Forest Inventory & Analysis (FIA) – how it works

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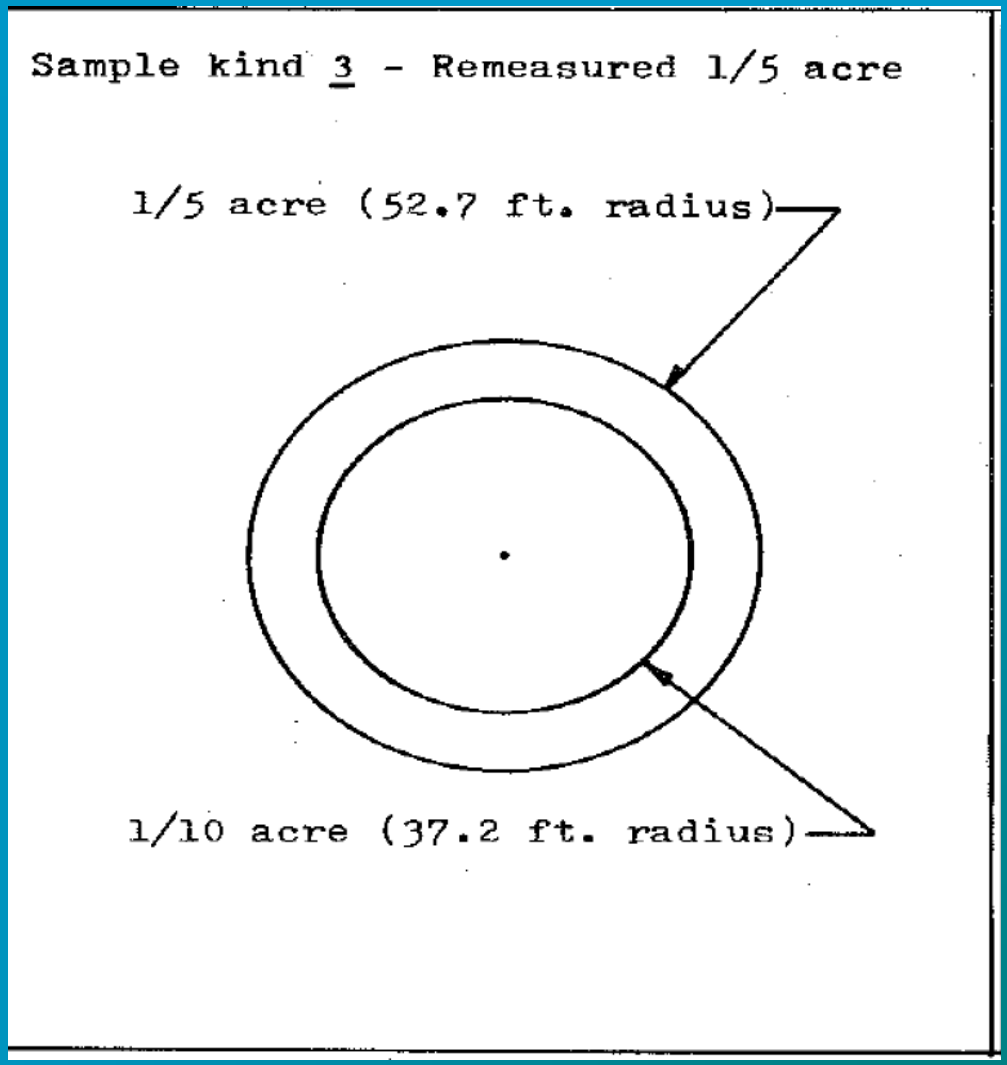
FIA

- Is a program/unit within the USDA and Forest Service, structured into 4 regions.
  - Maine is one of 21 states in the Northern Research Station.
- Motto – “Trees count, so we count trees” and it is the tree census of the U.S.
- Collecting data in the U.S. since the 1930s, but in Maine starting in 1954.
- Has undergone a transition process of data collection from just commercial timberland, to all forestland, and now transitioning to all land (incl. Urban)

