AFOLU CARBON CALCULATOR TOOLS

2014

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APPLICABILITY

Each tool was designed to estimate carbon impacts of a specific AFOLU activity

	Examples	Tool
Protecting Forests	- Creating new protected areas - Strengthening existing protected areas - Reducing community timber harvesting inside protected areas - Managing forest fires - Preventing/Reducing illegal logging activities - Protecting mangrove wetlands	Forest Protection
Managing productive forests	- Promoting reduced impact logging (RIL) and reducing the volume of timber harvested. - Stopping logging in uneven-aged forests	Forest Management
Planting forests	- Reforesting degraded lands - Forest plantation (natives or exotics) - Reforesting mangrove wetlands - Implementing agroforestry systems	Afforestation/Reforestation Agroforestry

APPLICABILITY CONT'D

	Examples	Tool
Managing agricultural lands	- Diversifying agricultural and forestry yields through agroforestry - Improving livelihoods through agroforestry - Reducing or eliminating tillage - Altering fertilizer input (type and amount) Modifying the flood regime of rice paddies	Agroforestry Cropland Management
Managing grazing lands	- Improve management of grasslands - Reducing the number of livestock per area - Altering the type of livestock managed - Rewetting organic soils	Grazing Land Management
Reducing degradation from fuelwood collection	- Improved cookstoves programs - Switch fuel used in cookstoves - Improved indoor air quality initiatives	Forest Degradation by Fuelwood

AFOLU CARBON CALCULATOR TOOLS

Forest Protection

Forest Management

Afforestation / Reforestation

Agroforestry

Cropland Management

Grazing Management

Fuelwood & Charcoal Efficiency

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APPLICABILITY OF THE CALCULATOR

- Not applicable to all USAID land use related projects!
- Must have real, quantifiable impacts on GHGs

Yes	No
Strengthening forest reserves by protecting against deforestation	Ecotourism support
Creating new protected areas	Environmental education
Forest fire management / fire avoidance	Policy reform
Reducing illegal logging activities	DNA/UNFCCC assistance
Changing timber harvesting practices	Training/capacity building activities*
Stopping logging activities	Promoting certification/certified timber
Restoring degraded lands/ forest regeneration	Strengthening application of laws and regulations
Improving livelihoods through agroforestry planting	
Reduced fuelwood collection through improved cookstove implementation	

* Accounted for in the effectiveness rating

FOREST PROTECTION TOOL

Designed for project activities that reduce GHG emissions from deforestation, and/or forest degradation through fire or illegal logging.

Examples:

- Creating new protected areas
- Strengthening existing protected areas
- Managing forest fires
- Reducing illegal logging activities

http://www.usaid.gov/news-information/frontlines/depleting-resources/cofan-guardians-amazon-forest

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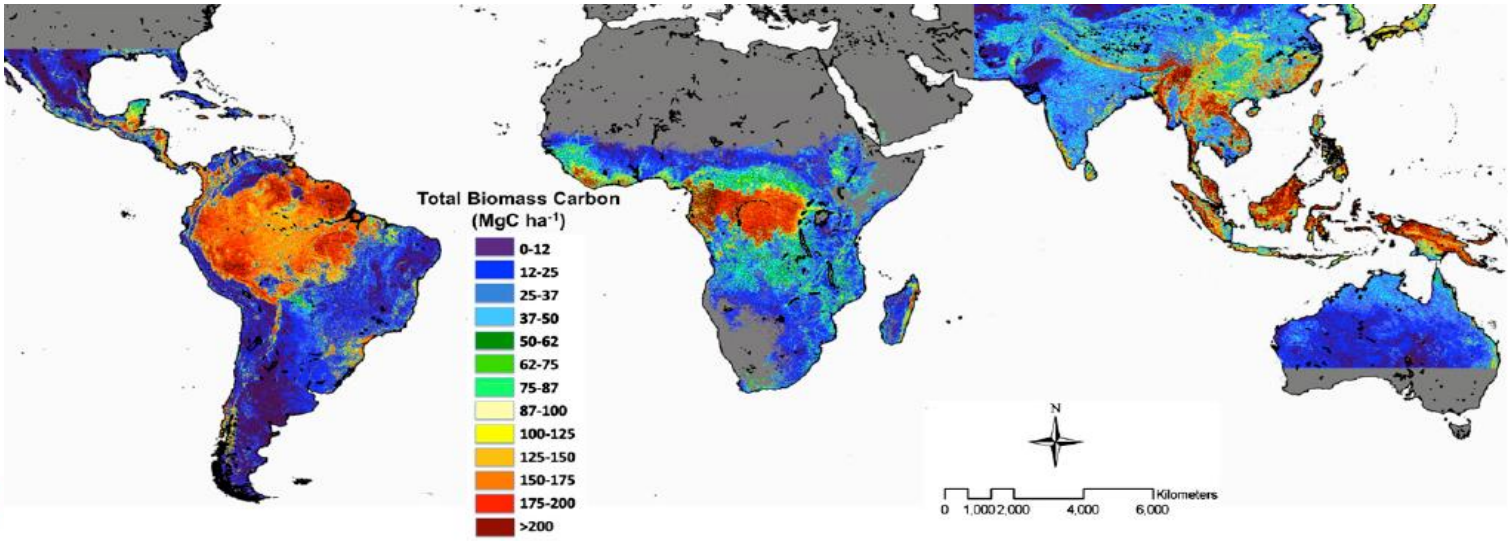
FOREST PROTECTION TOOL

