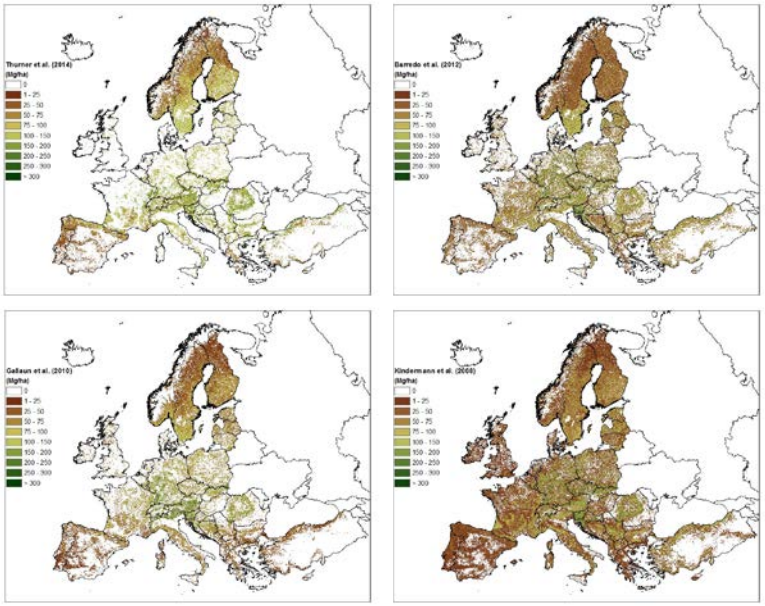
Assessing biomass maps in Europe with harmonized statistics and plots



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Overview

- Context: the JRC BIOMASS study
- Data:
  - Statistics and plots
  - Biomass maps
- Comparison:
  - Maps vs. statistics
  - Maps vs. plots
- Conclusions and next steps

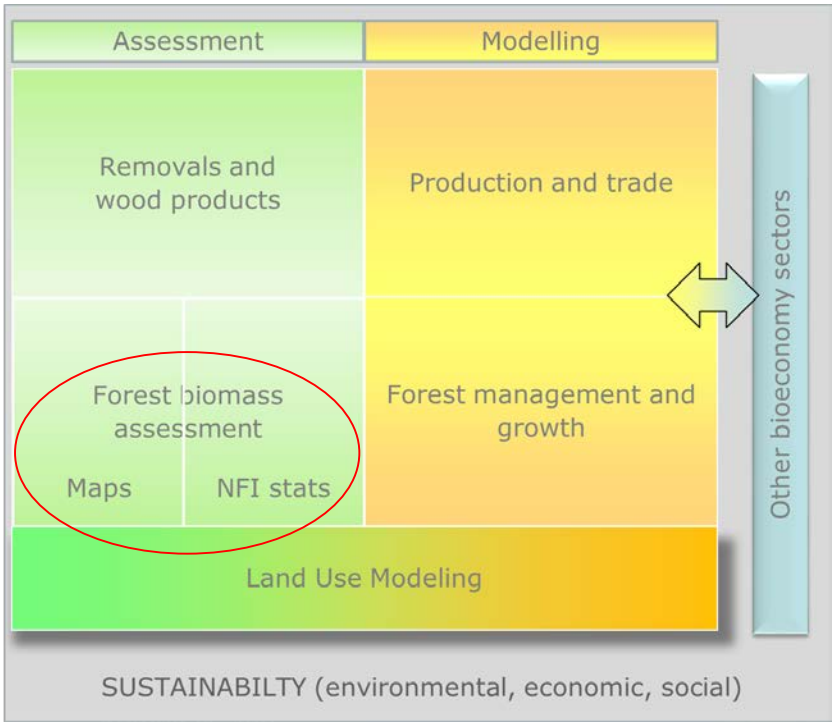
European Commission

The JRC Biomass assessment study

- The Joint Research Centre (JRC) is the science and knowledge service of the European Commission (EC)

- The JRC has a long term mandate to assess:
  - global and EU biomass supply and demand
  - flows and sustainability
  - for all sources and all uses
  - scenarios and projections till 2050

