

NFI Methodology

**National Forest Inventory Conference
11 July 2007**

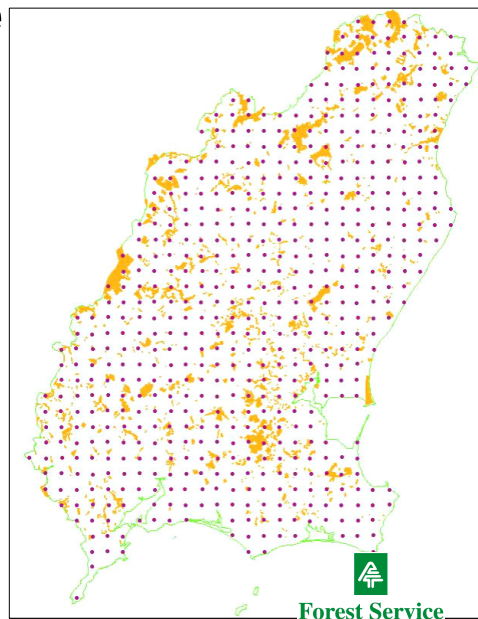
Martin Černý*, Radek Russ*, John Redmond#, Mark Twomey#

***Institute of Forest Ecosystem Research, #Forest Service,**



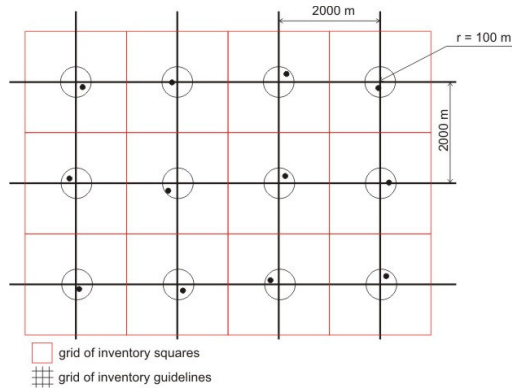
Sampling scheme Sampling intensity

- National volume stock, with reliability estimates based on the 95% confidence interval.
- Wexford pilot study
- 2 km x 2 km grid



Sampling scheme

Sampling design



➤ systematic 2 x 2 km grid covering whole landbase of Ireland

➤ 100m random displacement of inventory plot around grid intersections

➤ 17,423 primary sample points in total

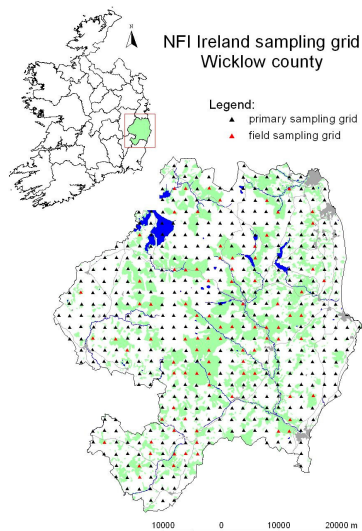
➤ each representing approx. 400 ha (i.e. inventory square)

➤ co-ordinates in Irish National Grid



Sampling scheme

Field sampling grid



➤ all plots marked as forest or “check” plots during aerial photo interpretation visited by field teams

➤ land-use category checked/corrected

➤ all plots assessed land-use class (i.e. subdivision of land-use category)

➤ if plots divided between more land-use categories then it is shifted

➤ plot fixed by marked point



Definitions

Forest

Land with a minimum area of 0,1 hectare, a minimum width of 20 m, trees higher than 5 m and canopy cover of more than 20% within the forest boundary, or trees able to reach these thresholds *in situ*.

Forest Open Area

A non-stocked area enclosed within the forest boundary, e.g. ride-lines, setback from stream, etc.