Maine FIA Surveys & Reports

1959 (1960) – The Timber Resources of Maine

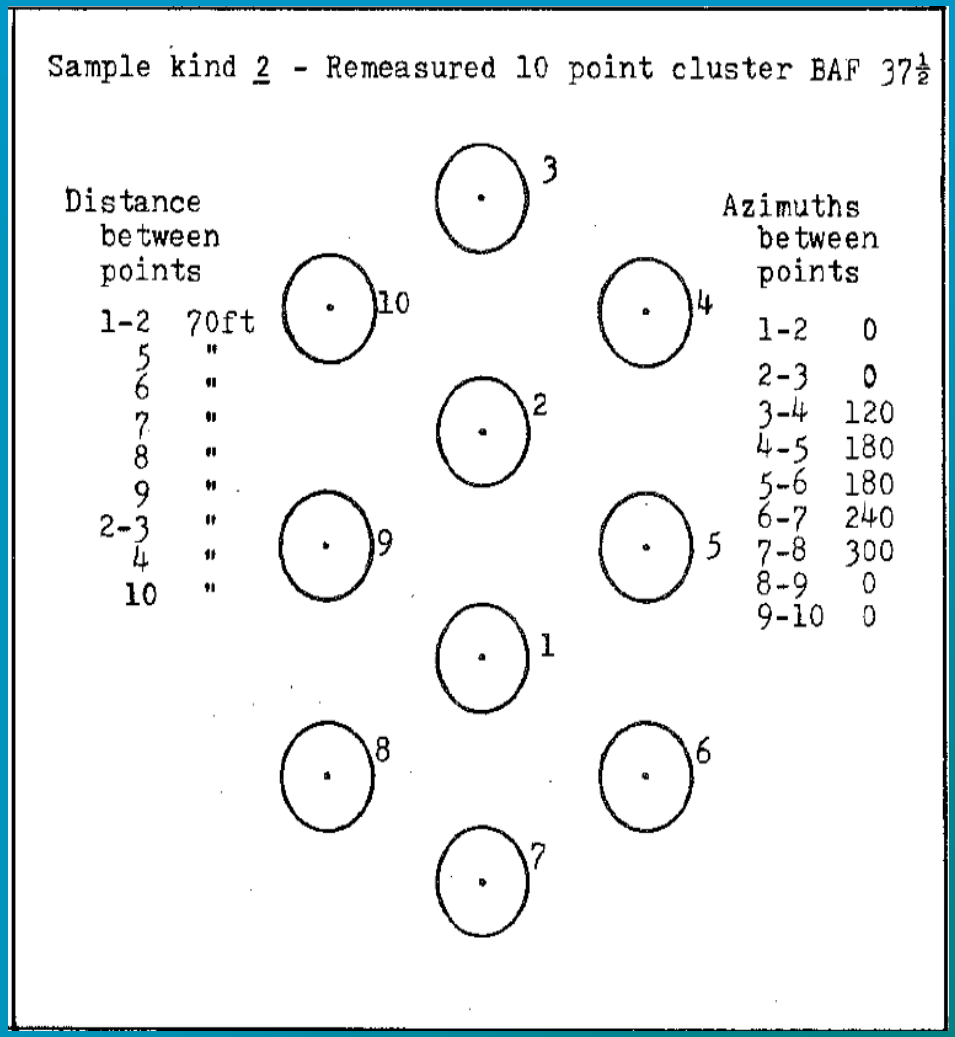
- The 1st statewide survey and based on data collected over the 1954 – 1958 period from 2,267 newly established 1/5 acre plots.
- Growth information obtained from increment core data.



ME FIA Surveys & Reports cont.

1971 (1972) – The Timber Resources of Maine

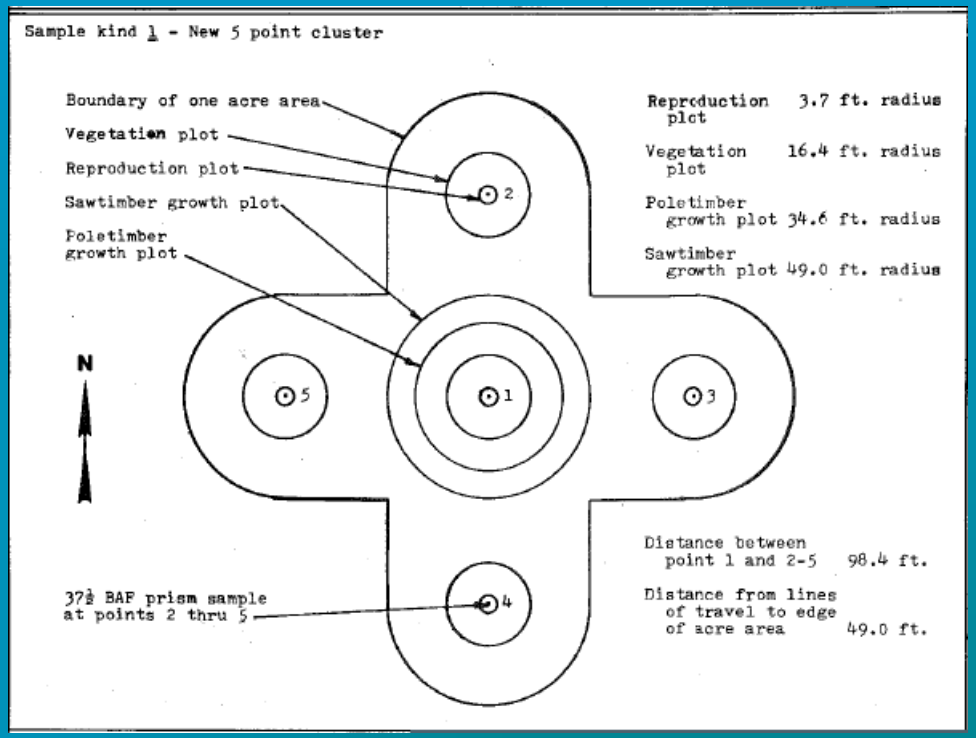
- A 1968 – 1970 resurvey of 2,489 total plots including the remeasurement of 902 1/5 acre plots and the establishment of 1,587 10-point clusters.



ME Surveys & Reports cont.