Framework for forest biomass



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Joint Research Centre

Harmonized data

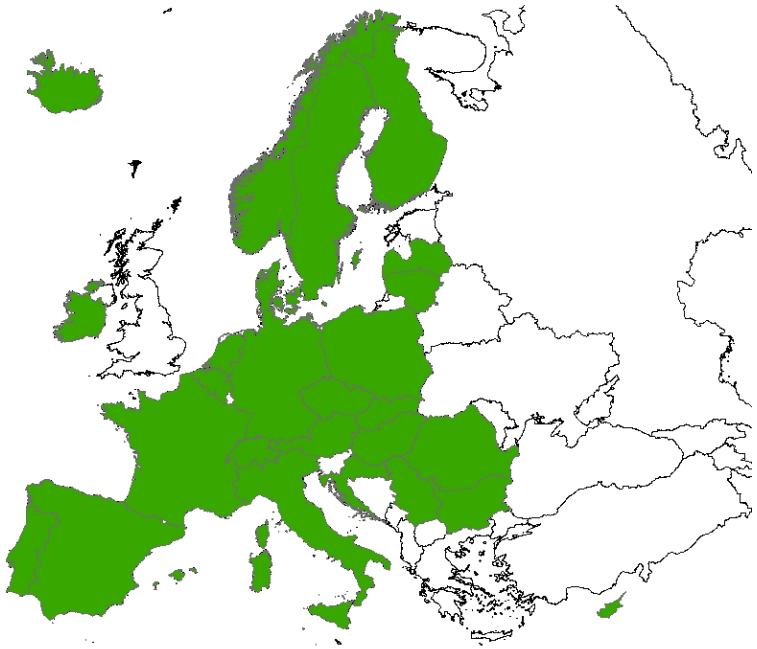
European Commission

The harmonized forest biomass dataset

Collaboration with European NFIs (26 countries) to develop comparable forest biomass data, using:

- Harmonized definition
- Common estimator

26 countries with harmonized data



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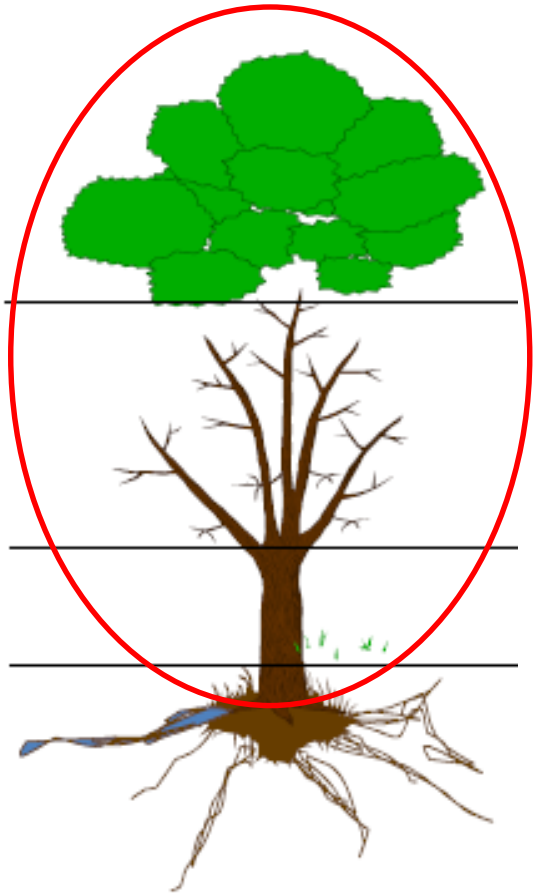
Harmonized Biomass definition



