FOREST RESOURCES & STAND ASSESSMENT

A practical journey from landscape planning to tree-level decisions

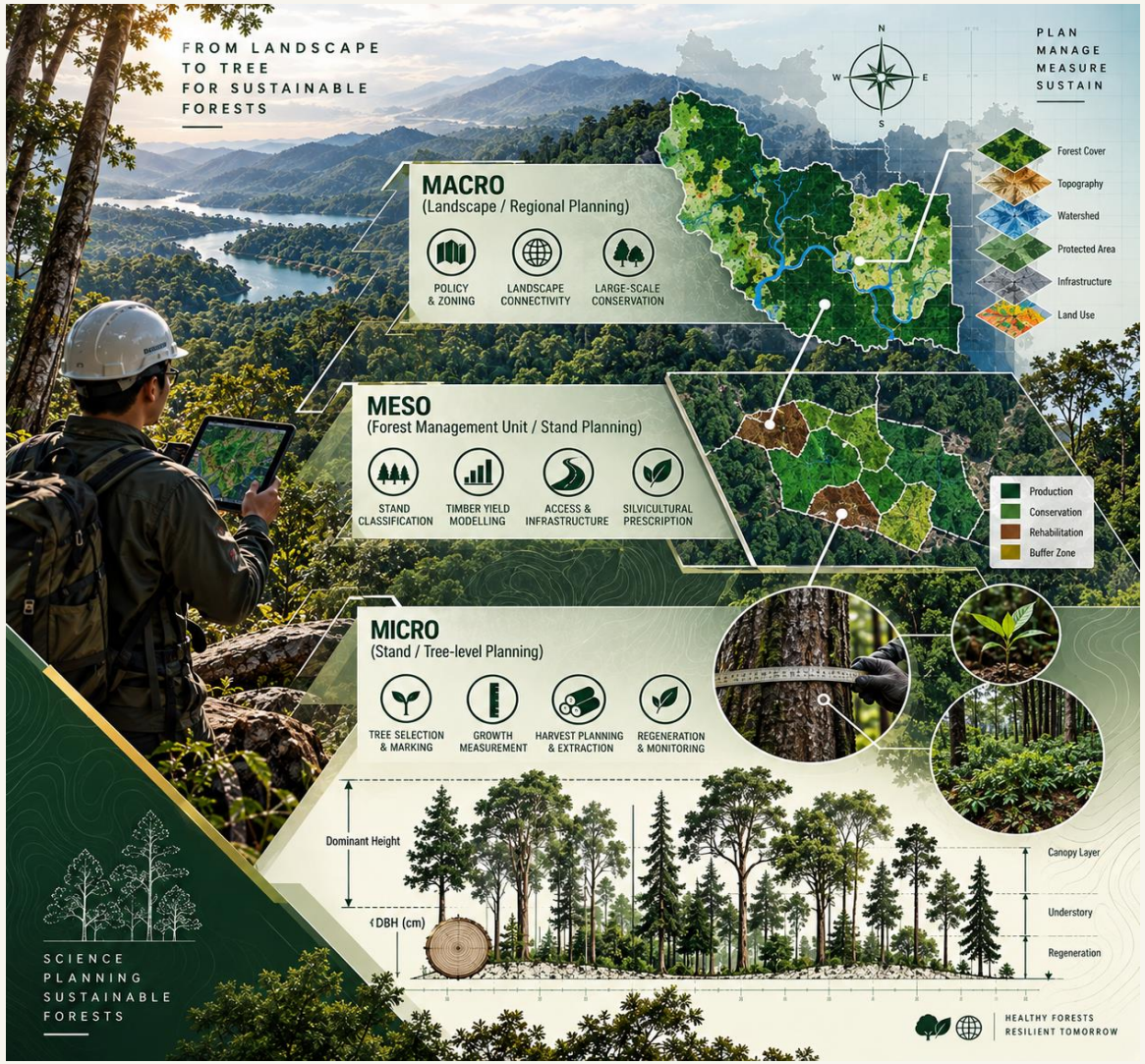
Macro → Meso → Micro



From the big picture to the tree

Three planning scales work together.