1982 (1984) – Forest Statistics for Maine 1971 & 1982

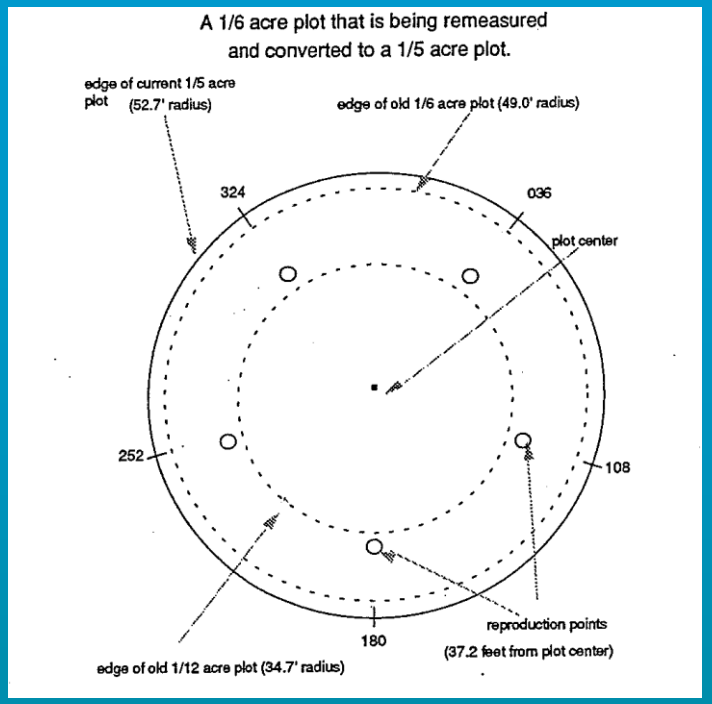
- A 1980 – 1982 resurvey, a total of 3,700 plots, including the remeasurement of 873 1/5 acre plots, remeasurement of 352 10-point clusters, and the new establishment of 2,475 1/6 acre plots.

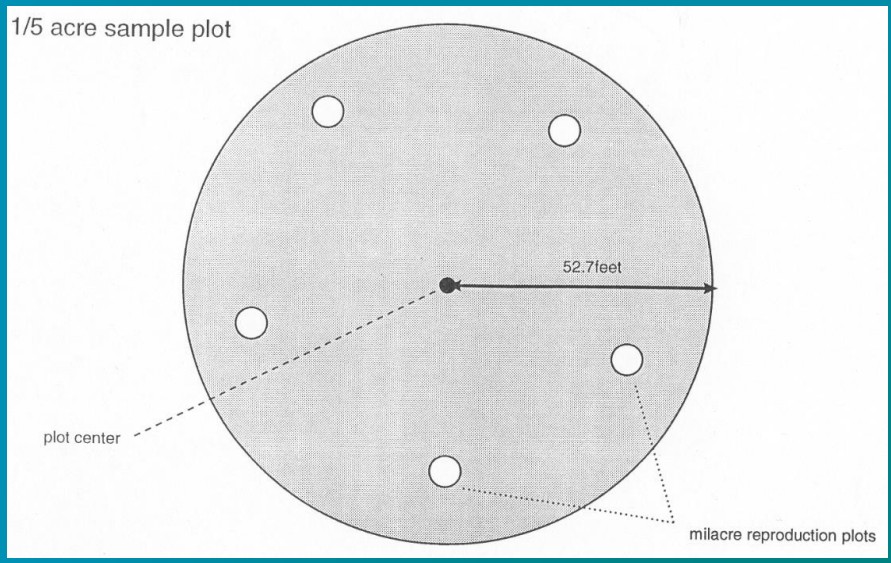


ME Surveys & Reports cont.

1995 (1996) – Forest Statistics for Maine, 1995

- A 1994 – 1996 resurvey, a total of 3,001 plots, including the remeasurement of 844 1/5 acre plots, the remeasurement of 1,348 1/6 acre plots and their expansion to a 1/5 acre, and the establishment of 809 new 1/5 acre plots





Blue Ribbon Panels

- The timeliness, quality, and usefulness of estimates from periodic inventories came under scrutiny in the 1980s and 1990s, and not just in Maine.
- The 1992 report of the first Blue Ribbon Panel recommended a nationally consistent approach to the collection, analysis, and reporting of forest inventory data.
- The 1998 Blue Ribbon Panel affirmed that and other recommendations, resulting in the passage of the 1998 Farm Bill

1998 Farm Bill Directions

- An annual forest inventory program;
- State Reports every 5 years;
- A set of prescribed core variables, standards, and definitions; and
- Integration of the ground sampling components of the FIA and FHM programs.
  - FHM (Forest Health Monitoring) was established in 1990 as an independent, cooperative effort among multiple State and Federal agencies to assess and monitor the health and sustainability of forest's using standardized procedures and 4 primary activities.