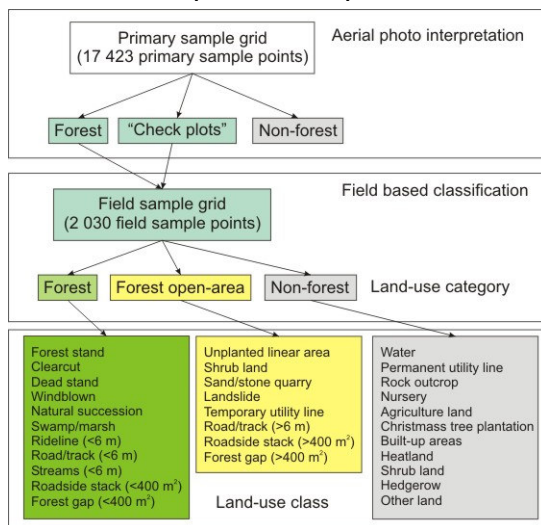
Bareland within forest ownership boundaries

Bare-areas within the forest ownership boundary which are **not** integral to the forest. These areas have to be greater than 2 ha if they are surrounded by trees on all sides.



Land-use classification

Aerial photo interpretation and field classification



Parameters of air photos:

Details	Description
Scale	1:40,000
Data format	Tiff
Pixel size	1 m x 1 m
Year of flight	2000 a 2004
Specification	2 x 1,5 km
Number of photos	26,500 approximately
Individual file size	8 MB approximately

➤ manual aerial photo interpretation was carried out by trained staff and resulted in 2,030 field sample points (forest or "check" plots), which have been visited and classified according defined list of land-use classes



Land-use classification

Aerial photo interpretation

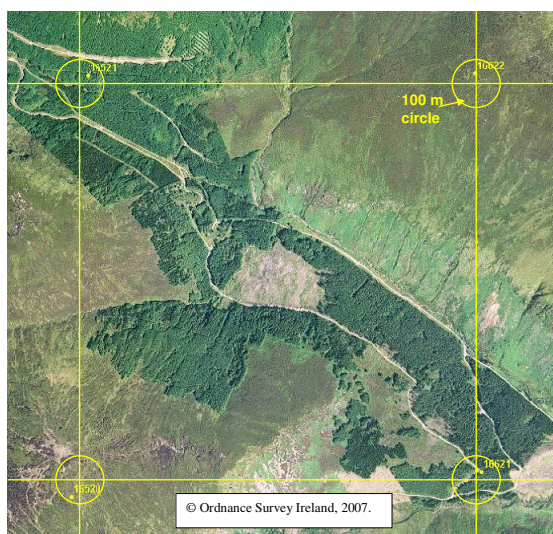
Land-use type	Land-use type
Forest	Green space (urban)
Bareland within forest ownership boundary	Green space (rural)
Check plots	Coastal complex
Other woodland	Cropland
Individual tree	Grassland/forage/pasture
Hedgerow	Water bodies
Stonewall	Sea
Bare rock	Quarry
Bare soil	Paved road
Bog and heath	Sand
Cutover peat (industrial)	Shrub
Cutover peat (domestic)	Deforestation
Built land (urban)	Other
Built land (rural)	



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Land-use classification

Aerial photo interpretation example



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Forest boundary

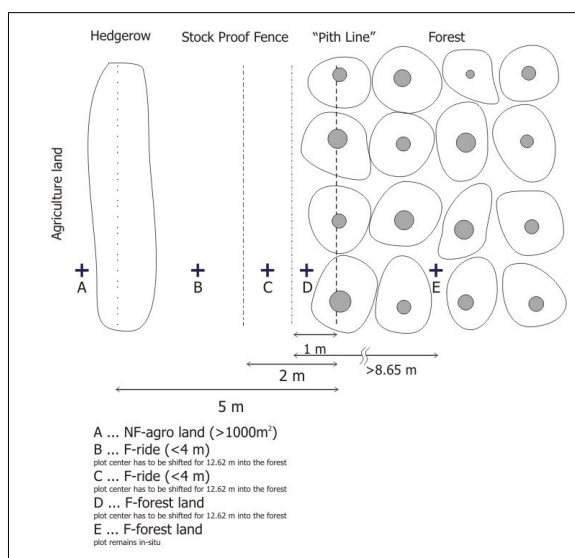
Definition:

Forest boundary is defined by any man made boundary enclosing the forest area (i.e. hedgerow, wire fence, stonewall etc.) or in absence of such boundary feature, the edge of the forest is determined by extending out 1 m from the position of the pith-line* of the outermost tree.

* Pith line is a notional line connecting the ground-level tree piths/centres of the outermost trees.

