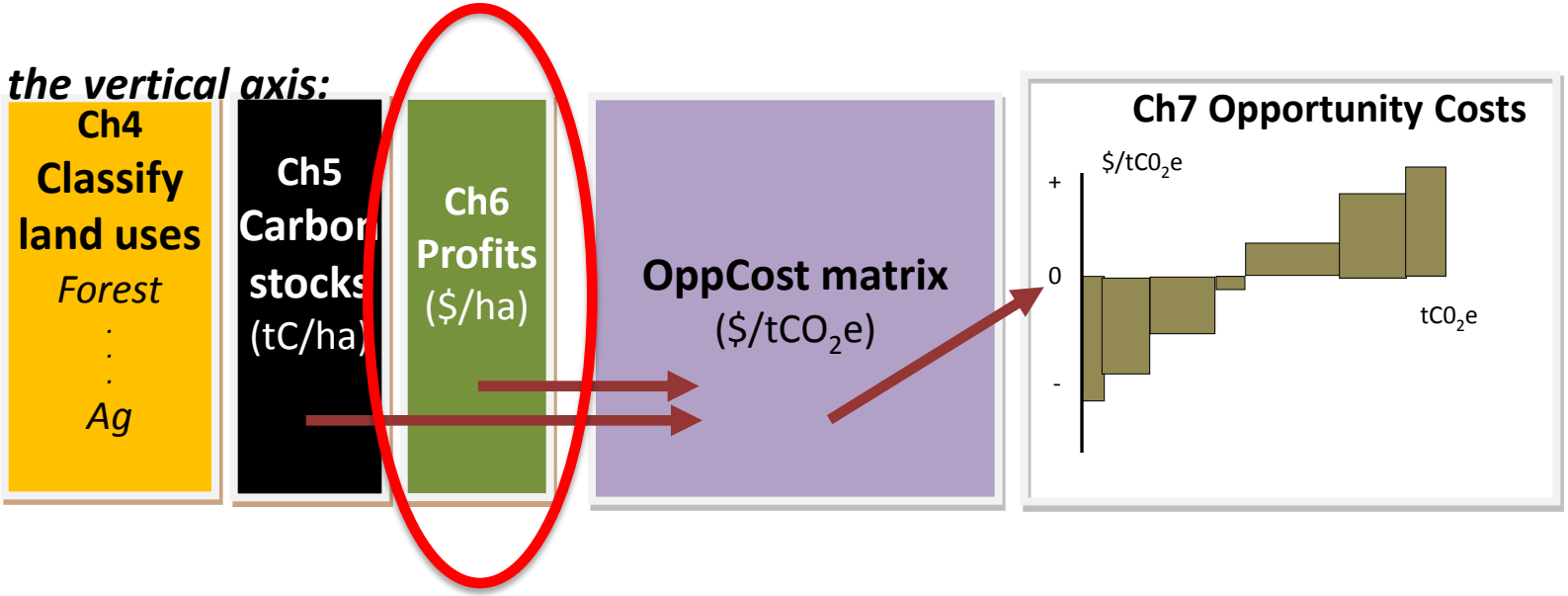
Profits from land uses

Douglas White, Jan Börner, Jim Gockowski

OppCost process

For the vertical axis:



Profits from land uses: Objectives

1. Present an analytical framework to estimate profits (forest, agriculture, livestock raising…)
2. Identify information sources of costs & revenues
3. Estimate budgets of land uses
4. Develop multi-year profit analysis of land use trajectories
5. Critically review methods and data

Introduction

Other terms for profit:

- **net benefits**
- **net revenues**
- **net returns**

***Profit* is a concise and convenient way to describe the concept of benefits – costs.**

Is profit the appropriate measure?

- **Especially in rural regions:**
  - **the value of production not always based on money**
  - **many products not purchased or sold**
    - **seeds, family labor inputs**
    - **household consumption of harvests**
- **Estimating non-marketed goods and services is a challenge**

How to estimate profits

- **The methods are based on a bottom-up approach of**
  - **data collection**
  - **analysis of revenues and costs**

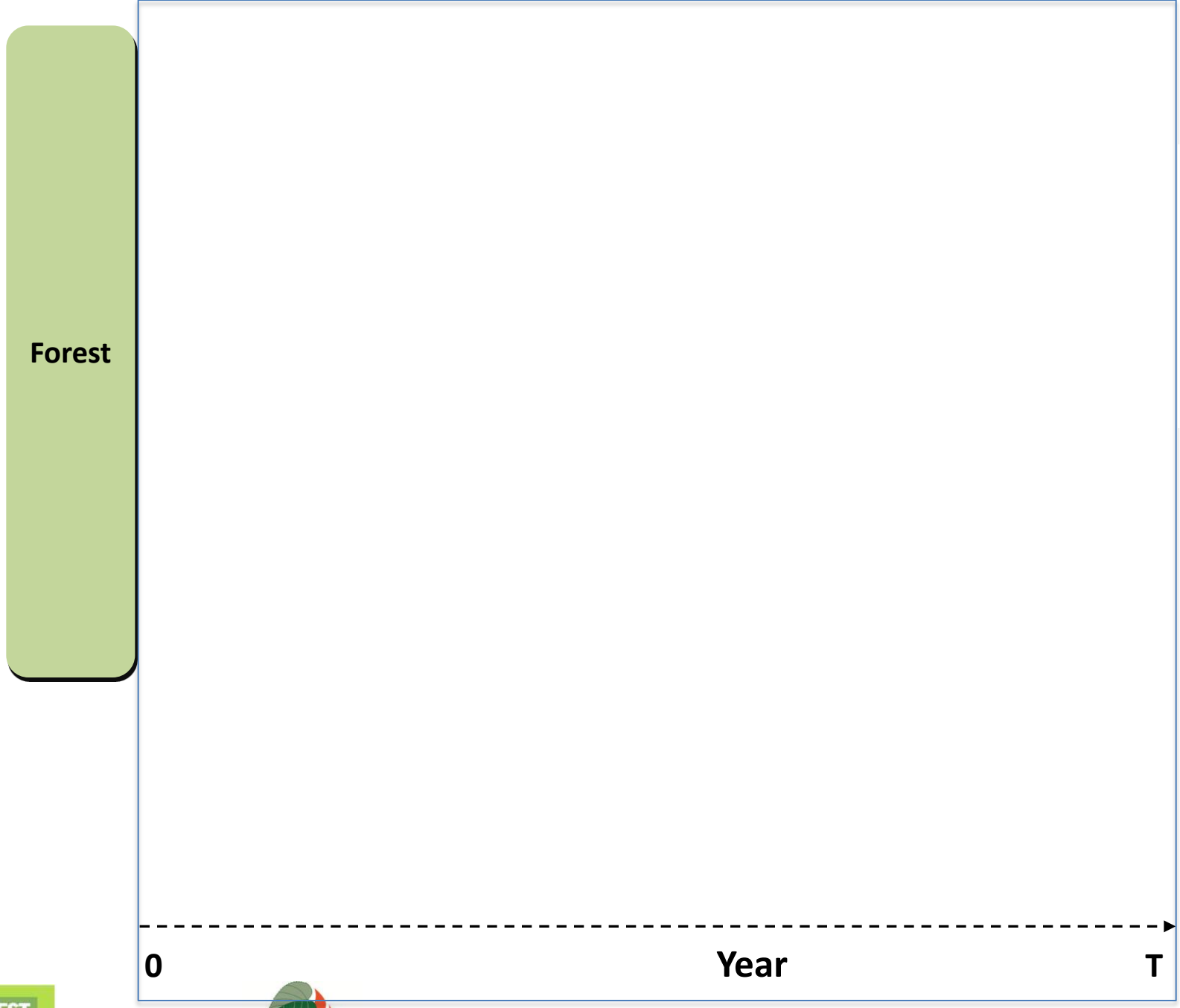
  for all of land use activities
- ***Why such detail?***
  - **To not be a "black box" analysis**
  - **Basis for adjustment within scenarios**
  - **To substantiate national policy and REDD+ participation decisions**

Profits of what?

- Opportunity costs are based on comparisons of land uses
- What do we mean by land use change?
- Essential to clarify when estimating profits

Analytical framework
Land use in a REDD+ context

- **Not just a simple change**
- **Multiple**
  - **products**
  - **phases**
    - **Establishment**
    - **Production**
  - **changes**


