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WHO WILL GROW FOREST, BRING BENEFIT AND SAVE THE EARTH?

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CLIMATE CHANGE

This paper is about current thoughts and contemporary issues to discuss on how to connect climate change with community forests in the Nepal Himalaya, to usher local benefit and global improvement. To address global climate change, the Kyoto Protocol (UN, 1992) aims at reducing emissions of green house gases (GHGs) in the atmosphere where carbon dioxide (CO_2) is the principal explanation. The Protocol has voluminous rules that details accounting of greenhouse gases, how to encourage investments in poorer countries, regulatory trade in greenhouse gas emissions and reams of other operational details.

Forestry related activities in the Kyoto Protocol fall under the Clean Development Mechanism (CDM). The CDM of the Protocol explicitly states two objectives: 1) assist non-industrialized countries (non-Annex I) in achieving their sustainable development; and 2) monitor carbon emission commitments (limit and reduction) of industrialized countries (Annex I) (UN, 1997).

Until 1800s, the CO_2 concentration in the atmosphere was estimated to be 280 parts per million (ppm) and now, it has risen to over 375 ppm. Hence, 40 industrialized nations of 190 countries connected with the Kyoto Protocol, have agreed to curb their emissions of heat-trapping gases, mainly from burning fossil fuels by 2012. Also, forest products may assist in curbing fossil fuel because sustainable management of forest resources in the least developing countries is achievable (Watson et al., 1996). Thus, forests have become an integral part of the Kyoto Protocol.

FORESTS AS SINK AND SOURCE

The earth's ecological sinks to absorb GHGs (carbon, methane and water vapours), are oceans and vegetation. Forests absorb CO_2 and convert it into biomass comprising of tree-trunks, branches, and leaves. Such carbon absorption is termed net primary productivity. Forests also release CO_2 through other processes, such as respiration and plant matter decay. Given the carbon balance between sink and source, managed forests sequester more carbon than unmanaged forest (mature) where more trees die and decay. Therefore, active management and restoration of the world's degraded forest will not only check soil erosion but enhance carbon sink, revitalize soil nutrients, and increase the level of soil organic carbon (SOC).

Globally, forest vegetation including tropical, temperate, boreal forests and savannas, accounts for over 90% of carbon in plants (Janzen, 2004). Forests sequestrate 20 - 100 times more carbon per unit area than croplands (Brown and Pearce, 1994). Of the estimated global terrestrial carbon of 835 Gt (Bajracharya et al., 2004), about 2/3rd, excluding those sequestered in rocks and sediments, are stored in forested areas in the form of biomass, and forest debris, and soil (Sedjo et al., 1998 cited in Upadhya et al., 2005).

Knowing that 50% of biomass is estimated as the carbon content (sink) for all species of trees on average (MacDicken, 1997), the Protocol is keen to engage in maintaining global forests. As of now, some 222 countries manage their forests covering four billion ha which is over 30% of the total land area of the Earth (FAO, 2005).

CLEAN DEVELOPMENT MECHANISM (CDM)

Nepal became a party to the Kyoto Protocol in 2005 as CDM is the only mechanism where by non-industrialized countries can participate. Two key sectors of CDM are: energy, and land use including land use change forestry. Under energy, bio fuel schemes such as Biogas Support Program in Nepal, will get carbon credit which means support money. CDM can generate private sector investment from industrialized countries towards climate friendly projects such as forestry for switching to carbon free technology or investing on afforestation / reforestation related activities in non-industrialized countries.

CLAIMING CREDITS

The International Panel on Climate Change (IPCC) has identified carbon sequestration, carbon conservation and carbon substitution as three forest management strategies that can effectively reduce the concentration of CO_2.

In the first commitment period of the Protocol beginning 2008 till 2012, forest-related credits include only afforestation and reforestation (Aukland et al., 2002).