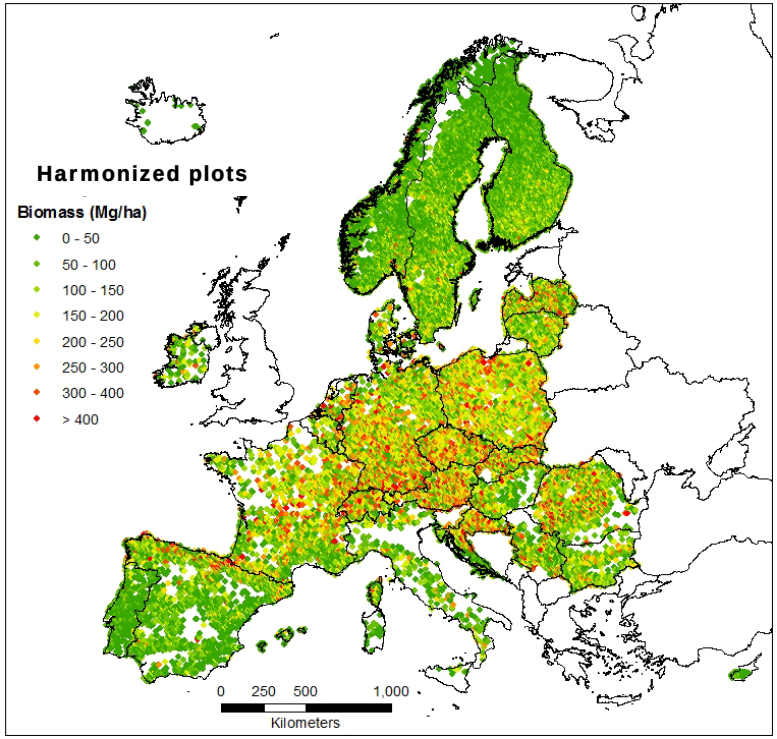
Harmonized biomass

Statistics:

- Based on ~500,000 plots
- Provide: Mean & Total Biomass (±SE)
  - By species group
  - At sub-national level
- Harmonized stats:
  - Total stock: +4% than national stats
  - Signif. difference for 14 countries

Plots:

- Subset of 22,166 plots
- Geolocation @ 1km

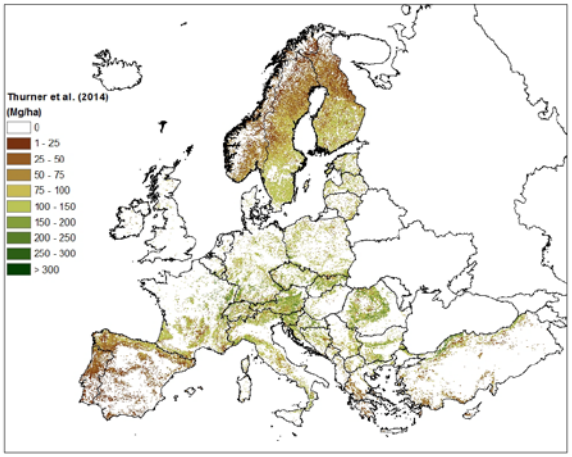


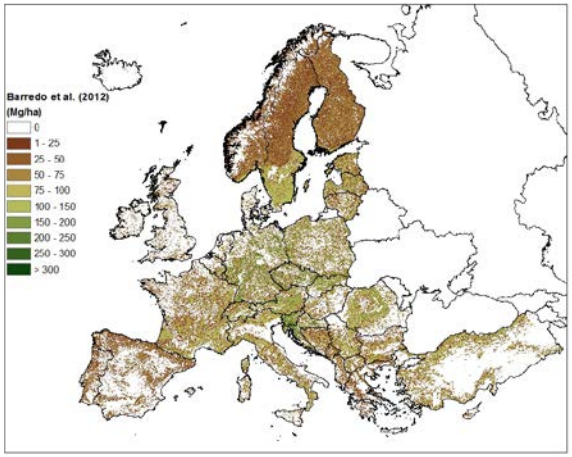
Total biomass stock (Tg)			
	National definition	Harmonized definition	Difference definition (%)
National estimator	16,234	16,907	4.1%
Common estimator	16,213	16,846	3.9%
Difference estimator (%)	-0.13%	-0.36%	3.8%