Enhanced FIA

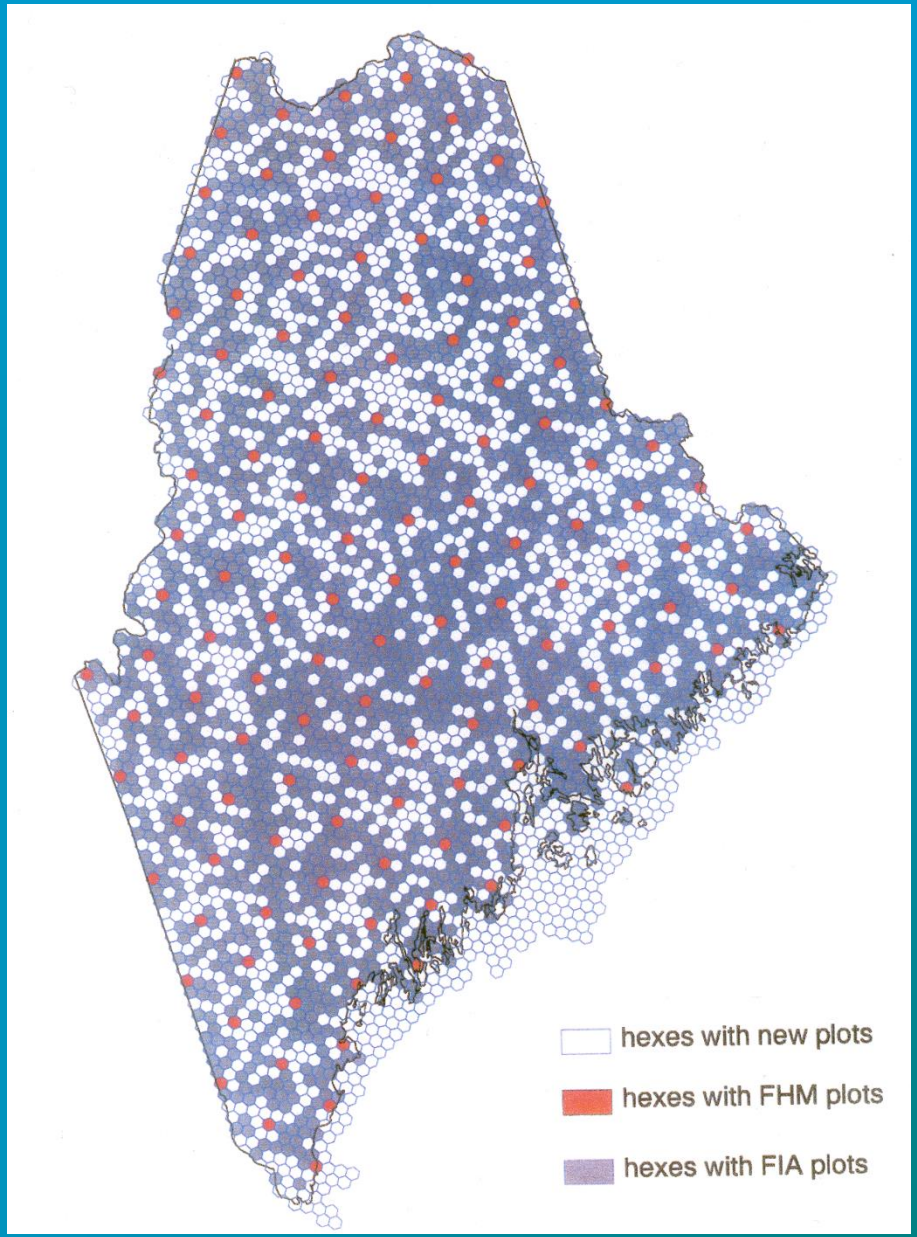
1. A nationally consistent plot with four fixed-radius subplots.
2. A systematic national sampling design for all lands.
3. A complete, systematic, annual sample of each State.
4. Reporting of data or data summaries within 6 months of completion of designated proportions of plot measurements.
5. Provision for several estimators to combine data from multiple panels, some of which incorporate updating techniques.
6. State inventory reports every 5 years.
7. Integration of the FIA field component and the ground sampling component of the FHM detection monitoring activity.

Maine and Annual FIA

- In 1998, the Maine legislature directed that:
  - the Maine Forest Service become a partner/cooperator with the USDA Forest Service and FIA;
  - institute an annualized inventory; and
  - hire a Biometrician.
- The first 10 plots were measured week ending 4/24/1999, and I was hired for that position and began work on April 26, 1999.
- What does this systematic sample look like?

The Soccer Ball Analogy

1. Take a very large soccer ball, such that each hexagon panel is roughly 6,000 acres, becoming my sampling frame.
2. Ink the ball up and starting at the North Pole, roll it across the entire coterminous United States.
3. In Maine, this marked out some 3,500 hexes, but not all were a valid sample.
4. If a hex already contained an existing FHM plot, it was retained and converted to a FIA plot (Red).
5. If a hex only contained historic FIA plots, only the plot closest to the hex center was retained (Blue).
6. If the hex contained no historic plots, a new FIA plot would be established at the hex center (White).



Maine's Core Sample (1999-2003)

- The total valid sample is 3,379 plots consisting of
  - 1,199 Pre-1995 1/5 acre plots that had the 1/24 acre donut hole at Subplot 1 remeasured and 3 new 1/24 acre subplots established.
  - 432 1995 Era 1/5 acre plots that had the 1/24 acre donut hole at Subplot 1 remeasured and 3 new 1/24 acre subplots established.
  - 1,702 new establishments of the 4 – 1/24 acre FIA Core Design
  - 46 new establishments of the 4 - 1/24 acre FIA Core Design to intensify FHM data.