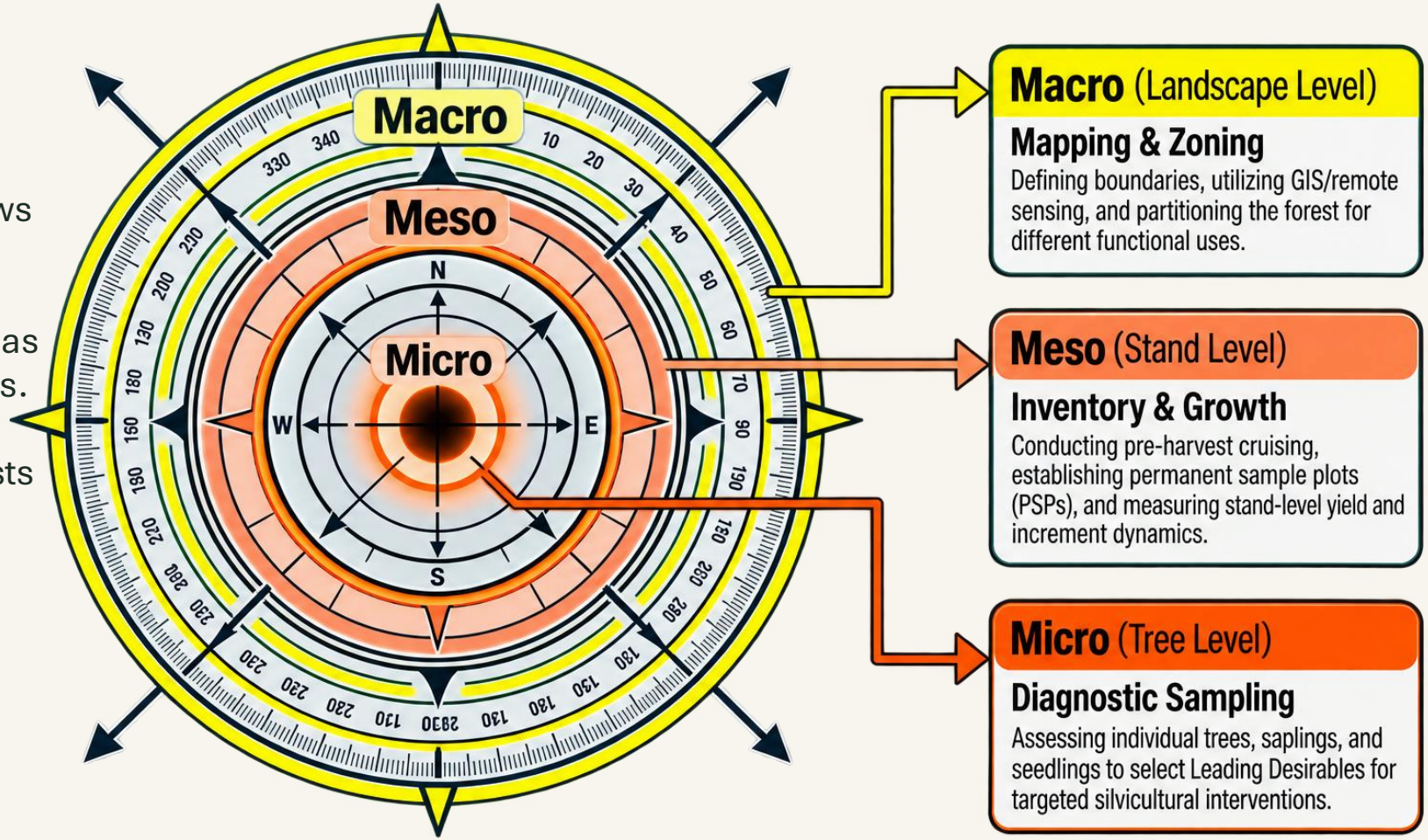
- Macro: map the landscape and define broad forest zones.
- Meso: assess the stand, its condition and its growth.
- Micro: examine individual trees and support field decisions.
- Use the right scale for the question you need to answer.



Physical demarcation

Mark boundaries clearly before field work begins.

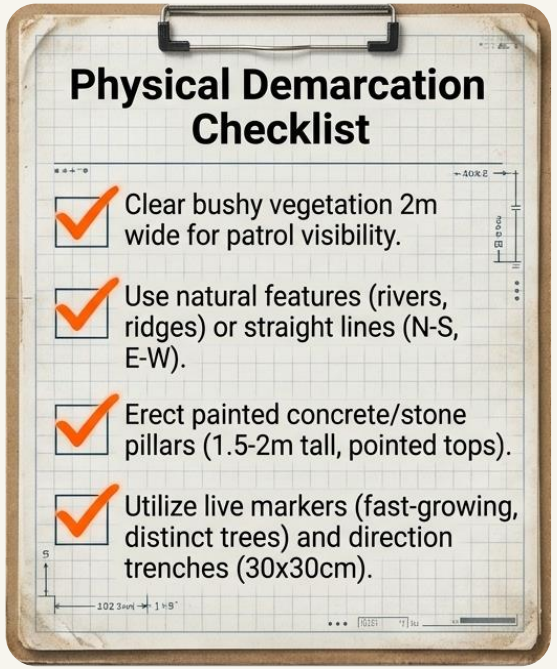
- Use clear boundaries so crews can identify the correct area.
- Check natural features such as rivers, ridges and forest edges.
- Use permanent markers, posts or trenches where needed.
- Good demarcation reduces confusion, overlap and field errors.

