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Draft methodologies for frontier and mosaic deforestation

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Promoting Transformation by Linking Natural Resources, Economic Growth, and Good Governance

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Key components of a REDD methodology

- Additionality
- Baseline GHG emissions
- Actual GHG emissions
- Leakage
- Net GHG emission reductions
- Monitoring plan
- (Social, Economic, and Environmental Impacts)

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Additionaliy

- A REDD project activity that would happen in absence of carbon incentives should not lead to "fungible" credits ("tropical hot air").
- Problem for "early start" projects.
- The draft methodologies propose to use the EB approved "additionality tool".

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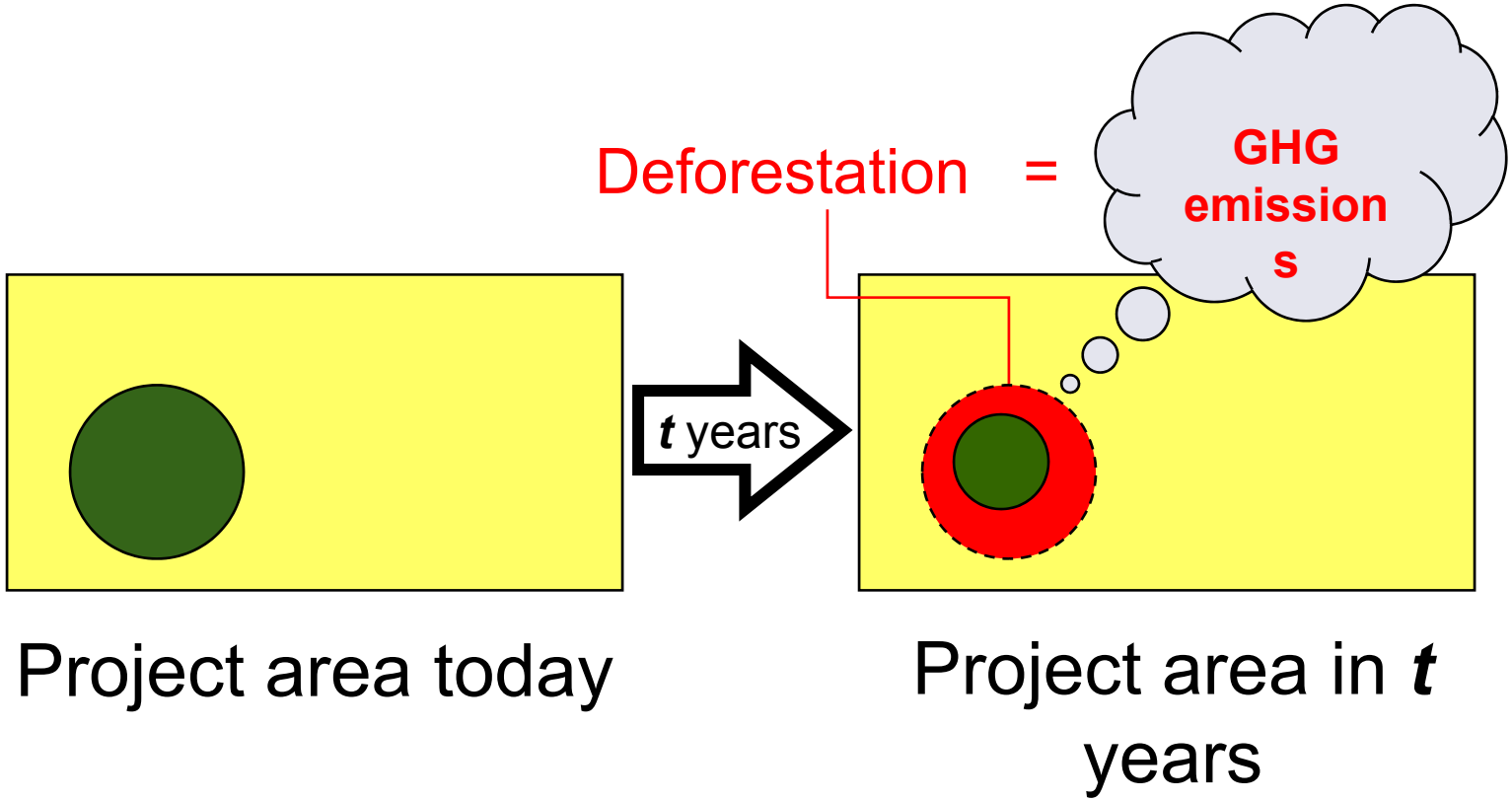
Baseline GHG emissions

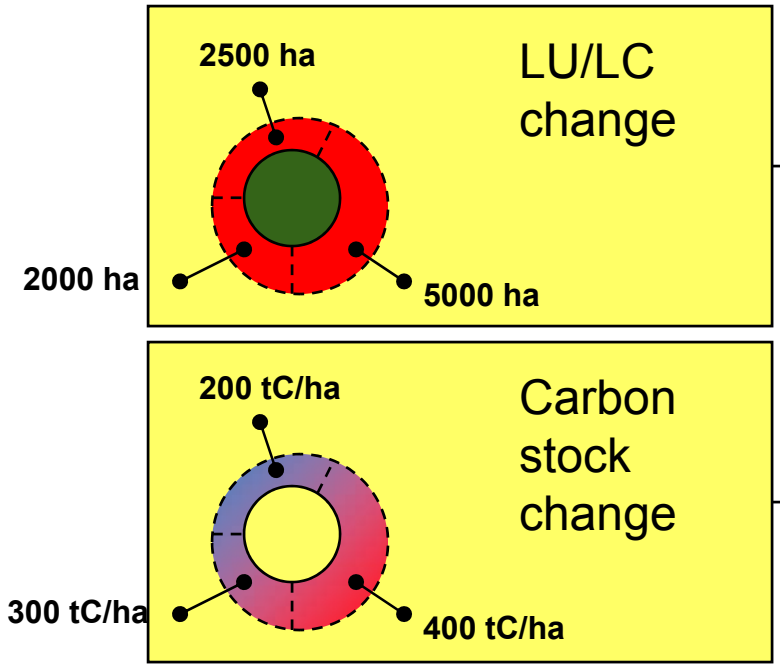
What would happen to the forest in absence of the REDD project activity?



Baseline GHG emissions

Two components:

- Land-use and land-cover change
- Associated carbon stock changes



ha	tC/ha	tC	tCO2e
2.500	200	500.000	1.833.333
2.000	300	600.000	2.200.000
5.000	400	2.000.000	7.333.333
9.500		3.100.000	11.366.667

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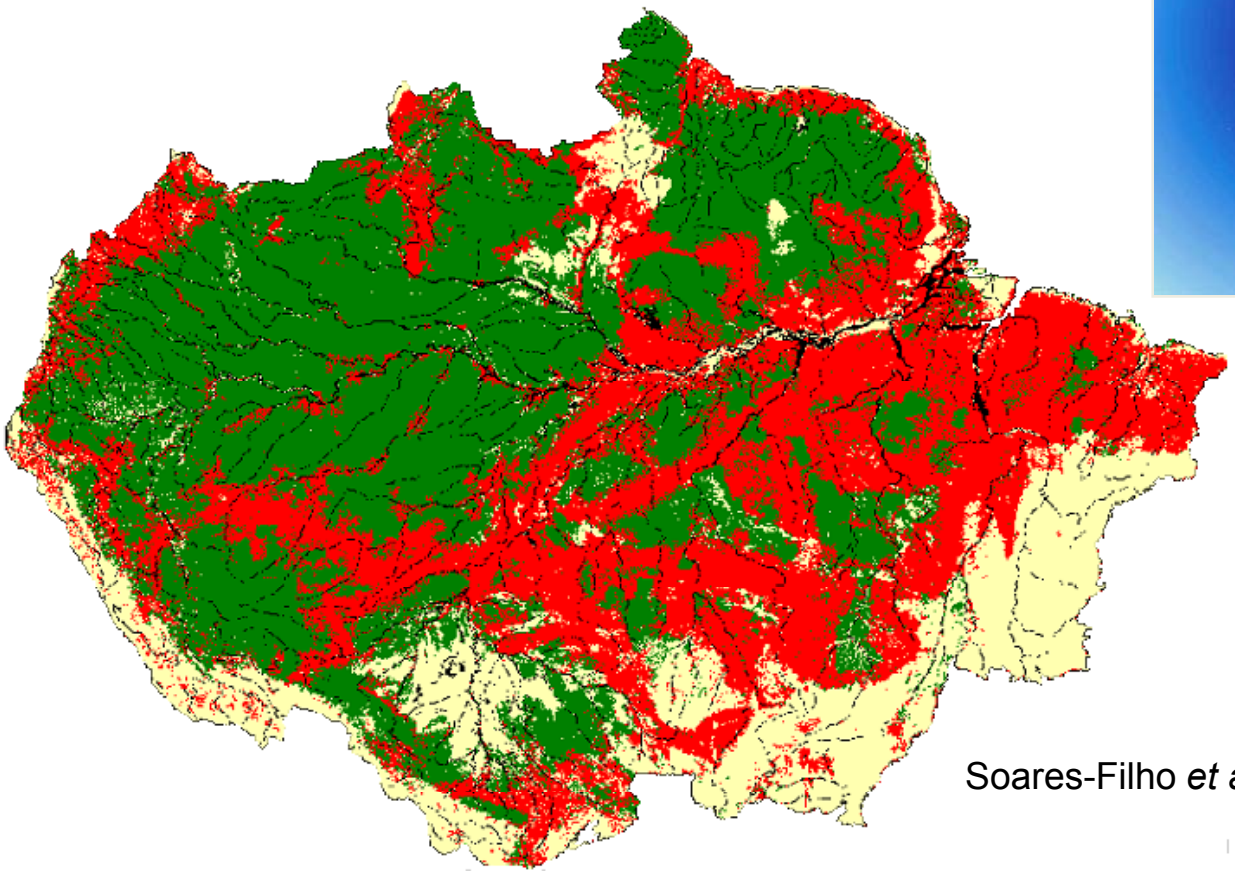
Example: Amazon Basin

