Reducing Emissions from Deforestation and forest Degradation

REDD+ for Green: *Reality or Myth?*

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Climate Change

Global Warming

Greenhouse Gas Emissions

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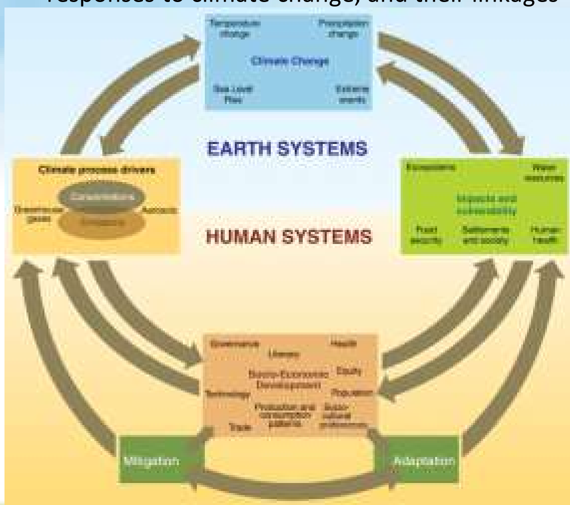
Schematic framework representing anthropogenic drivers, impacts of and responses to climate change, and their linkages



IPCC, 2007

Greenhouse Gases (GHGs) and Forests

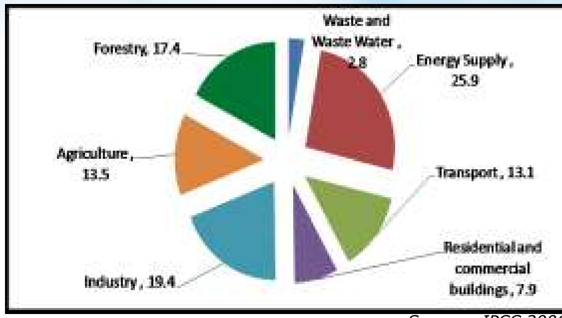
Carbon dioxide (CO_2)

❖ One of the major Greenhouse Gases with global warming potential

❖ A chemical compound of two oxygen atoms with one carbon atom

The carbon reservoir in the world's forests is larger than the capacity in the atmosphere

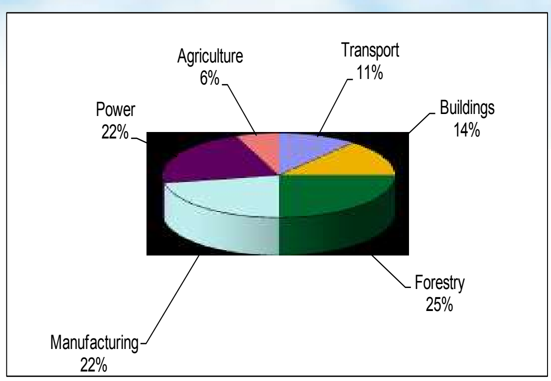
Share of Different Sectors in total anthropogenic GHG emissions in 2004 (in %)



Source : IPCC 2006

Carbon Sequestration and Storage Potential (Sink)

Avoided deforestation and reforestation/afforestation can uptake CO_2 from the atmosphere	
Total Potential	6.7 Billion tonne
Avoided Deforestation	3.3 Billion tonne
Afforrestation/ Reforestation	3.4 Billion tonne



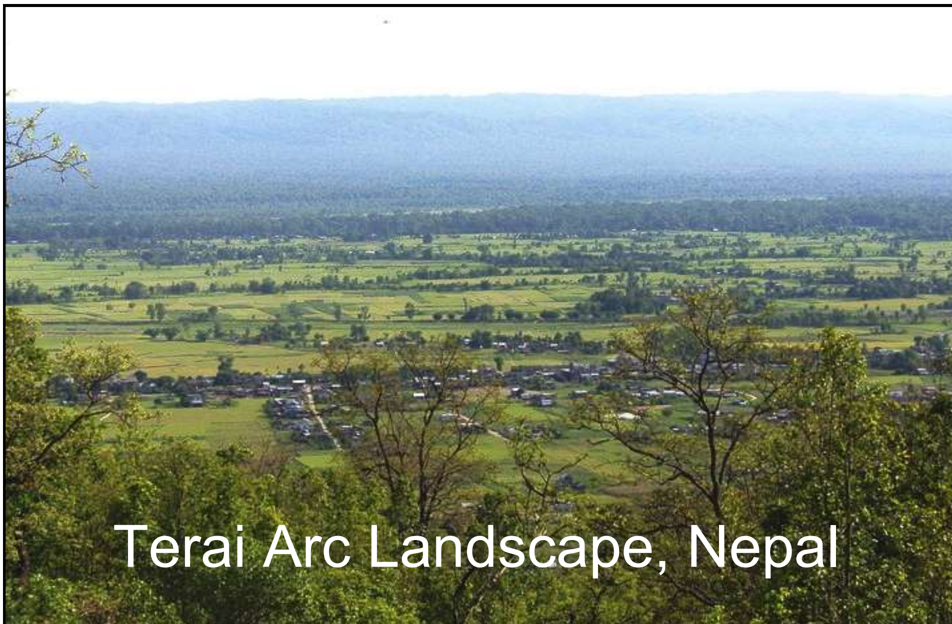
Source : Mckinsey et al, 2007

Reducing Emissions from Deforestation and Forest Degradation (REDD+)