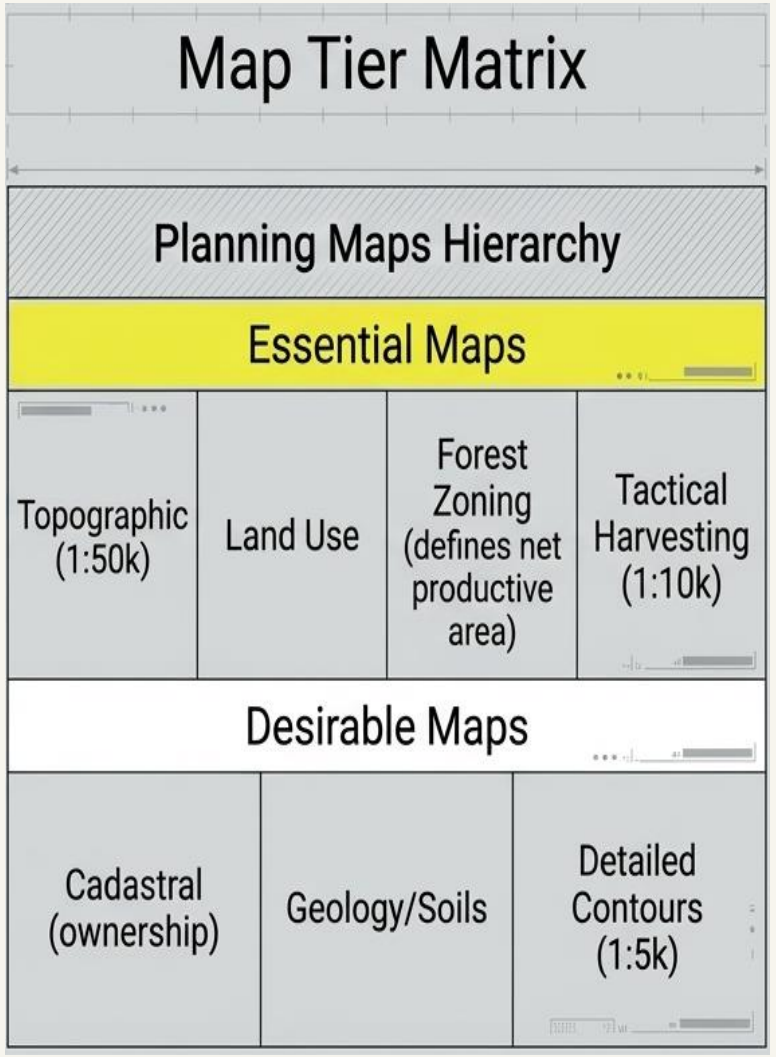


Map tiers for planning

Different decisions need different map detail.

- Essential maps support broad planning and location decisions.
- Desirable maps add detail for operational planning.
- Use topographic, geological and contour information where relevant.
- Match map scale to the level of decision-making.