Business as Usual Deforestation Scenario =

2,698,735 km^2 will be deforested by 2050



Soares-Filho *et al.* 2006

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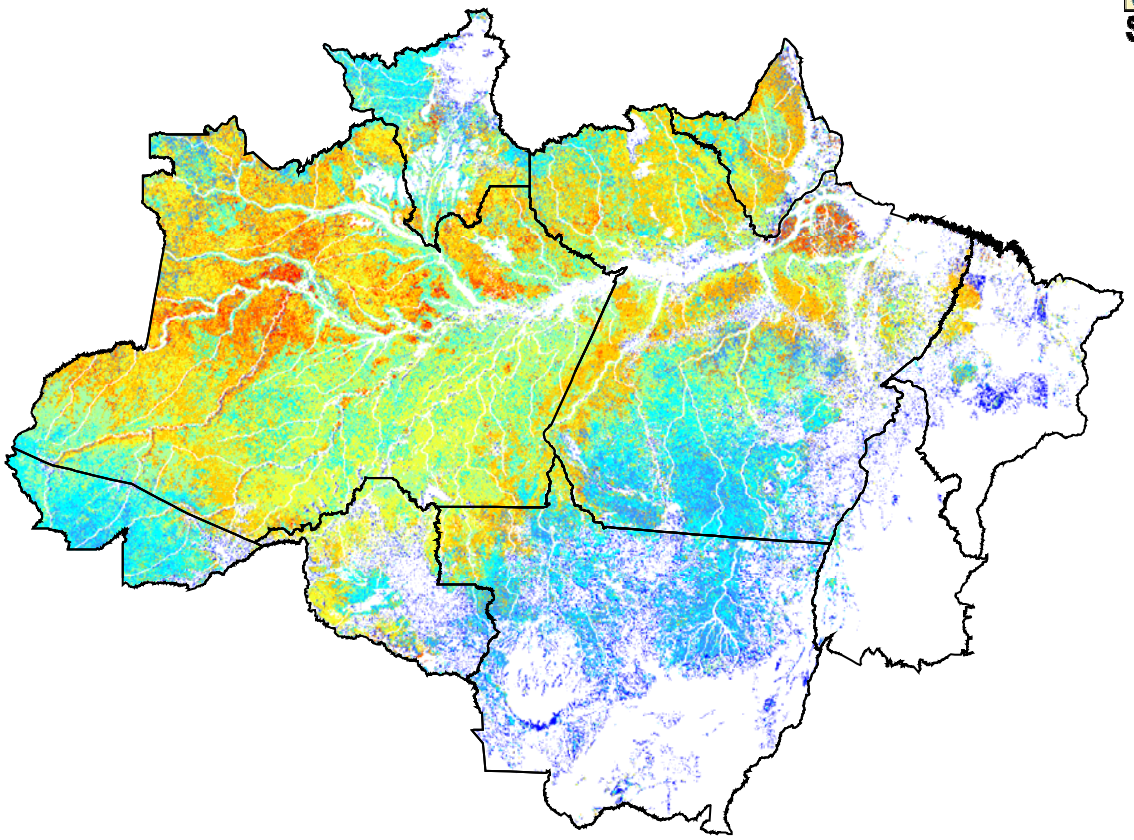
Example: Brazilian Amazon Carbon stock changes

AMAZON SCENARIOS



225 tons/hec.

0 tons/hec.

Saatchi et al., 2007

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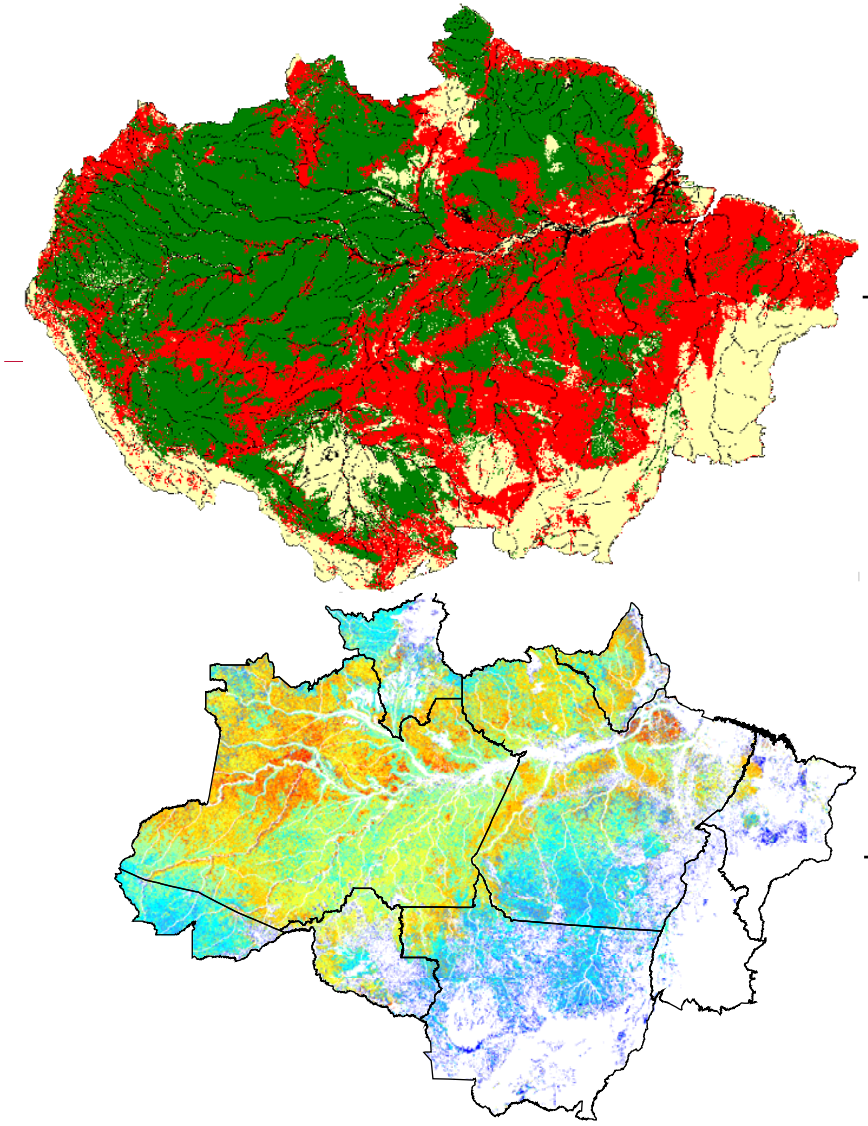
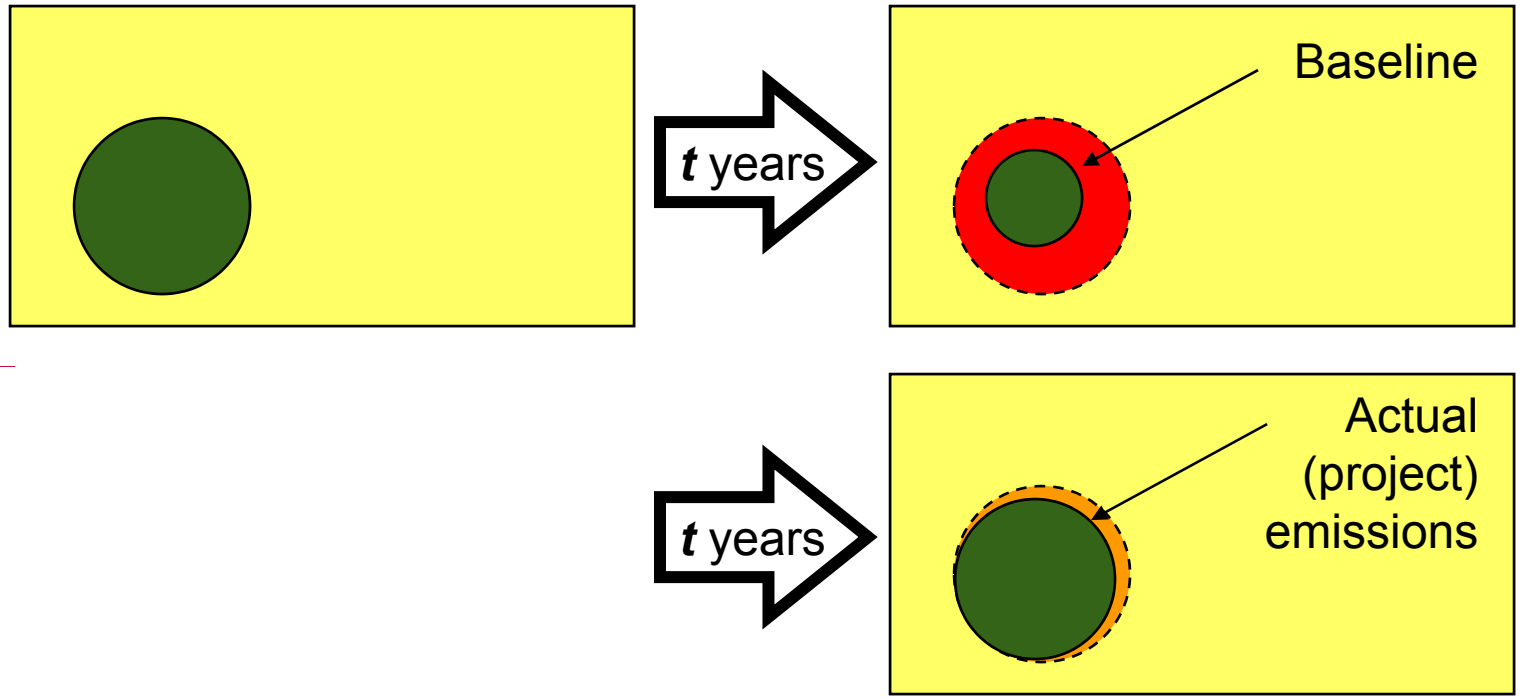
Example: Brazilian Amazon
Baseline GHG emissions 2007-2050