- Results calculated using basic IPCC approach of coupling activity data with emission factors

  Deforested area * Carbon stocks

- Activity data:
  - Hansen et al. 2013. High-Resolution Global Maps of 21st Century Forest Cover Change. *Science*.
- Emission factors:
  - Saatchi, S.S. In preparation. Unpublished dataset.



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FOREST PROTECTION TOOL - MANGROVES

Activity Data:

- Spatial extent: USGS Earth Resource and Observation Science (EROS) - Giri et al. (2011)

Global mangrove forests distribution – 2000 (Giri et al., 2011). Map redrawn by UNEP/DEWA

Emission Factors:

- Fatoyinbo & Simard (2012) biomass data for several African countries. Area weighted average assigned to each relevant sub-administrative unit.
- Twilley et al. (1992) allometric equation based on latitude of mangrove forests for areas not covered by Fatoyinbo & Simard (2012)

$$AGB_{Man} = 298.5-7.2918*LAT \ (R^2 = 0.56)$$

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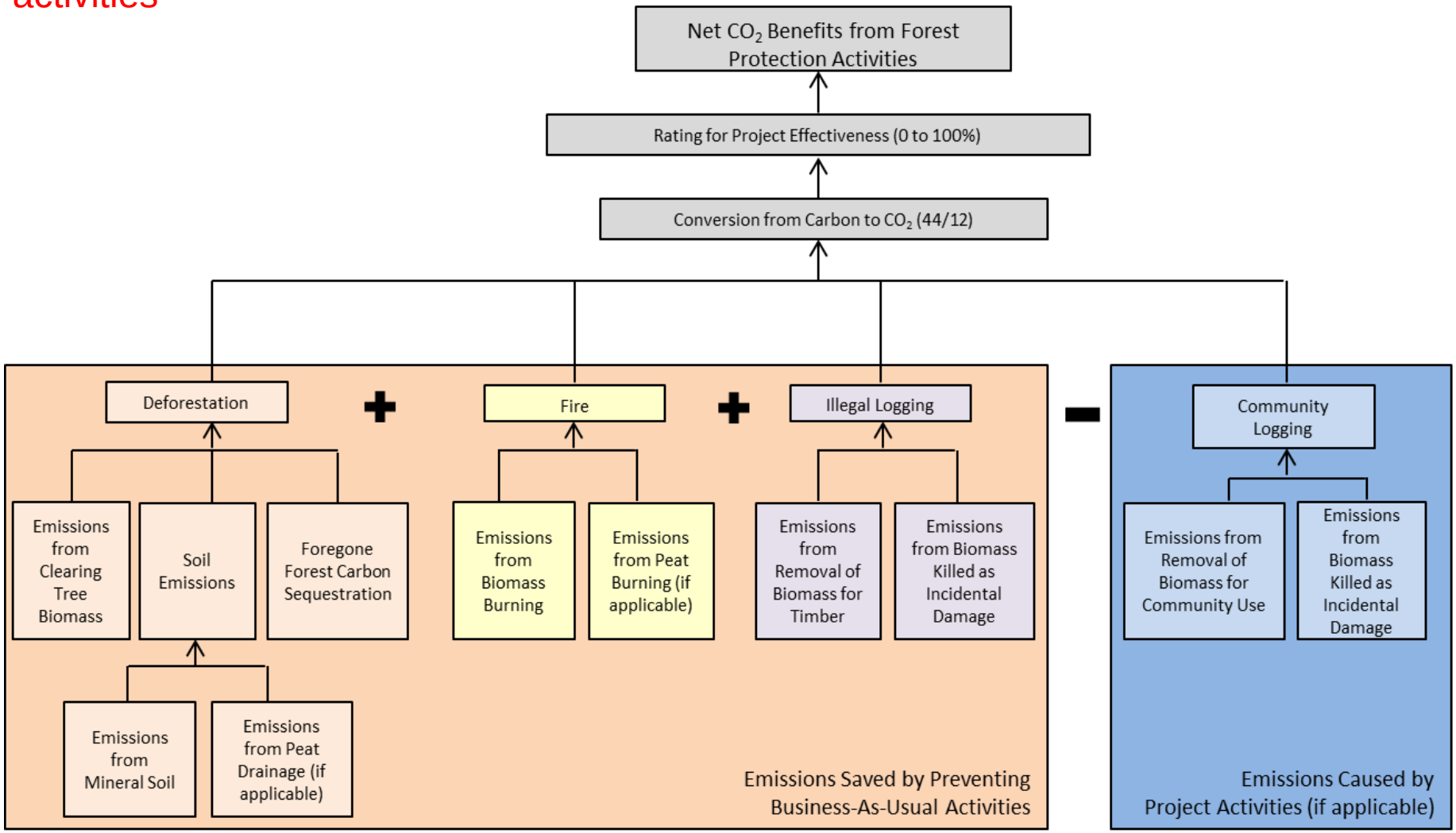
FOREST PROTECTION TOOL