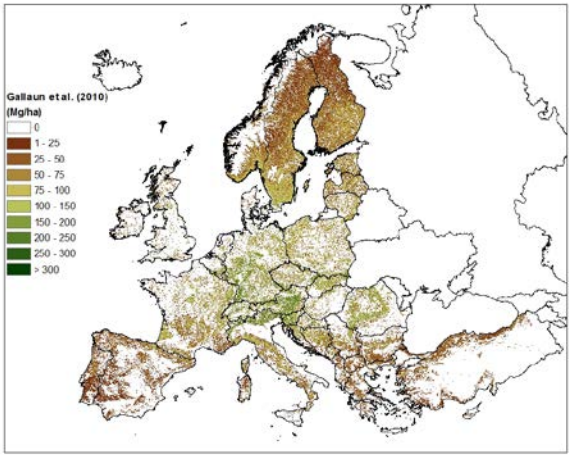
Biomass maps

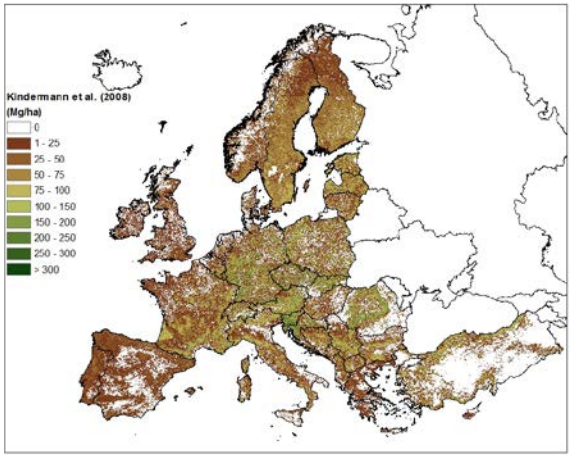
Biomass maps for Europe:

- Thurner et al. 2014
- Barredo et al. 2012
- Gallaun et al. 2010
- Kindermann et al. 2008



