Assessment of Innovative Technologies and Their Readiness for Remote Sensing-Based Estimation of Forest Carbon Stocks and Dynamics


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**WHAT IS THE ISSUE AND THE SOLUTION?**

MRV systems are complex and human-dependent → not efficient, i.e. 6-22 months

EO combined with innovative technologies could enable a more automatized system → more efficient, i.e. 3-6 months
HOW CAN WE GET TO THE SOLUTION?

- The WB published in June 2021 a study on the readiness of innovative technologies for RS-based estimation of carbon stock dynamics.
- Result from in-depth bibliography review and the participation of more than 200 international experts.
- Conclusions served to define the policy pathways for an MRV 2.0.
- The analytical study assessed the status and gaps of technologies in four different domains:
  - Remote sensing;
  - Artificial Intelligence (AI);
  - Geostatistics (GS); and
  - Cloud Computing.
INNOVATIVE TECHNOLOGIES — STATUS AND GAPS

Remote sensing
- **Status** → Combination of LiDAR data and L-band SAR (ALOS series, SAOCOM) **enables direct carbon stock estimation**
- **Gap** → Access to in-situ data (and partly RS data) **main challenge**

Cloud computing:
- **Status** → Cloud computing is a **mature and developed technology**. The only way to have the required processing capability is through CC.
- **Gap** → **institutional arrangements constrain its use** (e.g., data sharing policies, dependency on providers,...).

Artificial Intelligence (AI):
- **Status** → AI could bring significant improvements to different operations of the process (e.g., curation, data processing,...).
- **Gap** → There is currently a **gap between the AI and RS community**, i.e., no communication.

Policies
- **Status** → RS data access has **been improved greatly** and new technologies recognized initially under IPCC
- **Gaps** → Lack of standardization, inadequate data access and sharing policies (in-situ data),...

Geostatistics (GS):
- **Status** → GS represent mature technology in the forestry domain, but, for the most, have not yet found their way into an operational MRV context
- **Gap** → Lack of examples scaling-up to national/sub-national scales, **lack of access to in-situ data**, gap between the GS and RS community.
HOW CAN WE GET TO THE SOLUTION?

• The report describes technological challenges, and recommendations for overcoming them related to five areas:
  • data availability and access;
  • processing and computational performance;
  • uncertainty management;
  • standardization and protocols; and
  • Enabling environments
The golden age of Remote Sensing, with a plethora of spaceborne sensors, however... there are many challenges, but the main challenge to enable an EO-based system is the lack of appropriate high quality *in-situ* data.
RECOMMENDATIONS

• **Data availability and access**
  • Seek international partnerships to facilitate access to data, i.e., in-situ data, RS data,..  
  • Supporting existing efforts in in-situ data collection (i.e. Global Forest Biomass Reference).

• **Processing and computational performance**
  • Support the integration of new approaches (i.e. AI, GS) in traditional ones  
  • Support the convergence of techniques between research groups  
  • Build a centralized cloud computing system to enable accessibility, new algorithms,...

• **Uncertainty management**
  • Pilot the implementation of GS / AI through demonstration activities  
  • Include estimates of error propagation from the input data to the final output in MRV sys

• **Standardization and protocols**
  • Develop standards and protocols for data collection and development of components  
  • Promote data protection and security.

• **Enabling environments**
  • Support data policies (in-situ and RS data): access and sharing.  
  • Create incentivization mechanisms for data sharing, communication, etc.  
  • Creation of a perceived neutral entity that coordinates these actions (similar to WMO).  
  • Establish cross-communication among experts and users.
  • Invest in research, training, and knowledge transfer.
  • Create the necessary financial public and private support mechanisms  
  • Engage stakeholders to build confidence on new approaches
THANK YOU!