≅ 47 billions of tons of Carbon

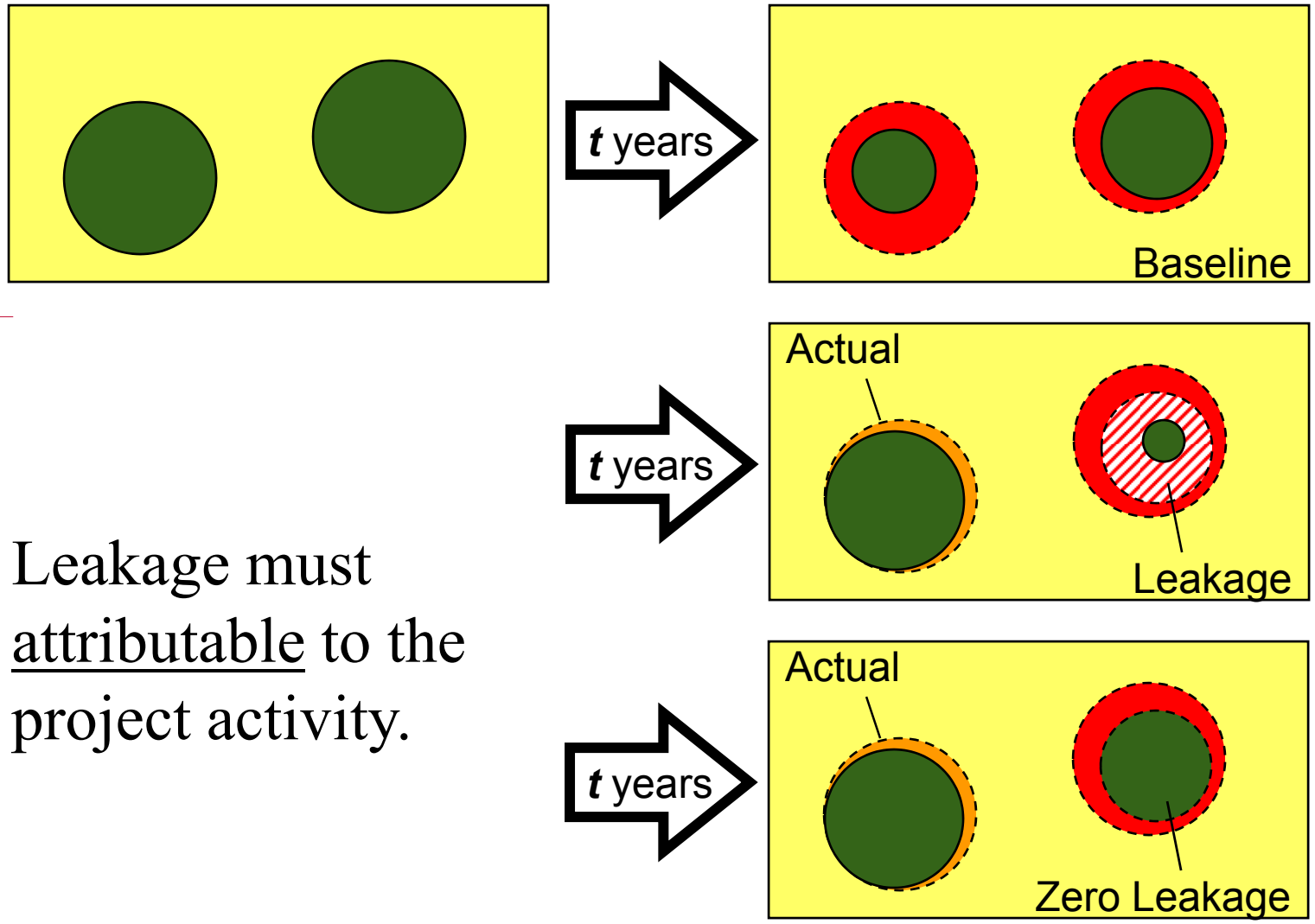
≅ 172.3 billions of tons of CO_2e

Actual GHG emissions



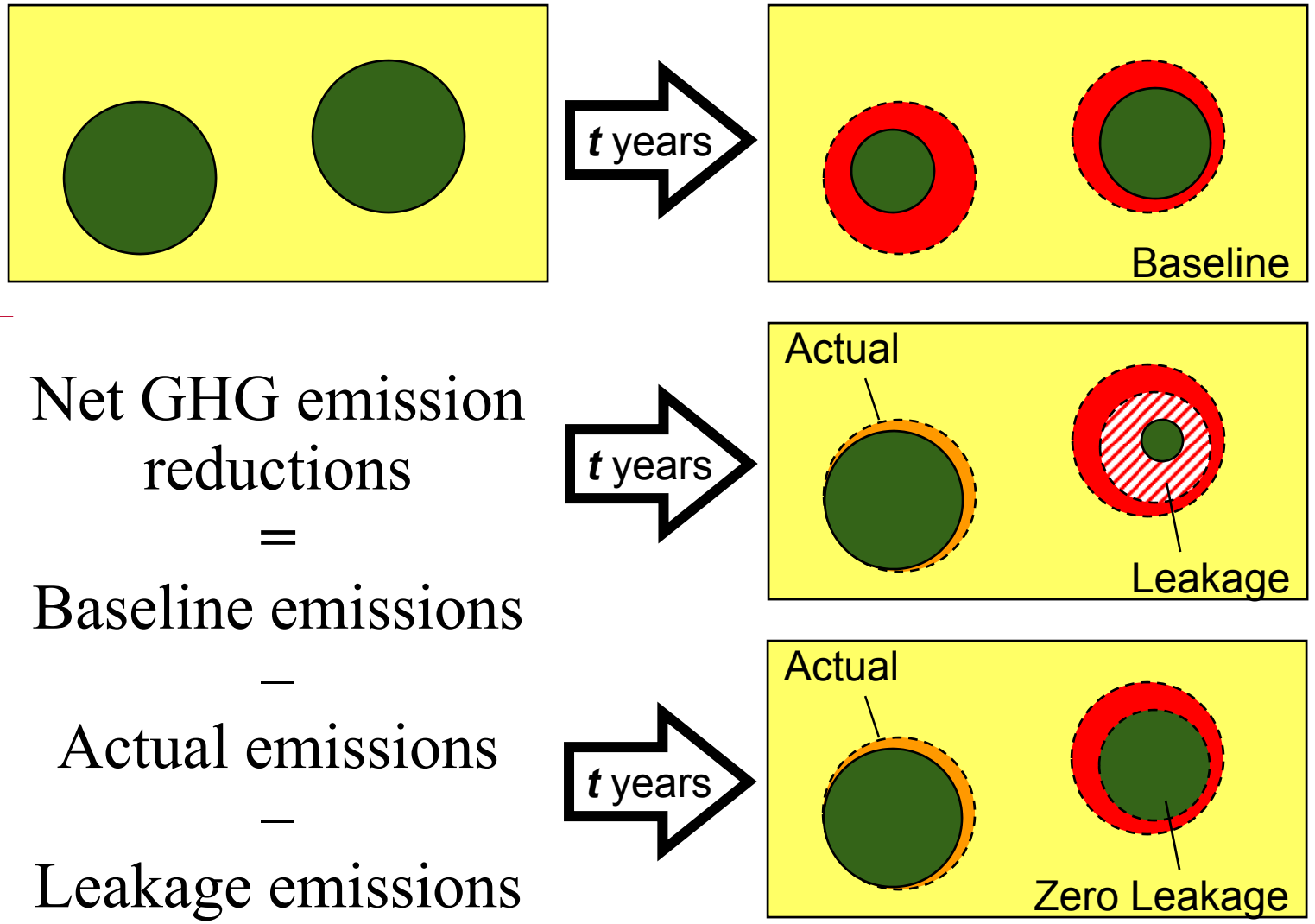
Actual GHG emissions are calculated exactly in the same way as baseline emissions: Sum of the products of predicted (*ex ante*) or observed (*ex post*) forest loss times the carbon stock change.

Leakage



Leakage must attributable to the project activity.

Net GHG emission reductions



Net GHG emission reductions

=

Baseline emissions

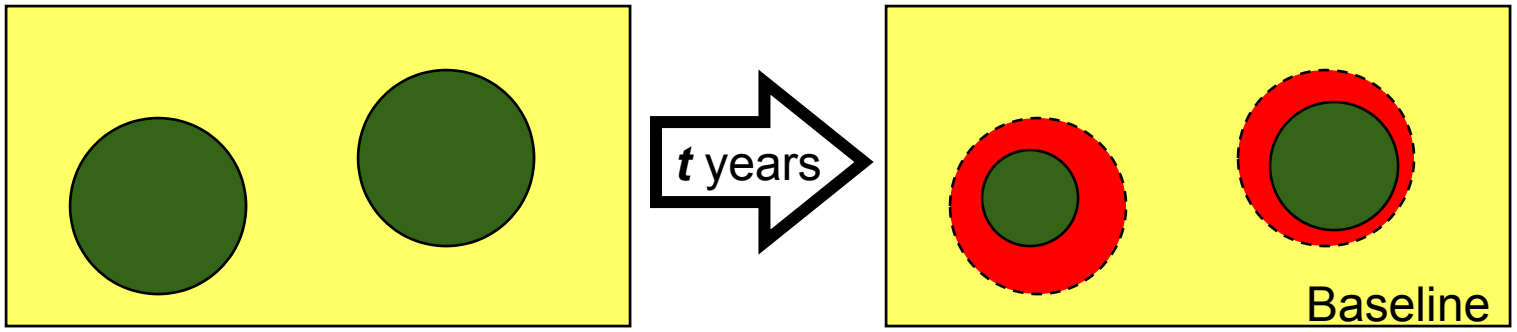
–

Actual emissions

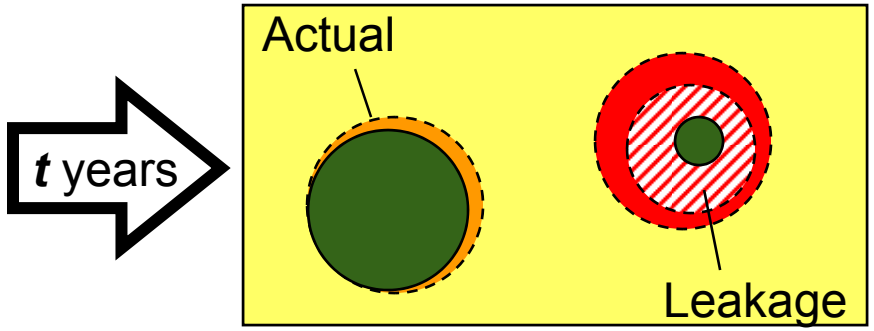
–

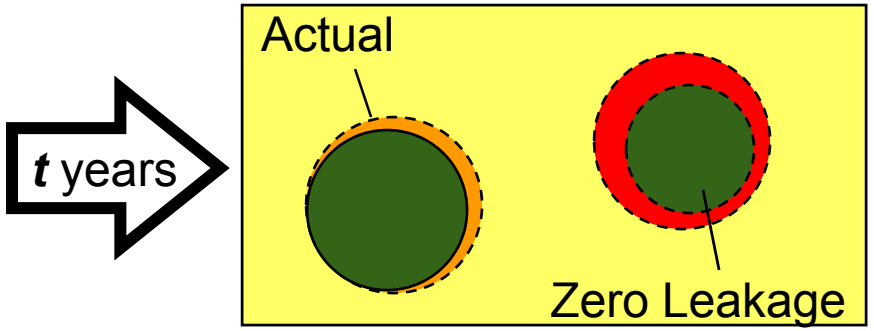
Leakage emissions

Monitoring plan



1. Actual emissions
2. Leakage emissions
3. Agents and drivers of DD to revisit the baseline periodically
4. (Impacts)





Basic *ex ante* methodology steps

Step 1. Definition of project boundaries

↓

Step 2. Analysis of historical Land-Use and Land Cover Change

↓

Step 3. Analysis of agents, drivers and underlying causes of deforestation

↓

Step 4. Projection of the rate and location of future deforestation

↓

Step 5. Identification of land-use and land cover classes

↓

Step 6. Estimation of baseline carbon stock changes

↓

Step 7. Estimation of actual carbon stock changes and non-CO_2 emissions

↓

Step 8. Estimation of possible leakage

↓

Step 9. Calculation of net anthropogenic GHG emission reductions

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Step 1: Definition of project boundaries