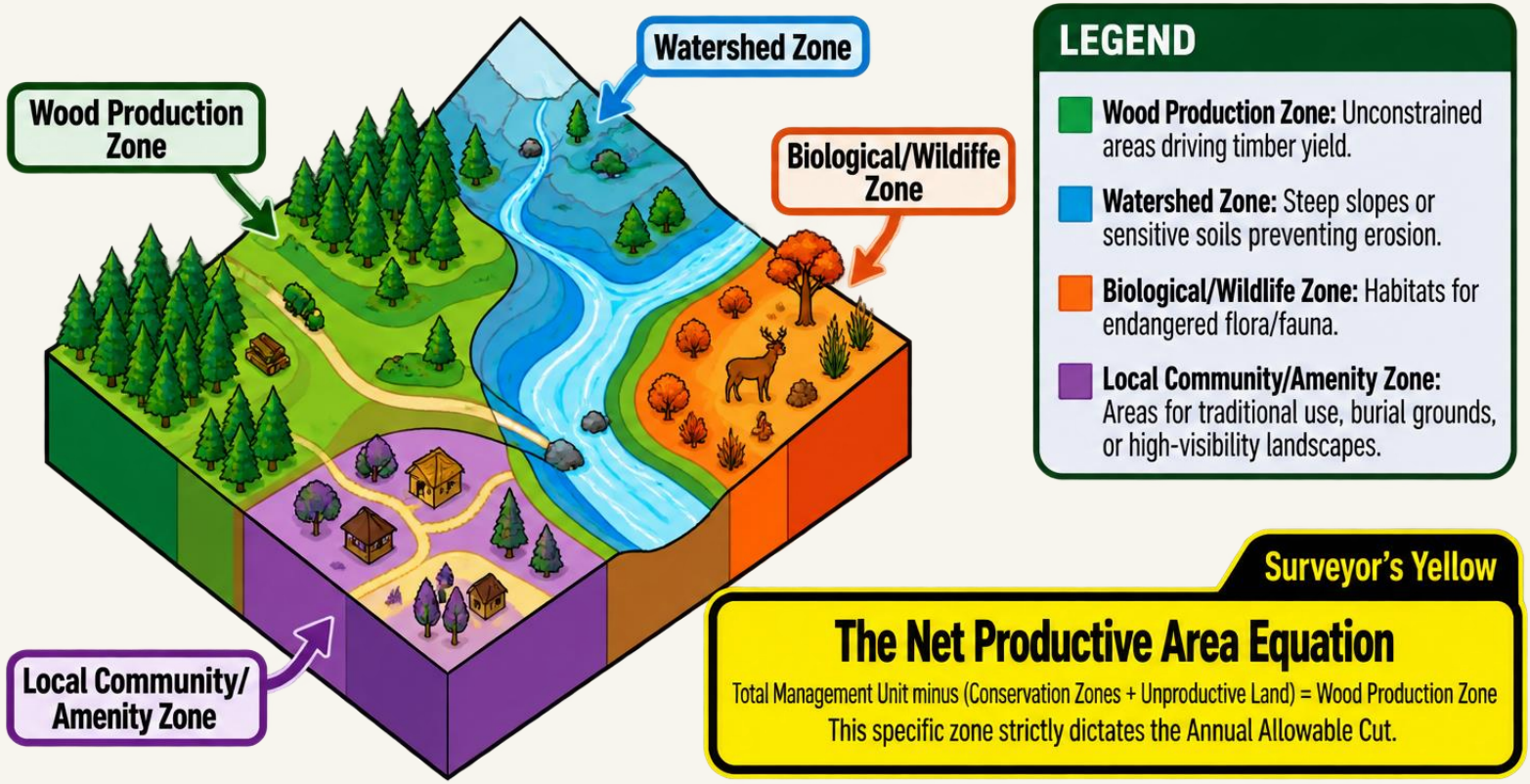




Forest Zoning & Net Productive Area

Not every part of a forest can produce timber.

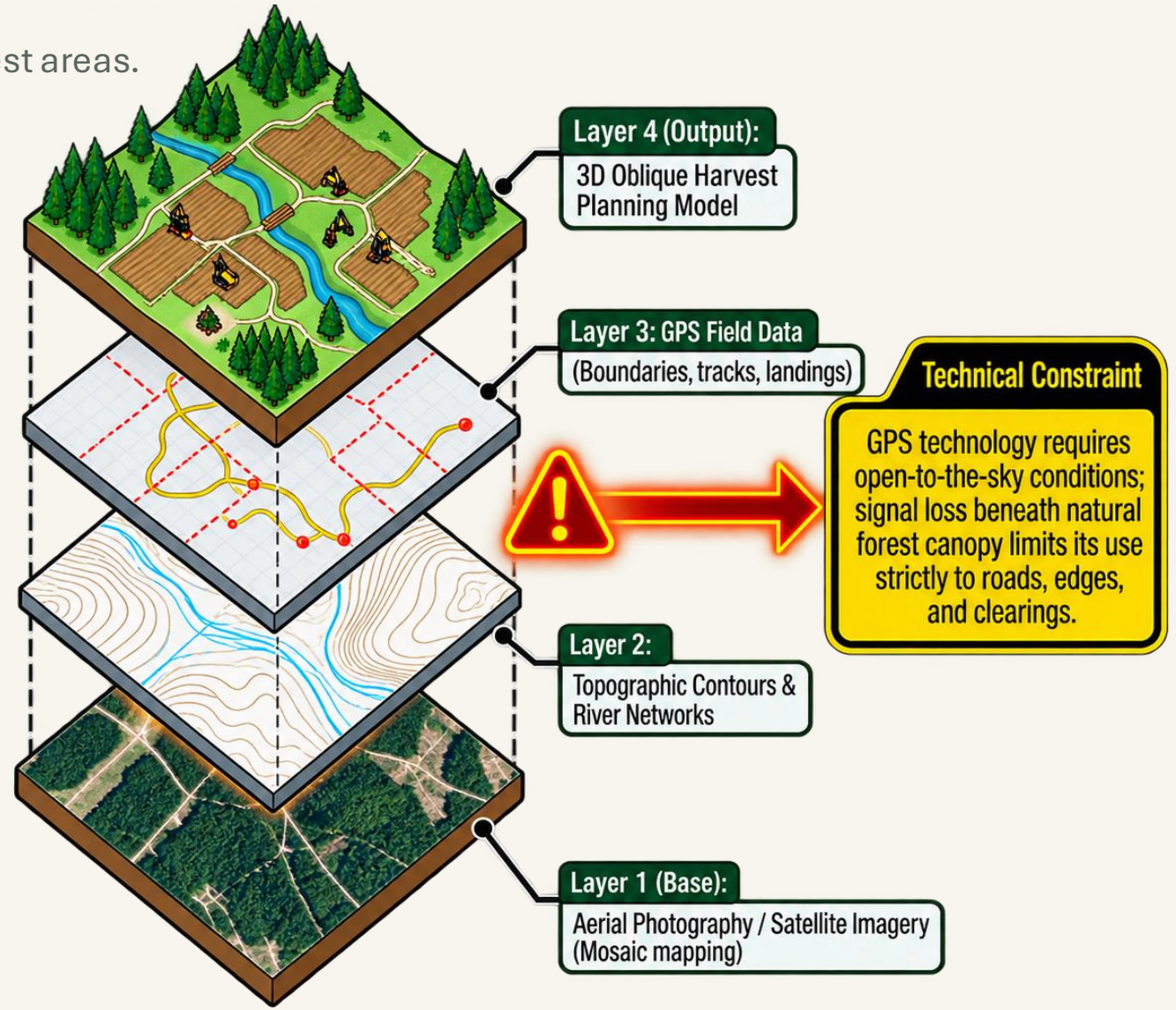
- Separate production zones from protection and biological zones.
- Recognise water bodies, steep areas and sensitive habitats.
- Calculate the net productive area before estimating harvest potential.
- Planning becomes more realistic when constraints are mapped early.



