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

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FAO FIAT PANIS

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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

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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 & 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?

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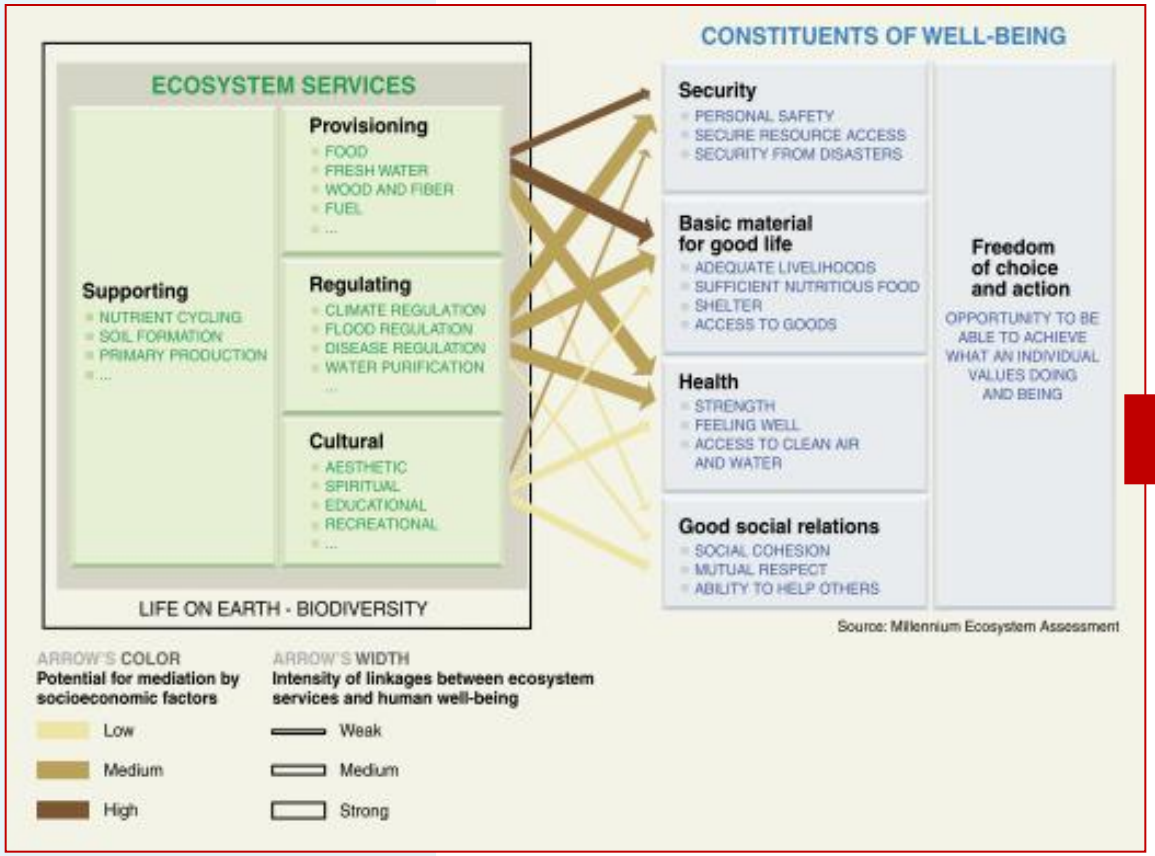
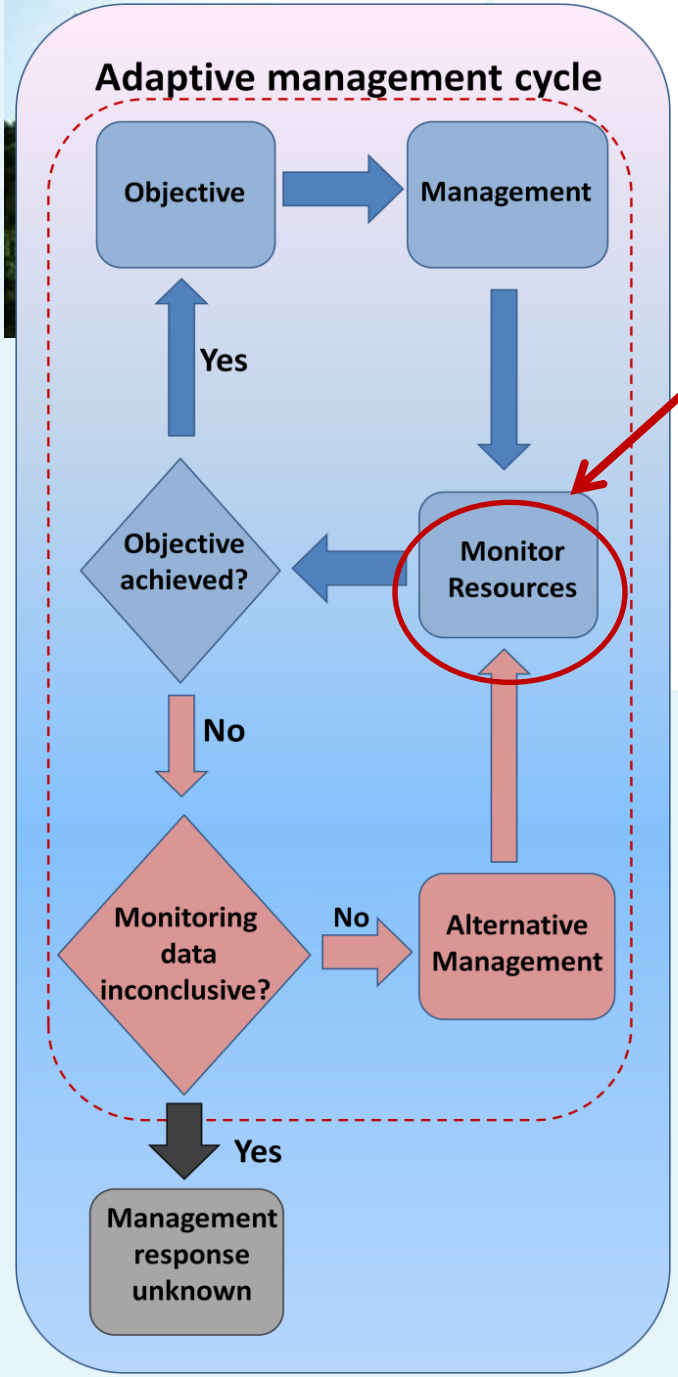
Ecosystem co-benefits