Cycles and Panels

- 1999 represented the start of the 5th resurvey of Maine. In FIA parlance this is Cycle 5.
- FIA was mandated to be able to produce both annual and 5-year reports
- A parallelogram pattern was used to parse hexes into 5 systematic panels, such that adjacent hexes are never sampled in the same year.
- MFS crews annually measure about 700 plots that are systematically spread across the entire state.
- Each single 1-year sample is statistically robust to be a stand-alone inventory, meeting desired precision standards of 3% per million acres of timberland and 5% per billion cubic feet of growing stock volume

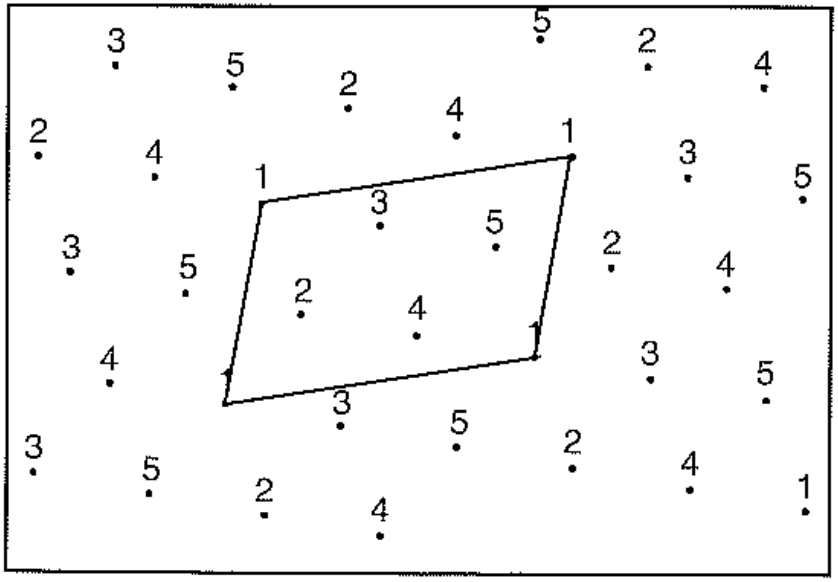


Figure 2.4—Hexagon panel assignments illustrating the parallelogram pattern of a five-panel rotation.

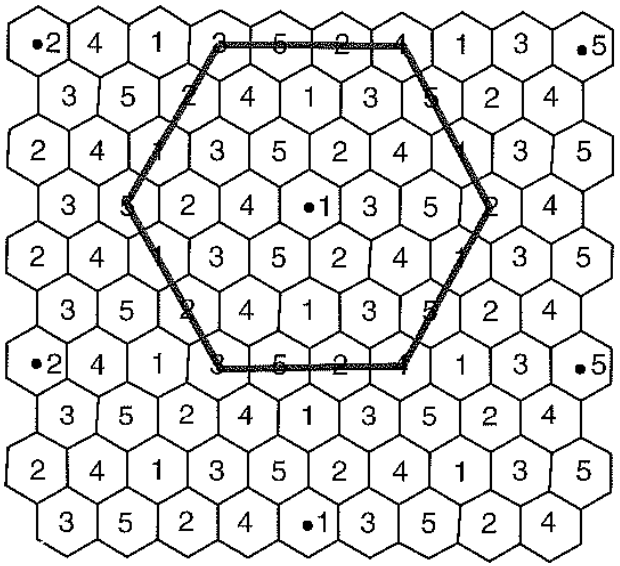


Figure 2.6—Assignment of hexagons to one of five panels (shown by number).

