GFOI Global Forest Observations Initiative

Artificial intelligence in forest monitoring:

uses, applications, adoption and precautions

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What to use AI for in forest monitoring?

New and powerful approaches have already begun transforming forest monitoring.

What to use AI for in forest monitoring?

New and powerful approaches to working with data

AUTOMATION & EFFICIENCY

Automating labor-intensive tasks

- Scalable, standardized deforestation risk analysis (Open Foris Whisp).
- AI-generated multi-temporal data summaries.
- Structured risk assessments aligned with regulations.

DECISION SUPPORT & SIMULATION

User-friendly, interactive systems

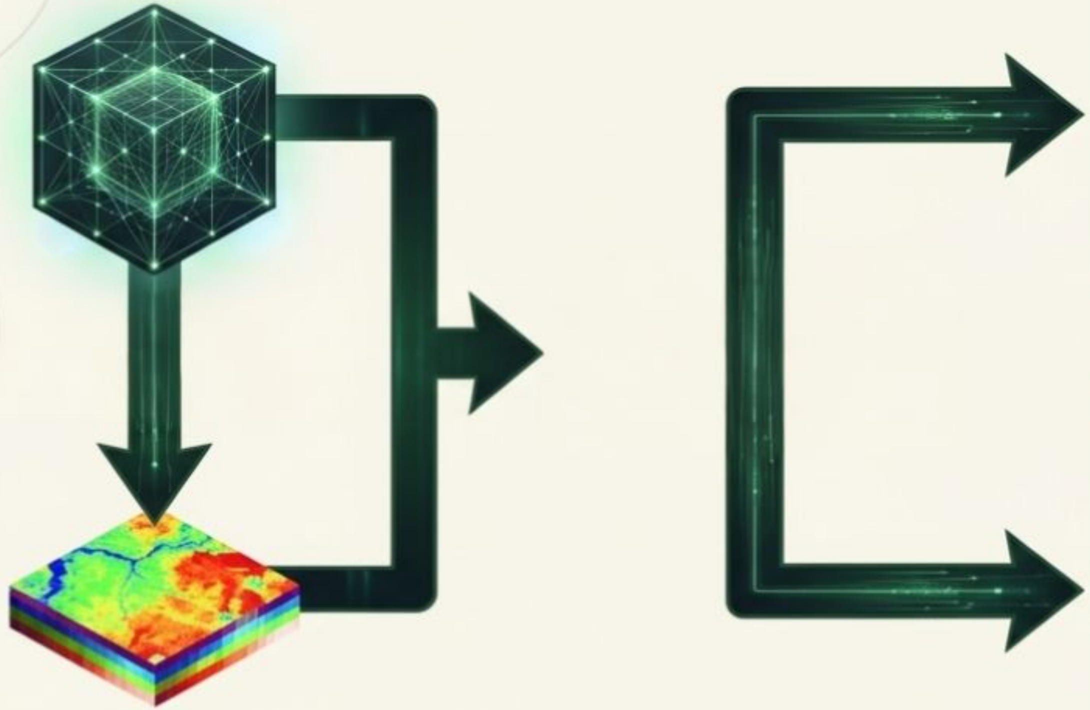
- Chatbots for non-experts (e.g., GIZ chatbot).
- Automated geospatial analysis via GeoJSON uploads.
- Collaborative management simulators (SIMANFOR).

COMPLEX DATA FUSION & PREDICTION

Analysing diverse datasets

- Integrates LiDAR and satellite imagery (ForestMap).
- Predictive modeling for growth and biomass (MATRIX).
- Satellite embeddings for large-scale analysis (SEPAL).

Fusing Complex Data to Simulate Future Scenarios



Output 1: ForestMap (Present State)

Highly accurate, standardized technical reports estimating current volume, biomass, and stand structure while reducing physical inventory costs.

Output 2: MATRIX & SIMANFOR (Future Projection)

Projecting forest evolution under climate stress and silvicultural scenarios. MATRIX outperforms outperforms established models like FVS at a 3km resolution for dynamic carbon accounting.

Deep Dive: Continental-Scale Density Mapping

Accurate global assessments have historically relied on sparse, heterogeneous ground data. By leveraging deep learning, researchers produced a pan-continental, uncertainty-aware framework for North America.