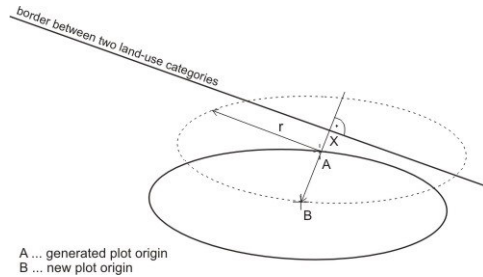


Forest boundary



Data collection

Plot shift

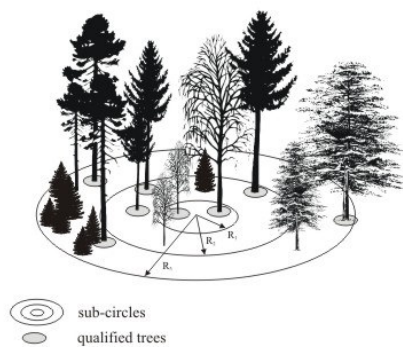


- when greater than 10% of another LUT occurs within the plot,
- position of both centres (generated plot origin and new plot origin) is measured
- reason for plot shift is to get whole plot to be representative for particular land-use category



Plot design

Scheme of inventory plot



- reducing workload and working time necessary to finish the inventory plot

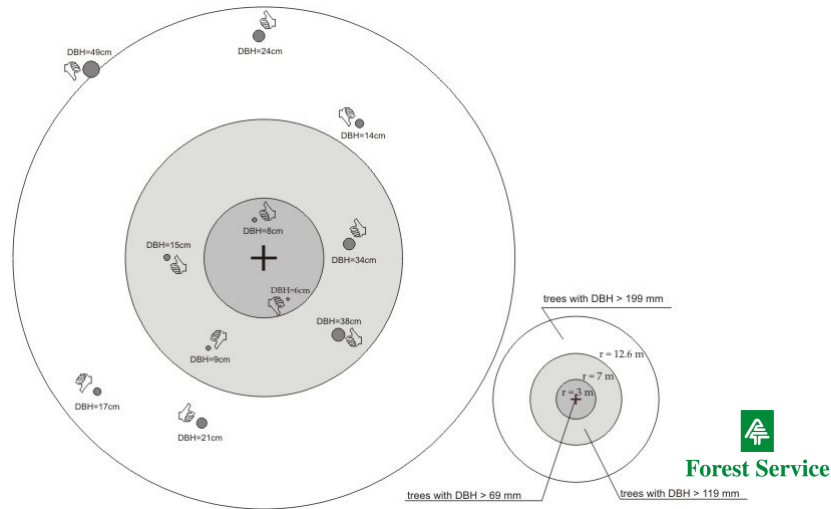
- tree qualifies if its position and diameter at breast height fulfils defined limits

	R_1	R_2	R_3
Sub-circle radius (m)	3	7	12,62
Sub-circle area (m ²)	28,3	153,9	500
Threshold diameter (mm)	70	120	200