- Most cost effective way to mitigate Climate Change (Stern Review, 2006)
- REDD received much attention during recent climate change negotiations and has been proposed as an incentive mechanism
- Feasibility of REDD: Borner and Wunder (2008): Brazilian Amazon; Swallow *et al* (2007): Indonesia and Peru; Nepstad *et al* (2007): Brazilian Amazon

Reducing Emissions from Deforestation and Forest Degradation (REDD+)

- C stock in the forests have to be estimated
- Global estimates (DeFries et al., 2002; Gibbs et al., 2007; Houghton, 1999; IPCC, 2006; Saatchi et al., 2011), and some regional estimates (Ajtay, 1979; Brown and Lugo, 1982; Houghton, 2005)
- C stock varies from region to region, country to country and place to place
- We estimated C stocks across the pools and management regimes in the Terai Arc Landscape of Nepal



Terai Arc Landscape, Nepal

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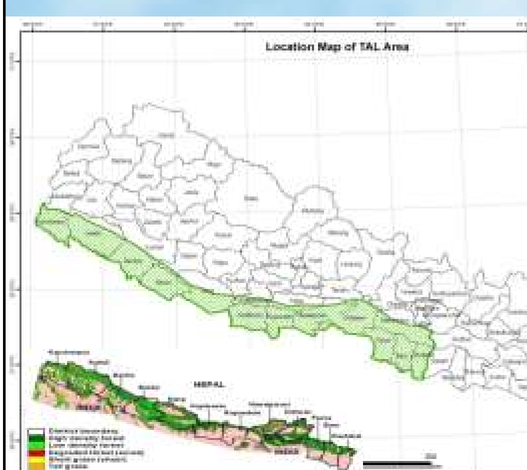
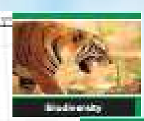
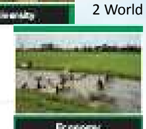




435 rhinos
121 tigers
148 elephants
4 PAs, 3 Ramsar sites
2 World Heritage sites



"Rice bowl"
US$ 3.2 M timber revenue
US$ 1.4 M ecotourism
Trade backbone

6.7 Million people
>4.5 Million Cattles
80% forest dependant

10872 sq km of largest commercially exploitable Sal forest in Nepal.

Methodology

- ❖ Field Measurement-based forest inventory method
- ❖ AGB: Best predictive allometric model

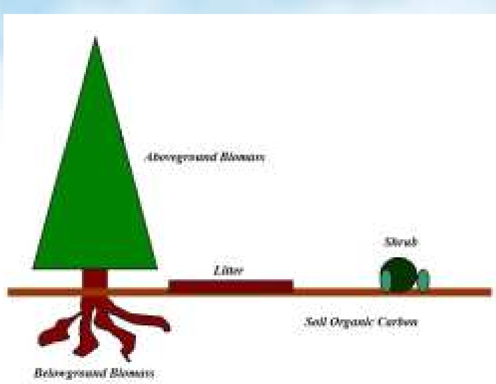
$$\ln AGB = \alpha + \beta \ln (D^2 H \rho)$$

$$\ln AGB = -3.080 + 1.007 \ln (D^2 H \rho)$$

(Chave et.al., 2005)

- ❖ Shrub and Litter: Destructive methods
- ❖ SOC: up to 30 cm depth

Methodology: Field measurements



Carbon pools	Method
Above ground (Tree) Biomass	Plot method (113 plots)
Shrub and Litter	Plot method
Below ground Biomass	Root: Shoot ratio
Soil Organic Carbon	• Field sampling • Laboratory analysis

