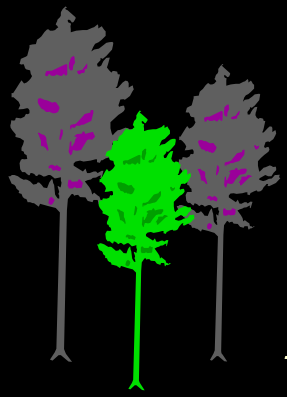

REMOTE SENSING NEEDS FOR USDA FOREST SERVICE: AN **FIA** PERSPECTIVE

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Presented at the LCLUC Science Team Meeting on GOFC and Disturbance,
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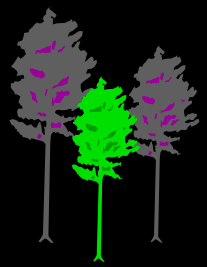
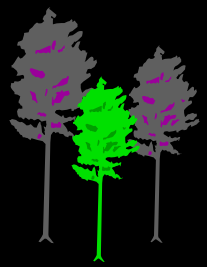


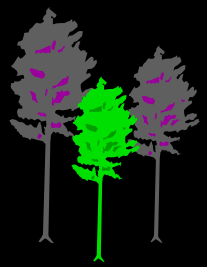
Forest Inventory and Analysis (FIA) Program Overview

- Collect and report information on status and trends of Nation's forested ecosystems (since 1930's)
  - Area of forest by stand type, condition class, ownership, etc.
  - tree species., sizes, wood volumes, biomass, growth, mortality, removals, regeneration,
  - understory, habitat components, down woody debris
  - forest health
  - Montreal Process Criteria and Indicators sustainable development
- Statistically reliable at National, regional, state, sub-state scales (county scale too small)
- Covers all lands, including the 73% Nation's forests in private ownership



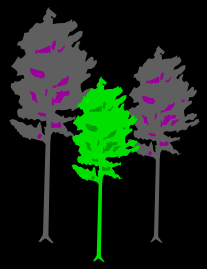
Forest Inventory and Analysis (FIA) Program Overview

- Primary measurement protocols designed for field plots
- 0.40-ha primary sampling unit (2x2-pixel area)
  - trees measured on 0.06-ha (less area than one 30-m Landsat pixel)
- 5x5-km grid over entire conterminous USA
  - 360,000 field plots in USA
  - 120,500 are forested
- Each field plot re-measured every
  - 9-12 years in eastern USA ($1,800-$2,600 per forested field plot)
  - 20 years in western USA ($3,700-$7,600 per forested field plot)
  - Average 2-person field crew 1 forested field plot per day
  - 300 permanent staff, plus small army of seasonal “plot-getters”



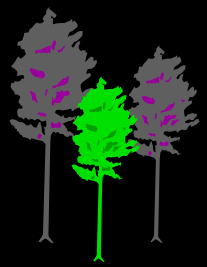
Forest Inventory and Analysis (FIA) Program Overview

- FIA Program has broad support from States, forest-products industry, environmental organizations, etc.
- 1998 Farm Bill
  - provide more timely data, less than 5 years old
  - re-measure 20% field plots every year in every state
  - better utilize remote sensing
  - assess trends over past 20 years
  - predict future conditions 20 years into future
- FIA budget increasing 20% per year
  - FIA budget in 1997 was $20,000,000
  - FIA budget in 2003 planned to be $62,000,000
  - Cost sharing with State agencies



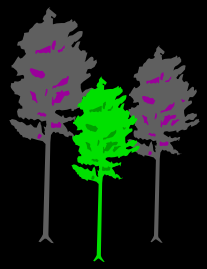
Forest Inventory and Analysis
Remote Sensing

- Stratification to improve precision (statistical efficiency)
- Currently use photointerpretation of NAPP aerial photos
  - 1x1-km grid
  - over 9,000,000 photo-plots in conterminous USA
  - nominal 0.4-ha photo-plot
  - repeated every NAPP cycle
- Replacing NAPP with Landsat 7
  - better mesh with shift to annual re-measurement of field plots
  - provide maps, not just “dot grid” of photo-plots
  - might be less expensive