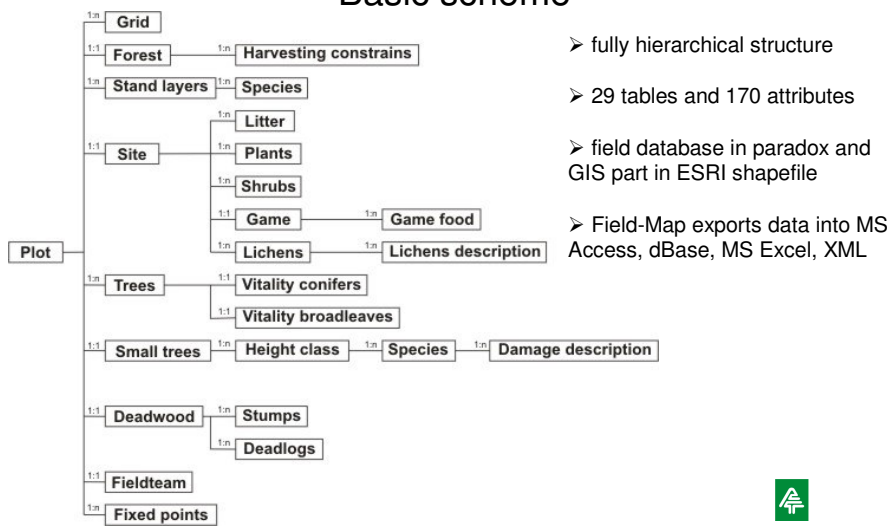
Plot design

Principle of sub-circle approach



Database structure

Basic scheme



Database structure

Overview of main attributes

- the goal of the NFI of Ireland is to assess the current composition of Ireland's forest resource in a representative and reproducible manner.
- forest is monitored with regards to structure, production of wood or other non-wooded products and services, biomass/carbon content, biodiversity, forest management and forest health and vitality
- database is structure to answer as questions from different parties concerned (i.e. international bodies, state institution, environmentalists, foresters etc.) at a national level
- the information spectrum of NFI Ireland is compatible with other NFI's carried by European countries.



Technology

Hardware part

Basic components

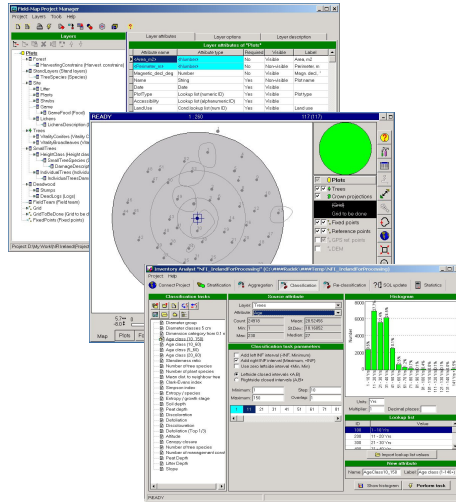
Computer: Hammerhead XRT.
GPS: Trimble ProXR
Laser: Impulse/Impulse LR
Compass: MapStar II.

Accessories:

Harness
Monopod
Cables&batteries
Rechargers
Port replicator
Scope
Slash hook, saw
...



Technology Software



- Field-Map Project Manager
 - creating/changing database structure
 - database management
 - preparation of background maps
 - data check
 - data export
- Field-Map Data Collector
 - data collection (mapping, attributing)
 - on-line communication with electronic equipments
 - data check
 - data import
- Field-Map Inventory Analyst
 - data processing



Data collection Navigation

Navigation:

- driving/walking to the close-to-centre position using hardcopy/digital maps & colour air photo
- checking and preparation of the equipments (assembling the Field-Map set, test of magnetic field, magnetic declination)
- navigation to the plot centre using either GPS or laser/compass navigation
 - assessing land-use class
 - defining forest boundaries
 - shifting plot (if necessary)



Data collection

Overview of plot measurement

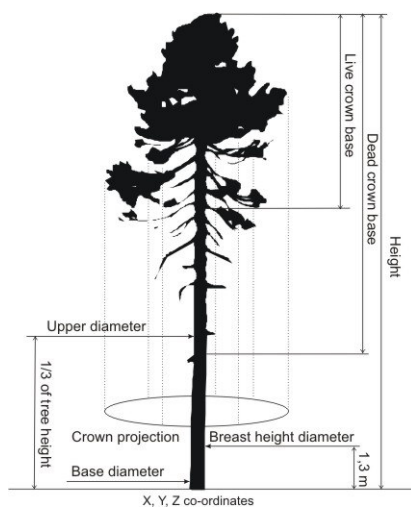
Data collection procedure:

- describing the inventory plot
- measuring the tree position, numbering of trees, measuring dbh and describing qualified trees
- measuring crown parameters (total height, live/dead crown base, crown projection)
- describing and measuring other attributes (deadwood, stumps, site, ...)
- taking photos
- database check (check of the missing data, running script for logical relations in database, visual check)



Data collection

Tree measurement



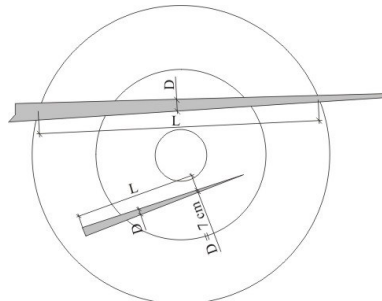
Tree measurement:

- **qualified tree** ... all trees which fulfil DBH threshold of particular sub-circle to which tree belongs
- **crown sample tree** ... total height, crown base, dead crown base and crown projection (excluded are dead, broken or forked trees) is measured for 7 trees per species distributed across DBH range
- **stem sample tree** ... upper diameter and base diameter are measured for 5 crown sample trees of dominant species or 3 crown sample tree of other species
- **vitality sample tree** ... vitality is measured for all Crown sample tree, which belongs to selected species (spruce, pine, beech and oak).

