Sampling Optimization for Training ALS-Based Predictive Models

Planejamento e Controle Florestal

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Introduction

Even-aged Forest Management Elements

Land classification

Location, tree size, growth and harvest stocks, species, soils, physiography…

Prescriptions

Regulatory rotation, harvesting regime, silvicultural treatments.

Forecast

Prediction and projection (numerical description of expected timber yield in intermediate and final harvests)

Forest Management

Understanding growth and yield processes

Projection of future production based on consistent information

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The challenge
Methodological transition

Traditionally

Growth and yield models calibrated with permanent plots.

Permanent plots representative of site conditions.

Robust growth and yield models exhibit low variability when compared to predictive models.

Transition

LiDAR - ALS

ALS-based models require representative samples, since their development typically involves the correlation of LiDAR-derived metrics with plot-level volume measurements.

Rethink sampling.

Random sampling does not always ensure good calibration.

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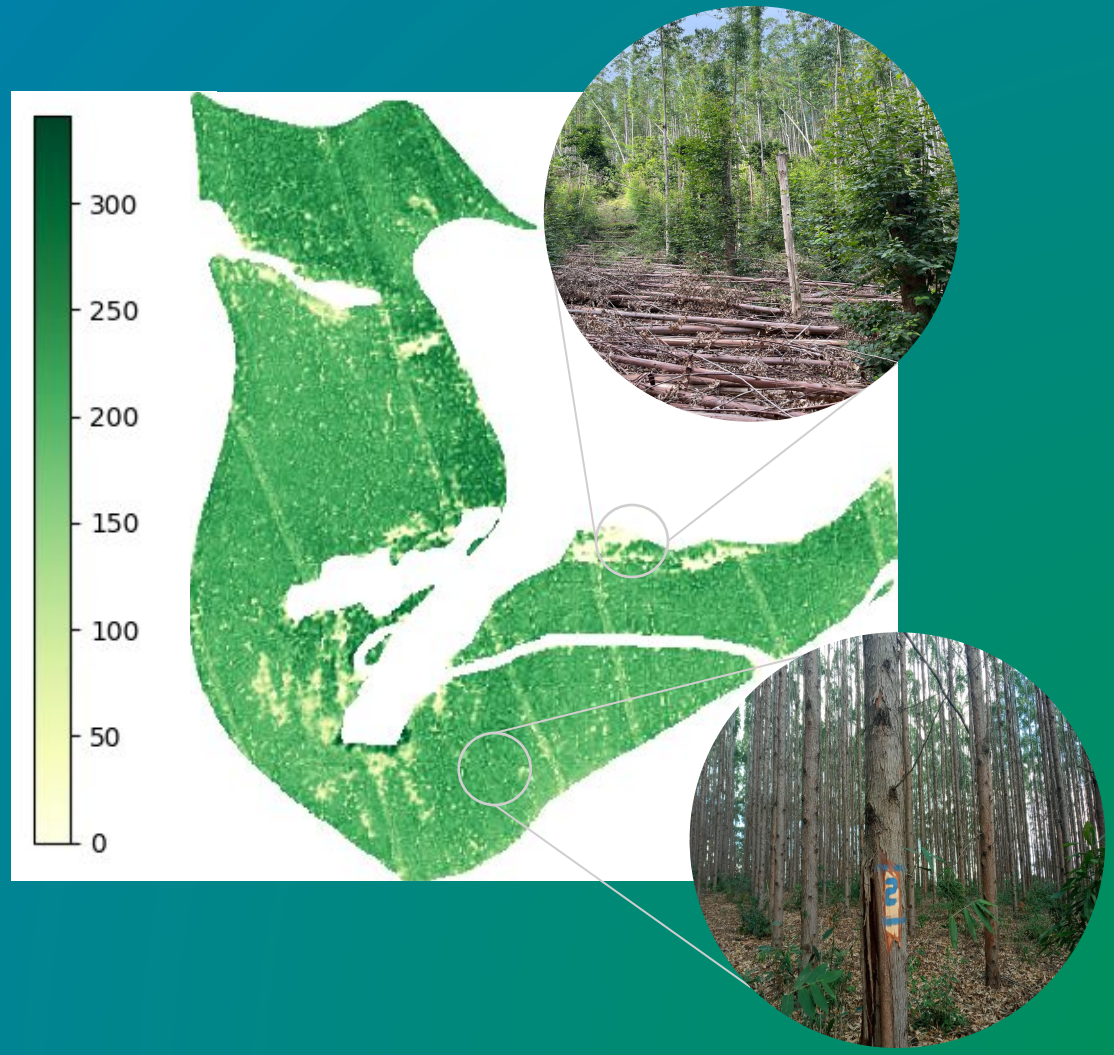
Study Objectives

Definition

To evaluate strategies for selecting permanent plots to train ALS-based models that are:

- Representative;
- Accurate;
- Efficient in sampled area.