GHG benefit of forest protection activities = [Avoided deforestation + foregone sequestration + reduced fire + illegal logging] – emissions from community forestry activities



FOREST MANAGEMENT TOOL

Improved tropical forest management in uneven-aged stands including:

- Reduced impact logging (RIL)
- Stopping logging

Activities that improve C storage or avoid emissions from even-aged forest management practices including:

- Extended rotation
- Stopping logging

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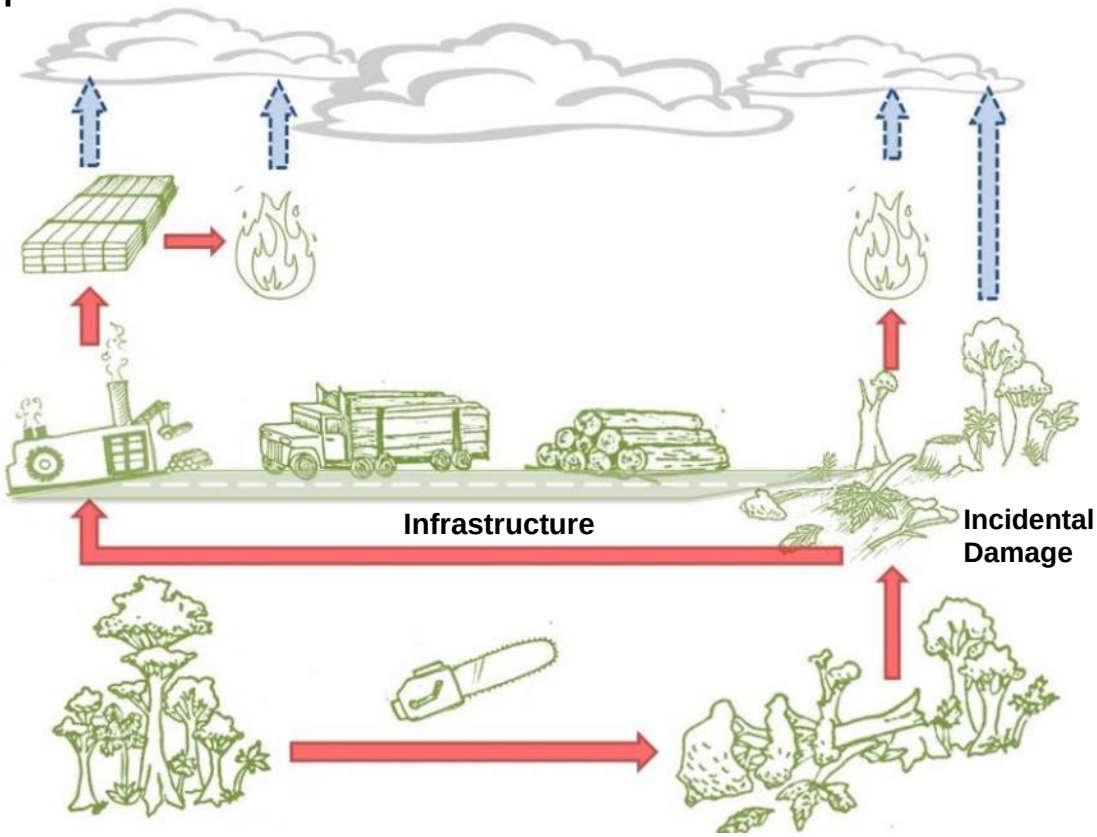
FOREST MANAGEMENT TOOL

Calculation approach is based on the methodology described by Timothy R H Pearson *et al* 2014 *Environ. Res. Lett.* **9**

Timber harvesting results in emissions from several distinct sources:

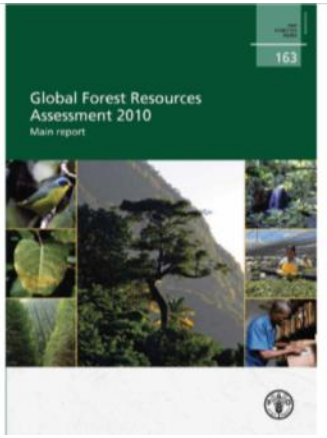
- Removal of biomass from forests that eventually decomposes
- Incidental damage to surrounding trees after felling
- Forest clearing to build infrastructure needed (skids, roads, decks)



FOREST MANAGEMENT TOOL

Log Emissions + Incidental damage + Infrastructure

Extracted Log volume:
- FAO country reports/literature
- Consultants/ Expert assessments
- Field missions



Regional damage factors developed (t CO_2 per m^3 extracted) based on field data collection:
- Measurements from > 530 logging gaps in Belize, Brazil, Bolivia, Indonesia, Malaysia, ROC, Guyana

- Literature review
- Consultant reports
- Field data collection

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AFFORESTATION/REFORESTATION TOOL

Estimates the CO_2 benefits of project activities that sequester atmospheric carbon by the establishment forests in non-forested areas.

Examples of activities:

- Forest landscape restoration
- Restoring degraded lands
- Planting native and/or exotic species
- Reforesting mangrove wetlands

→ Separate Agroforestry tool for implementing agroforestry systems

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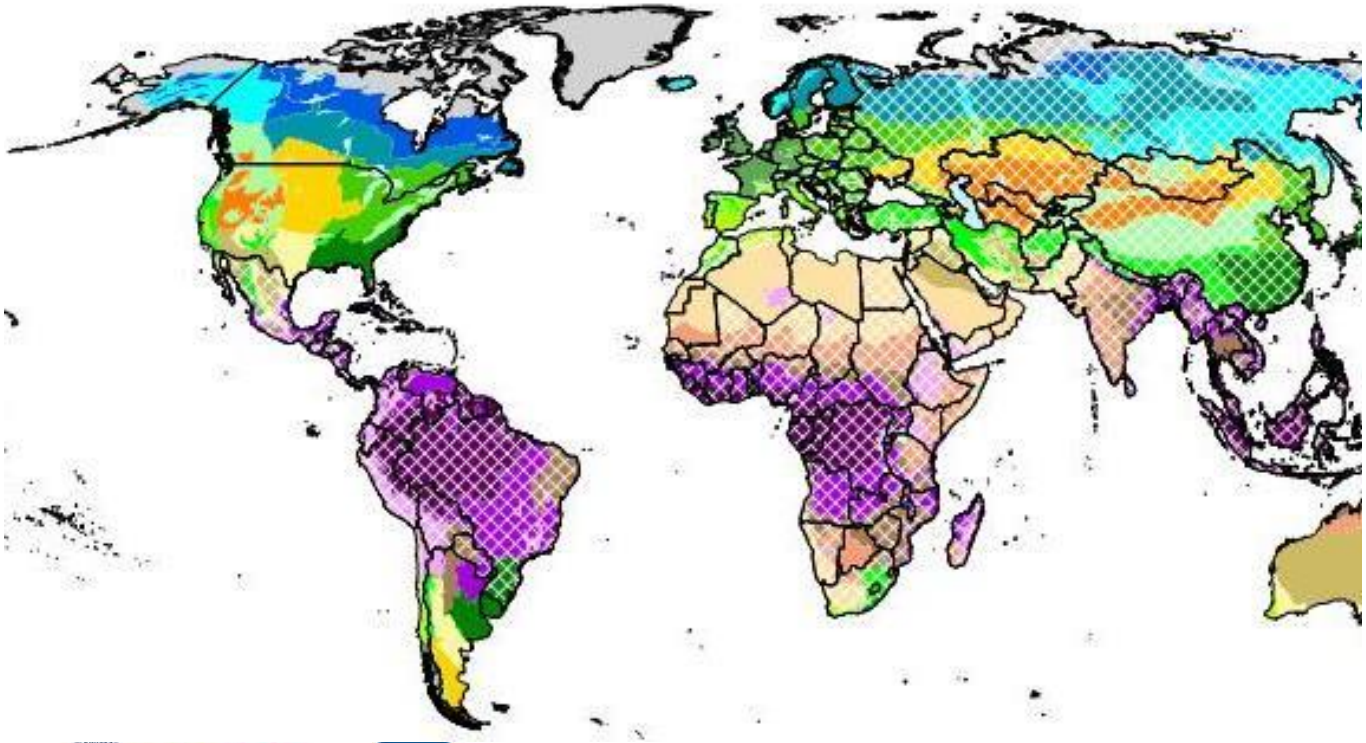
AFFORESTATION/REFORESTATION TOOL

At what rate do trees grow and accumulate carbon?