Mosaic Deforestation Frontier Deforestation

Spatial Boundaries

Temporal Boundaries

Carbon Pools

Sources of non-CO_2 gases

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Step 1: Definition of project boundaries

Spatial boundaries

Mosaic Deforestation Frontier Deforestation

Project area

Reference region

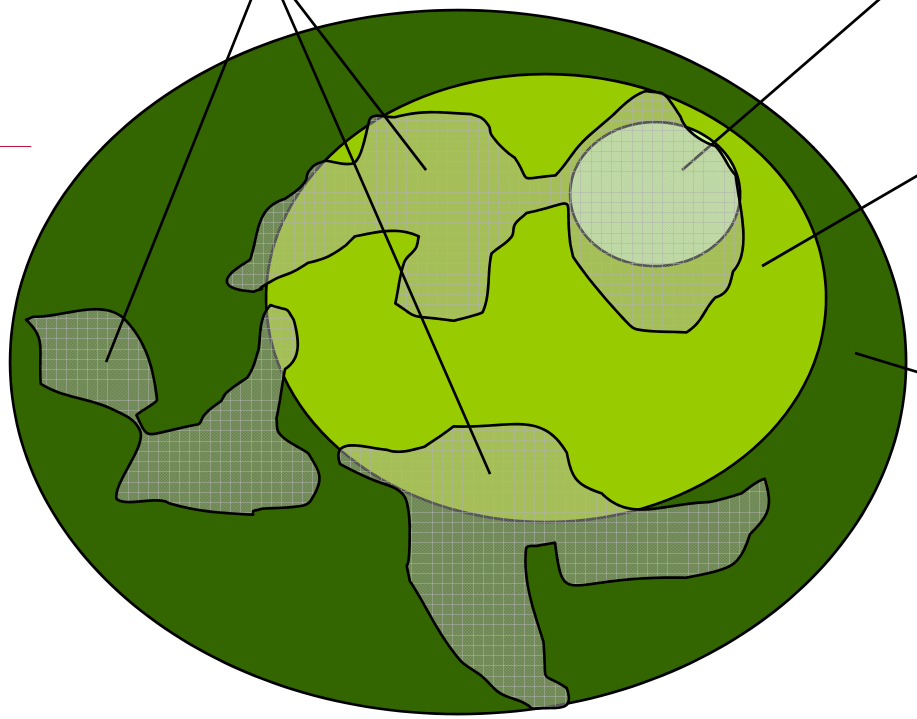
Leakage belt

A leakage belt is not required in most cases (deforestation agents come from outside)

Forest

Spatial Boundaries

Forest = Area that is actually "forest land" at the start of the project activity



Project area = Area to be protected / managed

Leakage belt = Area where pre-project activities could be displaced

Reference region = Domain from which information on DD agents, drivers and rates is extracted and projected.

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Step 1: Definition of project boundaries

Temporal boundaries

Mosaic Deforestation Frontier Deforestation

Historical reference period (past 10-15 years)

Project term (duration of the project activity, 20-100 years [VCS])

First crediting period (≤ 10 years [VCS])

Monitoring period (≥ 1 year ≤ 1 crediting period)

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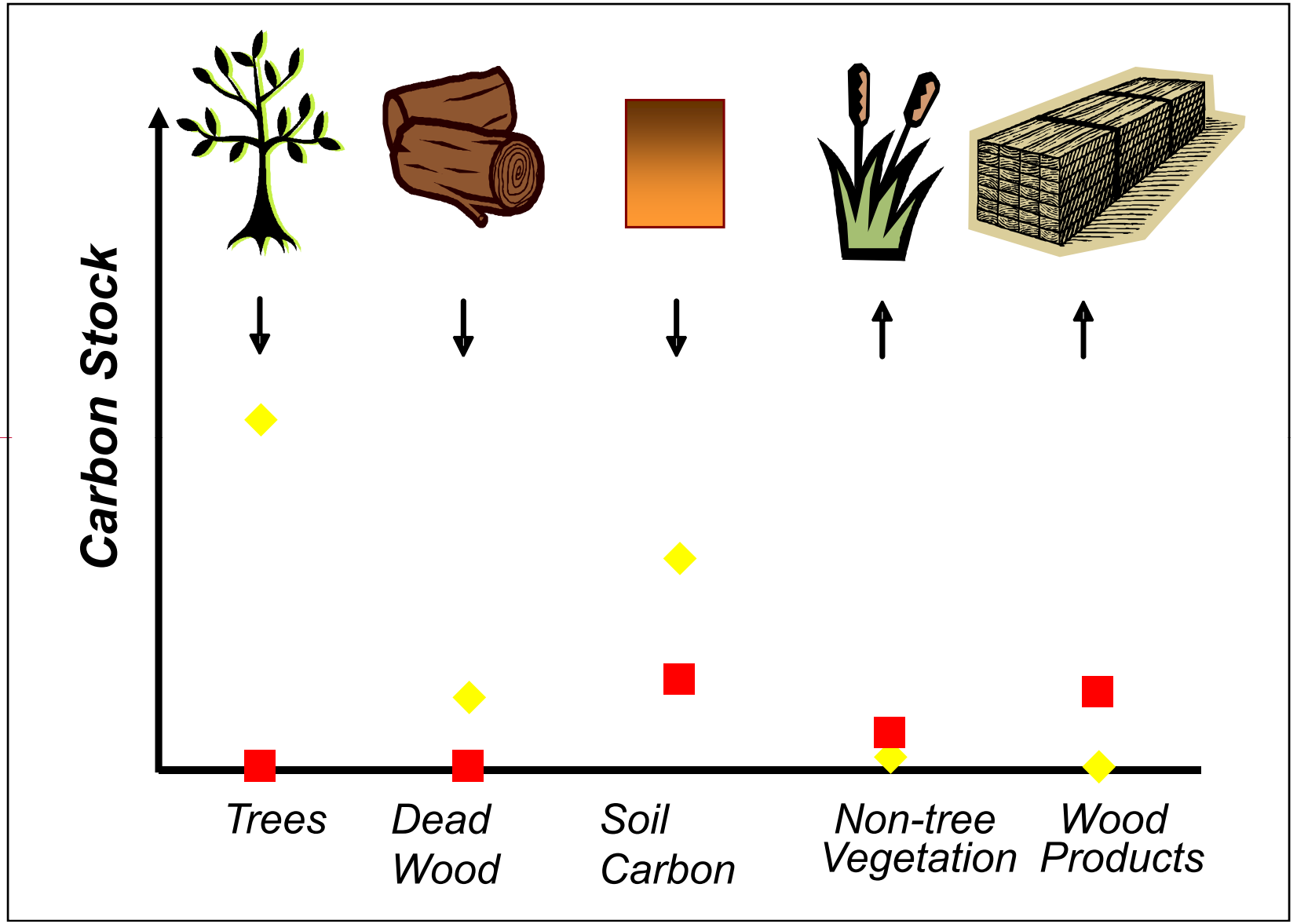
Step 1: Definition of project boundaries

Eligible Carbon Pools

Mosaic Deforestation Frontier Deforestation

- Above-ground biomass
- Below-ground biomass
- Dead wood
- Harvested wood products
- Litter
- Soil Organic Carbon



Before Deforestation

After Deforestation

(Brown *et al.*, 2007)

Step 1: Definition of project boundaries

Sources of non-CO_2 gases

Mosaic Deforestation

Frontier Deforestation

Sources	Gas	Included/TBD/ excluded	Justification / Explanation
~~Biomass~~ burning	CO_2	Excluded	Counted as *carbon stock* change
	CH_4	TBD	
	N_2O	TBD	
Combustion of fossil fuels by vehicles	CO_2	TBD	
	CH_4	Excluded	Not a significant source
	N_2O	Excluded	Not a significant source
Use of fertilizers	CO_2	Excluded	Not a significant source
	CH_4	Excluded	Not a significant source
	N_2O	TBD	
Livestock emissions	CO_2	Excluded	Not a significant source
	CH_4	TBD	
	N_2O	TBD	

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Step 2: Analysis of historical Land-Use and Land-Cover Change