GIS integration & harvest planning

Combine spatial layers before choosing harvest areas.

- Layer satellite images, contours, roads and field observations.
- Use GPS data to check whether mapped features match reality.
- Identify technical constraints before operations begin.
- GIS helps planners see conflicts, access limits and suitable areas.



Two types of forest inventory

Planning inventories and operational inventories answer different questions.

- Planning inventory: covers a large area and supports broad forecasts.
- Operational inventory: focuses on compartments or smaller units.
- Planning asks: What resources are available?
- Operations ask: Which trees, areas and actions are ready now?

	Planning Inventories	Operational Inventories
Scale	Whole or substantial part of a forest management unit.	Compartment or sub-compartment level.
Types	Pre-concession (for bidding), Management planning, Biomass/Biodiversity surveys.	Pre-harvest cruising (100%), Diagnostic sampling, Post-harvest assessment.
Goal	Broad strategic data for long-term yield forecasting and concession valuation.	Direct tactical execution, tree-by-tree selection, and immediate silvicultural tending.

Pre-harvest inventory workflow

A consistent workflow improves field reliability. Operational steps for a 100% preharvest inventory.

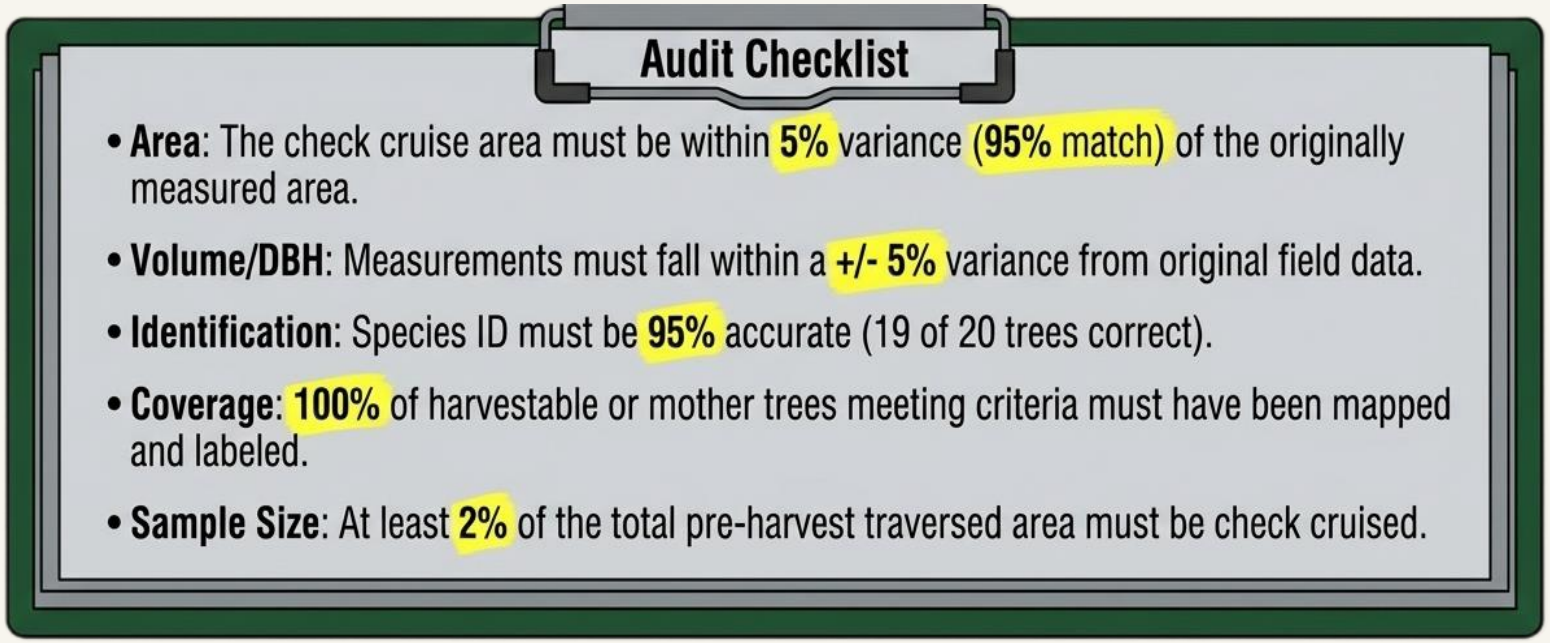
- **Access:** Reach and inspect the area by cut clear.
- **Transect:** Walk systematic lines through the stand and establish 20 m to 70 m wide parallel cruising strips.
- **Sketch:** Record stand features, map tree positions and topographic contours.
- **Label:** Identify and mark trees consistently. (E.g., Affix waterproof plastic labels. Red labels for harvestable trees and yellow labels for protected mother trees).
- Tally: Record species codes, DBH, and calculate pre-felling volumes via database.