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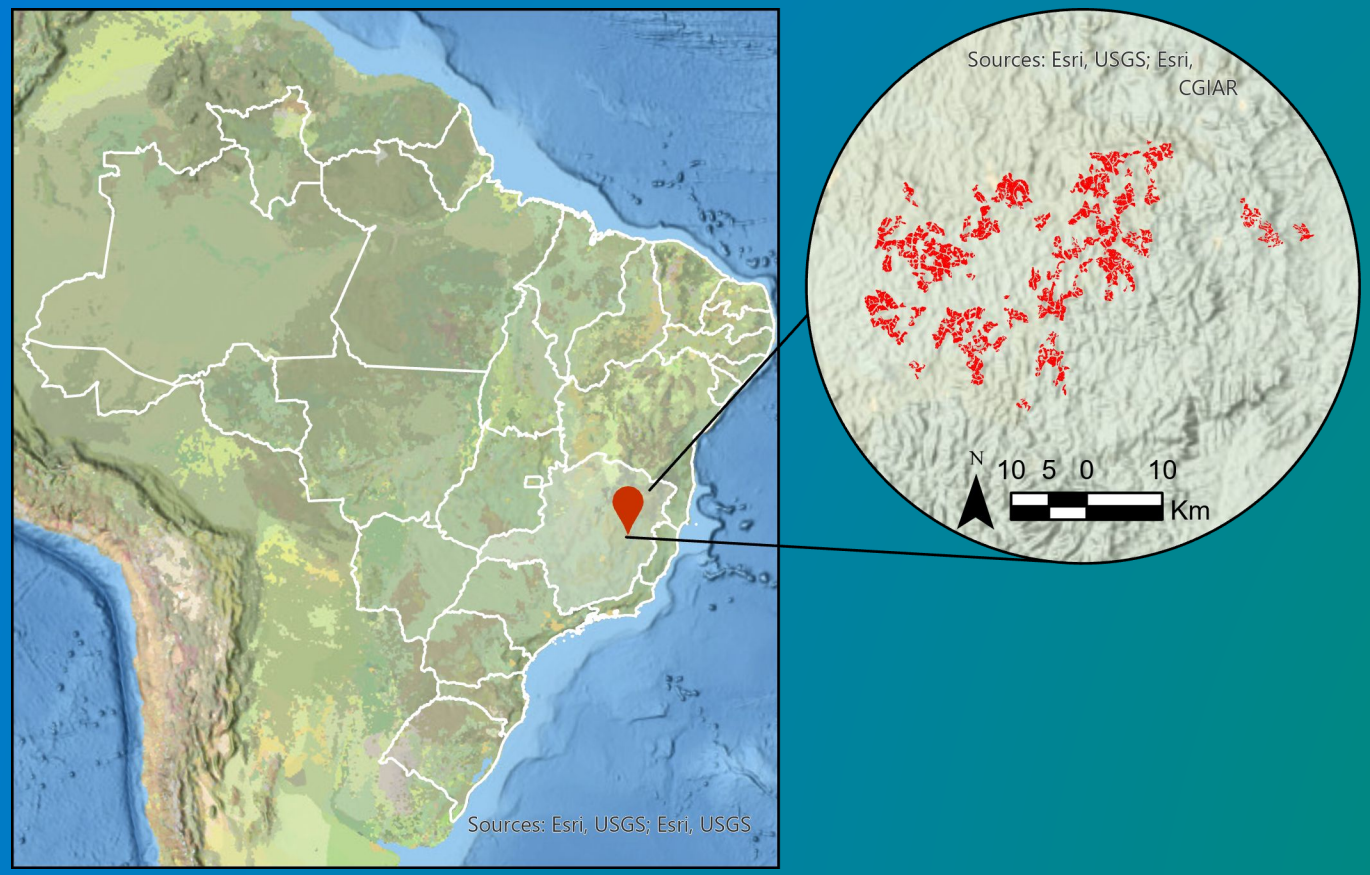
Area and data



15,514 ha of commercial *Eucalyptus urograndis*;

6,121 permanente plots;

Age: 2 a 8 years;

Measurements: 2010 a 2024;