Mosaic Deforestation Frontier Deforestation

Collection of appropriate data sources

Definition of classes of Land-Use and Land-Cover

Definition of categories of LU/LC-change

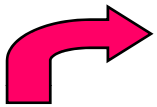
Analysis of LU/LC-change

Map current forest and forest types

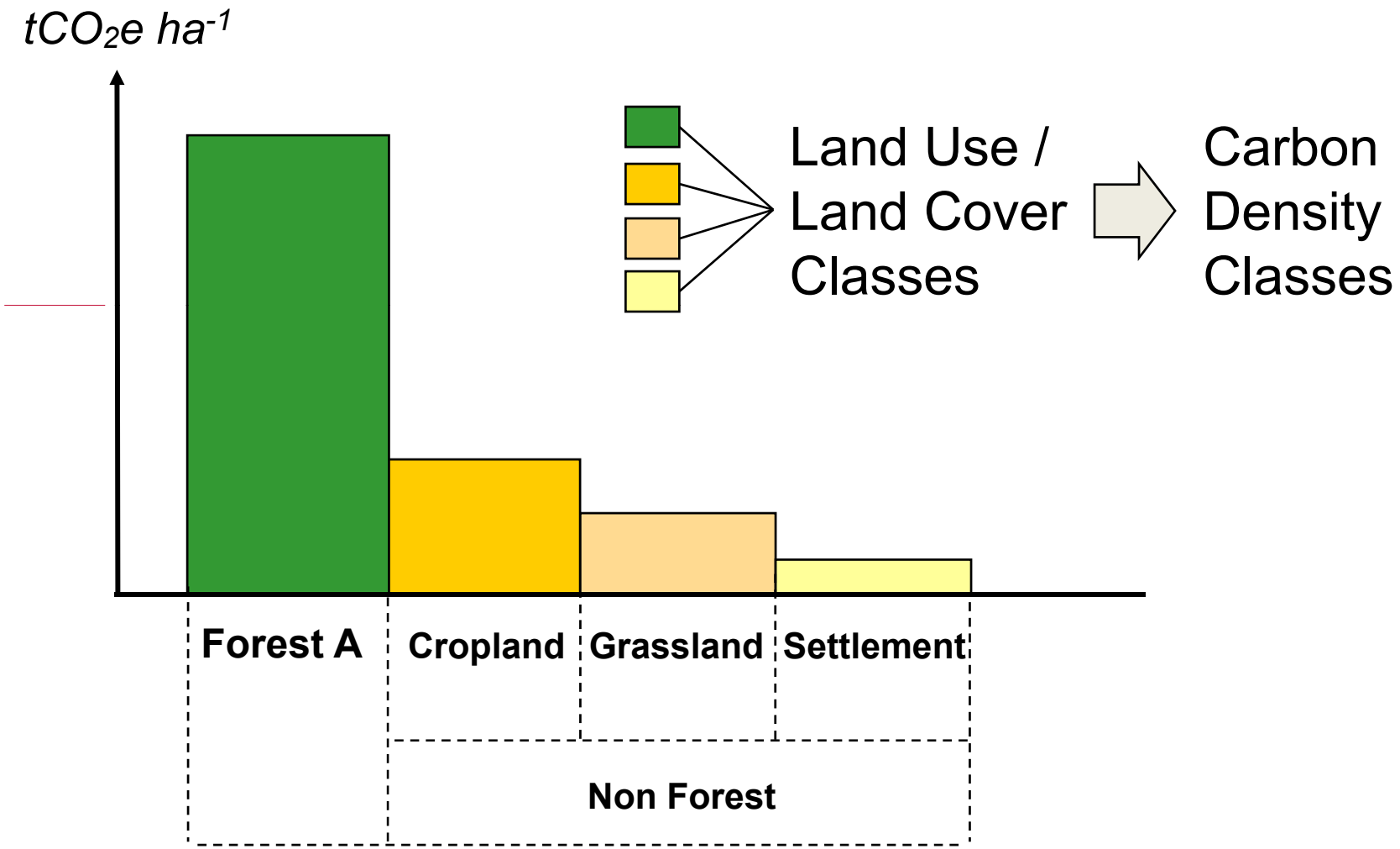
Map accuracy assessment

Methodology annex to the PDD

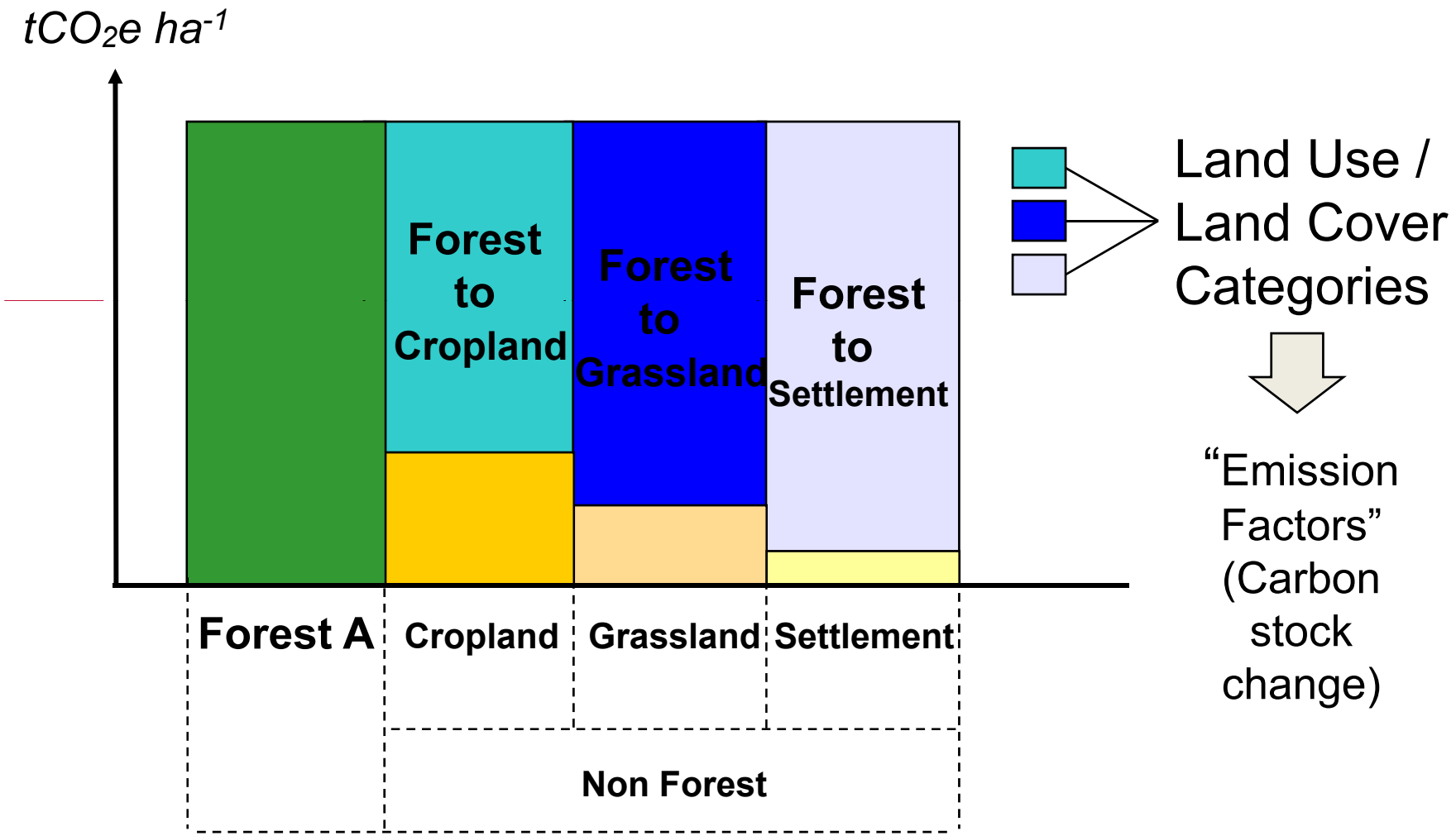
Classes and *Categories*

	**Grassland**	**Cropland**	**Settlement**
Forest A	Forest A to Grassland	Forest A to Cropland	Forest A to Settlement
Forest B	Forest B to Grassland	Forest B to Cropland	Forest B to Settlement
Forest C	Forest C to Grassland	Forest C to Cropland	Forest C to Settlement