- Depends on:
  - project location
  - Tree species



FAO Ecological Zones

- Tropical rainforest
- Tropical moist deciduous forest
- Tropical dry forest
- Tropical shrubland
- Tropical desert
- Tropical mountain system
- Subtropical humid forest
- Subtropical dry forest
- Subtropical steppe
- Subtropical desert
- Subtropical mountain system
- Temperate oceanic forest
- Temperate continental forest
- Temperate steppe
- Temperate desert
- Temperate mountain system
- Boreal coniferous forest
- Boreal tundra woodland
- Boreal mountain system
- Polar
- Water
- No data

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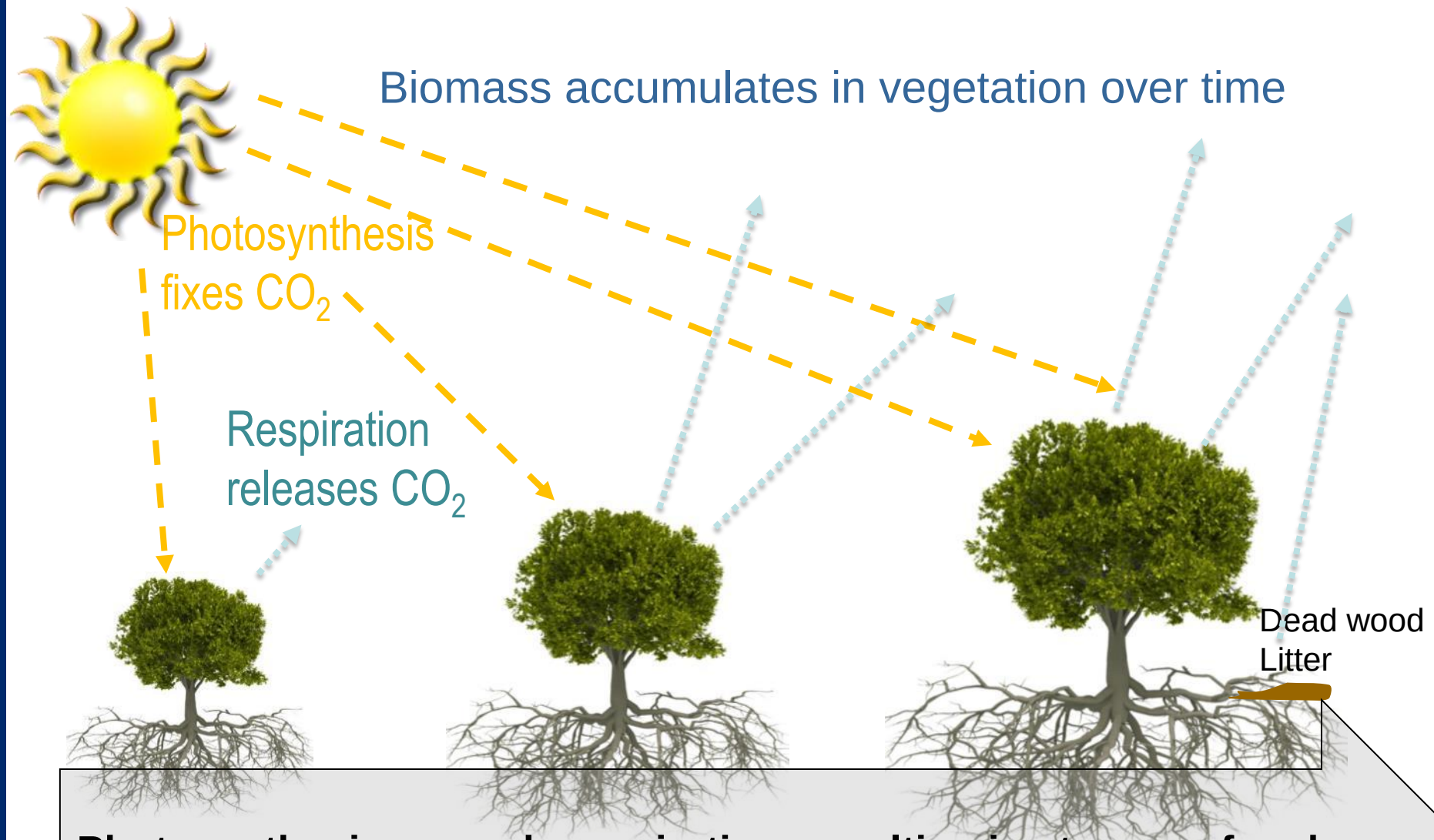
AFFORESTATION/REFORESTATION TOOL



