- Crops: Soybean, Maize, Sugar Cane, Rubber
- Used historical data for Cambodia from MAFF, FAO, World Bank, etc.
- Data also collected by team (EIC) through interviews with farmers in Koh Kong and other provinces
- Time period: 20 years, 2010 – 2030
- 2010 NPV with 10% discount rate
- Costs include forest clearance (Year One) and crop production (Year Two and after)

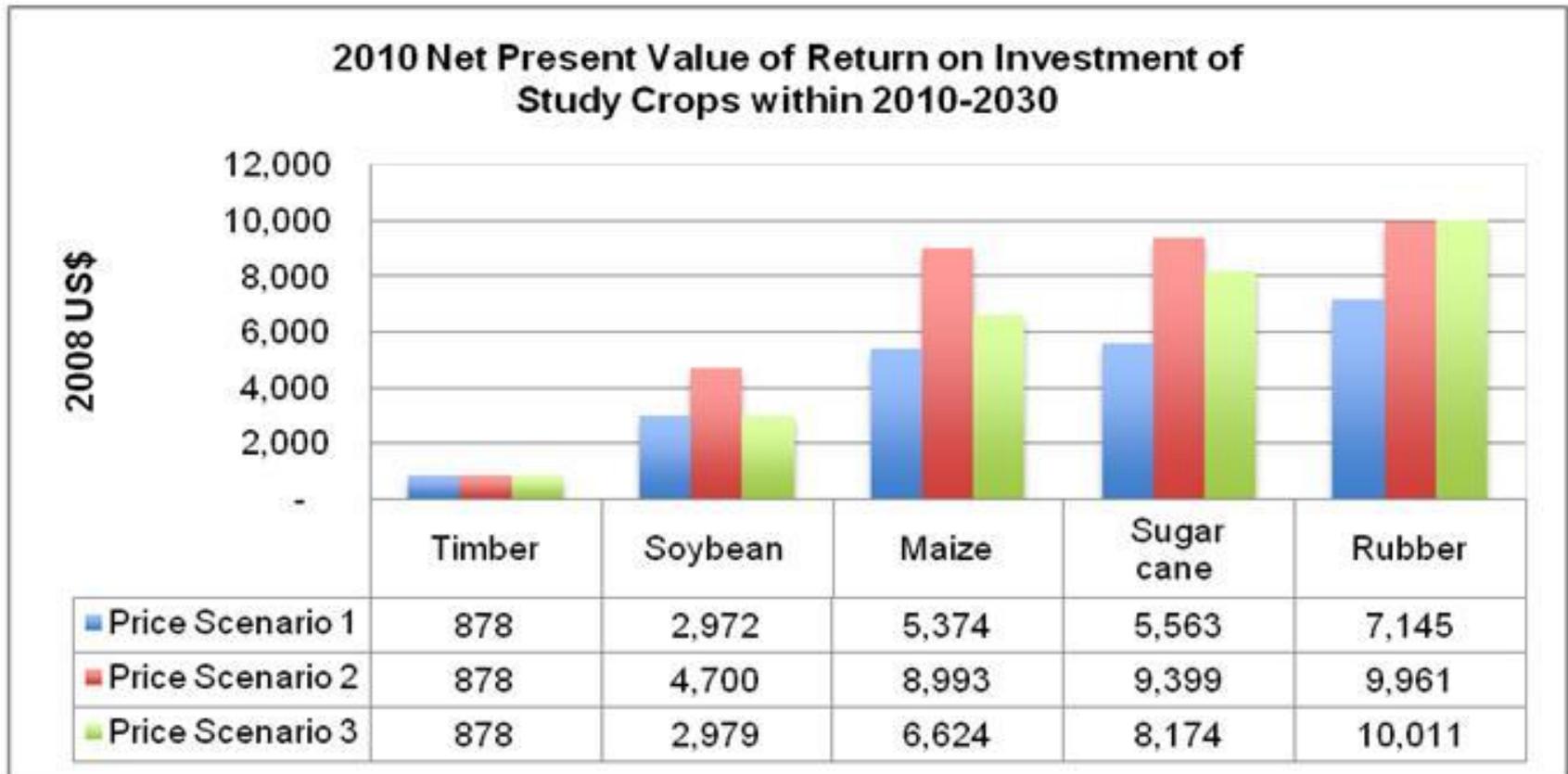
Opportunity Cost Study: Assumptions

- Yields: Increase at the annual average growth rate from 2000 – 2009 until reaching maximum level, then held constant after