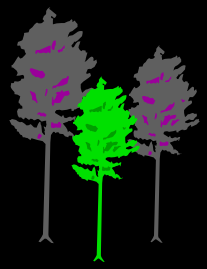
FIA Remote Sensing
Stratification with Landsat

- **Forest/Nonforest** classification adequate for statistical stratification
  - Forest and tree measurements mostly equal **0** in nonforest stratum, which is biggest single increment of gain in efficiency
  - High classification accuracy needed to achieve practically significant gains in efficiency
- Classification of detailed forest types valuable
  - Detail needed for regional analyses and modeling
  - Need at least 80-90% accuracy for significant statistical efficiency
- Probably need new land cover classifications every 5 years, or updates every 5 years through change-detection



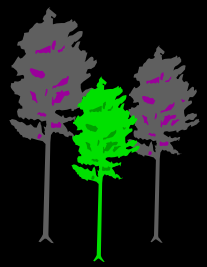
FIA Remote Sensing Stratification with Landsat

- Precise registration important to merge Landsat data with FIA field plots, which are optimized for tree-level measurements
  - FIA plot covers 2x2 30-m pixel block
  - moving FIA field plot 60-m can make significant difference in tree-level measurements, or assign plot to wrong stratum
  - 30x30-m is a large area to measure trees on the ground, but 30-m pixel is tiny speck on Landsat image



FIA Remote Sensing Stratification with Landsat

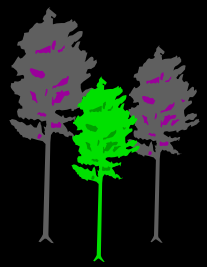
- 500 Landsat scenes, every 5 years is big job for FIA
  - FIA is world-class for gathering field data
  - FIA has a $1,000,000/year investment in remote sensing R&D
  - FIA does not currently have operational capabilities for classification of 100 Landsat scenes per year
  - Developing a large infrastructure for a new application can be intimidating to program managers
- Looking for opportunities to share costs and products with other programs (e.g., MRLC/NLCD-2000 Consortium)
  - Seeking agreement between statistical estimates of forest area and count of forested pixels in national land cover map (selecting the threshold between forest/nonforest classification)
  - Partnership in classification of more detailed forest categories



FIA Remote Sensing

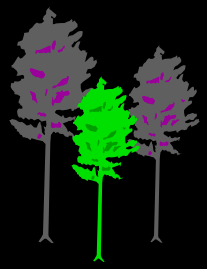
Sample of High-resolution Imagery

- Premise: Landsat has insufficient information-content to significantly improve statistical efficiency for detailed FIA estimates of forest composition and some types of change (partial cutting, spread of urban/wildland interface, moderate insect damage, changes in tree mortality)
- Premise: while 0.4-ha FIA field plot is rather large for measuring trees, it is small for measuring stand attributes, local context (landscape), and registration to Landsat.
- Premise: changes at 5-year time scale (1998 Farm Bill) can be accurately observed with high-resolution imagery (0.1- to 1-m) for sample plots (50- to 500-ha in size)



FIA Remote Sensing
Sample of High-resolution Imagery

- Assumption: Sample of larger plots around FIA plots, with new high-resolution imagery every 5 years, improves:
  - statistical efficiency of monitoring composition and changes in Nation's forests
  - fusion of Landsat and coarser-resolution satellite data with field measurements (better matching of scales/resolutions)
- Partnership of FIA with USDA NRCS National Resources Inventory (NRI) might share costs
  - NRI has 300,000 60-ha primary sampling units in USA
  - NRI acquiring 1:8,000 photography for sub-sample of 42,000 plots each year
  - Pilot study with Minnesota Department of Natural Resources



FIA Remote Sensing
Sample of High-resolution Imagery

- Forest Inventory and Analysis 1999 Business Report
  - http://www.srsfia.usfs.msstate.edu/wo/wofia.htm
- Forest Inventory and Monitoring Environmetrics
  - http://www.fs.fed.us/rm/ftcol/rwu4804.htm
- Journal of Forestry
  - December, 1999 FIA program
  - June, 2000, Remote sensing in forestry

Thank you, Questions?