

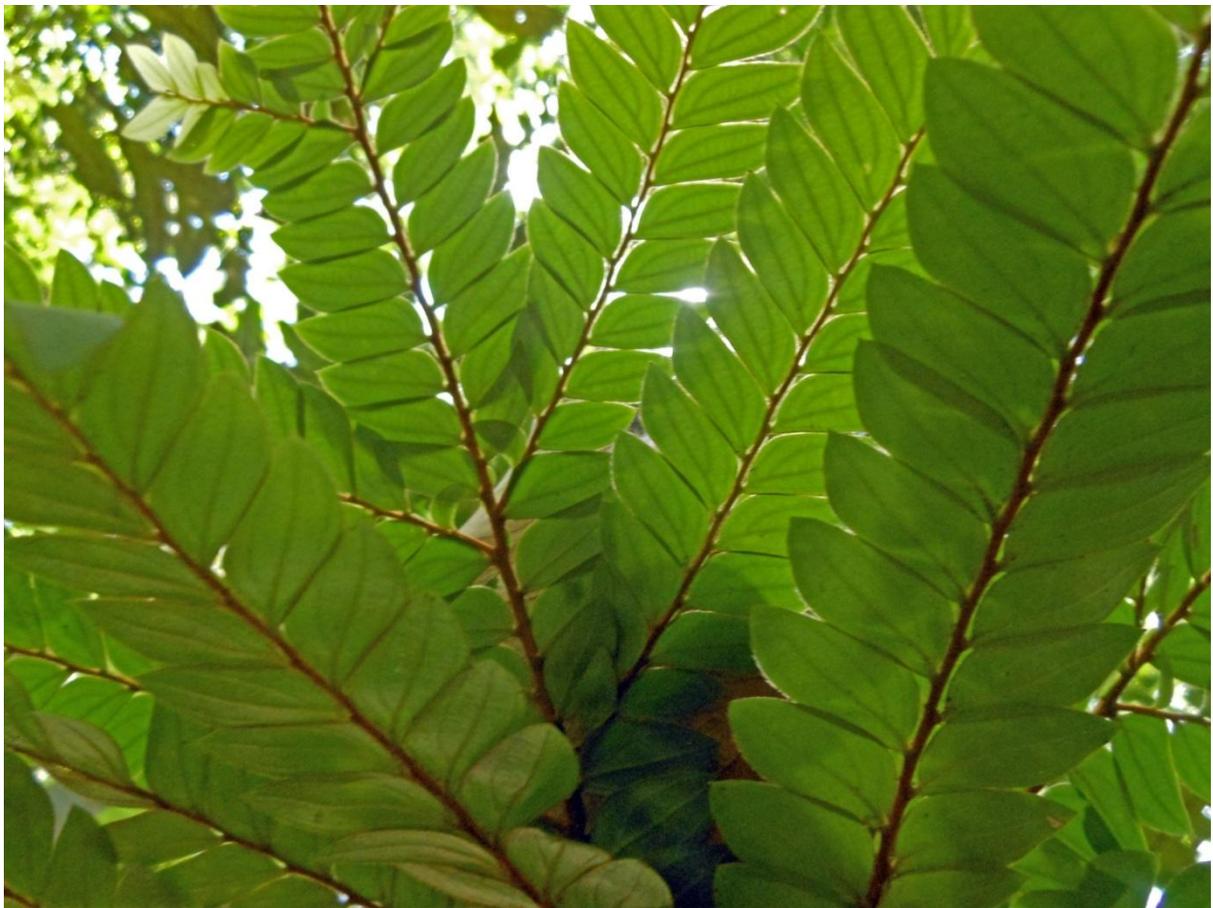


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**LEAF TECHNICAL GUIDANCE SERIES FOR THE
DEVELOPMENT OF A NATIONAL OR SUBNATIONAL
FOREST
MONITORING SYSTEM FOR REDD+**

**Module EM-H: Estimating Historical
Emissions from Deforestation**



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Module EM-H: Estimating Historical Emission from Deforestation

Winrock International

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ICONS WITHIN THE DOCUMENT

The icons below are found throughout the document and indicate areas that the reader should pay special interests to:

Icon	What does it signify?
	A key decision that must be made.
	A key technical step that must be accomplished before moving forward.
	The need for personnel with specified skill set
	An example
	A key term described in the framework
	A reference to relevant resource

1. SCOPE

This module provides guidance for estimating historical emissions  from deforestation. Historical emissions are determined by combining activity data  for deforestation and emissions factors  for deforestation over a defined period of time.