Forest
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Year
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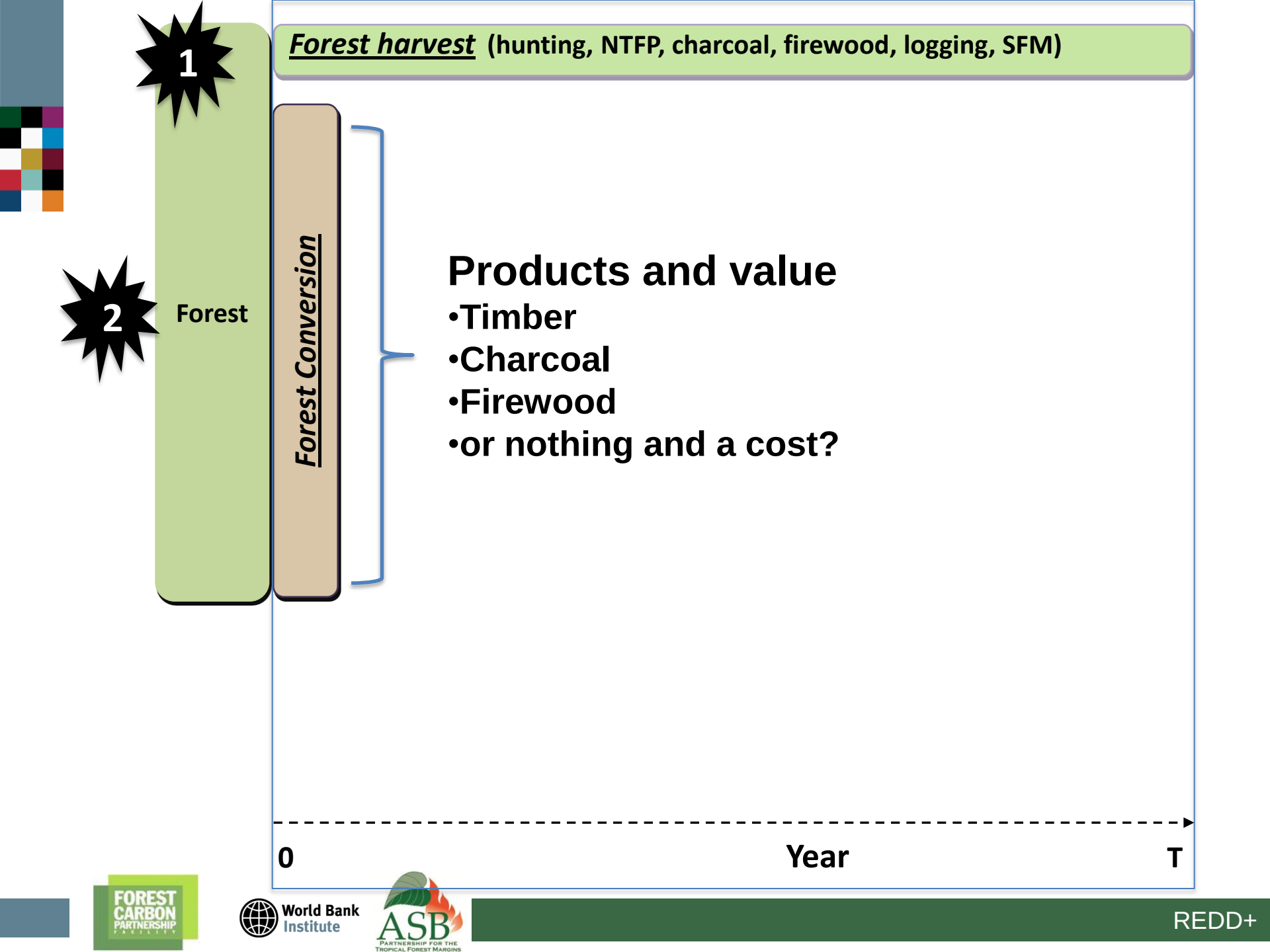
1

