

# Relationship & synergies between monitoring systems for carbon stock change and ecosystem co-benefits

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# REDD+, carbon & ecosystem co-benefits

- Implementing REDD+ will require a system to establish the success of the mitigation actions
- Monitoring & reporting carbon emissions, removals, carbon stock and forest area changes
- REDD+ can generate co-benefits – but to understand what these are and how they change - monitor co-benefits



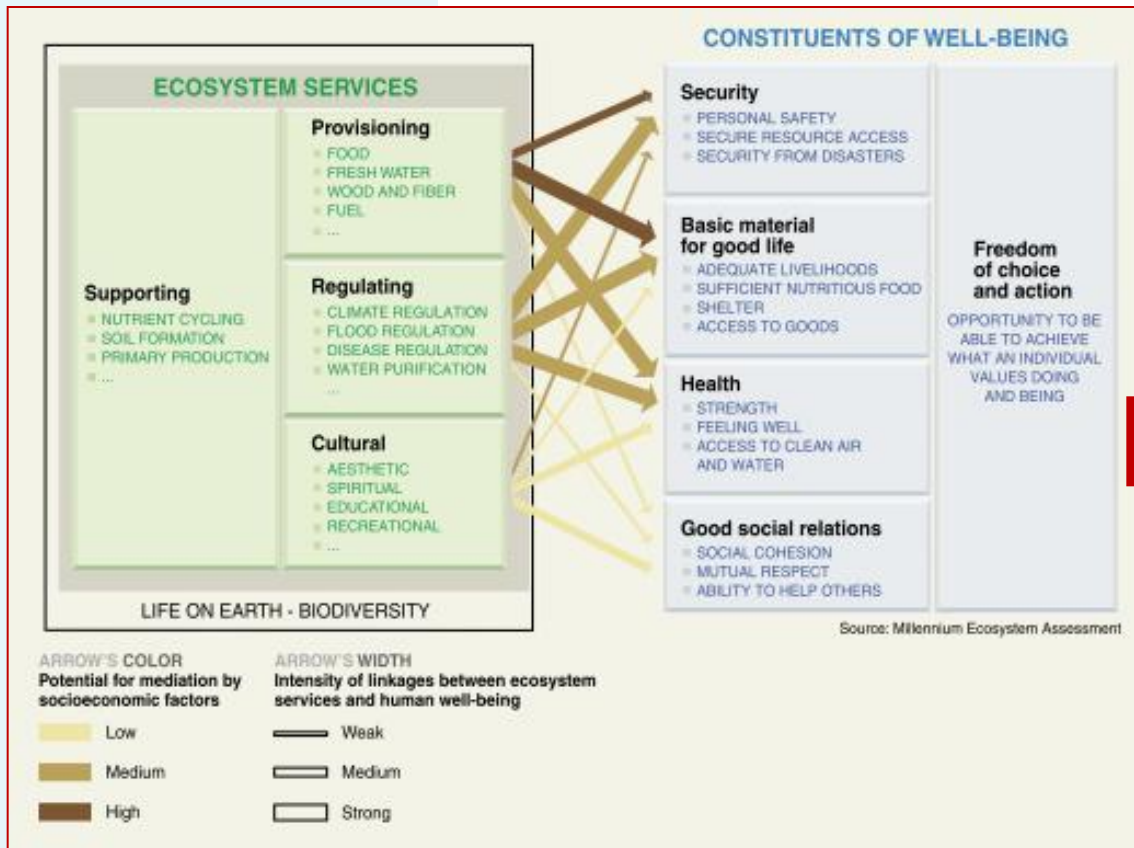
# REDD+, carbon & ecosystem co-benefits

- Which co-benefits? How to monitor them? How to reduce cost burden?
- Are there any **relationship** between monitoring systems for carbon stock change and ecosystem co-benefits?
- Are there **synergies** between monitoring carbon stock change & co-benefits?
- Should be the two monitoring systems distinct or combined into a single monitoring system?
- Should the monitoring system for ecosystem co-benefits be mandatory or voluntary?