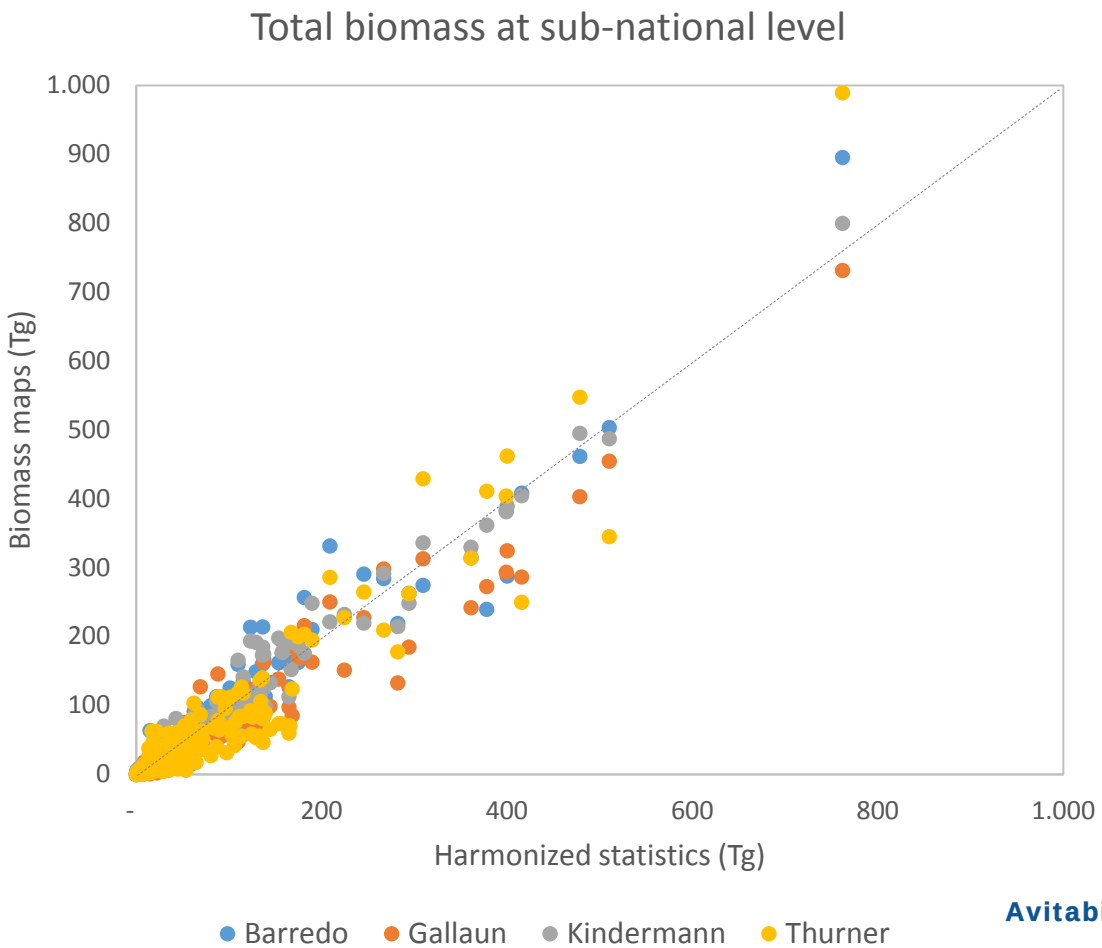






Map	Thurner	Barredo	Gallaun	Kindermann
Year	2010	2010	2000	2010
Resolution	0.01°	1 km	500 m	0.083°
Reference data	NFI Stats	IPCC Tier 1	NFI ground data	FRA 2005
Spatial data	Satellite (ASAR)	Land Cover (CORINE)	Satellite (MODIS)	Satellite (MODIS NPP)
Forest mask	GLC2000 (>50%)	CORINE	CORINE, FRA	GLC2000 (>20%)