Forest

Forest harvest (hunting, NTFP collection, charcoal, firewood,selective logging, SFM)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Forest harvest (hunting, NTFP, charcoal, firewood, logging, SFM)
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Products and value
•Timber
•Charcoal
•Firewood
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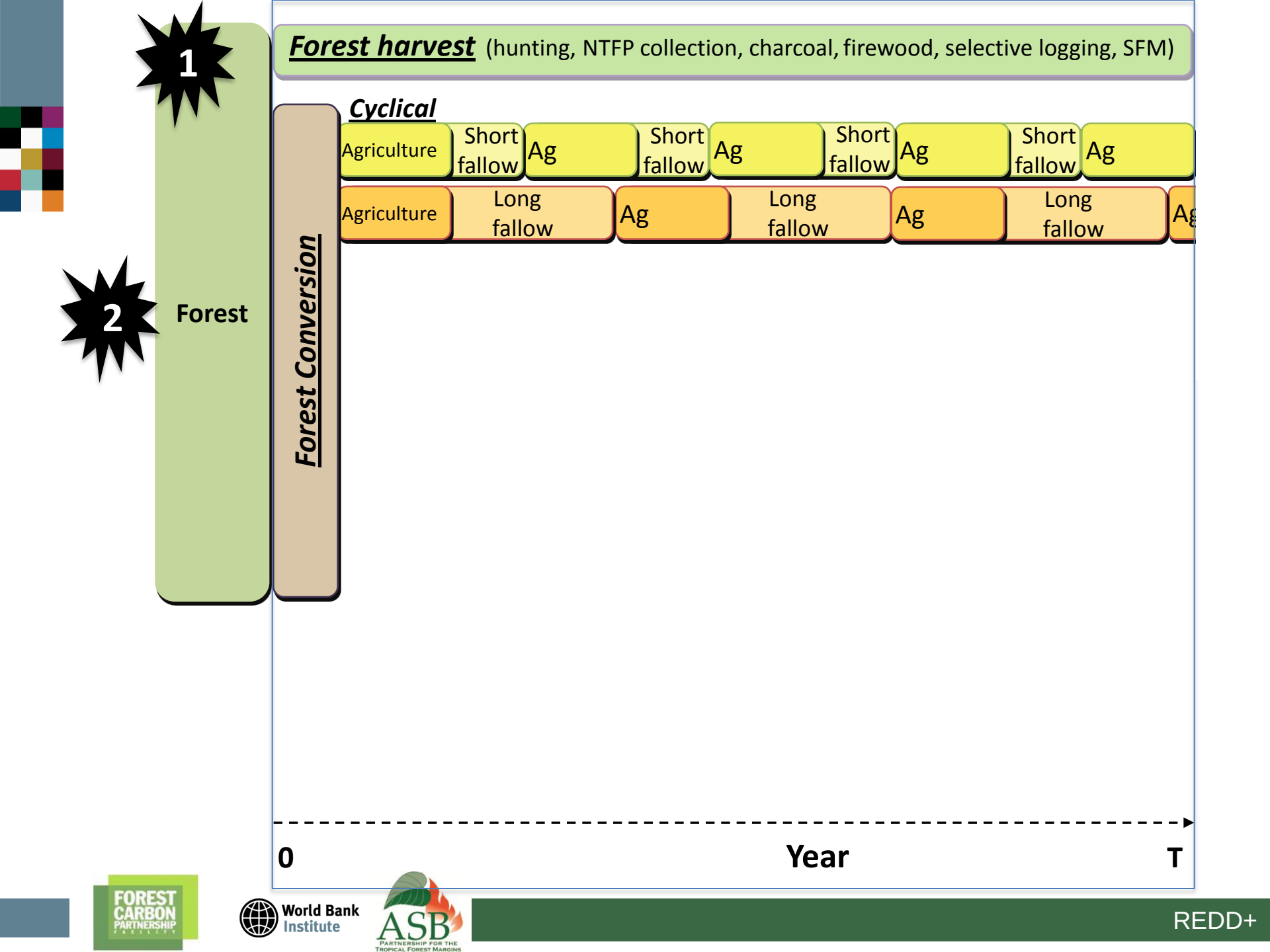
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Forest harvest (hunting, NTFP collection, charcoal, firewood, selective logging, SFM)
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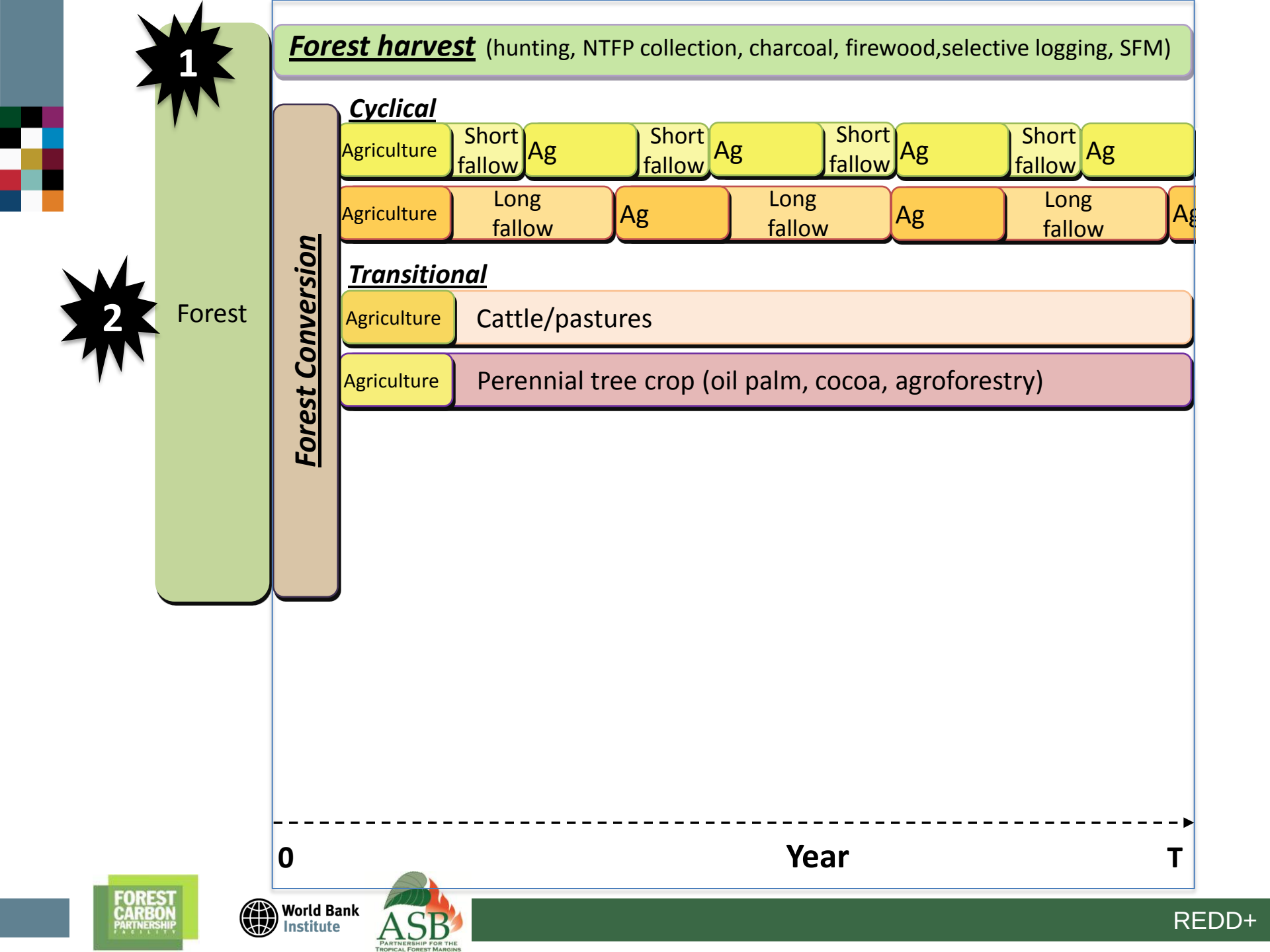
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Cattle/pastures
Agriculture
Perennial tree crop (oil palm, cocoa, agroforestry)
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Year
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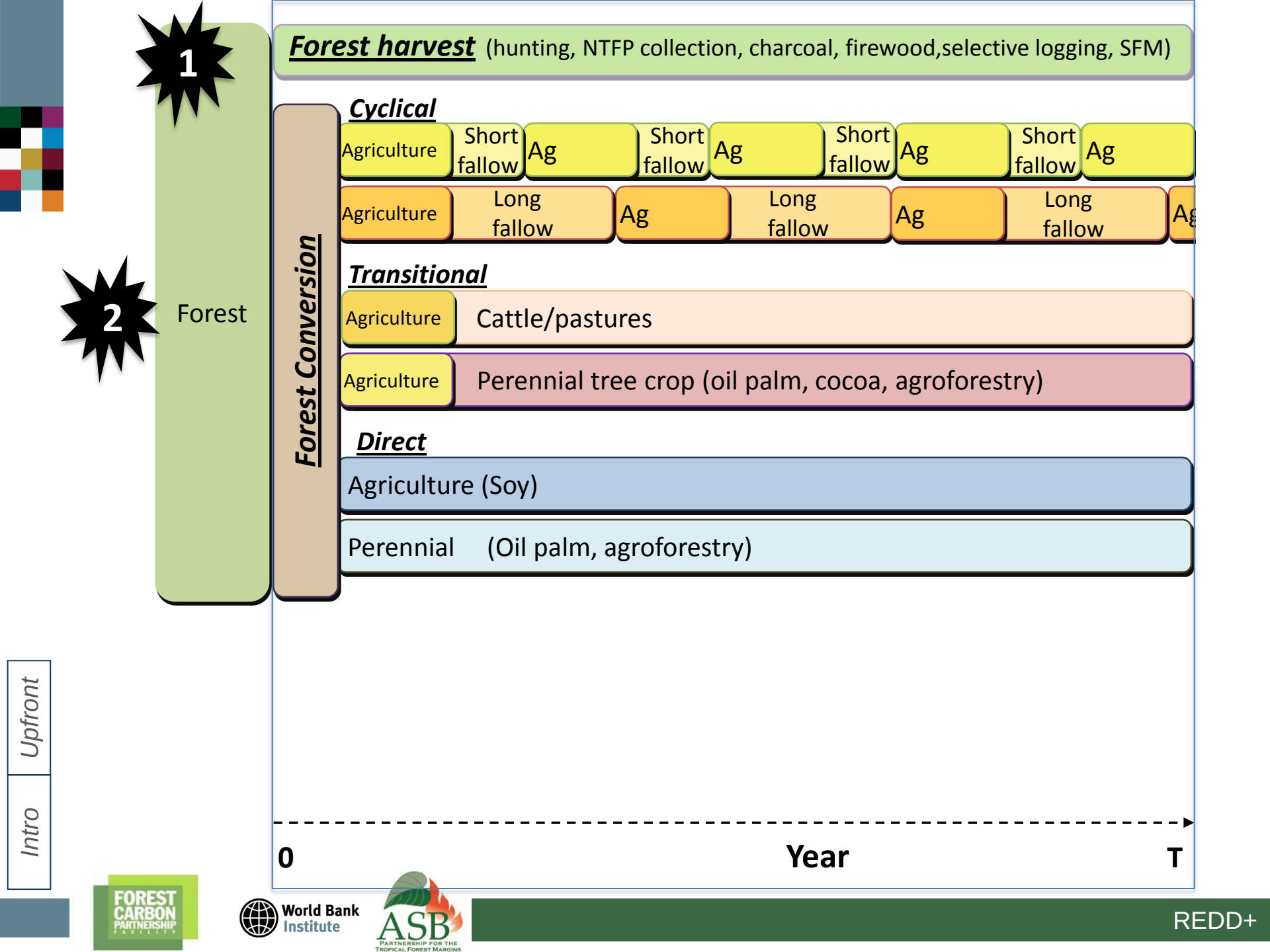
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Agriculture (Soy)
Perennial (Oil palm, agroforestry)
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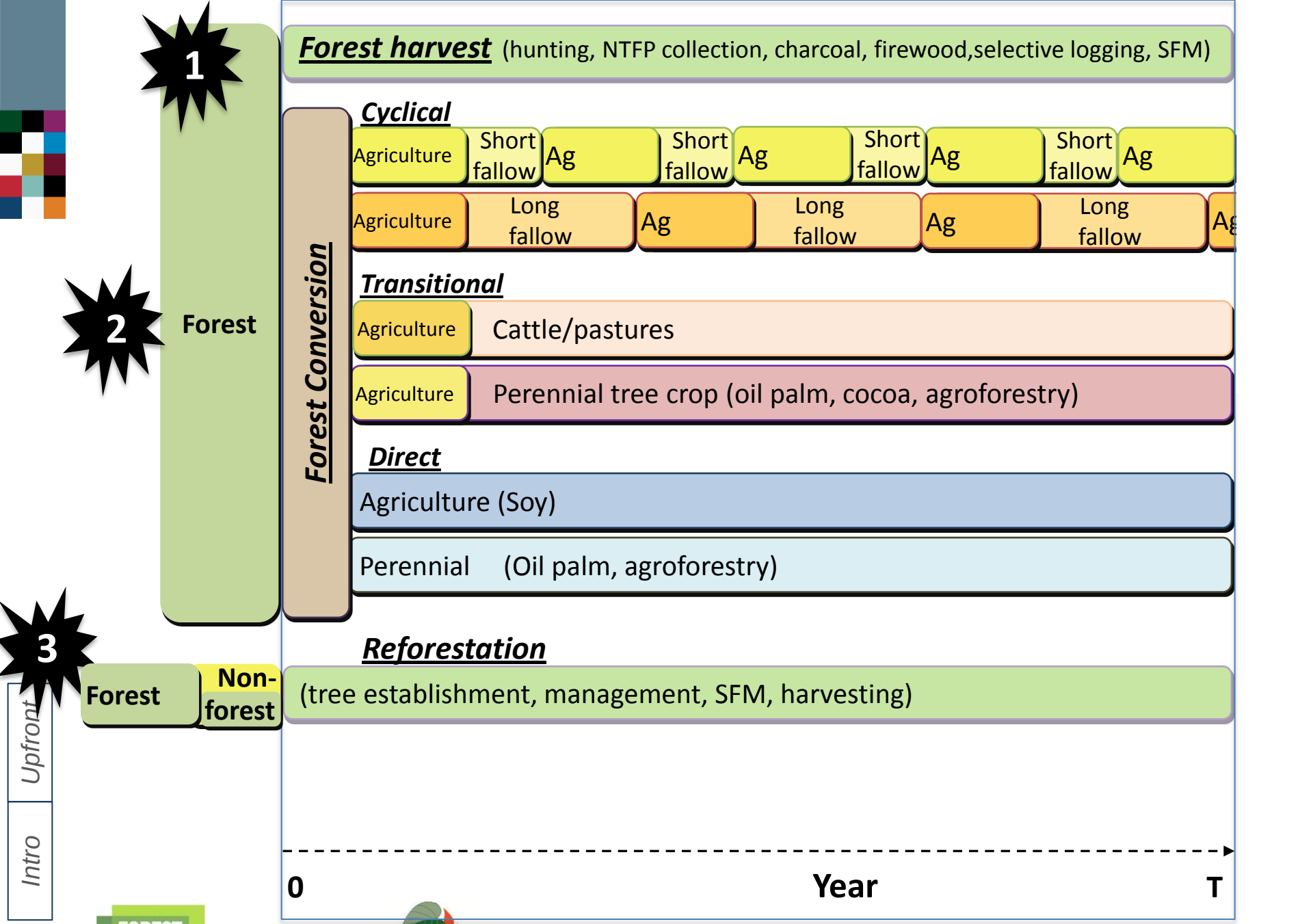
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Non-forest
Reforestation
(tree establishment, management, SFM, harvesting)
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Year
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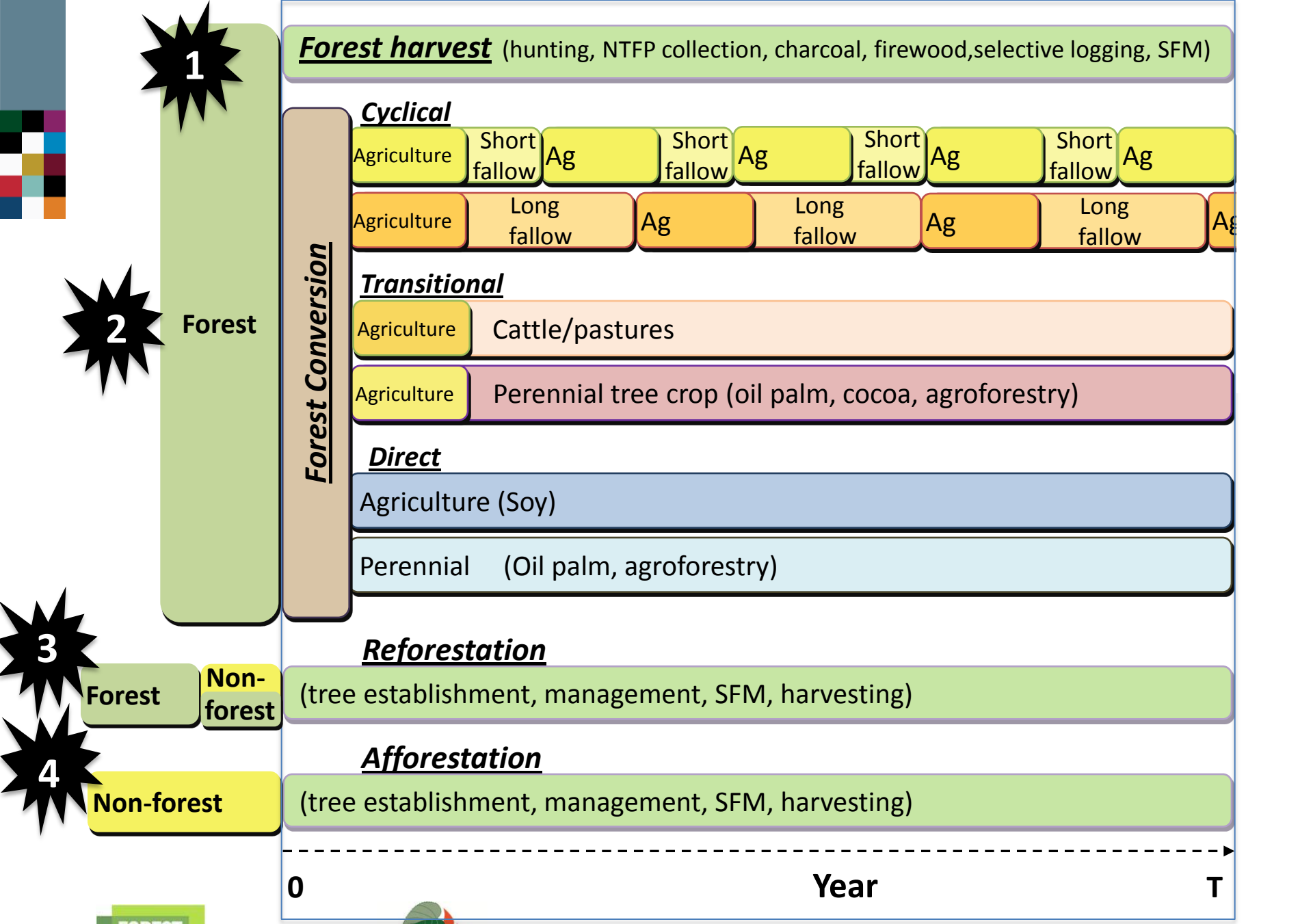
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4
Non-forest
Afforestation
(tree establishment, management, SFM, harvesting)
0
Year
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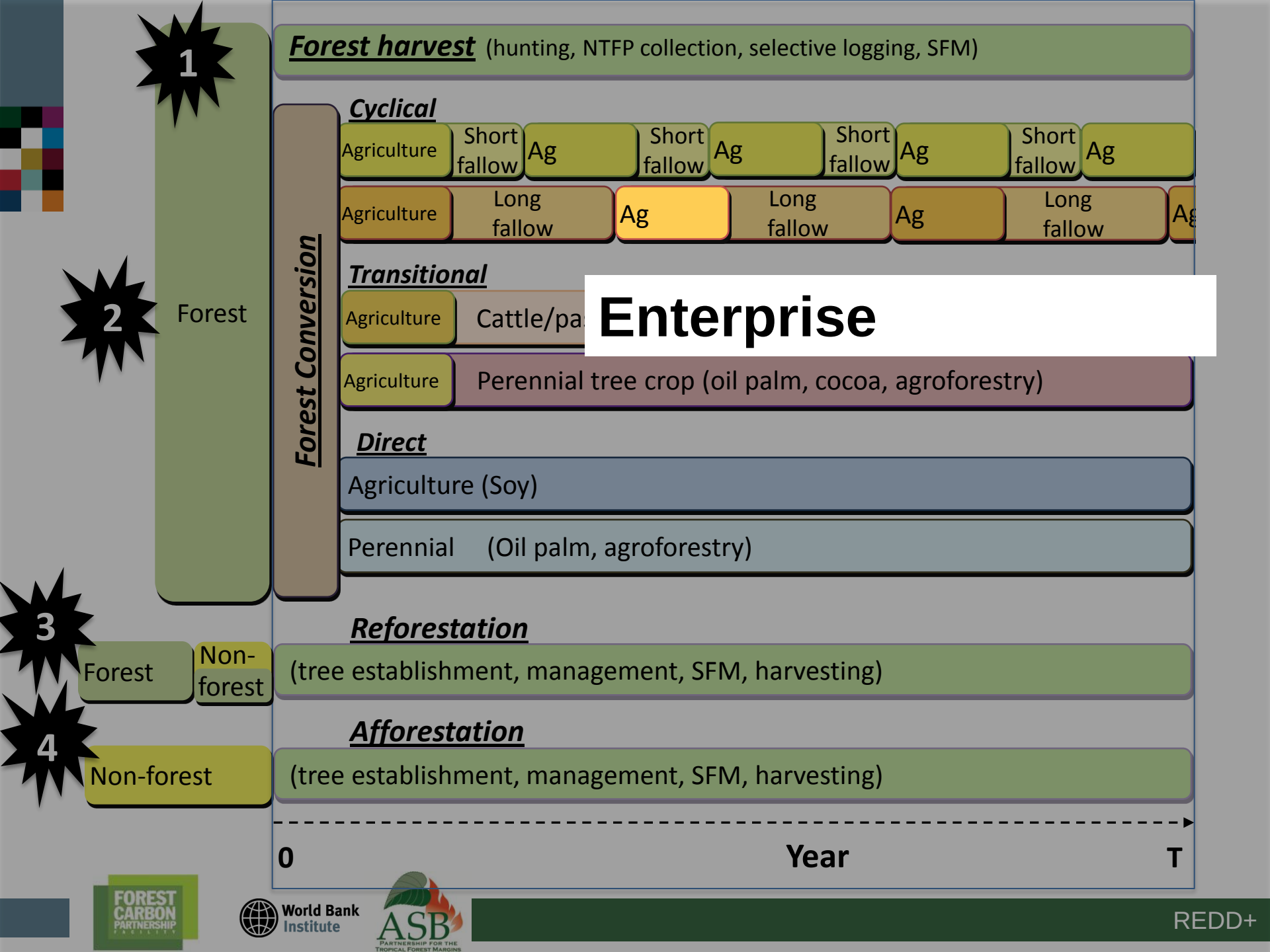
3 types of land use profit analysis