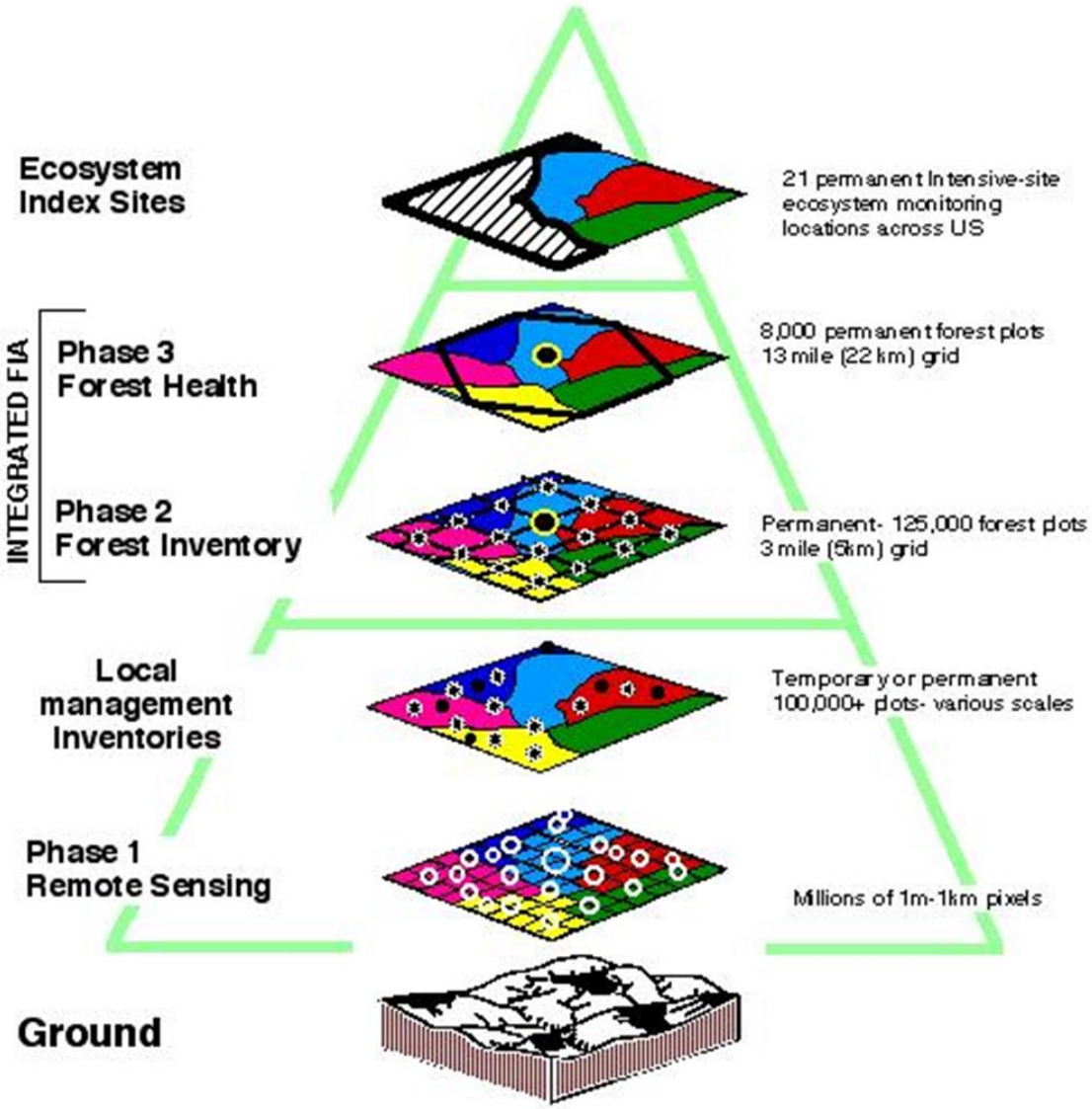
Cycles cont.

- In the beginning, with a state contribution, the intent was to have 5 panels per cycle for all land area east of the Mississippi, and 10 panels per cycle for all lands west of the Mississippi.
- Federal budget $'s have not kept pace to fully implement this intent.
- In FY 2014, FIA switched all lands east of the Mississippi to a default 7 panels per cycle.
- Maine has continued to buy-down, contributing extra $'s to the base program and in-kind services that add value, maintaining a 5 panel cycle.