Fieldwork

Use of DME and GPS

Marking plot centre for shrub/litter sub-plots

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Fieldwork

Litter sample collection

Diameter measurement

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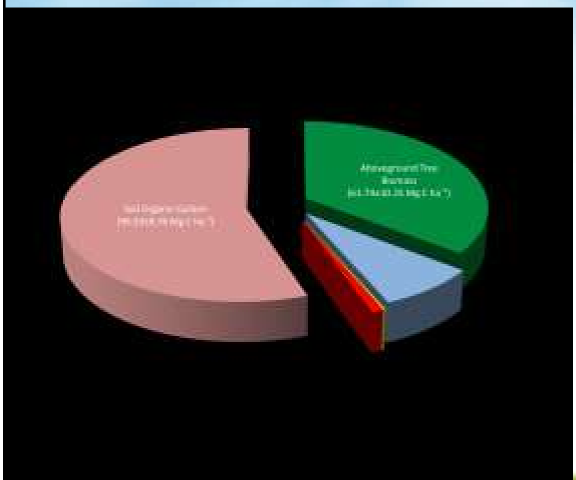
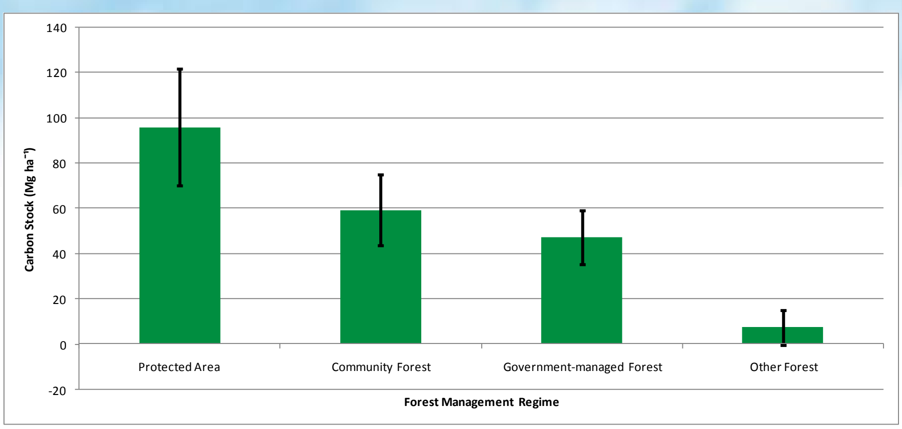
Result: Total C Stock (Mg ha^{-1})



- ❖ AGB Estimate consistent with site specific studies (*Boonpragob, 1998 and Ogawa, 1965*)
- ❖ Markedly differs from Biome average data of **250-264 Mg ha-1**, estimated using secondary data (*Ajtay, 1979, Brown and Lugo, 1982, Houghton, 2005*)
- ❖ SOC estimate within the range of **62-96.60 Mg ha-1** in the similar forests (*Seikh et al., 2009, Singh et al., 2011 and Sierra et al., 2007*)`

Result: C stock in Different Management Regimes (AGB Mg ha^{-1})



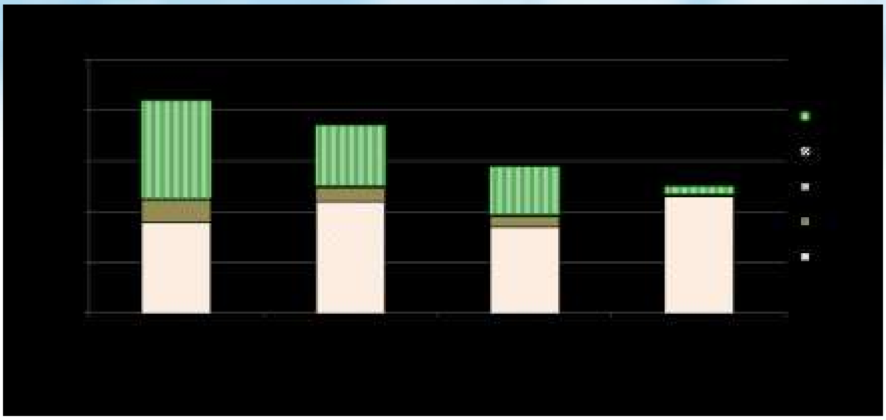
Estimates of C Stock in Belowground Biomass (Mg ha^{-1})

Forest Management Regime	Mean	Range
Protected Area	22.41	2.57-71.34
Community Forest	13.57	0.56-59.26
Government-managed Forest	10.63	0.29-40.18
Other Forest	1.46	0.02-4.04

Estimates of Soil Organic Carbon, Mg ha^{-1}

Forest Management Regime	Mean ± Uncertainty	Range
Protected Area	89.39±14.92	22.47-160.98
Community Forest	110.43±16.76	32.04-214.72
Government-managed Forest	85.26±12.43	26.09-197.13
Other Forest	115.56±55.66	61.86-217.93

Distribution of C stock across the management regime



Result: Emissions from Deforestation (1990-2009)

Total Forest Area (ha)	1,102,300
Total C stock (uncertainty at 95% CI), Gg	192,000±15,000
Deforestation (1990-2009), ha	40,000
Loss of C from biomass, Gg	3106±523
Emissions from deforestation, Gg CO2e	11,398±1920

Concluding Remarks

- Huge amount of C stored in the forest
- Importance of site-forest type-specific studies to obtain reliable estimates of C stock
- Role of conservation to preserve C stock and reduce emissions

What I am doing ....

Projecting future Deforestation Scenarios (applying economic model of deforestation)	XXXXX
Potential of reducing emissions (CO2e in *Mg*) from avoided deforestation	XXXXXXX
Opportunity Cost per Mg of CO2e	XX
Potential of REDD	?

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