1. the ***enterprise (or activity) budget*** is the basic building block of information
   - typically focuses on a single activity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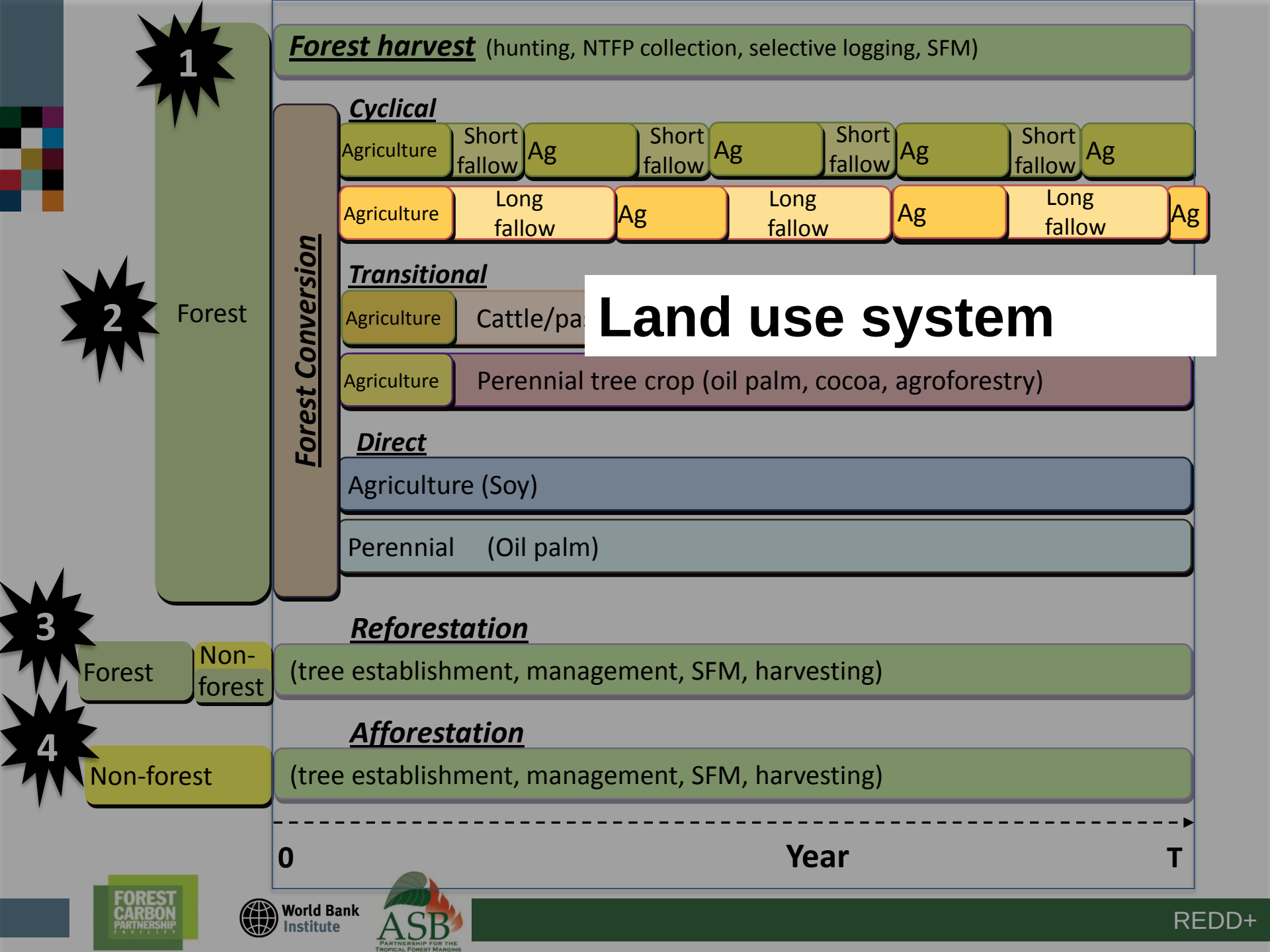
3 types of land use profit analysis