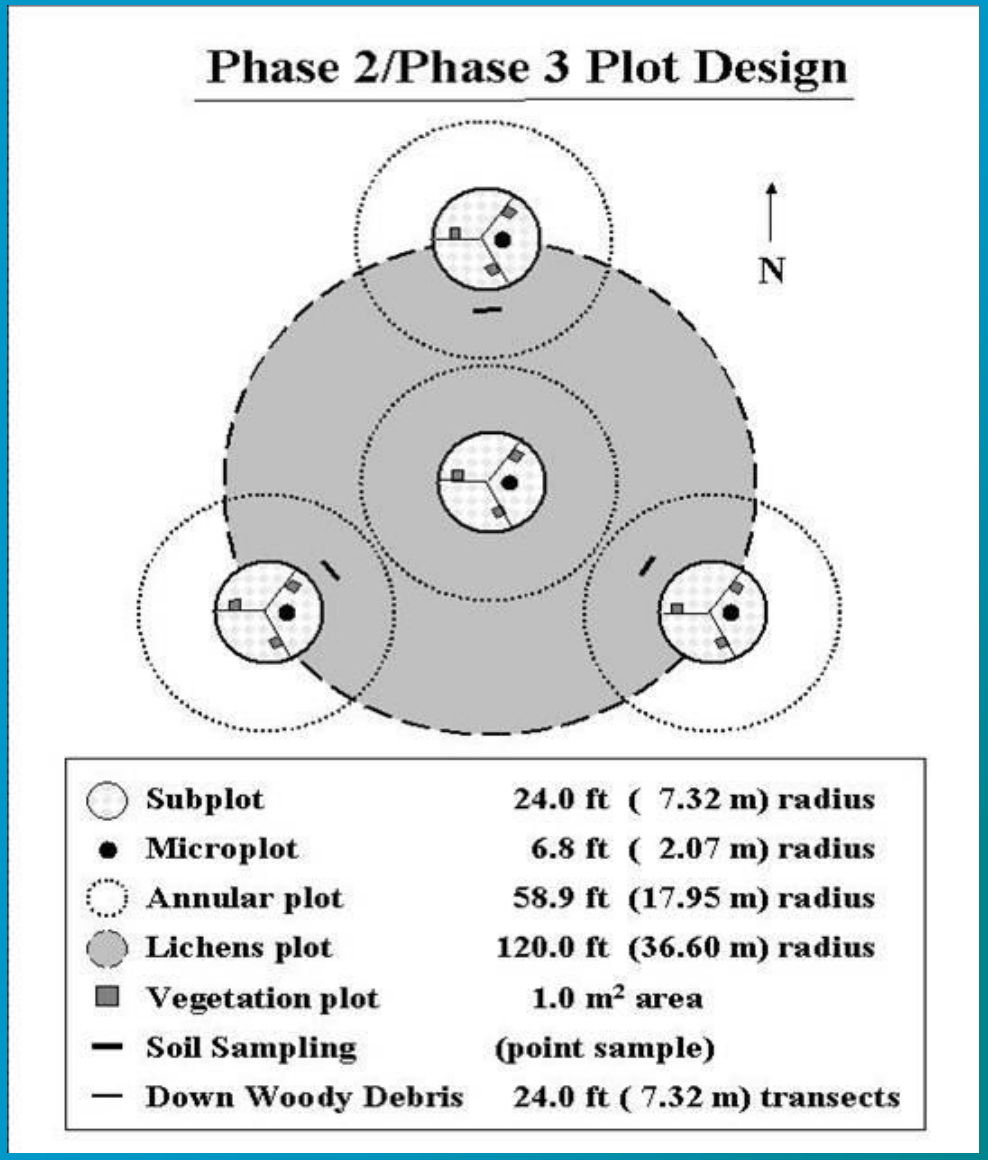
Phases 1, 2, and 3

- Phase 1 is a remote sensing activity, originally photo points, 1 per 240 acres, were evaluated for their forest/nonforest condition; satellite imagery and pixels are now used.
- Phase 2, typically known as FIA, is the primary field data collection activity. At the end of fiscal year 2016, 90% of the U.S. forest lands were sampled, with over 326,000 plots established.
- Phase 3, typically known as FHM, is a subset of phase 2 plots (1 in 16), selected for collection of a more extensive set of field data

USDA Forest Service Integrated Monitoring Framework



Annual Core Plot Design



Phase 2 Metrics

- General land use is determined on all plots.
- On forested plots, general stand characteristics are collected, such as forest type, stand age, and disturbance.
- Tree measurements such as species, diameter, height, damage, cull, and grade.
- Counts of tree regeneration (seedlings).
- By remeasuring plots after a 5-year interval:
  - Changes in land use and general stand characteristics are determined.
  - Estimates of growth, mortality, removals are obtained.

Phase 3 Metrics

- Crown Conditions – assessment of tree health and stress
- Soil Erosion Potential – slope % and length of slope
- Soil Chemical Analysis – Lab analysis of basic soil nutrients, pH, bulk density, and aluminum
- Lichen Communities – presence/absence is indicative of biodiversity and air quality
- Ozone Bioindicator Plants – plants are sensitive to ground level ozone
- Vegetation Structure – vertical composition (species and growth forms), abundance, and spatial arrangement; useful for wildlife habitat models.
- Down Woody Debris – both coarse and fine, useful for fire fuel loading potential and wildlife habitat models.

Phase 3 Changes

- Phase 3 data collection requires specialized skills and due to the seasonality of the data were also restricted to a 3-month collection window (June – August).
- In addition the low sample intensity, 1 plot per 96,000 acres was statistically weak for some desired analytics.
- Starting in 2012, some P3 measurements have moved to the P2 sampling frame, creating a suite of P2+ measurements.