The CDM also uses the term 'avoided deforestation' which is excluded from carbon credit. According to the Protocol, afforestation is the direct human-induced conversion of land to forested land that has not been forested for a period of at least 50 years. Reforestation is the direct human-induced conversion of non-forested land to forested land on lands that did not have forest before 1990. Also, forests are defined as a minimum area of land of 0.5 - 1.0 ha with minimum crown cover of 10 - 30%. Since early 2005, CDM market has been established where the volume of carbon from forestry sector, has to be certified using scientific methods.

IS COMMUNITY FORESTRY MAINSTREAM?

Deforestation and forest degradation are responsible for around 20% of the increase in green house gases (Bishop and Landell-Mills, 2002) and they are sources of CO_2 emissions in Asia (Dixon et al., 1994). Since late 1970s, community forestry has emerged as an approach to address negative impact on rural livelihoods and consequently decelerated environmental degradation. In some Asian countries like China, India, Nepal, and Philippines, community forestry has become mainstream forestry in its own right (Table 1). In others like Bhutan, Cambodia, Lao PDR and, Vietnam , it is a much more recent and in different formative stages.

AMBIGUITY AND THE UNKNOWNS

Carbon sink projects under CDM, are required to show additional emission reduction compared to the business as usual scenario, i.e. the baseline. Predicting baseline scenario in community forestry is complex and extremely difficult (Smith and Scherr, 2003) as it is a result of over 20 years of rehabilitating degraded government forests.

Site specific volume measurements of CO_2 in the field suggest that the CDM guidelines at local level, has some 'teething' problems because of ambiguities in the measurement procedures. For example, to measure the below-ground biomass for estimating carbon in the soil, there are gaps in root biomass measurements (Brown, 2002). Also, the SOC (soil organic carbon) varies with physiographic zones and their specific values are not known now (Bajracharya et al., 2004). At present, SOC measurements relate to only the top soil and do not account for the carbon stock in different soil profiles (Upadhya et al., 2005).

PRICING COMMUNITY FORESTS

To demonstrate community managed forests are carbon reservoir and to analyze the CMD defined activities in managing forest, three community-managed forests of different forest types in Nepal, were selected at different altitudes to assess their carbon pool levels and test the recommended methodology for carbon estimation. The three sites were: 1) subtropical broad-leaved forest in Ilam (elevation: 400 – 800 m); 2) lower temperate broad-leaved forest in Lamatar (elevation: 1,400 - 2,100 m); and 3) conifer forest in Manang (elevation: 3,500 - 4,200 m).

Table 1. Status of community forestry in Asian countries (Nurse and Malla, 2005).

Country	Management	Forest (million ha)	User Groups	Population
China	Collective Forest	153	NA	NA
India	Joint Forest	14	62,000	75 million
Philippines	Community-based	5.7	2,182	NA
Nepal	Community Forest	1.1	14,000	7.8 million

CONNECTING COMMUNITY WITH CLIMATE

Community-managed forests throughout Asia, are the source of stabilizing forest on a long-term basis for livelihood, and have addressed climate change through reducing green house gases. The science in forestry and climate change explicitly recognize activities that circumvent deforestation to stabilize atmospheric CO_2. However, the Protocol and its CDM recognize them to be a form of 'avoided deforestation.' As a result, all community managed forests in Asia, remain excluded.

In Nepal, forests handed over to the local communities before and after 1990s were all degraded and within the protocol definition of a 'forest' (10 - 30% crown cover and > 0.5 ha). Although community forests in Nepal, fully meet the sustainability criteria of the CDM better than afforested / reforested monoculture plantations as prescribed, they do not qualify under the fixed criteria of afforestation and reforestation. Therefore, the Protocol working modalities not only need to be robust but also adaptive to resolve local constraints for the global delivery. Also, due recognition of community managed forests and associated activities will be aggressively debated in days ahead.