Land-Use and Land-Cover *Classes*

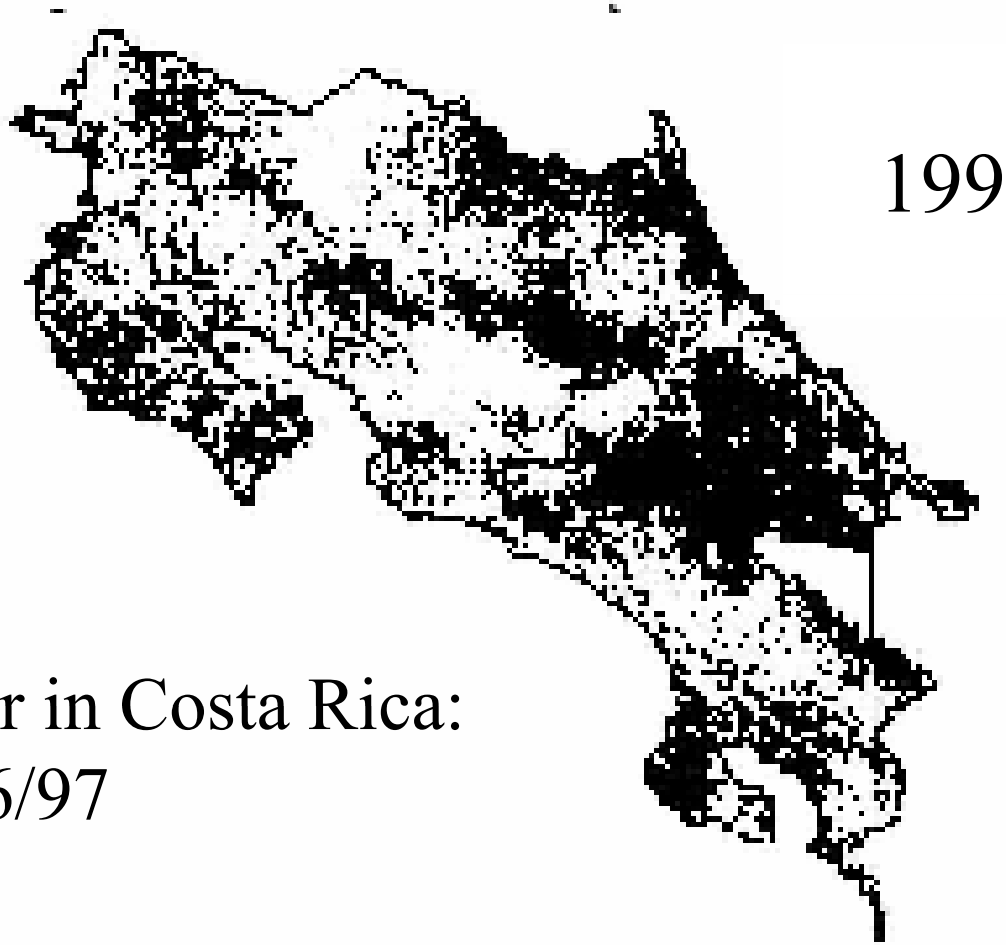


Land-Use and Land-Cover *Change Categories*



Analysis of LU/LC-change

Example: Costa Rica

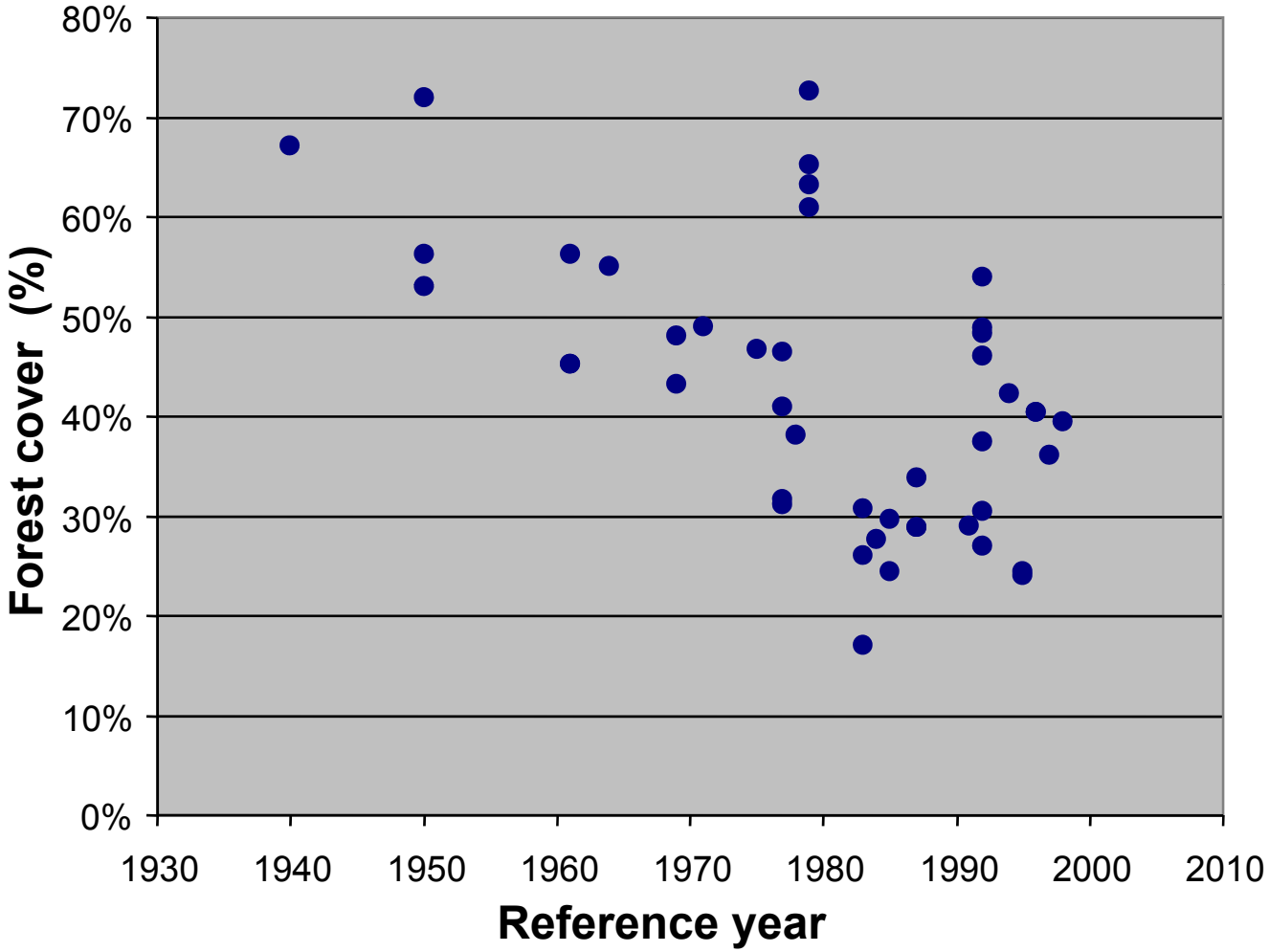


1996/97

Forest cover in Costa Rica:
1940 - 1996/97

More forest or different methodologies?

Published forest cover data for Costa Rica



(Kleinn, 2000)

Each dot is a published number

Documentation of the methodology used for LU/LC-change analysis is of foremost importance to achieve a consistent time-series of data

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Step 3: Analysis of deforestation agents, drivers and underlying causes of deforestation and degradation

Mosaic Deforestation	Frontier Deforestation
Agents	
Inside the project area	Outside the project area
Drivers	
Underlying causes	
Analysis of chain of events	

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Step 4: Rate and location of future deforestation

Mosaic Deforestation	Frontier Deforestation

Rate = hectares per year

- Historical trend within reference region (stratified as needed).
- Analysis of constraints.
- Model based on predictions of population density, prices of agricultural commodities, etc.

- Historical trend as associated to spatial features and time.
- Analysis of constraints.
- Model based on predictions of development of infrastructure.

Location of future deforestation

- Spatial model is not required to demonstrate threat but in most cases it is required to match location with carbon stock changes.

- A Spatial model is required to demonstrate that the project area is under threat and to match location with carbon stock changes.

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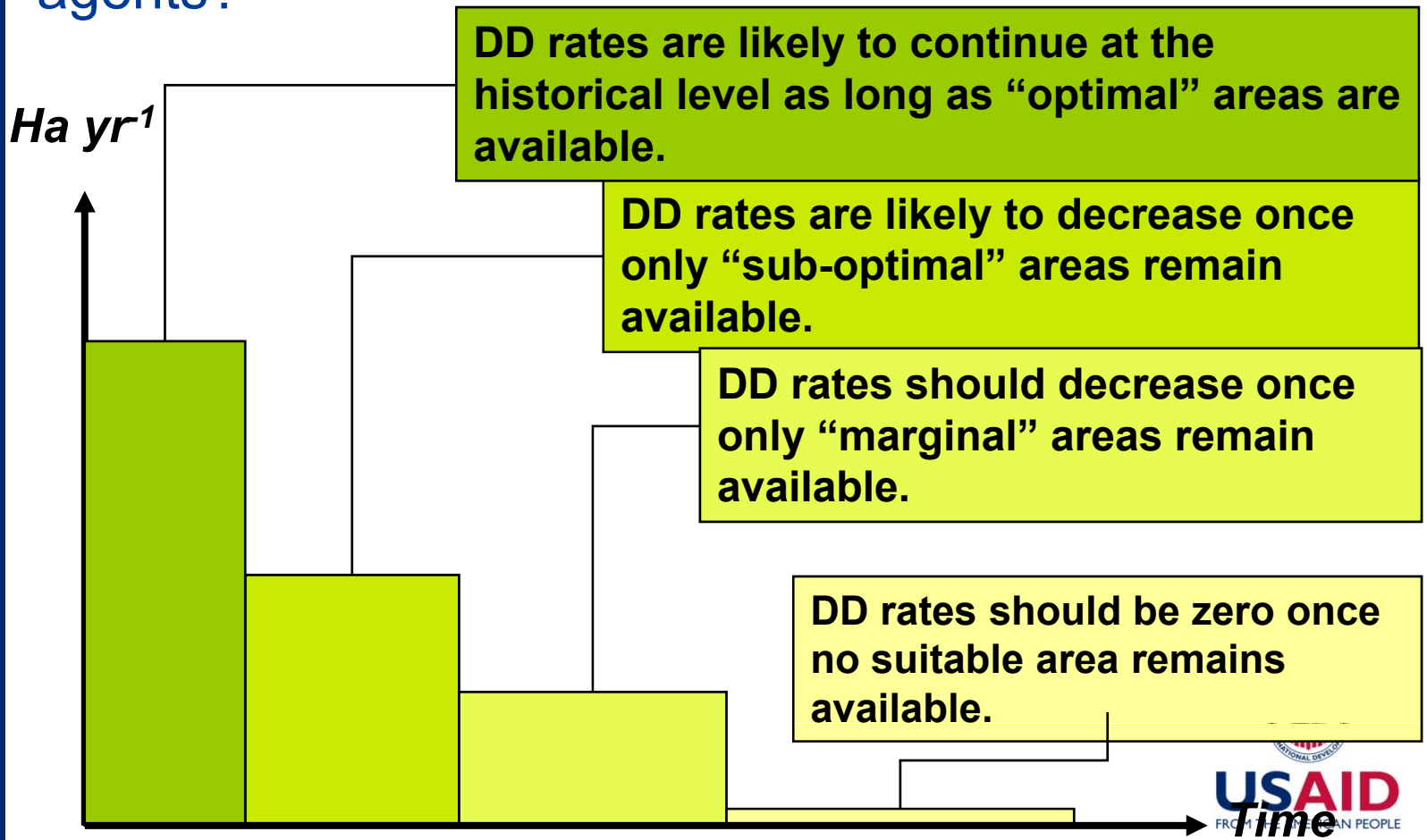
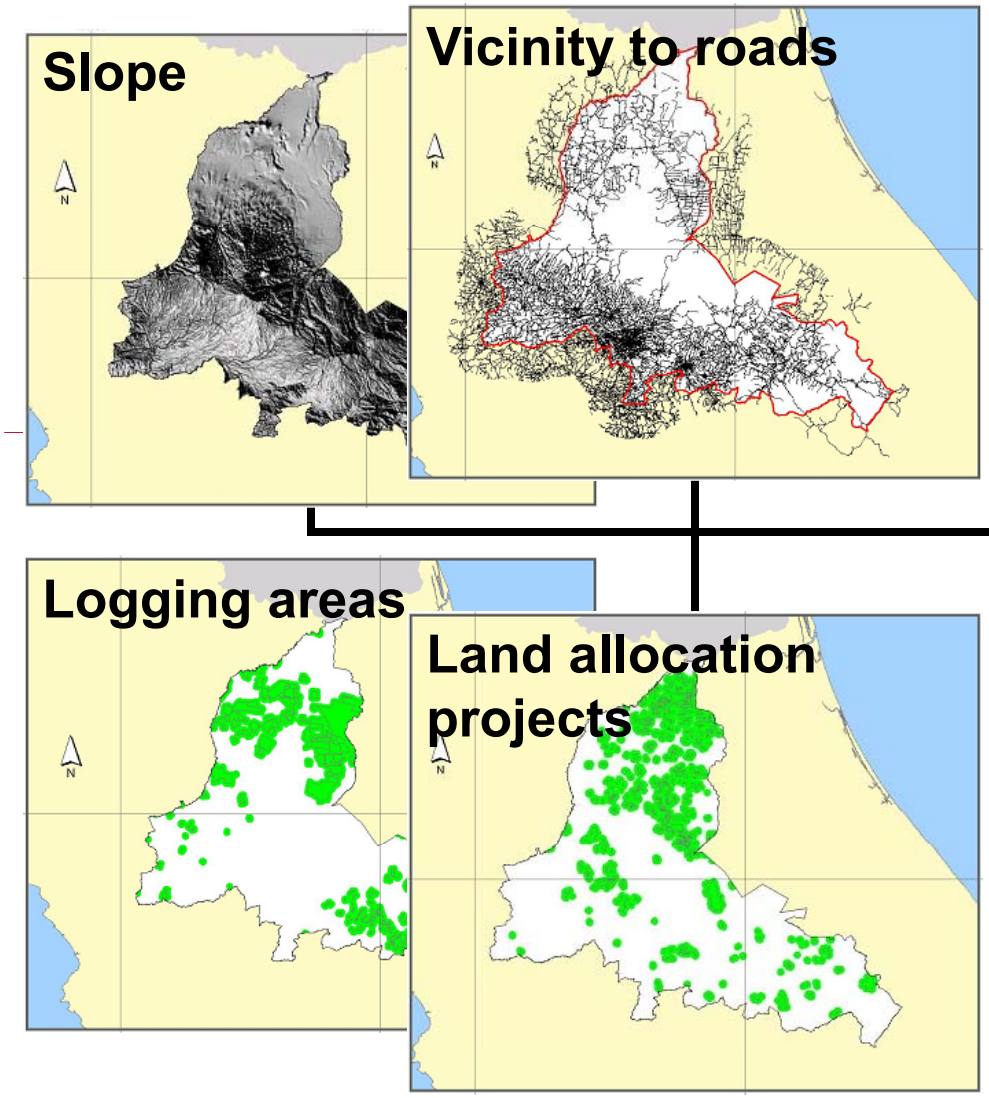
Analysis of constraints