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

Which monitoring system?

1) **Identifying and assessing threats and problems:** Identification of encroachment, fire risk, illegal camps, signs of exploitation, etc. (e.g. patrolling protected areas);
2) **implementation monitoring:** Inspection for checking if planned activities fulfill all prescribed requirements, and supervising and assessing interventions;
3) **effectiveness monitoring:** Assessing impact of activities and interventions, and checking that threats have been adequately dealt with (e.g. Environmental Impact Assessment)
4) **extensive inventories and repeated estimates:** Well-established systems providing extensive information of resources (e.g. carbon stock change assessment)

Initiatives monitoring ecosystem aspects

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)
- **MAP OF PANTROPICAL FOREST BIOMASS AND CARBON** (Woods Hole Research Center);
- **EARTH OBSERVATION APPLICATION** (Google, Carnegie Institution for Science, Instituto do Homem e Meio Ambiente da Amazônia and the Gordon and Betty Moore Foundation);
- **DEMOSTRATION ATLAS OF CARBON & BIODIVERSITY** (UNEP-WCMC)

Initiatives monitoring ecosystem aspects

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)
- MAPPING CARBON AND CO-BENEFITS OF TANZANIA & JIANGXI PROVINCE in CHINA (UNEP-WCMC with Forestry and Beekeeping Division, Ministry of Natural Resources and Tourism, Tanzania and the Chinese Research Academy of Environmental Science of China)
- 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^{-1}) (stratified by eco-regions, forest type, C pools)

(3) Changes: spatial, temporal, quantitatively variation of carbon density over time (carbon ha^{-1} yr^{-1})

Monitoring carbon stock changes for REDD+

- different REDD-plus activities and LULUCF

-different carbon pools & tier level

- different parameters/indicators/metrics 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

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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**: spatial, temporal, 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/metrics related to different Ecosystem services (timber; NTFPs, soil, water, etc.)*

⇨ No agreed standards

⇨ Remote Sensing & Ground-based measurements with different resolution, intensity & time frame

		Carbon stock	Ecosystem co-benefits
REMOTE SENSING	Coarse to medium resolution	e.g. land use categories, forest cover, deforestation, etc.	e.g. topography, forest cover and location and boundaries of different ecosystem and resources, etc.
	High resolution	e.g. Forest degradation; conservation and enhancement of forest carbon stock, etc.	e.g. Forest fragmentation; continuity of streams, etc.
	Multispectral Imagery	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.
	RADAR/ LiDAR	biomass; tree height	Degree of vulnerability of land to floods, landslide, erosion or subsidence, etc.
GROUND-BASED MEASUREMENTS		Calibration of RS; additional information (DBH, carbon pools; allometric equations; BECF), etc.	timber; NTFPs; biodiversity; soil, water and air quality, etc.