P2+ enhanced measurements

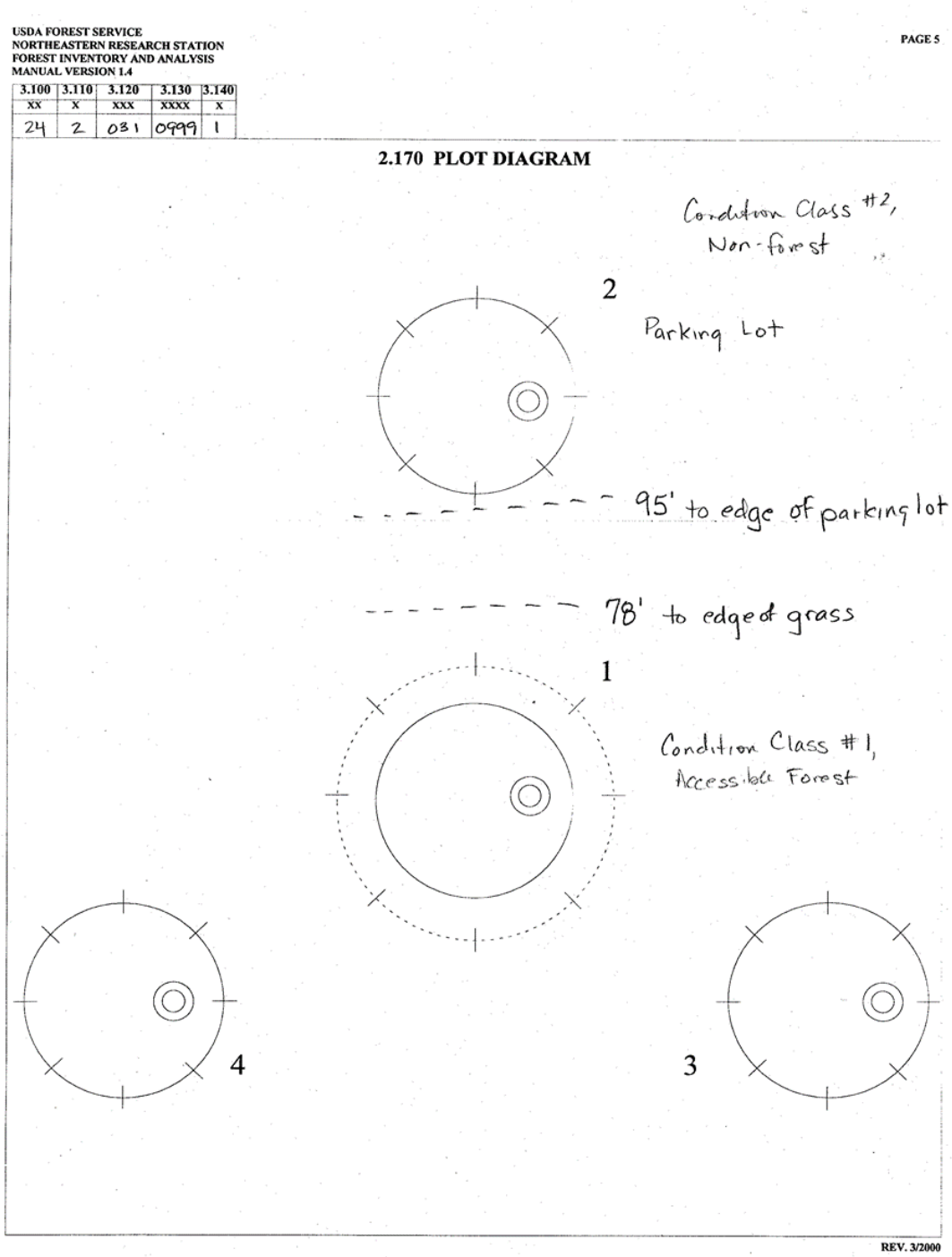
- Sampling Intensity = a combined 25% of annual P2 and P3 samples:
  - Regeneration and herbivory
  - Vegetation profile
  - Invasive plant sampling
  - Down wood material
  - Crown assessments
- Sampling Intensity = 6.25% (P3 ONLY)
  - Soil measurements
  - Lichen communities

FIA and Landowners

- Private landowners are essential partners for the program
- Without a landowner's permission, prior to each and every visit, field crews cannot collect data on private lands.
- To protect the privacy of the landowner, the exact plot location coordinates are kept confidential and the owners identity is never linked to plot data.
- Exact plot coordinates are never included in public databases nor released to individuals outside of FIA.

Condition Class

- Subplots are never reconfigured or moved; hence a subplot may straddle more than one “condition class” such as two different forest types or land uses (forest/nonforest).
- A condition class is defined by a specific combination of environmental attributes such as land use, forest type, stand age, owner class.
- Every FIA plot has at least one condition class representing all four subplots. I have seen 5 unique conditions delineated across the 4 subplots.
- Condition boundaries can occur between subplots or even within subplots.
- This mapping process of stratification improves reporting accuracy.


USDA FOREST SERVICE
NORTHEASTERN RESEARCH STATION
FOREST INVENTORY AND ANALYSIS
MANUAL VERSION 1.4

PAGE 5

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2.170 PLOT DIAGRAM

REV. 3/2000

FIA only collects data on trees within forested conditions

Forest – land that is accessible, can be occupied at subplot center, can safely be visited, meets these criteria:

1) has at least 10% canopy cover of live tally tree species of any size or has had such cover in the recent past.
2) Must be at least 1.0 acre in size and 120.0 feet wide measured stem-to-stem from the outermost edge.

Maine's FIA Enhancements

- Maine Forest Service collected tree data on the doughnut of 466 plots, comprising the remainder of the original 1/5 acre that were initially established in 1954-1958.
- Used to verify the historic control of *Ribes*.
- ME DEP – shoreland zoning & carbon sequestration accounting
- IF&W
  - Extra shrub data collected for use in habitat assessments by management zones.
  - Habitat trends for moose, deer, deer wintering areas.
  - Habitat trend documentation on Canadian Lynx

Maine's FIA 5-Year Reports

- FIA has published to date three 5-year reports, representing Cycles 5 (1999 – 2003), 6 (2004 – 2008), and 7 (2009 – 2013).
- ME is currently in the last data collection year of Cycle 8 (2014 – 2018), with the release of a new 5-year report probably not until 2020, and then it may only be available as an online download.

Maine's FIA Annual Report

- Since 2006, approximately in late July, FIA releases a 4-page annual report and a set of 12 core tables.
- The ME 2016 Annual Report was released in July 2017, and contains estimates based on data for the preceding 5 years (2012 – 2016).
- Report and core tables can be downloaded from this weblink - https://www.nrs.fs.fed.us/fia/data-tools/state-reports/ME/default.asp
- At the same website – ***Tableau*** offers some very user friendly interactive tabular and graphical estimates.

Conclusions

That's my historic and current assessment of FIA and how it works

Questions?