# Ecosystem co-benefits

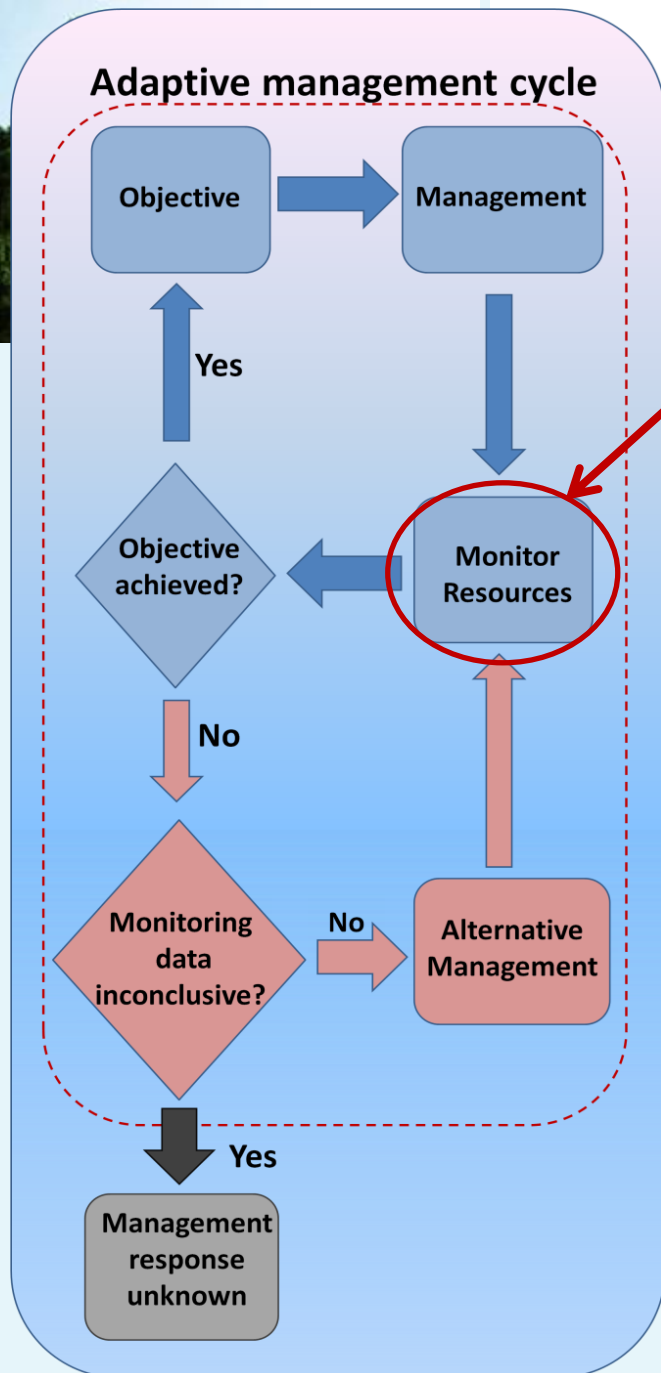
## Ecosystem services (MEA)



**Ecosystem  
co-benefits**

# Monitoring System

The collection and analysis of repeated observations or measurements to evaluate **changes** in condition and **progress toward meeting a management objective**  
(Elzinga et al. 2001)



As resources for monitoring are often limited:

- It should be **part of an adaptive cycle**
- It should be **driven by objectives**
- It is **justified** only if **opportunities for alternative management exist** otherwise is useless

# Some networks and/or monitoring systems related to ecosystem services



## International Initiatives

- GEO-BON (Global Earth Observation - Biodiversity Observation Network) & GEO-FCT (Forest Carbon Tracking);
- GFW, WRI (Global Forest Watch; World Resources Institute);
- GOFC-GOLD (Global Observation of Forest and Land Cover Dynamics);
- FRA, FAO (Global Forest Resources Assessments of the Food and Agricultural Organization of United Nations);
- ILTER (International Long Term Ecological Research Network)
- TEMS, GTOS (DBs of Terrestrial Ecosystem Monitoring Sites by the Global Terrestrial Observing System)
- IABIN (Inter-American Biodiversity Information Network);
- GBIF (Global Biodiversity Information facility);

## National Initiatives

- NATIONAL FOREST INVENTORIES
- OTHER MONITORING SYSTEMS
  - Satellite Land Monitoring System;
  - National Environmental Agencies;
  - Water Resources Agencies
  - Independent Monitoring Systems
- LTER (Long Term Ecological Research Network)
- LOCAL COMMUNITY MONITORING



# Monitoring carbon stock changes for REDD+

Monitoring carbon stock change requires assessing:

- (1) Location: i.e. land unit (ha); land use categories; carbon pools
- (2) Quantification: carbon density (carbon ha<sup>-1</sup>) and carbon stock (stratified by eco-regions, forest type, C pools)
- (3) Changes: quantitatively variation of carbon stock over time