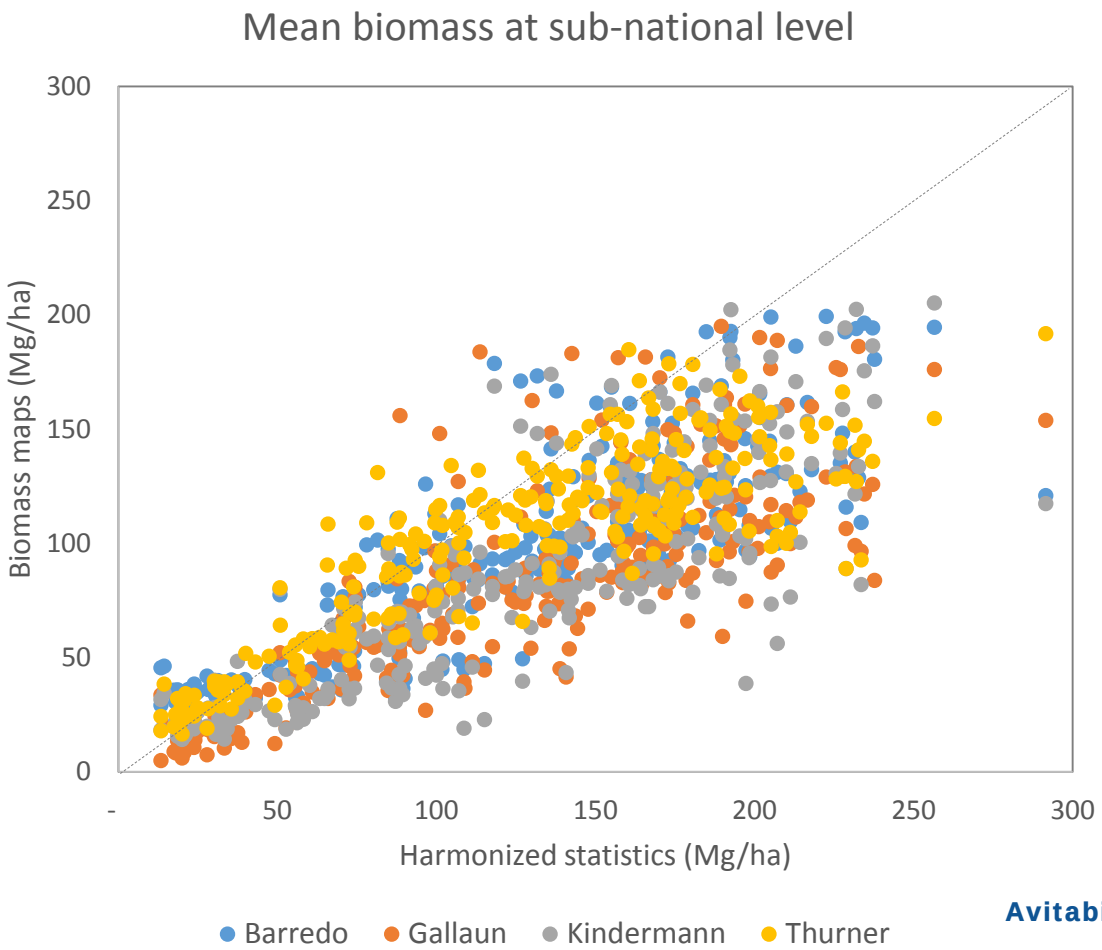
Maps vs. Stats



Avitabile & Camia (in review)

	Barredo	Gallaun	Kindermann	Thurner
		Sub-national		
Bias (Tg)	-1	-13	-2	-10
r^2	0.95	0.93	0.97	0.89
RMSE (Tg)	22	28	16	33
Rel RMSE (%)	37%	48%	28%	56%

Maps vs. Stats



Avitabile & Camia (in review)

	Barredo	Gallaun	Kindermann	Thurner
		Sub-national		
Bias (Tg)	-31	-44	-42	-29
r^2	0.71	0.66	0.68	0.73
RMSE (Tg)	46	57	54	52
Rel RMSE (%)	36%	45%	43%	41%

Maps vs. Plots

Differences between plots and pixels

Spatial mismatch

- NFI plot area: < 1 ha
- NFI released: 1 Km
- Biomass maps: 1 Km

Temporal mismatch

- NFI plots cycle: 2001 - 2013
- Biomass maps: 2000 or 2010

Remove plots:

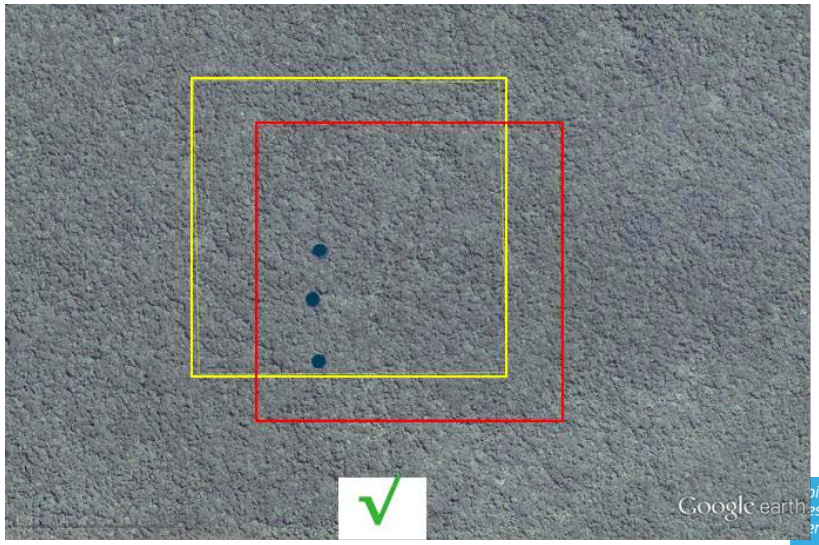
a. in heterogeneous pixels (tree cover)