Photosynthesis exceeds respiration, resulting in storage of carbon

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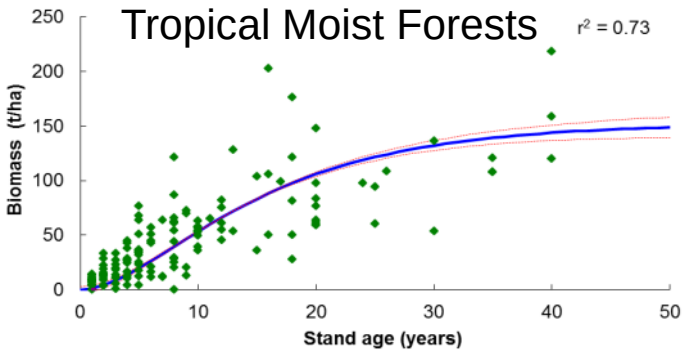
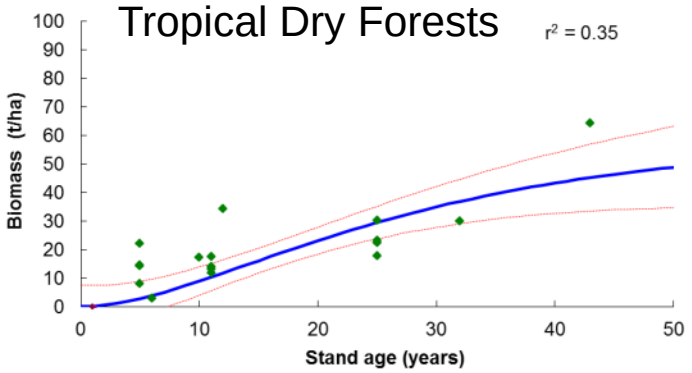
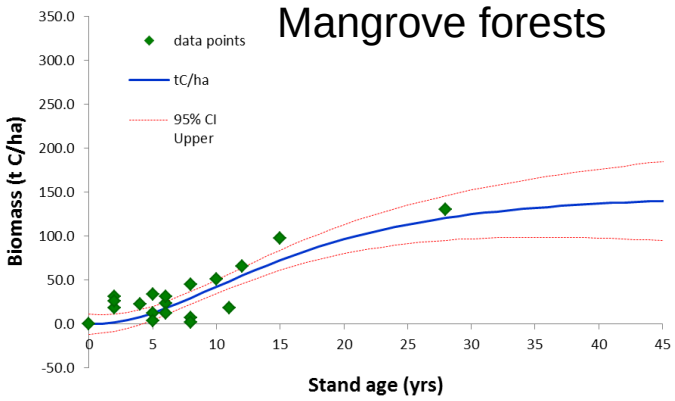
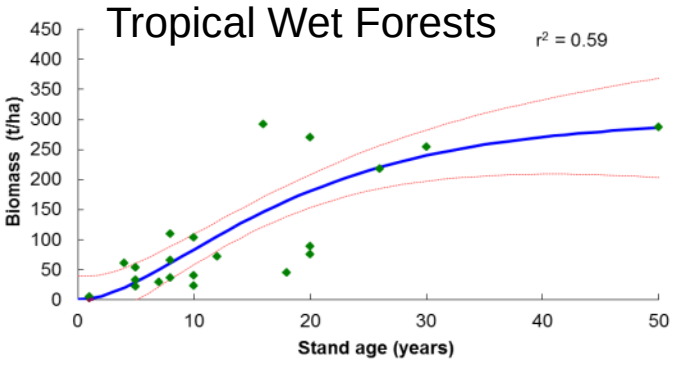
AFFORESTATION/REFORESTATION TOOL

Employs models developed by Wi Ecosystem Services Unit based on the Chapman-Richards growth equation (Richards 1959; Pienaar and Turnbull 1973) to estimate the rate biomass accumulation in planted forests, for native or commercial species.









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AFFORESTATION/REFORESTATION TOOL

Climate zones modeled based on the growth behavior of common species:

Tropical Moist / Wet: 9 species, including Eucalyptus, Rubber, Gmelina, Pine and Teak

Tropical Dry: 10 species, including Acacia, Pine, Teak and Cypress. Generic for all Acacias.