2. APPLICABILITY

This module is used as a first step in developing a reference level for deforestation only that can then be combined with modules used to estimate historical emissions and removals from other REDD+ activities. This module uses the AD-D module and the EF-D module to estimate historical emissions from deforestation, defined as the long-term or permanent conversion of forest land to non-forest land. The definition of forest is determined by each individual country.



Key prerequisite decisions, data and technical capacity (e.g. hardware, software and experts) must be fulfilled as described in the ‘Technical Guidance for the Development of a Terrestrial Carbon Monitoring System for REDD+ Framework’ document.¹

3. PRODUCTS

¹ Available on the LEAF website here: <http://www.leafasia.org/tools/technical-guidance-development-redd-reference-level>

The output of this module is emissions from deforestation at the national or subnational area, across all strata  and carbon pools , reported on an annual basis ($\text{tCO}_2\text{e.yr}^{-1}$). It is one component of a terrestrial carbon monitoring system for REDD+ outlined in the Framework document.

4. PREREQUISITE



The prerequisites to complete this module are as follows:

A. A “look-up table” of activity data for deforestation

This is the quantity of the activity (e.g. area of change) by stratum and deforestation driver, and divided into relevant time periods (see example in Table 2 from the AD-D module). This provides a “look-up table” of activity data for deforestation—the output of module AD-D of this series.



Guidance on how to develop activity data for deforestation can be found module AD-D of this series.

B. A “look-up table” for emission factors

This is the estimates of the standing stock of carbon in all selected pools by stratum and deforestation driver—the output of module EF-D of this series. Look-up tables will be updated periodically to account for any improvements in carbon stock  estimates, changes in the practices by the drivers of land use/land cover change, and changes in mean biomass stocks attributed to shifts in age distributions, climate, and or disturbance regimes.²



Guidance on how to develop emission factors for deforestation can be found in module EF-D of this series.

5. PROCEDURES

The basic methodology used to calculate emissions is to multiply activity data by an emission factor. The general formula is:

$$\text{Emissions} = \text{Activity Data} * \text{Emission Factor}$$



When estimating historical emissions it is important to ensure that:

- The units used for the emission factors (e.g. $\text{tCO}_2\text{e.ha}^{-1}$) and the units used for the activity data (e.g. ha.yr^{-1}) match so that emissions are expressed correctly in tonnes of carbon dioxide equivalent per year ($\text{tCO}_2\text{e.yr}^{-1}$).
- Historical emissions are calculated by the identified strata.
- Emissions for the selected stratum are summed across strata to provide total emissions from deforestation.

² GOF-C-GOLD, 2009

To facilitate the estimation of historical emissions, it is recommended that a calculator tool be created for the input of activity data and emission factors for deforestation. The calculator can be designed to combine the activity data with emission factors to produce estimates to emissions over different time frames for each activity, and once the tool is deemed to be error free it can be used over time for consistency of calculations.

Once all activity data are available and all emissions factors have been calculated based on carbon stocks, as explained in the prerequisite section, these can be combined, using the calculator tool to produce historical emissions. A separate table can be created, as shown in Table 1.



Table 1: Example table for area of deforestation, by forest stratum and deforestation driver.

Col = column.

Post deforestation land use class (Driver of deforestation)	Carbon stratum	AD per time period		EF (Col 3)	Estimated Historical Emissions	Estimated Historical Emissions
		2000-2005 (Col 1)	2005-2010 (Col 2)		2000-2005 (Col 1 x Col 3)	2005-2010 (Col 2 x Col 3)
		ha yr ⁻¹			tCO _{2e} .ha ⁻¹	tCO _{2e} .yr ⁻¹
Agriculture (Driver of deforestation - Agriculture)	A	265	163	1,082	286,730	176,366
	B	18	8	400	7,200	3,200
	C	246	160	760	186,960	121,600
	D	237	307	900	213,300	276,300
Bare land (Driver of deforestation - Mining)	A	487	16	1,300	633,100	20,800
	B	218	0	450	98,100	0
	C	1018	4	800	814,400	3,200
	D	143	43	1,050	150,150	45,150

Uncertainty must be calculated for historical emissions, using either the Tier I method of error propagation or the Tier II method of a Monte Carlo analysis. Both of these are described in full in the data analysis module.

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