# Monitoring carbon stock changes for REDD+

- different REDD+ activities and LULUCF
  - different carbon pools & tier level
  - different parameters/indicators all related to carbon
- ➔ IPCC guidance
- ➔ Remote sensing & ground-based inventories with different resolution, intensity & time frame (e.g. NFIs repeated every 5 yrs)





# Relationships





## Monitoring ecosystem co-benefits change in REDD+

Monitoring ecosystem co-benefits requires assessing:

- (1) **Location** : land unit (ha); eco-region; ecosystem; forest type; niche
- (2) **Quantification**: quantity/quality of ecosystem co-benefits (**info could be also stratified**)
- (3) **Changes**: quantitatively or qualitatively variation of co-benefits



## Monitoring ecosystem co-benefits change in REDD+

- different natural & human-induced activities (including also REDD+ activities) & LULUCF
- *Different parameters/indicators related to different ecosystem services (timber; NTFPs, soil, water, etc.)*

➡ No agreed standards

➡ **Remote sensing & ground-based measurements** with different resolution, intensity & time frame

		<b>Carbon stock</b>	<b>Ecosystem co-benefits</b>
<b>REMOTE SENSING</b>	<b>Coarse to medium resolution</b>	e.g. land use categories, forest cover, deforestation, etc.	e.g. topography, forest cover and location and boundaries of different ecosystem and resources, etc.
	<b>High resolution</b>	e.g. Forest degradation; conservation and enhancement of forest carbon stock, etc.	e.g. Forest fragmentation; continuity of streams, etc.
	<b>Multispectral Imagery</b>	e.g. Forest type or species differentiation, Indicator of growth rate, vegetation cover and density, NDVI, soil types, etc.	e.g. composition and thermal properties of ground, turbidity, temperature or pollution of lake and/or river, etc.
	<b>RADAR/ LiDAR</b>	biomass; tree height	Degree of vulnerability of land to floods, landslide, erosion or subsidence, etc.
<b>GROUND-BASED MEASUREMENTS</b>		Calibration of RS; additional information (DBH, carbon pools; allometric equations; BECF), etc.	timber; NTFPs; biodiversity; soil, water and air quality, etc.



# Synergies

# Distinct or combined monitoring?

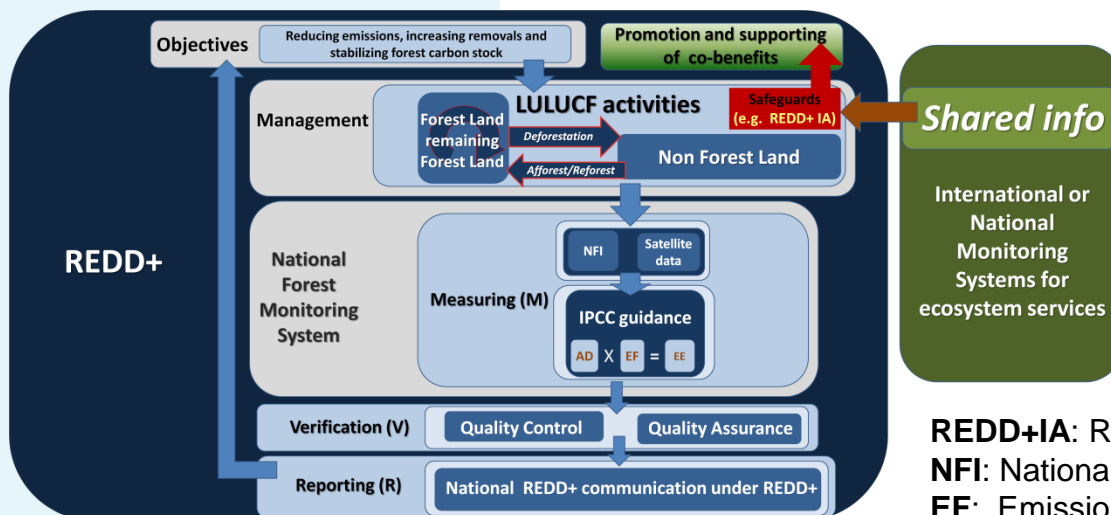
## Clarity:

- objectives of external monitoring system of ecosystem co-benefits are not necessarily directed toward meeting REDD+ objectives;

## Effectiveness :

- External monitoring systems of ecosystem services do not benefit of resources (e.g. RS and NFIs) utilised within the monitoring system for carbon stock change but these initiatives could provide information useful to support and promote safeguards;