Warm temperate: 3 species of Pine. Generic for all Pines

Cool temperate: 6 species, including Pine, Beech, Spruce and Chestnut

Boreal: Conifer

AGROFORESTRY TOOL

Agroforestry systems are extremely variable in carbon sequestration potential
Biomass accumulation varies by:

- Climate type
- Site quality
- Growth habit
- Stand density
- Management practices

Examples of activities:

- Diversifying commodity production
- Improve agricultural yields
- Improving livelihoods through agroforestry
- Enhance access to different markets

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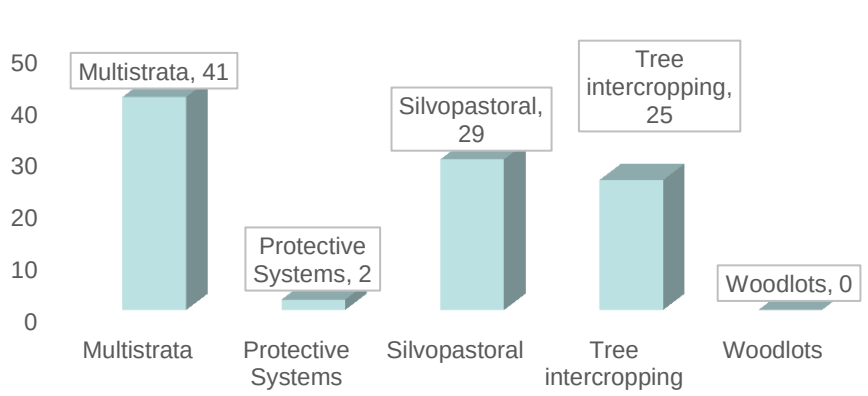
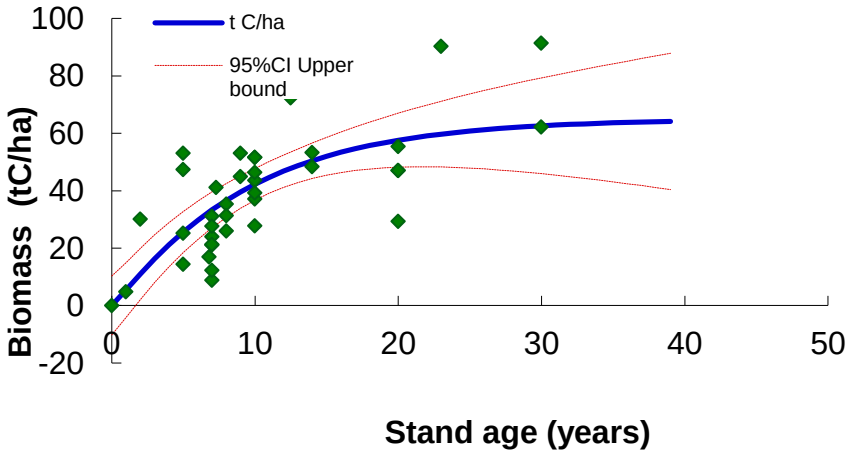
AGROFORESTRY TOOL

Calculates benefits from activities that establish agroforestry systems that sequester and store atmospheric carbon.

Types of agroforestry systems (by P.K. Nair):

- **Tree intercropping:** alleycropping, shaded perennials
- **Woodlots:** reclamation of land (eroded lands, waterlogged soils, etc)
- **Protective agroforestry:** windbreaks, boundary planting, shelterbelts
- **Silvopastoral:** tree-fodder systems
- **Multistrata:** homegardens, fruit, fodder, fuelwood and timber





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CROPLAND MANAGEMENT TOOL

Estimate the impacts of project activities that improve the management of croplands to reduce GHG emissions.

Examples include:

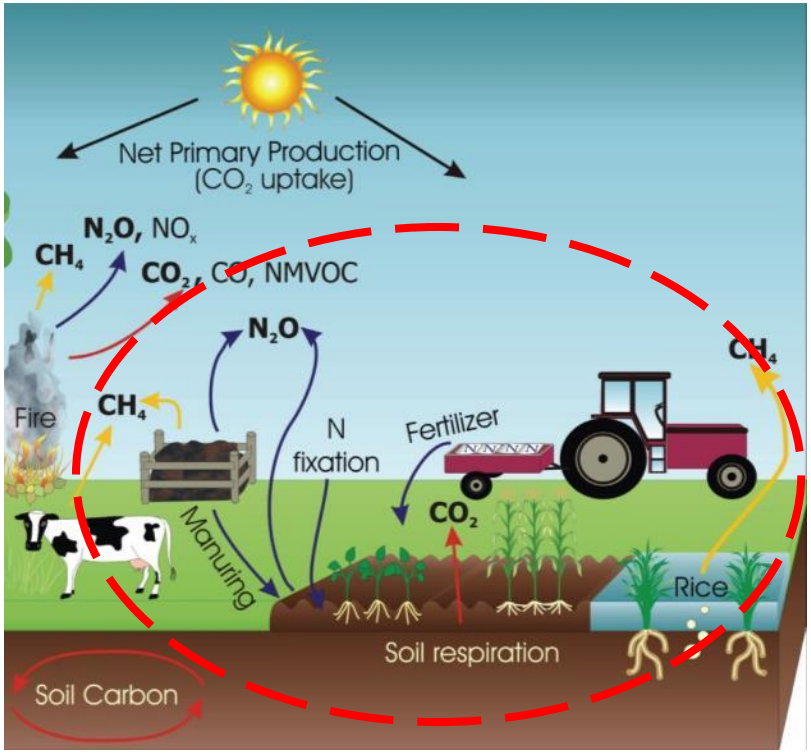
- Reducing or eliminating tillage
- Altering type of fertilizer input
- Reducing amount of fertilizer input
- Modifying the flooding regime of rice paddies