MAI7: 47 m³/ha/ano

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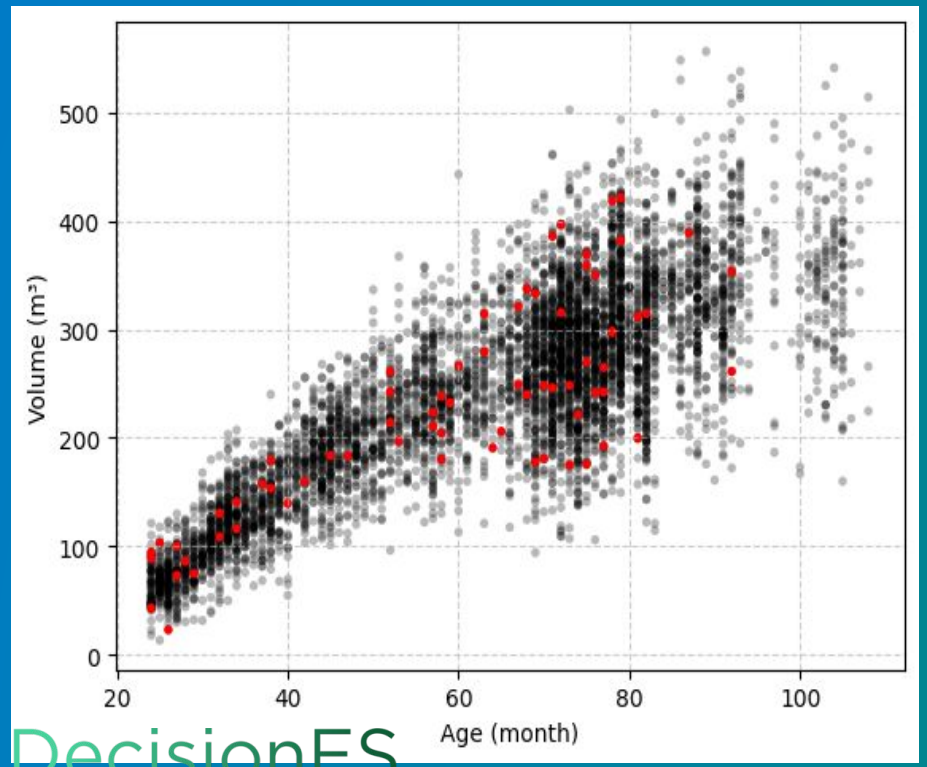
Strategies

Simulated Samplings

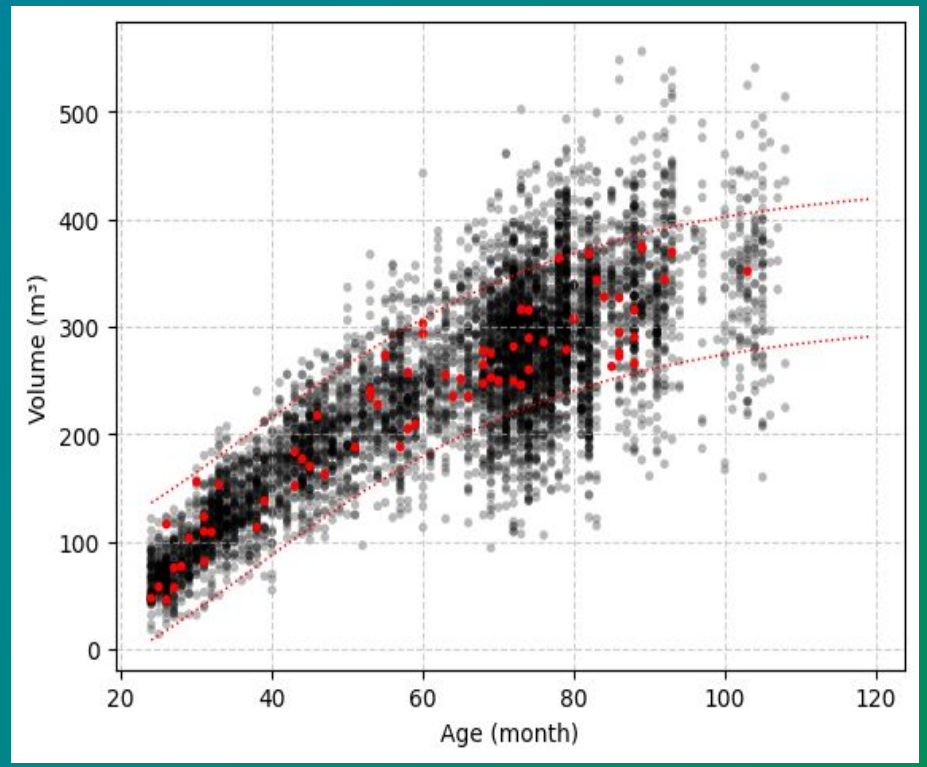
SRS

Simple Random Sampling



SRS-CB

Simple Random Sampling within a Confidence Boundary (CB)