1. the ***enterprise (or activity) budget*** is the basic building block of information
   - typically focuses on a single activity
2. ***land use system budget***
   - multi-enterprise, multi-phase land uses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Year
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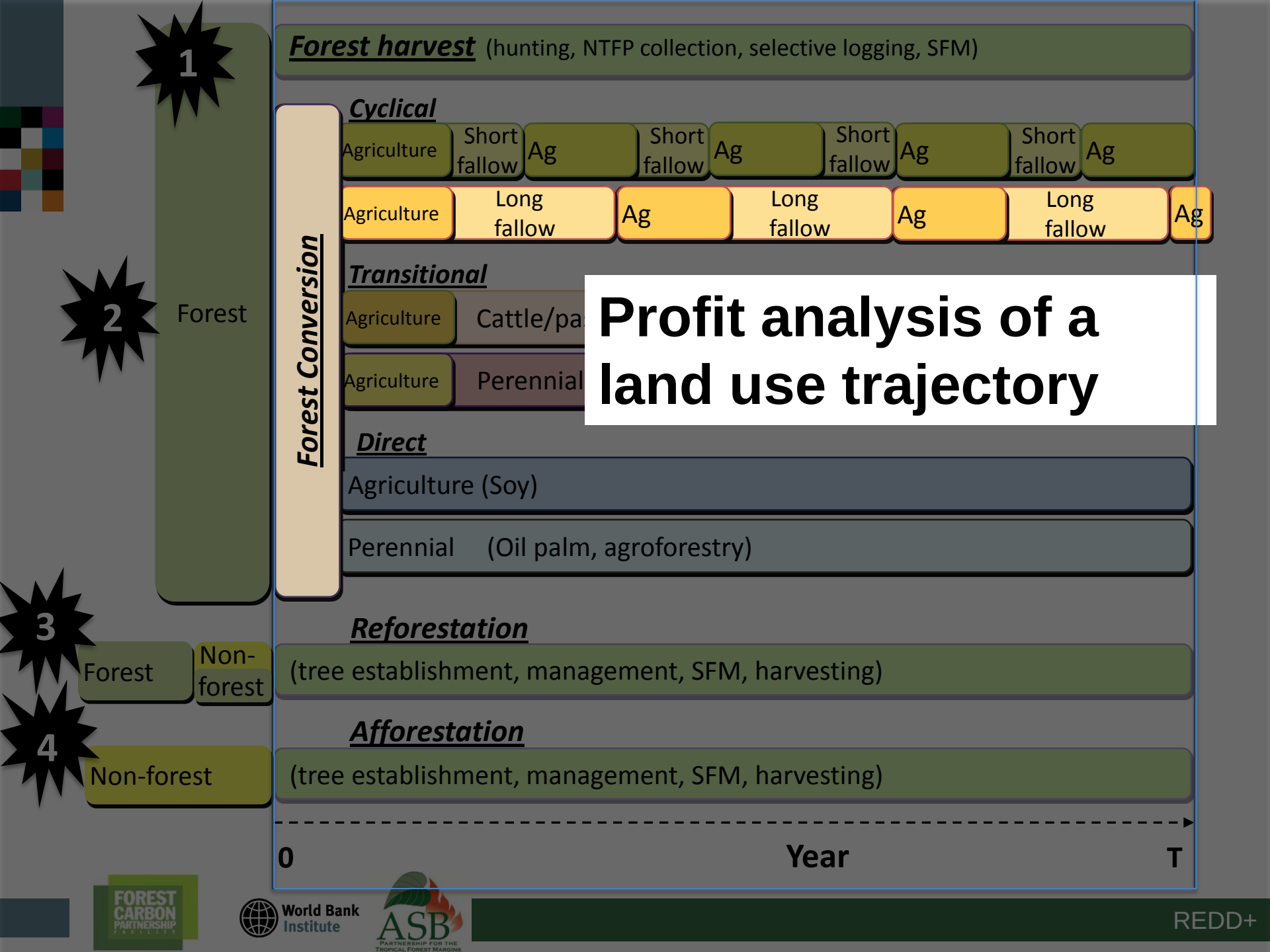
3 types of land use profit analysis

1. ***enterprise (or activity) budget*** **is the basic building block of information**
   - **typically focuses on a single activity**
2. ***land use budgets***
   - **multi-enterprise, multi-phase land uses**
3. ***land use trajectories***
   - **few or many land uses within a time horizon**
   - **basis for opportunity costs of REDD+**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Profit analysis of a land use trajectory
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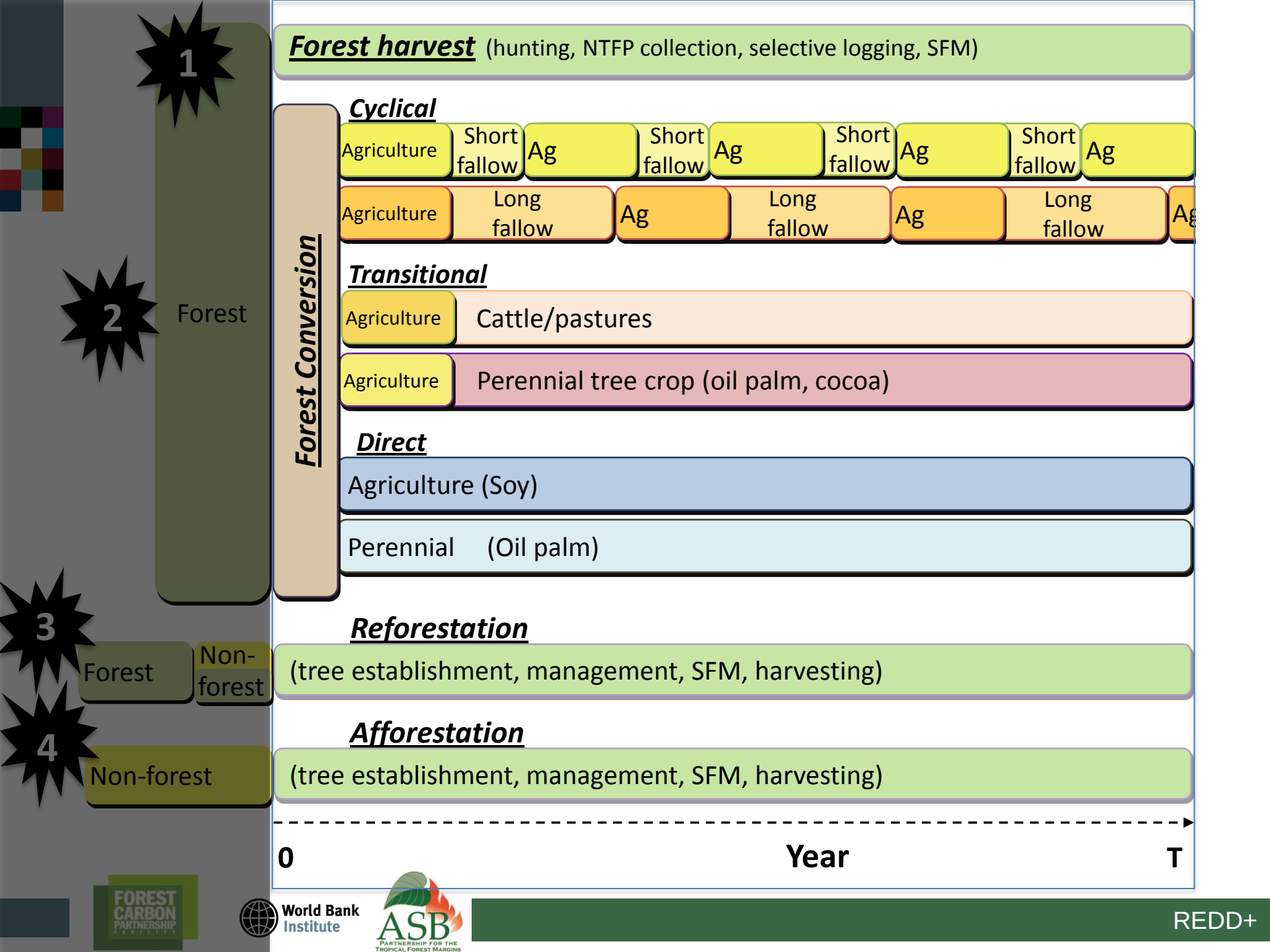
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1. Enterprise budgets

- Are a summary of costs and revenues
- Typically describe activities within a year's harvest season
- Forest and agriculture uses
  - NTFP collection, timber harvesting, annual crops, livestock, perennial crops
- Per hectare calculation

Rice *(per hectare)*	
Profit	$X

An enterprise budget

Rice (per hectare)	
Profit	$x
Total Input Costs	

Total Revenues	

An enterprise budget

Rice (per hectare)				
Profit		$x		
Total Input Costs				

Product	Unit	*Quantity*	*Price*	*Cost*
Seed				
Fertilizer				
Machinery				
Tools				
Total				

Total Revenues		
	Harvest	*Price*

Rice (per hectare)							
Profit		$x					
Total Input Costs					*Total Revenues*		
Product	Unit	*Quantity*	*Price*	*Cost*		*Harvest*	*Price*
Seed Fertilizer Machinery Tools							
Total							

Units

Careful record within budgets is essential

kg, liters, tons, should be noted

Local measures of input & yield converted to per hectare

Local currencies should be used

Can be converted later to a standard currency, typically € or $

Rice (per hectare)				
Profit		$x		
Total Input Costs				

Total Revenues		
	Harvest	*Price*

Product	Unit	*Quantity*	*Price*	*Cost*
Seed Fertilizer Machinery Tools				
Total				

Units (2)

Some cost information may come in different units

e.g., workdays per ton of product harvested

then convert to per hectare basis

If farm inputs are used for more than one enterprise, the cost should be shared and attributed to the other enterprises

Rice *(per hectare)*				
Profit		$x		
Total Input Costs				

Product	Unit	*Quantity*	*Price*	***Cost***
Seed				
Fertilizer				
Machinery				
Tools				
Total				

Total Revenues		
	Harvest	*Price*

Labor Activity	***Workdays***	***Wage***	***Cost***
Preparation			
Planting			
Weeding			
Harvest			
Threshing			
Transport			

An enterprise budget

Rice *(per hectare)*								
Profit		$x						
Total Input Costs					***Total Revenues***			
Product	Unit	*Quantity*	*Price*	***Cost***		*Harvest*	*Price*	
Seed **Fertilizer** **Machinery** **Tools**								
Total								

Labor Activity	***Workdays***	***Wage***	***Cost***
Preparation **Planting** **Weeding** **Harvest** **Threshing** **Transport**			

Calendar: Workdays

Activity	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***	***Total***
Preparation **Planting** **Weeding** **Harvest** **Post-harvest** **Transport**													
Total													

Enterprise budgets

- Many methodology and data assumptions underlie the information within enterprise budgets
- Make notes (low - high values)
- Parameters (e.g., input, harvest yield and price) can easily be adjusted to represent specific locations and contexts

Which price to use?