Quality Control: Check Cruising Standards

A sample re-check helps confirm inventory quality. The Check Cruise Protocol conducts randomly by supervisory staff within 2-3 weeks of the initial pre-harvest inventory.

- Re-check a sample of the original area and measurements.
- Compare area, volume and tree information with the first survey.
- Investigate differences instead of accepting them automatically.
- Quality control builds confidence in the inventory results.



Forest growth has three parts

Stand growth is more than new diameter or height.

- I_{trees} (Increment): Sum of volume increments of surviving trees over time.
- M (Mortality): Volume of trees that died and no longer contribute to net growth.
- R_e (Ingrowth/Recruitment): Volume of new trees reaching measurable size classes during the period.
- Growth (G) estimates should consider all three components.

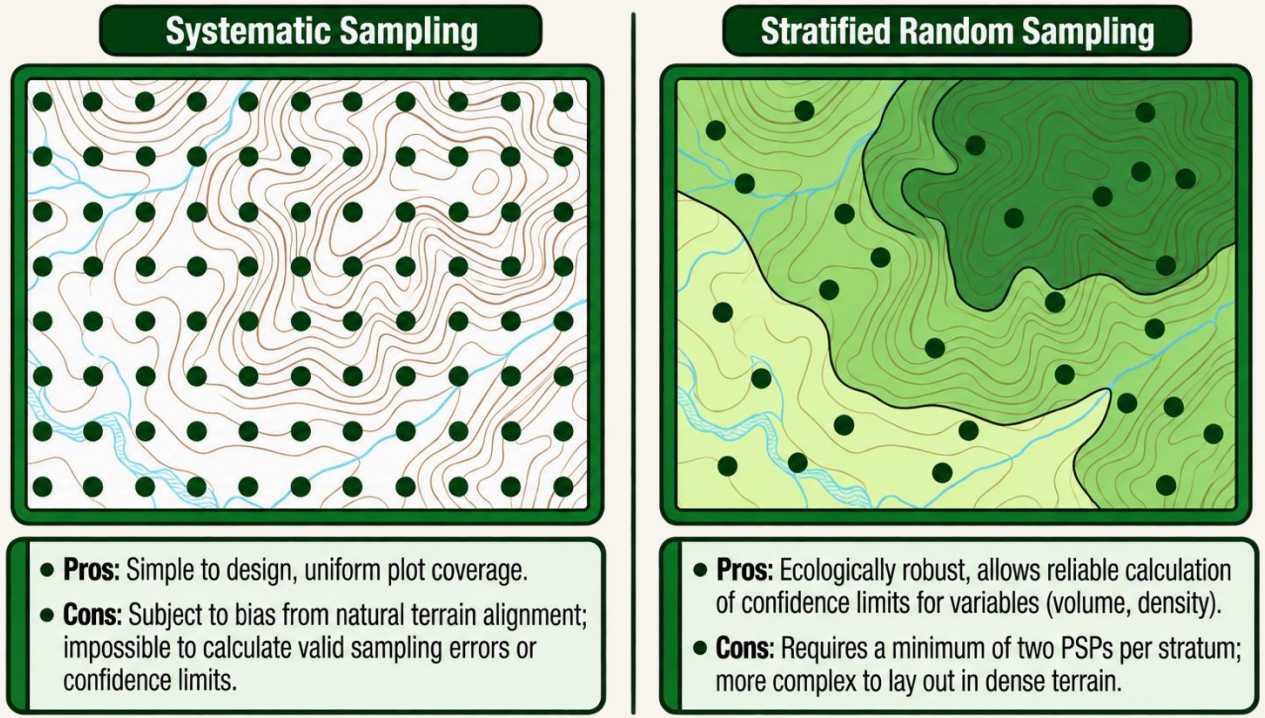
$$G = \{(I_{trees} \, x \, n) - (M + R_e)\} / n$$



Sampling designs for Permanent Sample Plots (PSPs)

Choose a sampling pattern that fits the landscape.