To estimate the carbon pool in these three sites, above ground biomass and SOC in topsoil were estimated. Methodology (MacDicken, 1997) for carbon inventory in forest included: 1) forest identification, 2) boundary mapping and stratification, 3) pilot survey for variance estimation, 4) calculation of optimal sampling intensity, 5) executing inventory and 6) data analysis.

While assessing carbon pool size in the three sites, Manang (High Mountain) had the largest with 6,601 tC and the lowest in Ilam (Hills) with 2,412 tC (Table 2). Highest biomass per unit area occurred in Ilam (103 t / ha) and the lowest in Manang (55 t / ha) which appears to be normal as biomass is low in higher altitudes.

The state of the human-influenced forests is determined by their management regimes. To monitor changes in

Table 2. Biomass and total carbon in three sites in the Nepal – Himalaya.

Region	Area (ha)	Plot No./Size	Biomass (ha)	Carbon (t/ha)	Total Biomass (t)	Total Carbon*
Hills (Churiya)	47	14/100 m^2	103	51	4824 t	2412 tC
Mid Hills	96	8/100 m^2	91	45	8690 t	4345 tC
High Mountain	240	13/250 m^2	55	28	13202 t	6601 tC

* for above ground plant biomass with >5 cm dbh; and excludes below ground biomass, SOC, carbon in herbs/grass and litter and those <5 cm dbh.

carbon pool overtime as they give the accurate picture, forest is better understood by dbh (diameter at breast height) class distribution. The forest in Manang is much older with over 40% of the trees having dbh between 21 - 50 cm class suggesting comparatively undisturbed and old forest (Figure 1). Deforestation in Manang, lowered more than two decades ago after people experienced severe forest degradation with growing tourist influx and intervened, thereafter. Community forest in Manang are largely regenerated through stringent protection norms.

The low carbon pool in Lamatar is better understood by the distribution of dbh class as nearly 3/4th of the trees in Lamatar and about a half in Ilam, had dbh between 5 - 10 cm suggesting relatively young forests. Lamatar and Ilam forests were also severely deforested as roads were built, which linked them to the vicinity of a growing population that had a demand for timber. Forest protection only started after the formal handover of these national forests by the government to local communities in the mid 90s. By avoiding deforestation and protecting against cattle grazing and illicit logging, these degraded forests have regenerated.

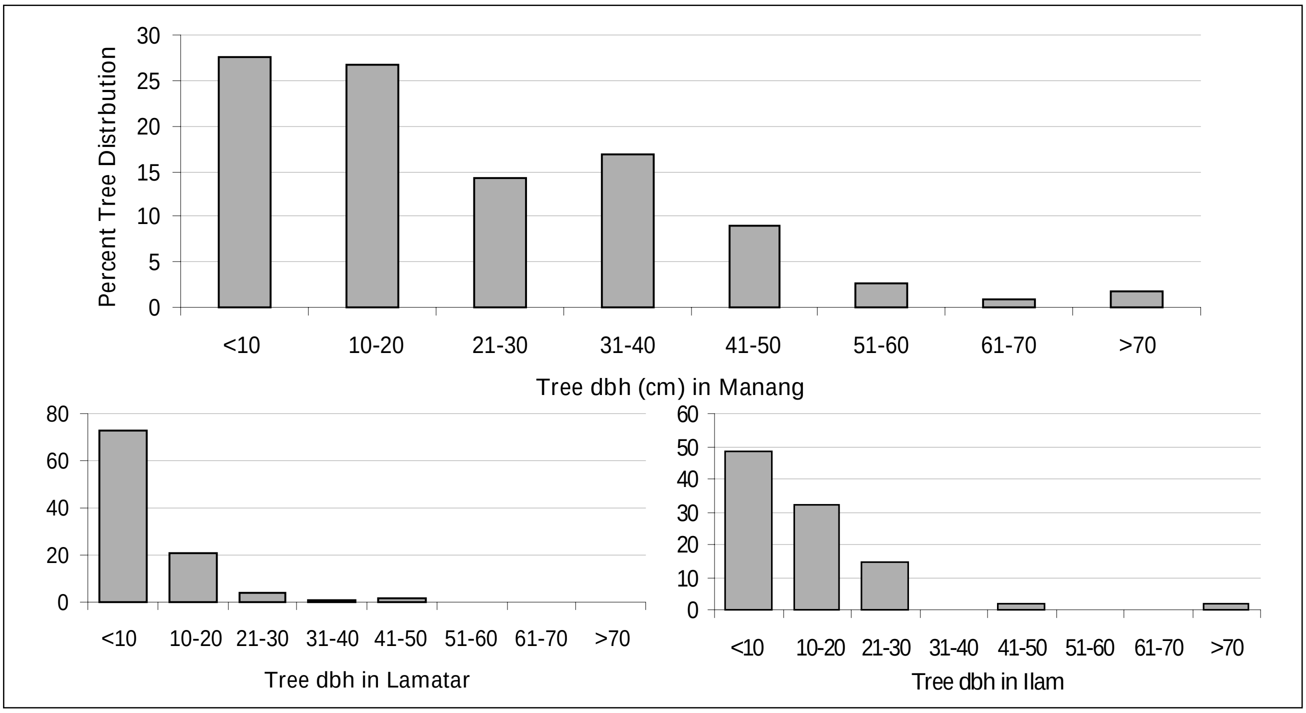
These forests have a significant amount of carbon pool in the soil. The SOC percentage for Lamatar was found to be 4.6% at 0 - 0.2 m depth and 2.97% at 0.2 - 0.4 m depth class. For Manang, the same was found to be 1.75% and 1.84% respectively. This on-going study will provide a comprehensive carbon sequestration in community forestry including soil, in near future.