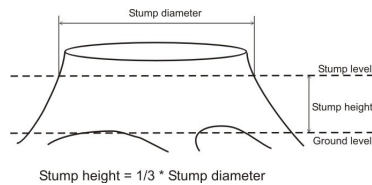


Data collection

Deadwood measurement



L ... length [m]
D ... diameter [mm]



Stump height = $\frac{1}{3}$ * Stump diameter

Deadwood components:

- **standing dead trees** ... measured and described if qualified for position, DBH, species, stand layer, age, stem rot, fork and other damage
- **lying dead logs** ... all dead lying timber to the top of 7 cm o.b. measured for length and mid diameter plus description of decay stage and dead logs distribution
- **stumps** ... all stumps with top diameter bigger than 20 cm and height less than 130 cm are measured for top diameter and height plus description of decay stage
- **branches** ... branch coverage



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Data collection

Small tree measurement

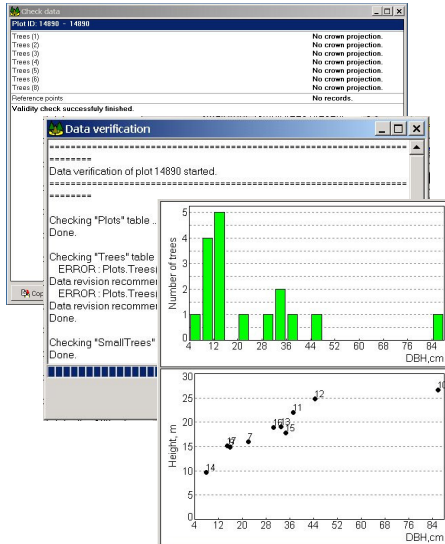
- planted trees and natural regeneration is assessed on 3 m sub-circle starting from 20 cm of height up to 7 cm of DBH
- general information about small trees presence, origin, distribution, species mixture, protection and negative factor affecting the regeneration are collected
- natural regeneration:
 - small trees from natural regeneration are grouped by species and their heights into classes and described by average values of DBH, height and age
 - number of trees in particular class is recorded
 - individual tree damage is also recorded regarding to damage type and age of damage
 - number of damaged trees is recorded
- planted trees:
 - all planted trees are described individually for species, height, diameter, age, damage type and age of damage
- stocking of small trees is counted on 7 m sub-circle for all species



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Data collection

Data check



Data check:

Prior leaving the inventory plot, the operator performs a comprehensive data checks including:

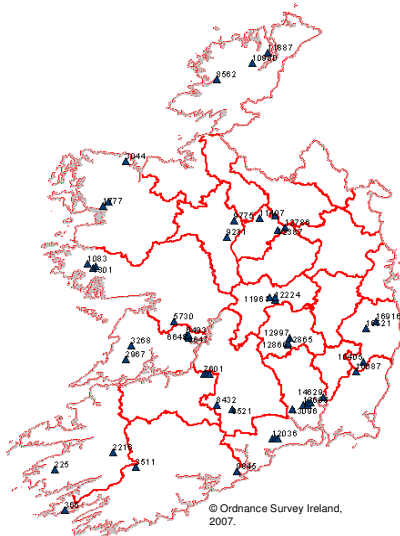
- **missing data check** ... Field-Map searches for all missing information which are required and list missing items in "Check data" output file
- **data verification script** ... Field-Map checks defined logical relations and list errors or "possible errors" in "Data verification" output file
- **visual check** ... visual check of DBH distribution and Height x DBH graphs
- operator is corrects missing or wrong information identified during data check procedure



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Data validation System

Quality assurance



Validation:

- Joint IFER/FS validation team
- Custom designed validation software
- 50 plots randomly selected
- Out of 50 plots, the number to be re-measured was 5 (10%), the number categorised as 'acceptable' was 16 (32%) and those termed as 'good' was 29 (58 %).

Actions

- Plot remeasurement
- Field team update
- Project management



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