Synergies

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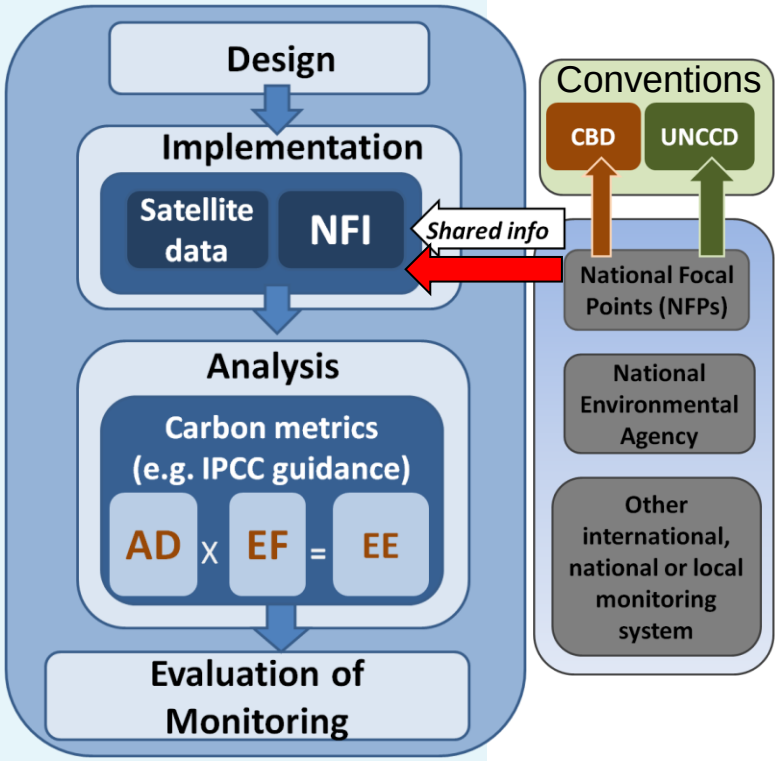
Distinct or combined monitoring?

Distinct



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

Clarity:

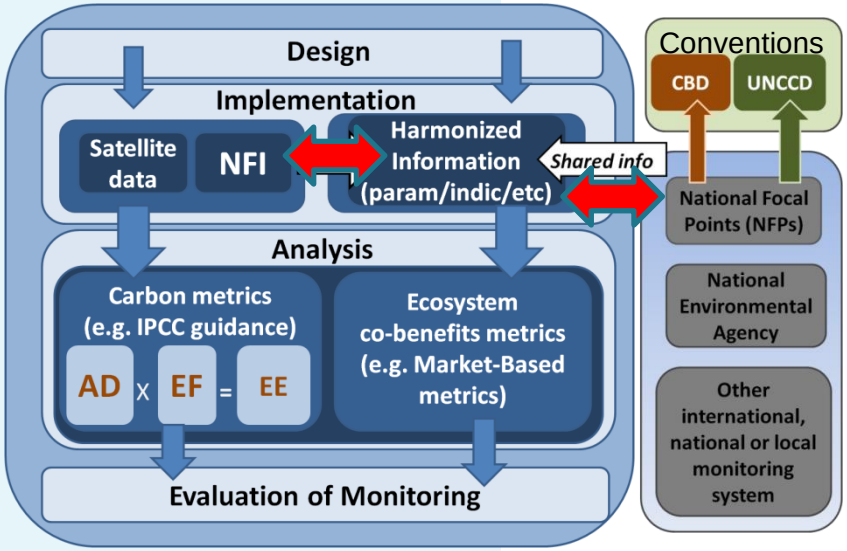
- objectives of external monitoring system of ecosystem co-benefits are not necessarily directed toward meeting REDD+ objectives;

Effectiveness :

- External monitoring systems do not benefit of resources (e.g. RS and NFIs) utilised within the monitoring system for carbon stock change but these monitoring systems could inform the monitoring system for carbon stock change (one way synergy);

Distinct or combined monitoring?

Combined



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

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 (two way synergy);

- External monitoring systems could inform the monitoring system for carbon stock change but they can also benefit of harmonized information coming from the combined system (two way synergy);

Difficulties in monitoring ecosystem co-benefits in REDD+

Monitoring Ecosystem co-benefits requires assessing different parameters, indicators & metrics

- 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

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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 monitoring system for ecosystem co-benefits

- Ecosystem co-benefits are **multidimensional concepts** and monitoring is challenging (timber; NFTPs, 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 at international, National or local level which may benefit REDD+
- Although external monitoring systems for ecosystem-co-benefits may inform REDD+ **synergies may be less effective if they do not have the same objectives**
- 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, metrics and standards need to be established

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Thank you for listening!

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