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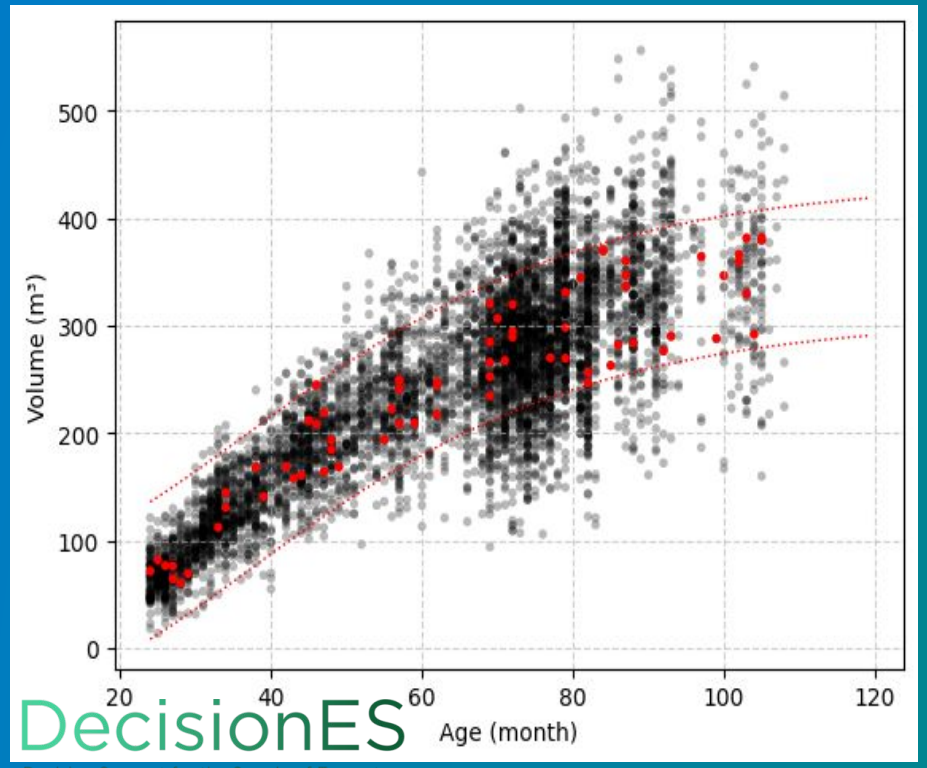
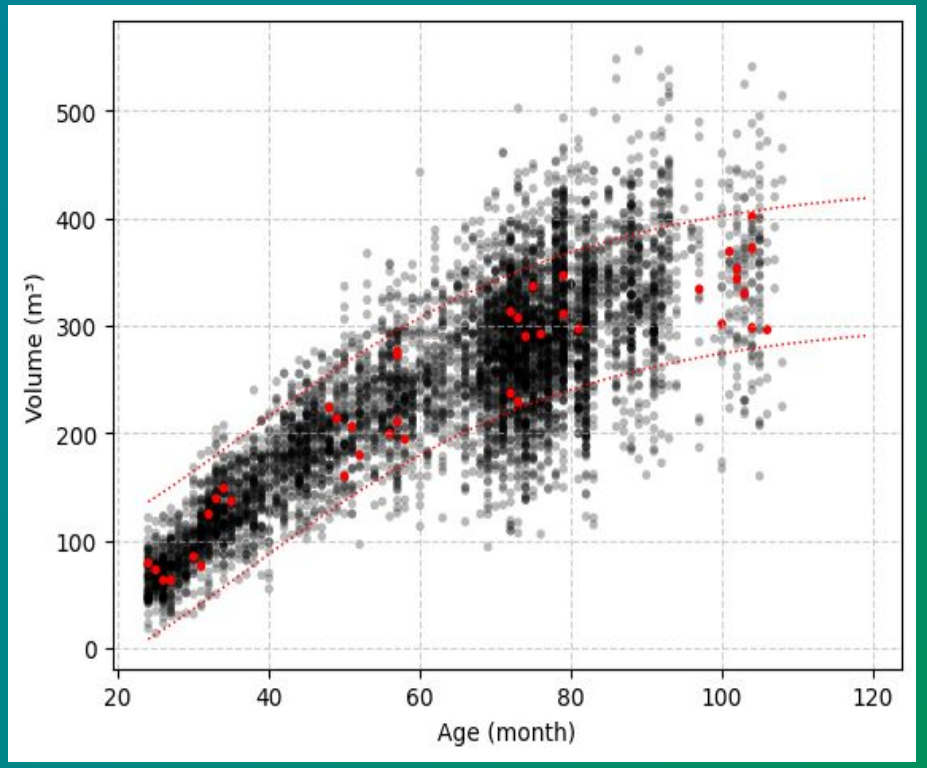
Strategies
Simulated Samplings

SRS-CB*
Stratified Random Sampling, segmenting samples by age within the CB



SRS-PAC-CB*
Stratified Random Sampling in main classes, within the CB.



