# Sampling for national-level estimates of trends in forest disturbance and regrowth

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# National-scale forest disturbance mapping

- Forests important players in carbon story
- North America Carbon Program needs national-level estimates of disturbance and regrowth
- *Decadal time-step of LEDAPS products misses some disturbance and recovery!!!*

# National Landsat Sample Design: Basic premise

- Dense time-series Landsat data needed to characterize disturbance/recovery
- Cost of time-series cubes is high
- Cost of linkage with FIA biomass is high
- Therefore: SAMPLE!
  - Sample from all possible Landsat scenes in lower 48 of U.S.
  - Fundamental sample unit: One Landsat scene

# National Landsat Sample Design: Competing objectives

*Good logistics*

Minimize inclusion of low-forest area scenes

Include fixed scenes

Allow for future expansion

*Good stats*

Defensible probability-based design

*Good modeling*

Capture of diverse forest types

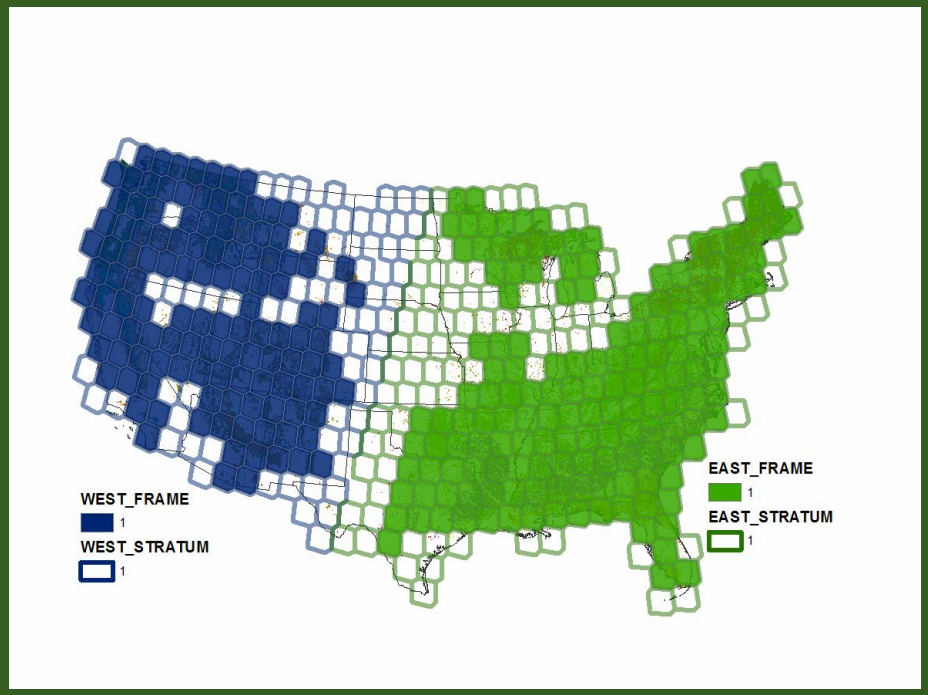
Good spatial distribution of scenes

# Landsat sample designs: Other work

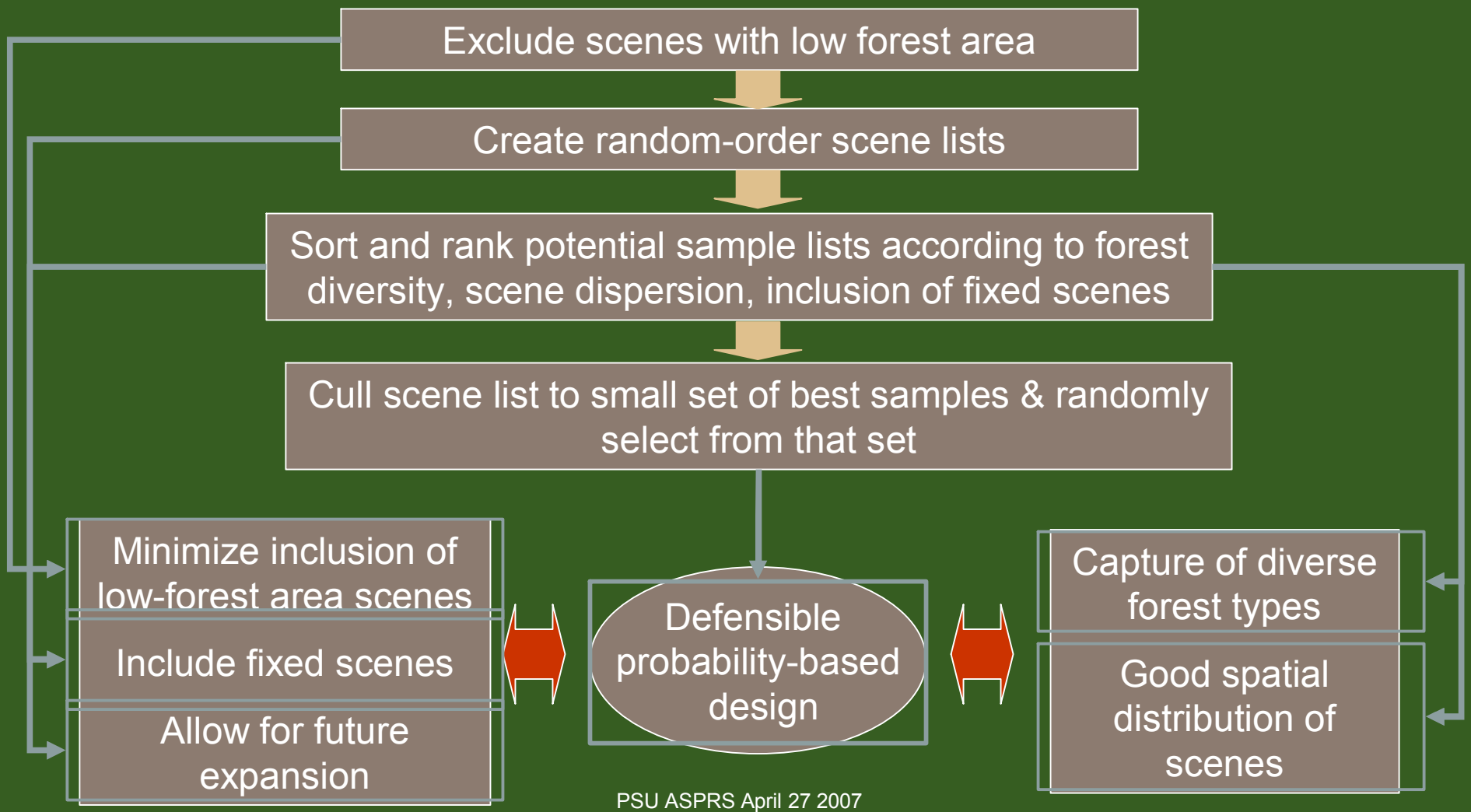
- Pan-tropical Landsat sampling – TREES-II and FAO 2000
- Lessons learned summarized in Gallego (2005):
  - Use spatially-dispersed layout
  - Work with unequal-probability estimators
  - Avoid scene overlap