Crop	Maximum Yield (tons per ha)
Soybean	2.5
Maize	5.5
Sugar cane	32
Rubber	2

- Price scenarios
 - » S1: 2011 real price held constant throughout period
 - » S2: Increase at average annual growth rate 2000 – 2010
 - » S3: Function of per capita GDP, export price and oil price

Opportunity Costs per Hectare



Results Summary

- The total 20-year NPV from soybean in both Scenarios 1 and 3 (nearly \$3,000) is the lowest among the study crops and scenarios
- The cost for maize is significantly higher than soybean, ranging from \$5,374 in S1 to nearly \$9,000 in S2.
- Sugar cane production is slightly higher than maize in S1 and S2, and nearly as high as rubber in the latter scenario (\$9,400).
- Rubber production gives the highest return in all three scenarios (~\$10,000 in S2 and S3).

Cost of Carbon Preserved Analysis

- Used the opportunity cost results to estimate the cost of preserving the carbon stocks in a representative target area (44,000 ha) within the study area from 2010 - 2030
 - » Inspired by Woods Hole Research Center REDD cost study of Brazilian Amazon, 2007
- Assumes 5% of original forest area (2,200 ha) is cleared each year starting in 2010
 - » Average cost per hectare therefore lower than above
- Total carbon stocks are 12.8 million tons CO₂e

Average Cost per ton Carbon Preserved (\$/ton CO₂e)

Crops	S1	S2	S3
Soybean	\$ 5.08	\$ 8.68	\$ 5.63
Maize	\$ 7.62	\$ 14.95	\$ 10.15
Soy/Maize	\$ 6.35	\$ 11.82	\$ 7.89
Sugar Cane	\$ 7.98	\$ 15.71	\$ 15.59

Cost varies from \$5 (soybean) to maximum of \$15.7 (sugar cane)

Carbon Stock Enhancement Analysis

- CCAP team estimated carbon enhancement potential in the target area (44,000 ha)
- Assumes forests can recover up to a level equal to 70% of the original (pre-logging) carbon content over 30 years
- This program would increase forest stocks by 2.7 tons CO₂e/ha annually
- Total carbon stocks in target area increase by:
 - » 1.2 million tons CO₂e, or 9% (10 years)
 - » 3.5 million tons CO₂e, or 27% (30 years)

Sensitivity Analysis

- Cost results are likely conservative (high-end) estimates
- CCAP team identified potential areas for further study
- Maize assumes two crops per year, but farmers may switch to less water-intensive crops with lower costs
- Rate of growth in crop prices high in some scenarios
- 100% of commercial timber assumed removed
- Assumed rate of forest clearance in target area (5%) high
- Carbon content of forest may be high
- Policy implementation costs; impact of enhancing carbon stocks; foregone revenues from NTFPs, ecosystem services all key areas of future research

Cambodia Study: Conclusions

- The average cost of protecting the carbon stock in the Koh Kong case study area is higher than most prices currently available on the voluntary market, but likely less than would be obtained on a future compliance market
 - » EU-ETS prices over US \$20 per ton
- Cambodia has tremendous potential for enhancement of carbon stocks through forest rehabilitation and regeneration which could help lower opportunity costs, make REDD more attractive

Lessons for REDD+ Policy and Opportunity Cost Analysis

- Cannot rely only on voluntary market to protect forests
- PES programs useful but no silver bullet -- countries will need a mix of policies for effective national REDD
- Integrate the “two D’s” with the “+” – combine REDD programs with carbon stock enhancement
- Account for multiple potential land use patterns (e.g., switching between crops) over time
- Address full range of land uses across the country
 - » Some drivers (e.g., palm oil, mining) have very high opportunity costs

THANK YOU

For more information, visit our website:

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