- **Actual prices can greatly differ according to location**
  - **Price data represent different stages within a product value chain**
    - **Farmgate**
    - **Wholesale**
    - **Retail**
  - **Farm to different markets**
    - **local, national, international**

Which price to use?

- ***Farmgate price:*** **the price a farmer receives for outputs or pays for inputs at the boundary of the farm**
  - **Data sources: field surveys with farmers, extensionists or agricultural census data**
  - **Adjustment needed when farmgate prices differ from local market prices**
  - **An adjustment factor often related to**
    - **distance to market and**
    - **quality of road/river transport**

How to estimate non-existent and unstable prices (1)

The value of inputs provided by the household

- **Labor**
  - **prices may change according to task and time of year**
  - **use the cost that farmers actually incur**
- **Seeds**
  - **retained from harvest**
  - **foregone income at harvest time**

How to estimate unstable and non-existent prices (2)

- Smallholder farm households may consume much of their harvests
  - the value of the output should be recognized
- It is important to document the assumptions and methods since
  - inputs and outputs can be valued in different ways
  - be done justifiably
  - but produce different results

How to estimate unstable and non-existent prices (3)

- Sensitivity analysis can reveal effects of assumption on analysis results
- Differences may be
  - insignificant or
  - worthy of discussion amongst peers to decide the best, most relevant, option
- Results need to be
  - relevant to landholders
  - accurately represent their situation

How to deal with prices distorted by policies? (1)

- **Prices can also differ due to government intervention**
  - **subsidies can decrease production input costs (e.g., gasoline, fertilizer)**
  - **taxes/tariffs can increase costs**
  - **such a basic assumption of what price to use can greatly affect REDD+ opportunity cost estimates**

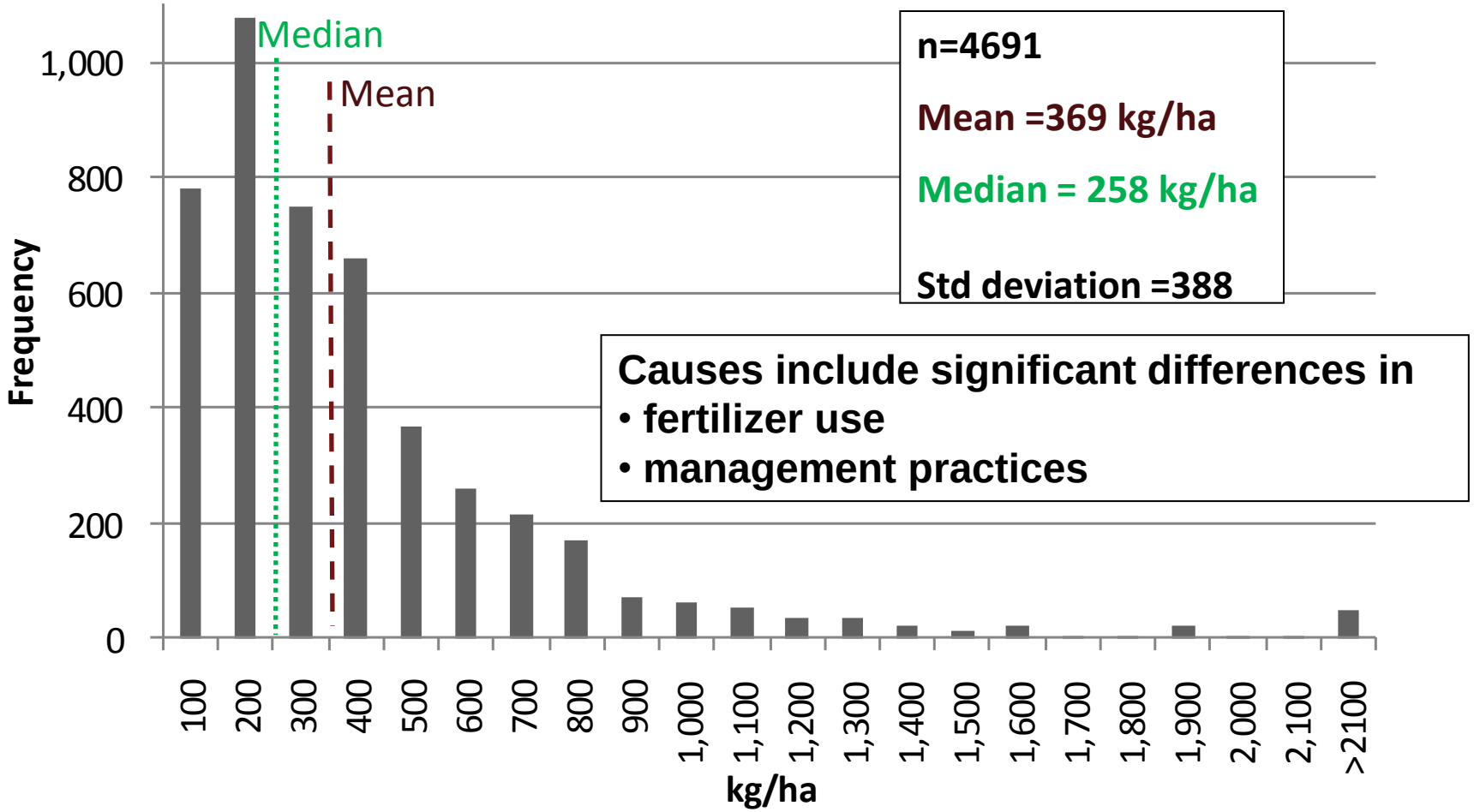
How to deal with prices distorted by policies? (2)

- If policy distortions are apparent and important, recommended to have separate estimates
- A Policy Analysis Matrix (PAM) is helpful to compare results of different accounting approaches (or methodological assumptions)
  - For more, see Monke and Pearson, 1989.

What to do when yields differ across sub-national regions? (1)

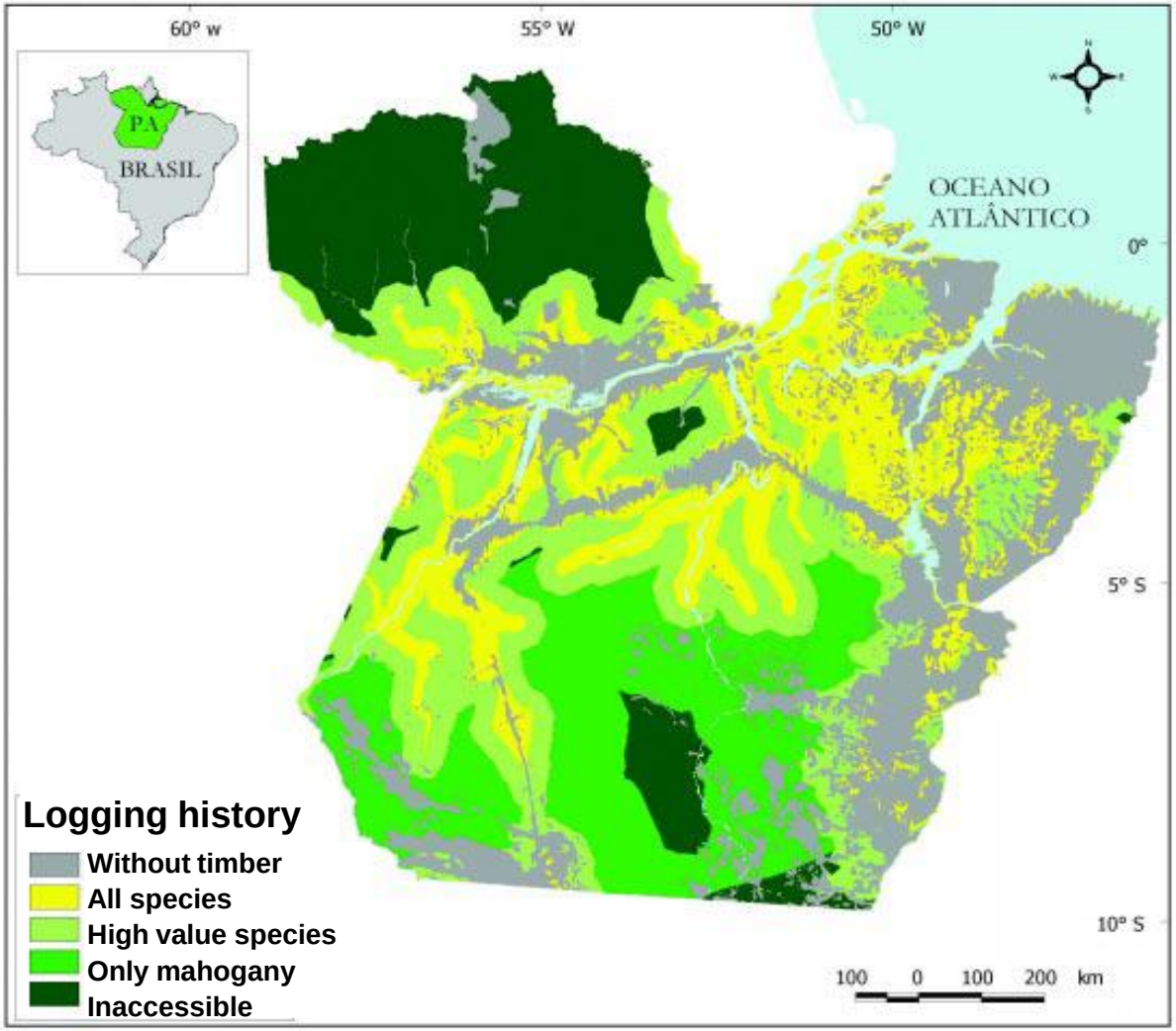
- The distribution of profits for a particular land use within a country can be highly variable
- For example, wide differences exist between the harvest yields of cocoa producers

What to do when yields differ across sub-national regions? (2)



Source: 2001/2 Sustainable Tree Crops Program, Ghana baseline survey (IITA, unpublished data).