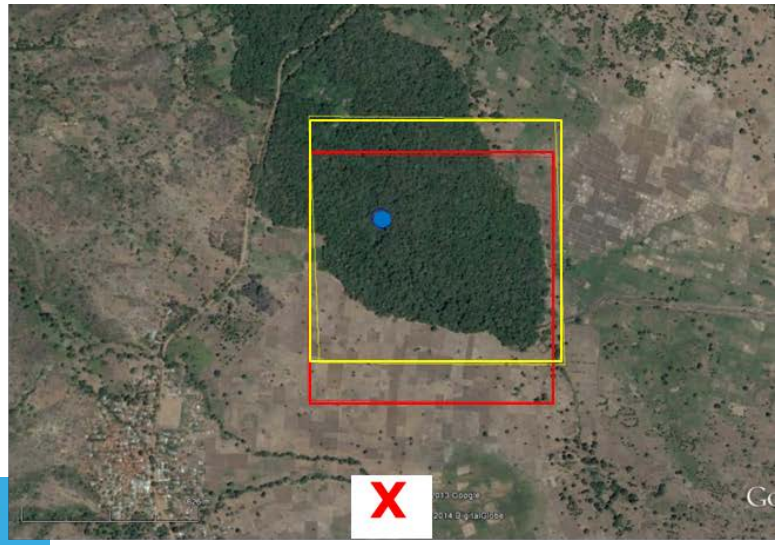
b. not representative of the pixel

Update plot biomass:

a. Use IPCC growth rates (Mg/ha/yr)

b. Update to the year of the maps





Maps vs. Plots

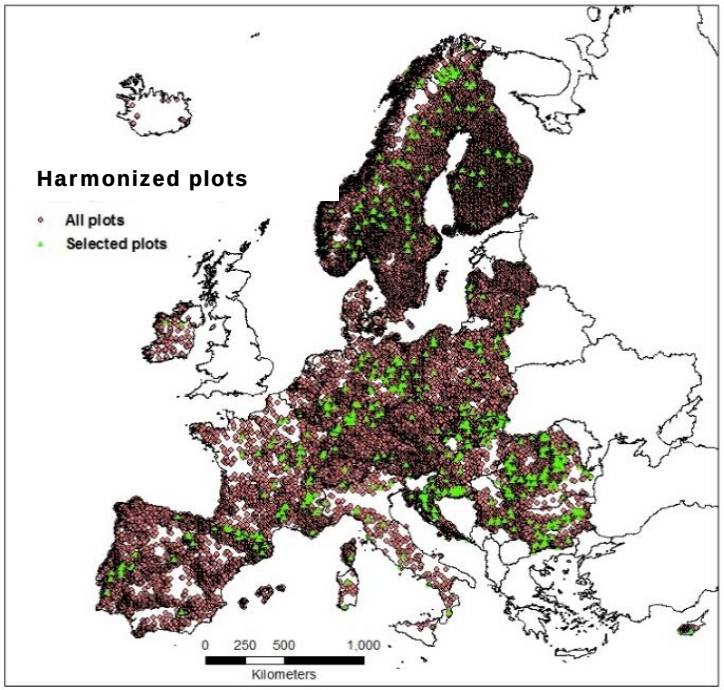
Relevance of plot screening

- Remove plots not representative of the pixels
- Increase the accuracy statistics
- Maintain the properties of the original dataset:
  - Spatial distribution
  - Frequency distribution