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Simulations

Parameters and Evaluation Criteria

Parameters

1,000 simulations per combination

576,000 total simulations

Comparison with models calibrated using CFI (Continuous Forest Inventory)

Criteria

Statistical accuracy of the fitted model

Representative sample coverage per stand

Reduction of sampled area

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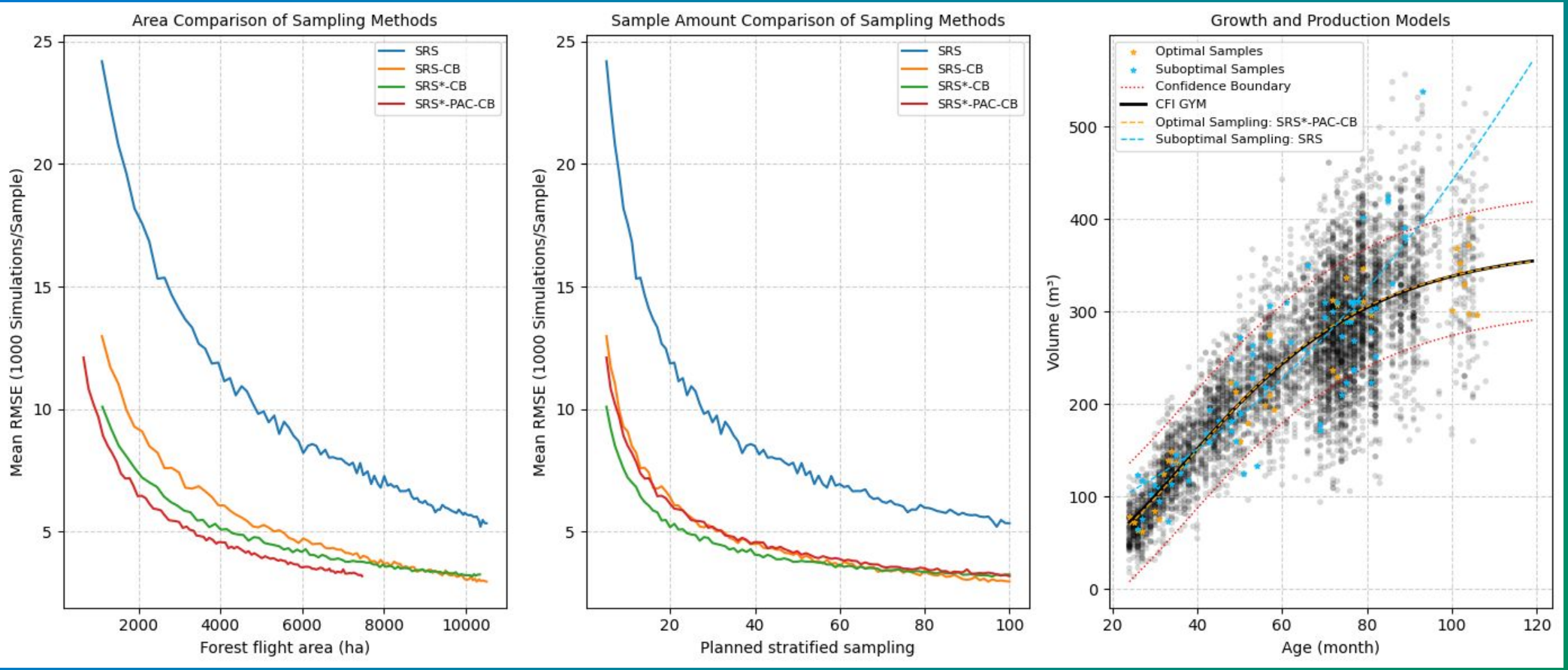
Results



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Conclusions

Advantages

Operational cost savings

Improved planning of ALS flight missions

Optimization of resources (time and cost)

Strategies can be Applied in future projects

Foundation for Building more robust remote inventories

Relevant for companies with large forest assets

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Thank you!

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