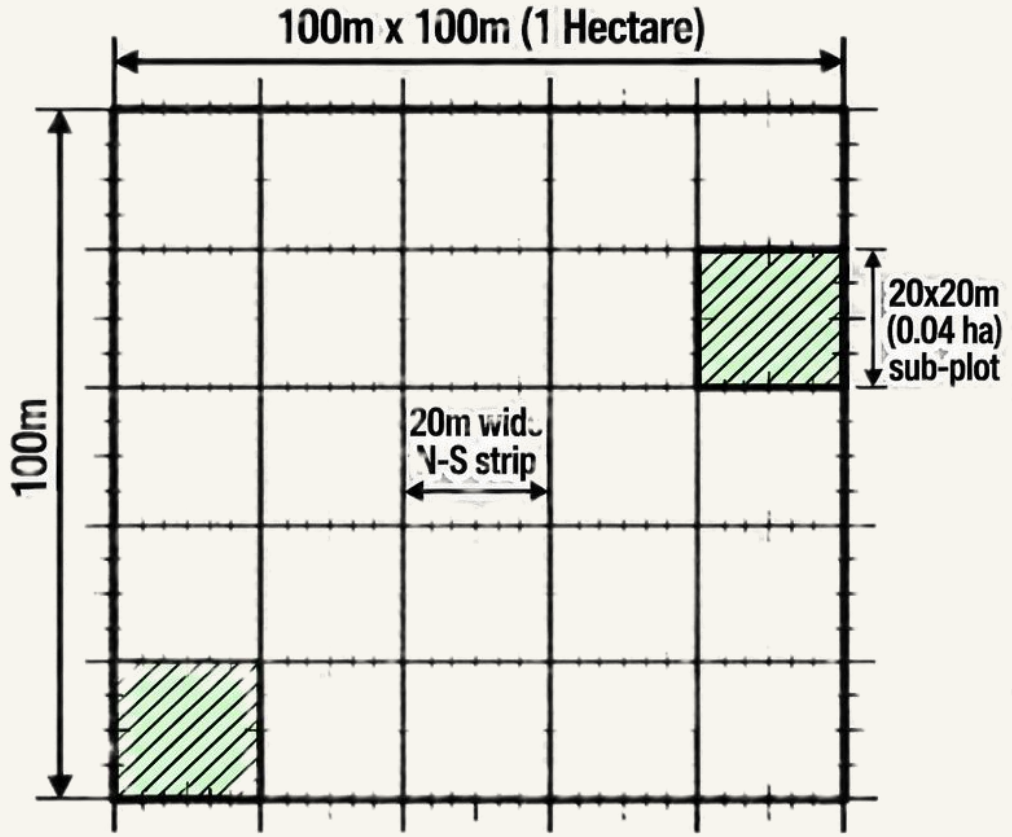
- Systematic sampling gives regular and easy-to-follow coverage.
- Stratified random sampling spreads plots across different conditions.
- Permanent plots support repeated measurements through time.
- Record plot location carefully so the same trees can be revisited.



Plot Architecture: A 1-hectare Permanent Sample Plot (PSP)

A clear plot layout supports repeated measurement.

- Use a consistent 100 m × 100 m plot boundary.
- Subdivide the plot to guide navigation and tree recording.
- Square plots are easy to map and revisit.
- Good layout reduces edge effects and improves data consistency.



Architectural Rationale (Why Square?)

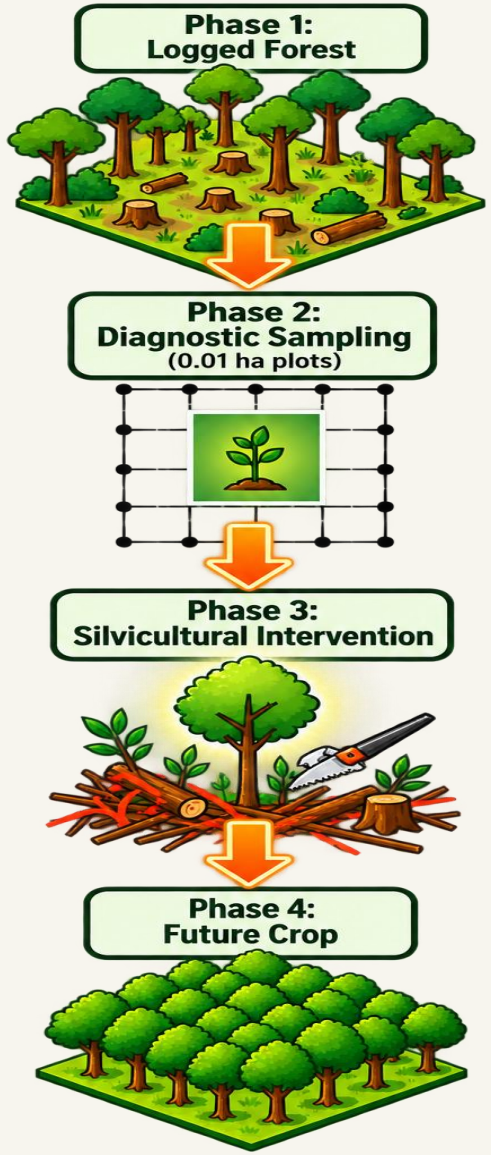
- Minimizes the edge-to-area ratio compared to long strips, reducing errors from boundary trees.
- Sub-plots ensure no trees are missed during repeated assessments.
- Much easier to establish by cutting compass-line boundaries in dense tropical vegetation than large circular plots.

Diagnostic sampling: from forest to future crop

Sampling can guide silvicultural decisions.