The Scale of Integration

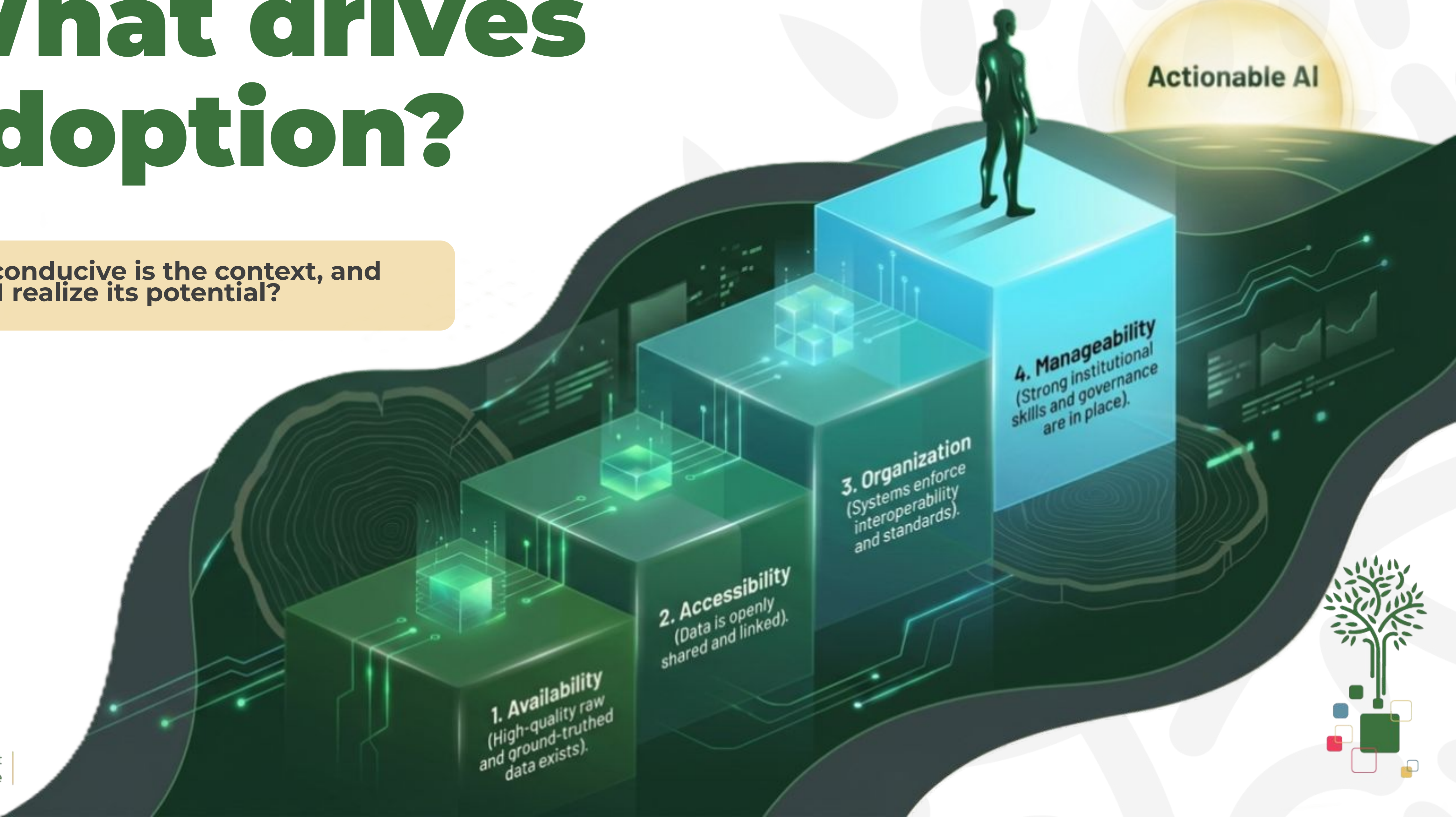
Ground Truth
600,000+ harmonized regional and national inventory plots.

Covariates
54 spatial layers spanning vegetative (MODIS, GEDI), structural (ALOS PALSAR-2), climatic, and edaphic domains.

Resolution
3-km grid cells creating a seamless wall-to-wall map across Canada, the USA, and Mexico.