What to do when yields differ across sub-national regions? (3)



What to do when yields differ across sub-national regions? (4)

- Examine yields and causes of differences to improve the accuracy and precision
- At a national level, different budgets should be developed

Data collection (1)

- **A variety of sources**
  - **National research centers and universities**
    - **May not be representative**
  - **Literature review of case studies**
  - **Interviews with farmers, or other experts (e.g., agronomists, extensionists, foresters)**

Data collection (2)

- **Database should be in domestic currency**
  - **Typically less vulnerable to exchange rate fluctuations.**
- **Convert to foreign currency for specific purposes**
  - **At some later point, to compare REDD+ opportunity costs with payments (US$/$tCO_{2e}$ or other terms)**

Data collection (3)
Surveys

- **Accuracy and reliability also depends on good sample design and well-trained enumerators**
- **Usually can only obtain reliable data for the current and previous years**
- **Difficult when the activities concerned are illegal (e.g., logging, bushmeat trade).**

Data collection (4)
Surveys

- **Although yield is available through producer surveys, many smallholder farmers do not have precise measures of their field size**
- **Accurate estimates of field size may be obtained by walking the field perimeter with a handheld GPS**

- **Detailed secondary information on inputs is rarely readily available**
- **Best obtained via farmer and key informant interviews**

2. Land use budgets

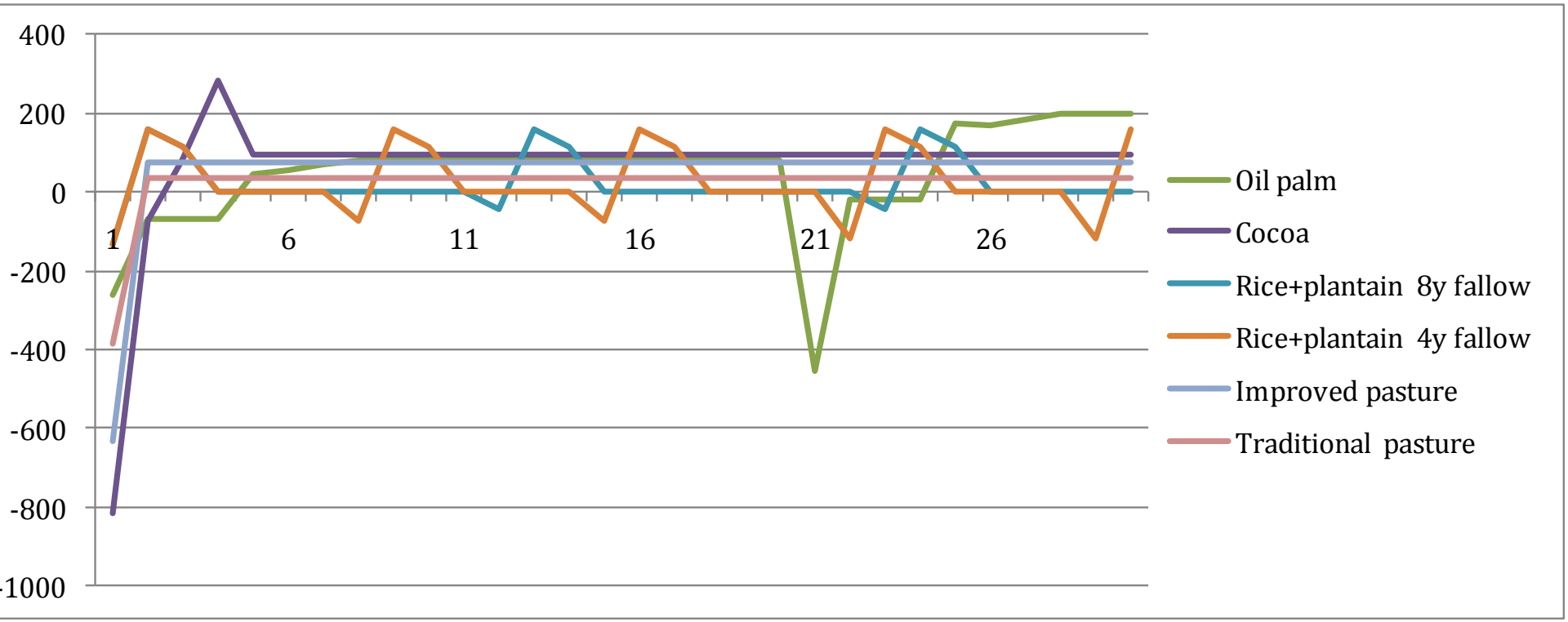
Land use budgets

- Account for a combination of activities, such as agricultural and tree crops
- Typically multiple year summaries representing all phases of an activity: preparation, production and fallow periods

Land use system

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	30
Oil palm	-264	-70	-70	-70	46	57	69	81	81	81	81	81	81	81	81	200
Cocoa	(815)	(75)	84	284	97	97	97	97	97	97	97	97	97	97	97	97
Rice+plantain 8y fallow	-133	158	115	0	0	0	0	0	0	0	0	-45	158	115	0	0
Rice+plantain 4y fallow	-133	158	115	0	0	0	0	-73	158	115	0	0	0	0	-73	158

Profit of land use systems



How to handle highly variable prices and yields (1)

- When collecting data at one point in time, information is not representative of other years
- Two basic types of variation exist
  - Variance around a static mean
    - weather conditions, pest & disease outbreaks, exchange rates
  - Variance around a changing (trending) mean
    - soil degradation vs new technology
    - increased consumer demand, energy costs vs demand shifts away for particular commodities

How to handle highly variable prices and yields (2)

- Past trends can provide important information for future years
- Price information should be examined over multiple years along with the market and technology context
- Major trends can be addressed in sensitivity and scenario analyses and economic sector models

3. Profit analysis of land use trajectories

Profit analysis of land use trajectories

- **A land use trajectory is a longer-term summary of land uses and land use changes**

Land use trajectory
Net present value (1)

- **Net present value (NPV), or present value, is a summary calculation used to estimate the profitability over many years**
- **NPV takes into account the time-value of money with a discount rate**

Why use a discount rate?

- A dollar today is worth more than a dollar tomorrow
- Thus, the value of future profits must be properly discounted

Land use trajectory
Net present value (2)

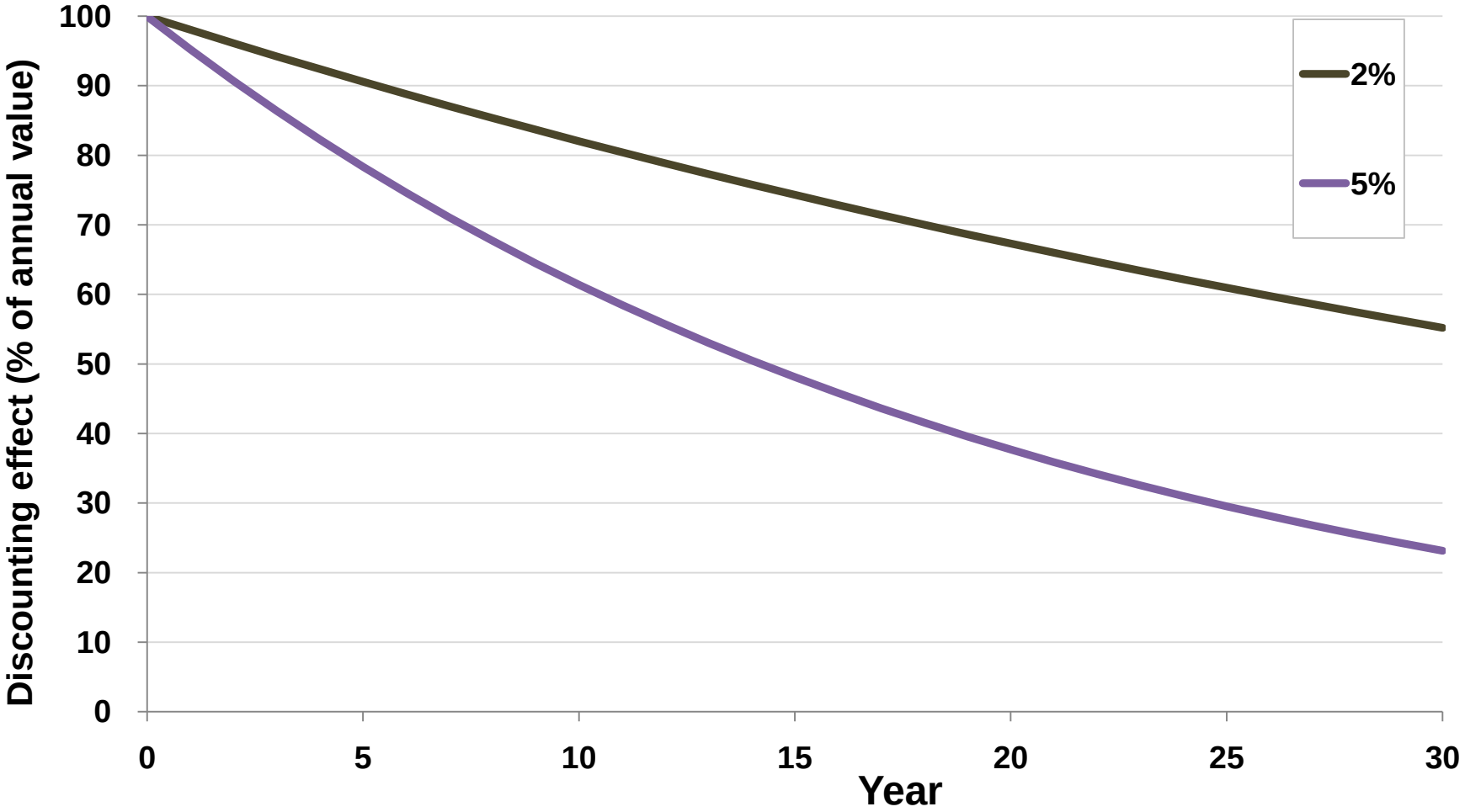
- **With multi-year analysis, NPV is a discounted stream of profits (revenues minus costs of capital, land and labor inputs)**

$$NPV = \sum_{1=t}^{T} \frac{\Pi_t}{(1+r)^t}$$

Where t = year, T = length of time horizon, Π = annual profits of the LU ($/ha), r = discount rate.