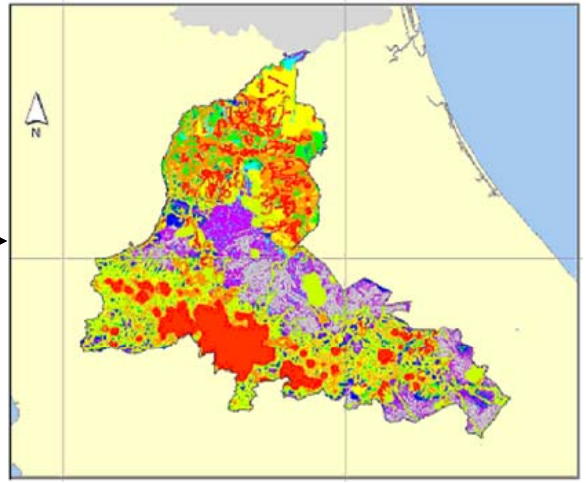
Is the project area really suitable for conversion to non-forest according to the decision criteria of deforestation agents?



Analysis of location of future deforestation



"Suitability" Map for deforestation



Costa Rica (1996-2006)
Ex post correlation with actual deforestation:
$r = 0.91$ ($p < 0.001$)

Spatial variables → Driver Maps

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Step 5: Identification of LU/LC classes

Mosaic Deforestation

Frontier Deforestation

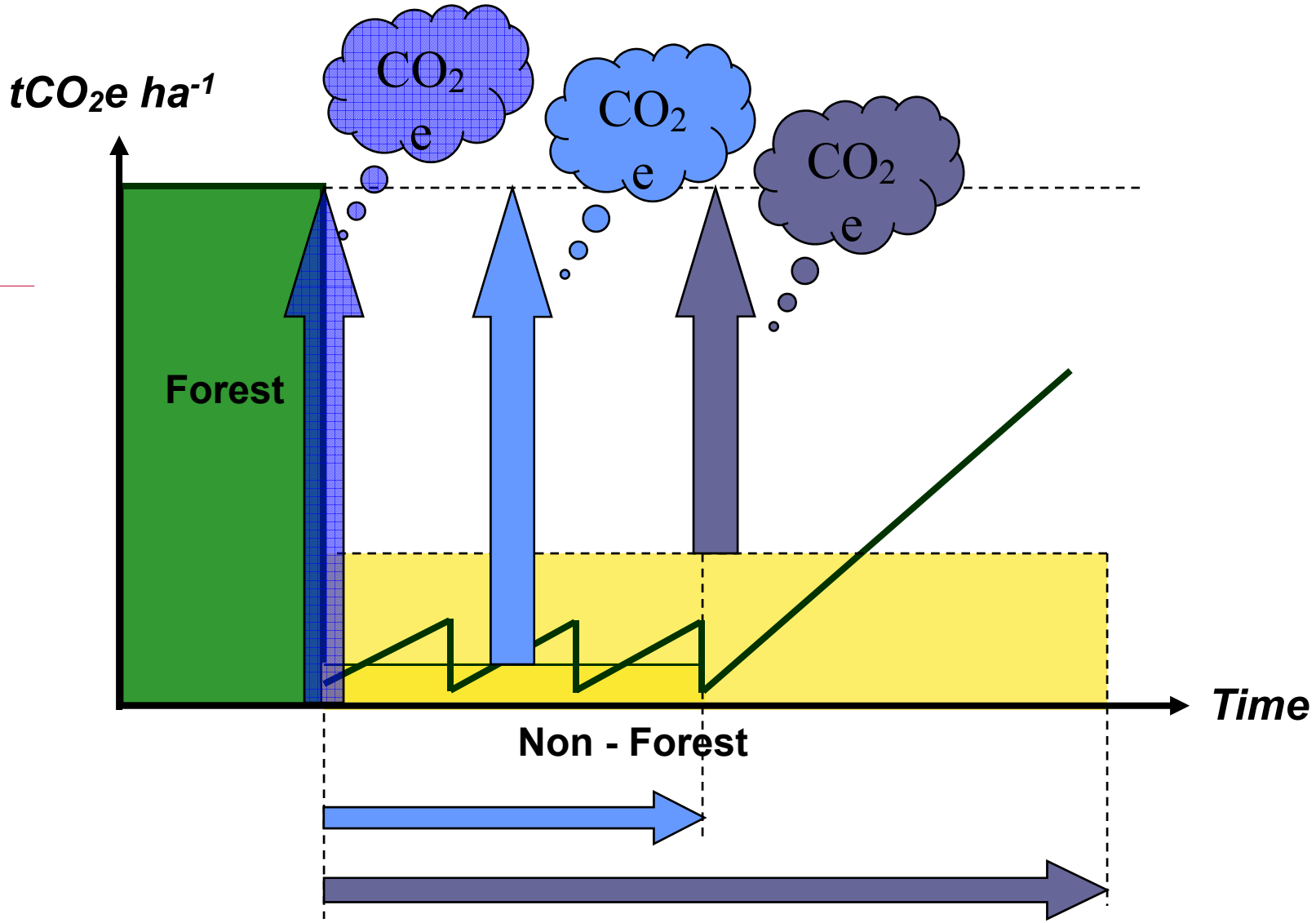
Match location with map of forest types

This is to locate the forest classes that need to be sampled for carbon stocks.

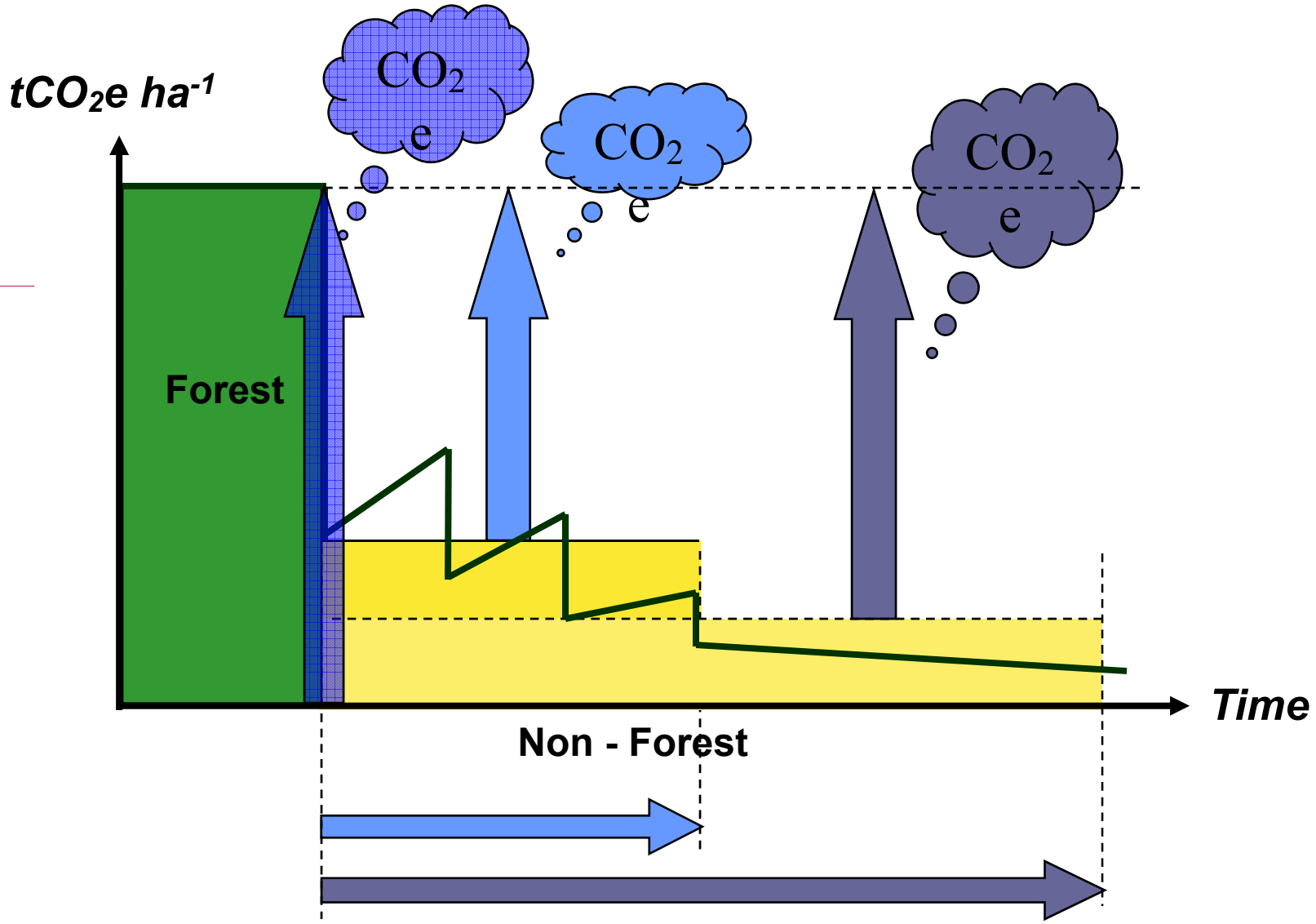
Estimate the carbon socks of each LU/LC class

Use sampling or applicable literature data to estimate the carbon stocks of the forest classes that would be deforested under the baseline scenario AND of the land-use/land-cover classes that would be established on deforested land in absence of the project activity.