# Landsat sampling: Initial steps

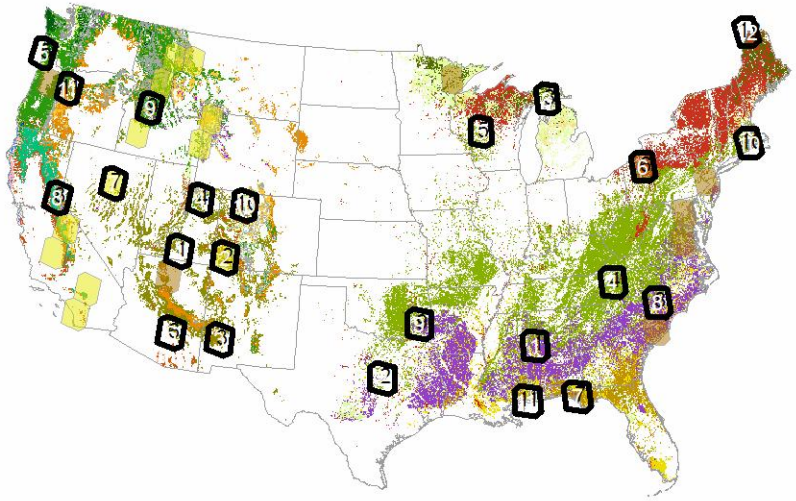
- Separate country into eastern and western sampling frames
- Identify Thiessen-polygons for each scene



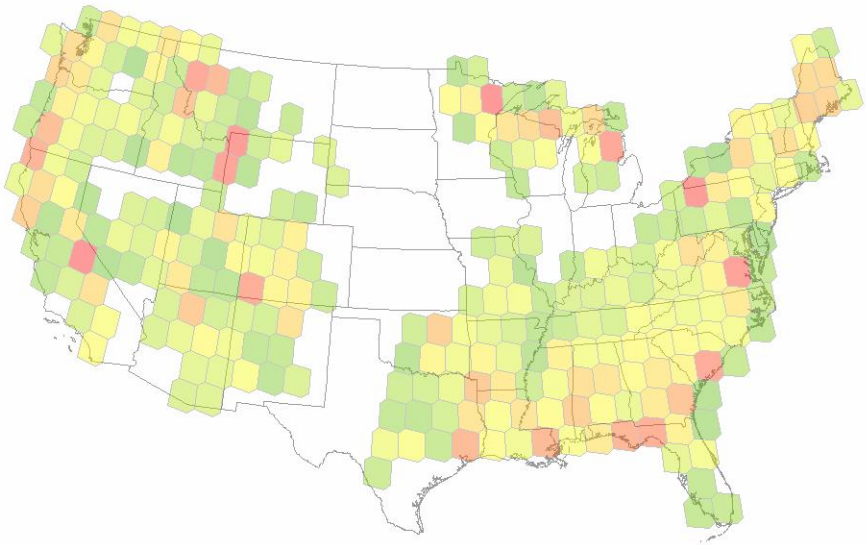
# National Landsat Sample Design: Strategies



# Sample



# Probabilities of inclusion



# National Estimation

- Use probabilities of inclusion within Horvitz-Thompson estimator framework:

# Sample Scenes

Disturbance/ recovery metric for scene *i*

$$\hat{\tau}_{\pi} = \sum_{i=1}^{\upsilon} \frac{y_i}{\pi_i}$$

Probability of inclusion for scene *i*

# Link with LEDAPS, etc.

- Complement temporal depth at sample scenes with spatial coverage of LEDAPS
- Include ownership, climate, forest type, etc. as predictors
- Result: Consistent, national-level products
  - Disturbed area/yr, biomass loss and gain, rates of recovery

# Summary

- We wanted to know:
  - How are our natural resources changing at broad geographic scales?
  - What drives change?
  - Are management and policy tools effective?