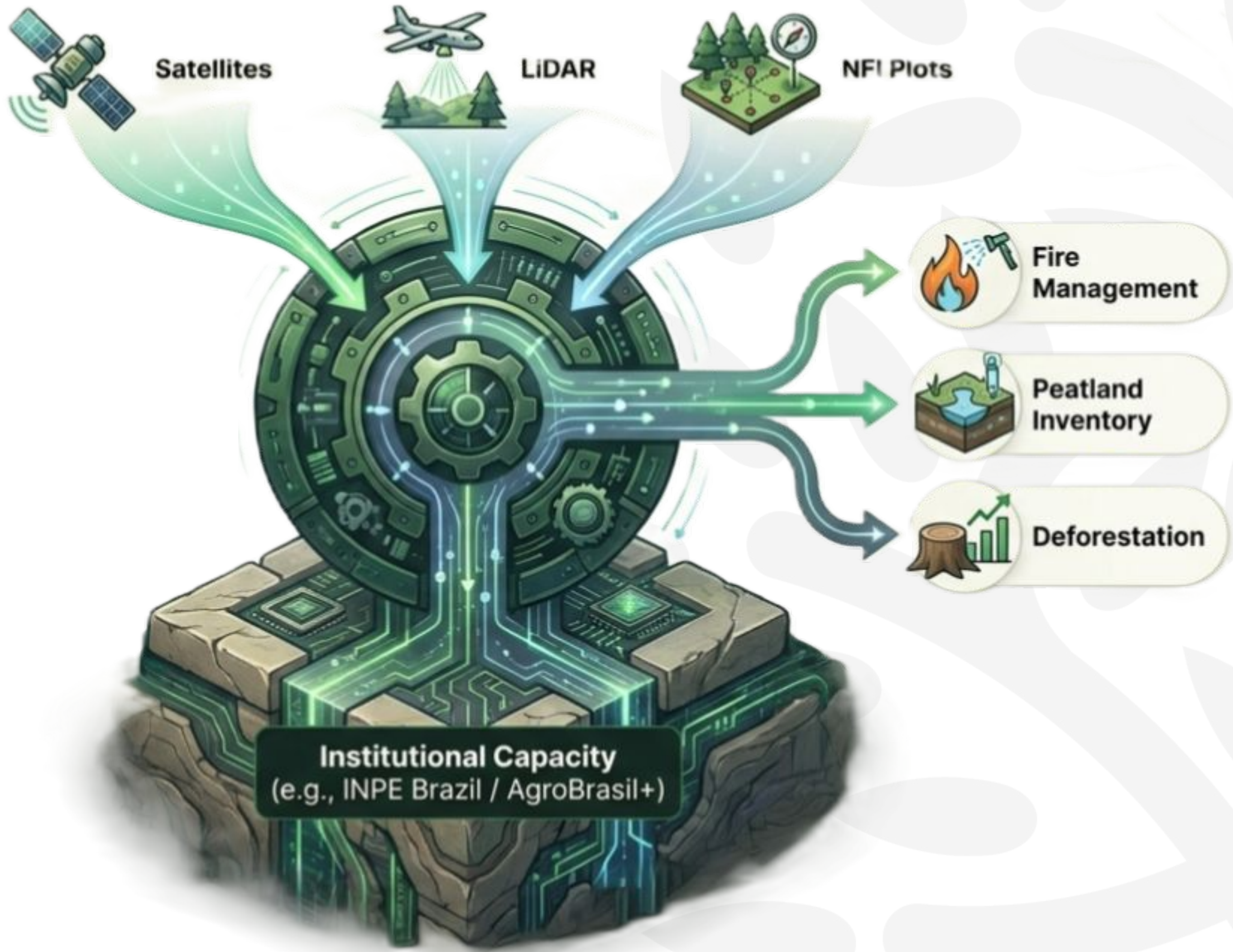
What drives adoption?

How conducive is the context, and can AI realize its potential?



Foundations: Data availability & Accessibility

Architecture: Interoperability & Institutional memory



Drivers of AI Adoption in Forest Monitoring

From Potential to Practice: The Context Required for Success

1. DATA AVAILABILITY

The "Golden Trio"

Success requires fusing LiDAR + Satellite + Field Data.

- **Crucial for "Policy-Grade" credibility & calibration of AI outputs.**

Robust in situ data is essential.

2. DATA ACCESSIBILITY

Open & Linked

AI needs open datasets to fuel Digital Public Infrastructure and innovation.

Example: Spain's open PNOA-LiDAR + NFI (National Forest Inventory).

→ Fuels development of public and private enterprise tools.

3. DATA ORGANIZATION

Interoperability

Systems must speak to each other (e.g., Open Foris Whisp, EarthMap).

Example: Indonesia's SIMONTANA integrates remote sensing and terrestrial data in one workflow.

Brazil's AgroBrasil+ Sustentável connects forest monitoring with financial decision-making.

→ Seamless exchange and structured architectures.

4. SKILLS & GOVERNANCE

Human Capacity

Tech needs qualified professionals, not just software.

- **Value depends on interpretation, validation, and sustained institutional memory.**

Supported by stable organizations, standard operating procedures, and continuous training.

→ Long-term capacity development.

What to be aware of

The central challenge is not simply to accelerate the uptake of AI.

AI in Forest Monitoring: What to Be Aware Of

Strategic Precautions for Responsible and Effective Deployment

NATIONAL SOVEREIGNTY

Data Ownership & Control

Countries must own and control their forest data.

- AI deployment should strengthen, not undermine, national data systems.

→ Respects principles of national data sovereignty.

MISSION-DRIVEN & INCLUSIVE

Prioritize Core Goals

Focus on climate action, biodiversity conservation, and rural livelihoods.

- Must support inclusive development and deliver measurable benefits for all.

→ Aligns with FAO's Digital Agriculture and AI Innovation Roadmap.

REGULATORY INTEGRITY

Robust Evidence Base

Reinforce efforts to build robust evidence for better decision-making.

- Enhance compliance and improve sustainable forest management (SFM).

→ Helps reduce deforestation through stronger evidence.

COLLABORATION & CAPACITY

Conducive Environment

Requires partnership among governments, international orgs, private sector, and science.

- Programs like AIM4Forests support capacity development and practical application.

→ Promotes AI use where it adds clear value.

GFOI Global Forest Observations Initiative

Lead partners

AUSTRALIA

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Federal Ministry for Economic Cooperation and Development

Food and Agriculture Organization of the United Nations

FOREST CARBON PARTNERSHIP FACILITY

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Thank you

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