CROPLAND MANAGEMENT

GHG sources covered by the Cropland Management tool are:

- methane from rice management (CH_4)
- nitrous oxide from fertilizer use (N_2O)
- carbon emissions from soils (CO_2)

All results are converted to t CO_2 e)



http://www.wri.org/blog/2014/05/everything-you-need-know-about-agricultural-emissions

CROPLAND MANAGEMENT TOOL

- Benefits estimated based on:
  - Tillage
  - Fertilizer type, quantity and area
  - Rice fields (various flooding regimes & upland)

- Methods based on IPCC 2006 Guidelines
  - Chapter 5: Cropland
  - IPCC 2006 default data
    - Tier 1

http://precisiontillage.com/archive/blog/index.html

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GRAZING MANAGEMENT TOOL

Estimate carbon impacts from activities that aim at improving the management of grazing lands and grazing practices to reduce GHG emissions.

Examples of project activities include:
- Improving management of grasslands
- Reducing the number of livestock
- Altering the type of livestock managed
- Rewetting organic soils

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GRAZING MANAGEMENT

Methods reflect IPCC 2006 Guidelines

- Chapter 6: Grassland
- IPCC 2006 default data
  - Tier 1

Benefits estimated from:

- Release of soil C based on management: sustainably managed, overgrazed/moderately degraded, severely degraded, improved
- Methane from enteric fermentation depending on type and quantity of livestock: Cattle, dairy cow, buffalo, sheep, goat, camels horses, mules, swine, deer
- Rewetting organic soil

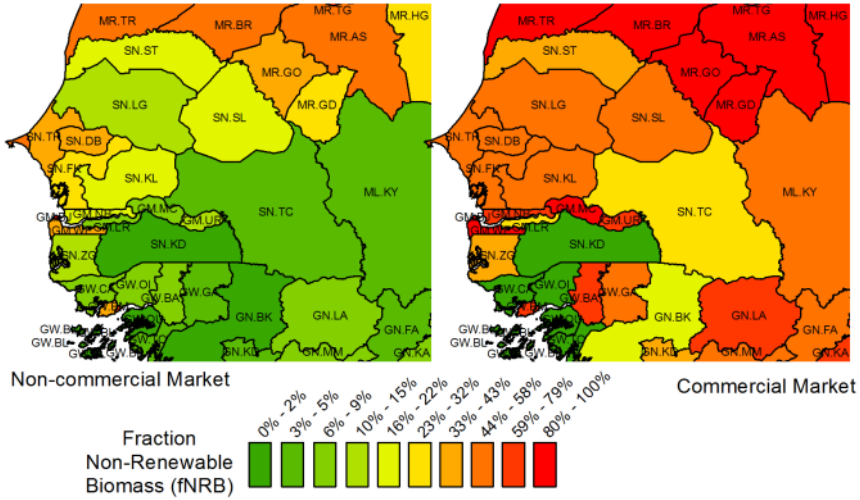
FOREST DEGRADATION BY FUELWOOD TOOL

Estimates the emission reductions from reduced forest degradation as a result of using improved cookstoves. Both direct and indirect emissions from fuelwood and charcoal use are estimated.

Direct emissions: Emissions from burning wood fuel

Indirect emissions:

- Damaged biomass left in the forest to decompose.
- If burning charcoal, emissions generated during the kiln process



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FOREST DEGRADATION BY FUELWOOD TOOL

Gross Biomass Savings per "Household-Year" of displacement Specific Fuel Consumption Rate Version

1 t wood at-stove per year

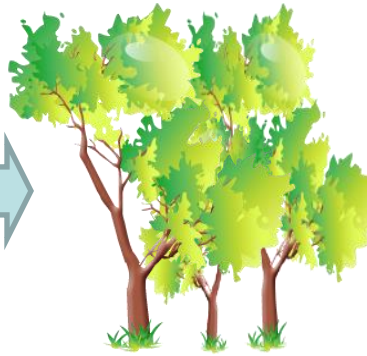
10% Efficiency

1 kg wood per meal or pot boiled water

30% Efficiency

0.67 kg wood per meal or pot boiled water

0.33 t wood saved per stove per year



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THANK YOU

For questions and comments:

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