- Phase 1: understand the logged forest and its current structure.
- Phase 2: diagnose the stand using a focused sample.
- Phase 3: select silvicultural interventions.
- Phase 4: evaluate the future crop and expected response.

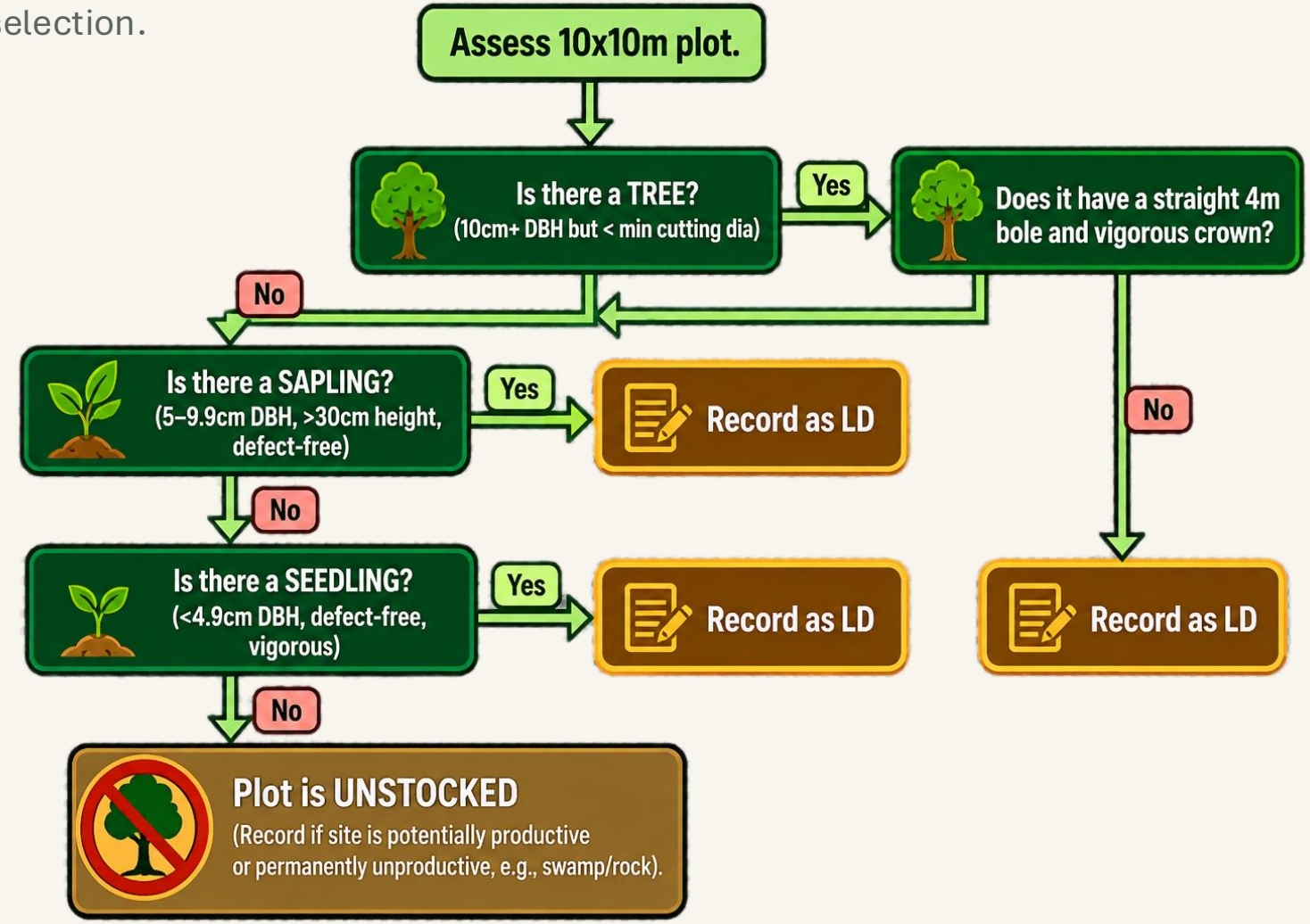
- Core Principles:
  - **Purpose:** It is not a wood inventory. It is a visual projection of future stand development based on existing spatial distribution.
  - **Scale:** Evaluates 10m×10m (0.01 ha) temporary plots to model an optimum stocking density of 100 final crop trees per hectare.
  - **Focus:** Identifying the single best Leading Desirable in that small plot to nurture.



Selecting a leading desirable tree

A simple decision path can standardise tree selection.

- Check whether the tree meets the minimum size requirement.
- Assess whether it is healthy, well formed and worth retaining.
- Check spacing and whether nearby trees compete strongly.
- Record the tree as a leading desirable tree, or leave it unselected.



Synthesis: link stand structure to productivity

Good decisions connect field data, analysis and ecology.

- Field inputs: DBH, species, plot layout and diagnostic observations.
- Analytical engine: estimate basal area and stand-level indicators.
- Ecological insights: interpret productivity, competition and biodiversity.
- Measure at tree level, scale up to the stand, then decide at the forest level.