- **The major assumptions introduced at the stage of NPV calculation are the discount rate (r) and the time horizon (T)**

Effect of the discount rate



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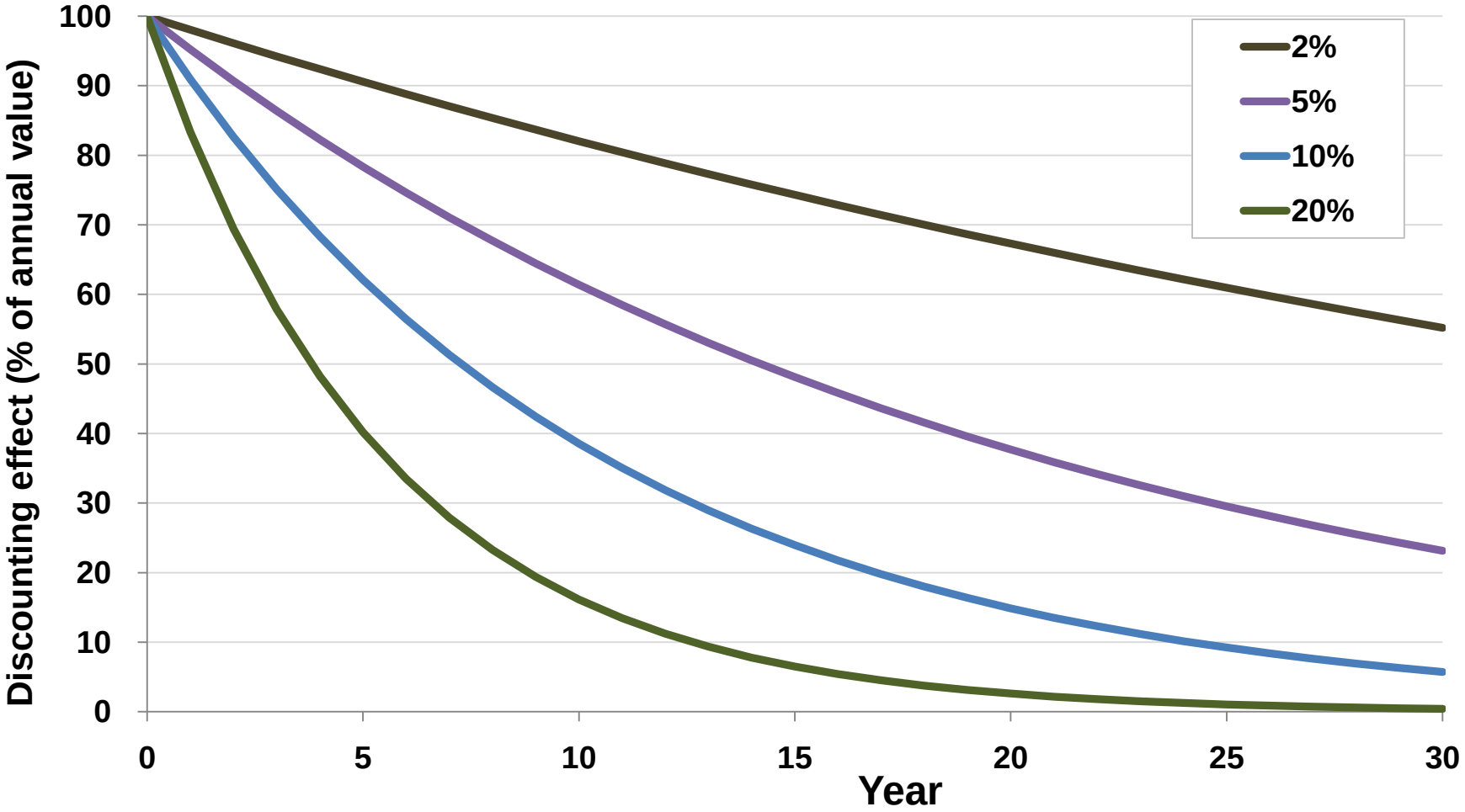


What discount rate?

- The local or national interest rate?
- They can be high, reflecting perhaps
  - less stable economic conditions or
  - the inherent risk of loans not being repaid
- Nevertheless, strong criticism arises from using high discount rates
  - Dramatically reduce the viability of long-term investments
    - forestry, agroforestry, and animal systems
  - Initial costs are scarcely discounted, future earnings is significantly lower.

What discount rate?

- An interpretation of discounting with high rates is
  - that future values do not matter
  - the benefits to future generations are unimportant
- High discount rates confront the conservationist view of biodiversity value
- Thus, a lower (social) discount rates could be more justifiable

Discount rates, in sum

- It is important to select a discount rate the reflects the market and policy context
- REDD+ programs are not based on the context of smallholders, conservationists or businesses
- The national accounting system of a country is the likely intermediate and appropriate financial context of a REDD+ program
- Therefore, within the training manual a 5% discount rate is employed

Time horizon of a NPV analysis (2)

- **The use of a discount rate and longer time horizon helps improve the methodological consistency when estimating the land use profits.**
  - **Land uses are likely to have differing period lengths. Discrepancies can result within a multi-year time horizon.**
  - **Some land uses may end in the end or middle of a productive phase while other may be in fallow**
- **Fortunately, the discount rate causes the contribution of later year profits to be less significant.**
- **If a short time horizon is used, substantial residual values may arise for many land uses.**
- **A long time horizon causes benefits or losses beyond the time horizon no longer matter**

Results of land use trajectory profitability analysis (30 year)

Land uses	NPV
Oil palm	346
Cocoa	604
Rice+plantain 8y fallow	302
Rice+plantain 4y fallow	383
Improved pasture	464
Traditional pasture	182
Charcoal	360
Charcoal+oil palm	706
Charcoal+rice+plantain 8y	662
Timber	429
Timber+improved pasture	893
NTFP collection	15

How to estimate budgets for hypothetical land uses

- **Countries may want to estimate hypothetical land uses**
  - **New crops**
  - **Reduced impact logging (RIL)**
  - **Biofuels**
- **Yet, prospective budgets often make unrealistic assumptions to obtain funds for research and implementation**
- **Careful review is recommended**

Accounting stance

Whose perspective? (the accounting stance)

- REDD+ programs involve different types of landholders
  - Country/national
  - Individual groups (e.g., farmer, rancher, logging company, community).
- Accounting stance – represents the viewpoint of individual groups or the country
- Affects the data collected and the way cost and revenue calculation
- Inappropriate mixing of data and methods is
  - a potentially easy and common error
  - can result in misleading estimates

Valuation and accounting stance

- **For individual groups:**
  - **revenues and costs are valued at actual prices**
  - **sometimes termed *private* or *financial* profitability**
- **For a country:**
  - **the social value may differ from market prices**
    - **policy distortions (taxes, subsidies, import restrictions)**
  - **social value of resources**
    - **adjusted market prices**
    - **sometimes termed social or economic profitability**

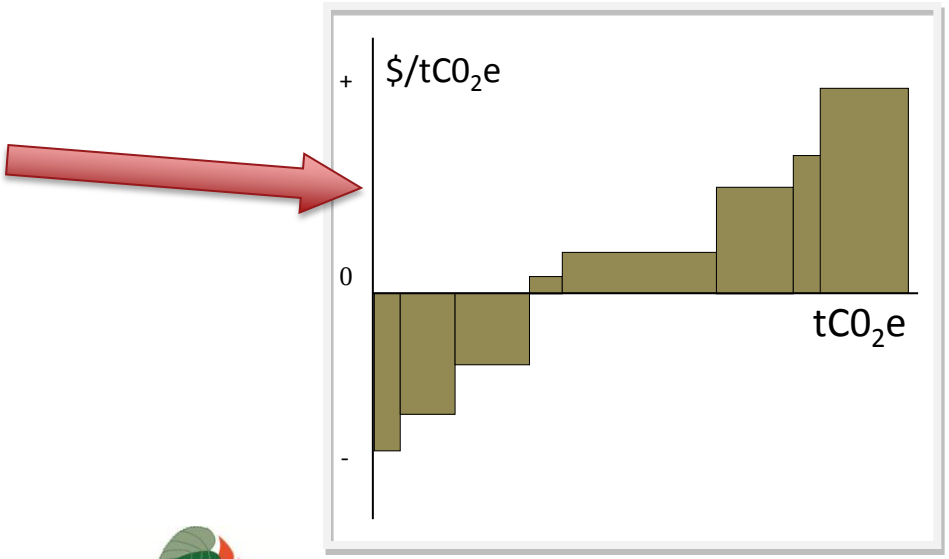
Summary

- **The bottom-up approach is**
  - **Based on history**
  - **Data, methods and assumptions are explained**
  - **With so much detail, it is not a black box**
  - **Foundation for additional analyses**
    - **Future scenarios**
    - **Models**

Profits from land uses

Taken many numbers and compressed them into one

To be part of an opportunity cost estimate



Key messages

- **Field data is the foundation**
  - **Large samples not as beneficial as good quality interviews**
- **Leave tracks: short notes are helpful**
- **The same land use is likely to have different profit levels**
- **Discount rate can greatly affect estimates**

Thank you