## Distinct



**REDD+IA:** REDD+ Impact Assessment  
**NFI:** National forest inventory; **AD:** Activity Data;;  
**EF:** Emission Factor; **E.E:** Emission Estimate

# Distinct or combined monitoring?



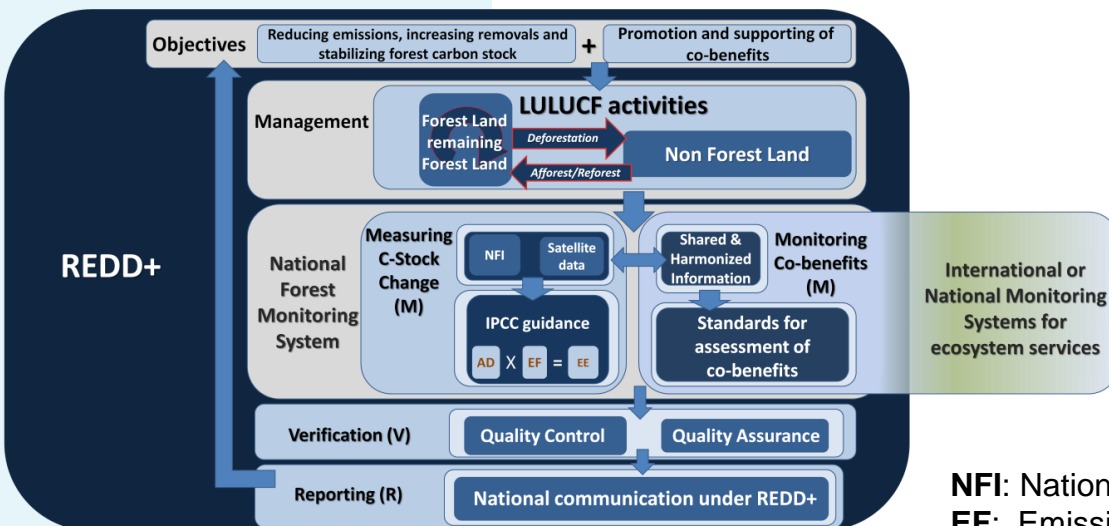
## Clarity:

-objectives of a combined monitoring system for carbon stock and ecosystem co-benefits are directed toward meeting REDD+ objectives


## Effectiveness:

- Resources are used effectively in the combined system;  
 - External monitoring systems for ecosystem services could inform the monitoring system in REDD+ but they can also benefit of shared and **harmonized** information coming from the combined monitoring system;

## Combined



NFI: National forest inventory; AD: Activity Data; EF: Emission Factor; EE: Emission Estimate



# Difficulties in monitoring ecosystem co-benefits in REDD+

## *Monitoring ecosystem co-benefits requires assessing different parameters & indicators*

- Not all co-benefits are measurable or have enough data
- difficulties to identify driver of changes linked with REDD+
- Resolution (implementation phases)
- No agreed standards
- Resources limited and in REDD+ for carbon assessment
- Current initiatives information may not match up





# Conclusions



# Conclusions

- There are **clear relationships** between monitoring systems for carbon stock change and ecosystem co-benefits;
- Carbon stock change assessment uses agreed standards (IPCC) and it refers to land use and some forest and soil characteristics **which may be also used for assessing changes of ecosystem co-benefits**
- Ecosystem co-benefits are **multidimensional concepts** and **monitoring is challenging** (timber; NFTP, soil; water; air; etc.); **methodologies are various** and generally they belong to the field of interest
- However RS and ground-based measurements are used to detect and quantify variables in both monitoring systems.



# Conclusions

- A mandatory monitoring system for ecosystem co-benefits may requires agreed standards (methods)
- Nevertheless there are numerous ongoing initiatives related to ecosystem services at international, national or local level which may benefit REDD+
- Although external monitoring system for ecosystem services may inform REDD+ **synergies may be less effective if objectives of monitoring are different and resources are not shared in an integrated and effective way**
- In REDD+ a combined monitoring system for ecosystem co-benefits may be costly although it may be more effective to achieve REDD+ objectives and to promote other international agreements and conventions



# Summary



Relationship between Carbon stock change monitoring and ecosystem co-benefit monitoring



Synergies depends on implementation of monitoring system whether combined or distinct



Ecosystem co-benefit monitoring still challenging as other indicators and standards need to be established

# For more information...

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**Thank you for listening!**