In Uttaranchal, India, the Central Himalayan Environment Association (CHEA), is doing similar research in calculating carbon sequestration rates in community managed forests. The CHEA Report for 2005 (unpublished), suggests that annual increment of 3 tC/ha/yr could be achieved from community managed forests. Assuming, if Nepal could achieve at least a half of the Uttaranchal estimate from its 1.1 million ha of community forests, 1.65 million tC/yr would be sequestrated. Using US$ 5 for a ton of carbon as certified emission reduction, Nepal would receive US$ 8.25 million annually for the community forestry sector.

EXTERNAL LEAKAGE

In CDM vocabulary, greater carbon emission for a given country beyond the carbon credit project boundary, is considered external and negative leakage. Therefore, present rate of deforestation in Nepal is considered a leakage in community forest management. For example, the average yearly deforestation rate has increased from 54,000 ha (between 1981 – 1990) to 180,000 ha (between 1996 – 2000) (Lal, 2004). This is another factor that disqualifies Nepal's community forests for carbon

Figure 1. Percent distribution of tree dbh class in three sites.



crediting. Although 35% of the Nepal's population have managed 25% of the total national forest area as community forest to check the degrading state of forest (Mikkola, 2002), government-managed forests that account for about 75% of the national forest, are open access and severely degraded. Until such external leakages are controlled, community forests as carbon sink, cannot qualify for CDM.

SURVIVORS AND FREE RIDERS

If fully assessed, carbon levels in forests managed by the communities in Asia, are important carbon pool as forests show signs of regeneration in previously deforested area. It is imperative to monitor such forests over extended period to evaluate their real capacity in stabilizing the emission of CO_2.

Even though halting deforestation in non-industrialized countries is an enormous task, the Kyoto Protocol and its CDM disqualify sustainable management of forests that stabilize CO_2. In addition, scientific requirements in following the global protocol procedures appear to be complex and often ambiguous for non-industrialized countries. My experiences from the field trials imply that community forest issues are important as the debate over the inclusion of 'avoided deforestation' remains open. Till then, it is clear that the Kyoto Protocol has no incentive for the far-flung communities in the Himalaya because locals connect forests with their survival and not as a carbon reservoir - a compelling local decision that allows the world to have a free ride on the carbon benefit!

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