Fate of the land after deforestation



Fate of the land after deforestation



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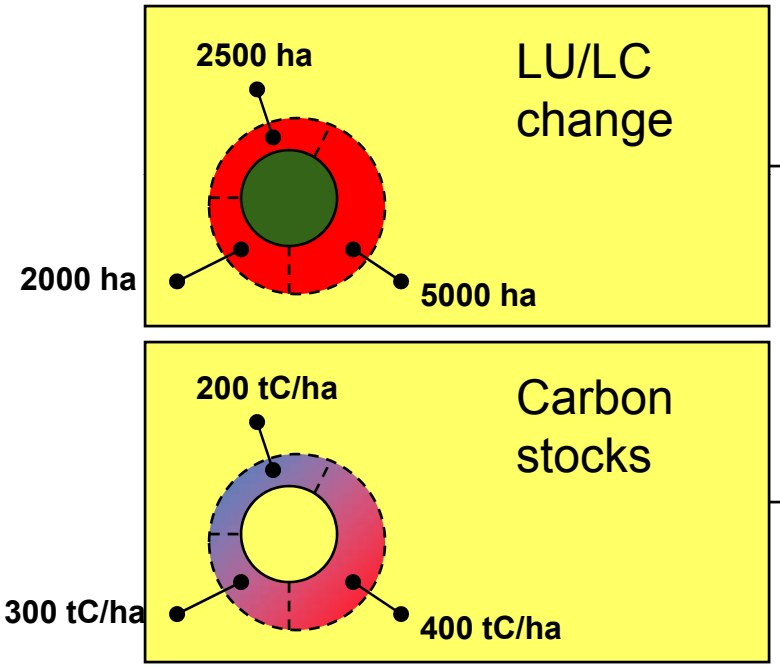
Step 6: Estimation of baseline GHG emissions



ha	tC/ha	tC	tCO2e
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2.000	300	600.000	2.200.000
5.000	400	2.000.000	7.333.333
9.500		3.100.000	11.366.667

As explained

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Step 7: Estimation of actual GHG emission

Mosaic Deforestation	Frontier Deforestation
Calculation as explained for the baseline	
Carbon stock enhancement in degraded or secondary forests that would be deforested under the baseline	
Must not be estimated and accounted.	
Carbon stock decrease in forests subject to management under the project scenario	
Must be estimated and accounted.	

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Mosaic Deforestation

Frontier Deforestation

Increased GHG emissions associated to project activities (leakage prevention measures)

Displacement of baseline activities

Activities implemented by pre-project communities and individuals (pre-project residents)

Activities implemented by deforestation agents that would encroach into the project area from outside

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Step 8: Estimation of potential leakage

Increased GHG emissions associated to project activities (leakage prevention measures)

Mosaic Deforestation

Frontier Deforestation

- GHG emissions associated to project activities implemented outside the project boundary.
- If these emissions are above pre-project levels and significant, they must be estimated and accounted as leakage.

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Step 8: Estimation of potential leakage

Displacement of baseline activities

Activities implemented by pre-project communities and individuals (pre-project residents)

Mosaic Deforestation

- A GHG emission baseline must be established for the land surrounding the project area where baseline activities could be displaced (**leakage belt**).
- *Ex post*, actual deforestation in the leakage belt is measured.
- If deforestation in the leakage belt is more than the baseline and attributable to activity displacement, this is counted as leakage.

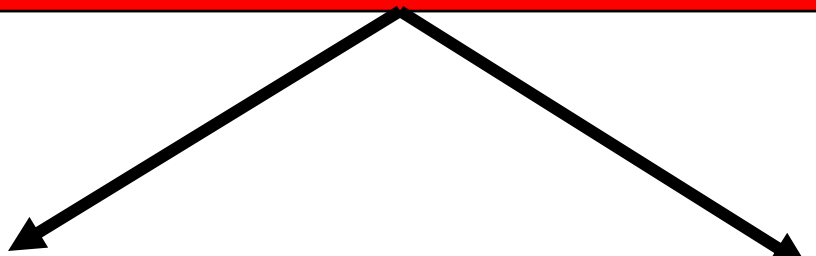
Frontier Deforestation

- Most likely not a significant source of leakage
- **Leakage belt** approach is optional.
- Methods of existing approved A/R CDM methodologies (AR-ACM0001 and AR-AM0004) can be used.

Displacement of baseline activities

Activities implemented by deforestation agents that would encroach into the project area from outside

Should this form of "leakage" be attributed to the project activity?



NO?

YES?

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Step 8: Estimation of potential leakage

Displacement of baseline activities

Activities implemented by deforestation agents that would encroach into the project area from outside

Mosaic Deforestation

Not considered in the current version of the methodology.

Frontier Deforestation

<u>Three options:</u>

Option 1: Time discount approach.

Option 2: Leakage liability transfer.

Option 3: Buffer of credits.

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Option 1: Time Discount

- It is assumed that the project activity will cause a 100% displacement of the baseline deforestation.
- The overall deforestation rate does not change compared to the baseline situation, but the total area of unprotected forest is reduced.
- As a consequence of the project activity, deforestation will stop earlier under the project scenario than under the baseline scenario.
- Using a 100-year time horizon, a discount rate of 1%, and the atmospheric carbon decay curve from the version of the Bern model used in the IPCC's Third Assessment Report, Fearnside (2007) calculated the net present value of avoiding the emission of one ton of CO_2 as being 0.6 tCO_2e.
- Thus, under option 1, leakage due to activity displacement is assumed to be 40% of the project's GHG emission reductions

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Option 2: Leakage liability transfer

- The liability for leakage is transferred from the REDD project activity to a broader REDD program (e.g. a state- or nation- wide REDD program).
- To demonstrate that leakage liability has been transferred, the following evidence must be provided:
  - A broader REDD program exists.
  - The duration of the REDD program is not less than the crediting period of the REDD project activity.
  - Any deforestation outside the boundary of the project activity will be detected by the monitoring plan of the broader REDD program and is included in its GHG accounting.

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Option 3: Buffer of credits

- A percentage of the credits issued for the emissions reductions is earmarked.
- The percentage to be earmarked is determined based on an objective assessment of the risk of leakage due to displacement of immigrant baseline activities.
- Earmarked credits are saved in a credit account that is not under the control of the project participants and are not available for trade. Earmarked credits can be transferred to a broader REDD program entity, as per option 2, once such a program is established.

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Thank you!

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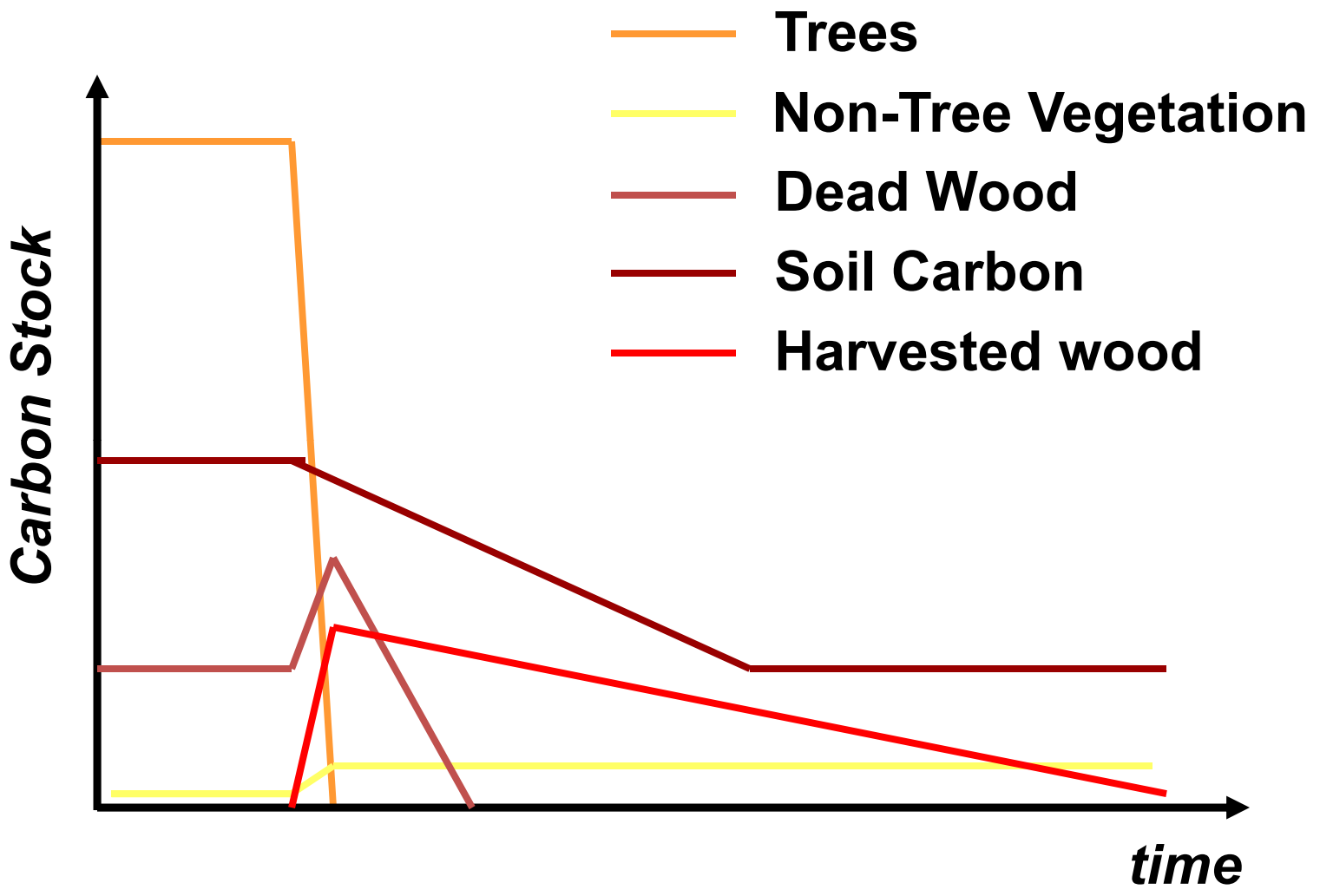

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