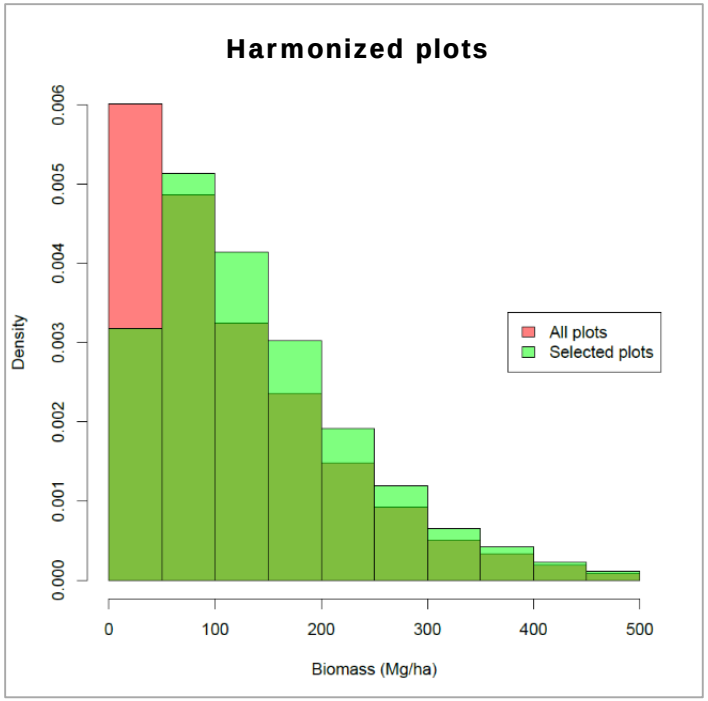
Accuracy improvements

Maps accuracy	selected vs. all plots
Bias	-58%
RMSE	-19%
Rel. RMSE	-27%
R^2	+44%

Spatial distribution



Frequency distribution



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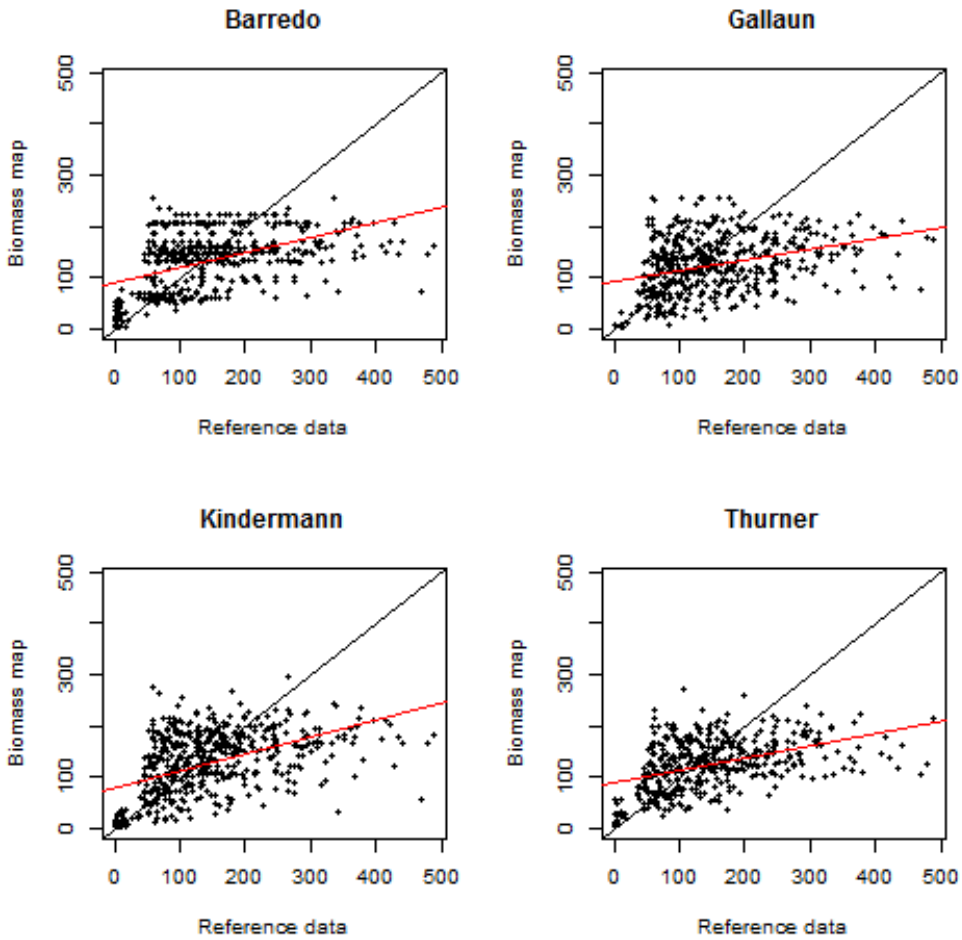
Maps vs. Plots



Avitabile & Camia (in review)

	Barredo	Gallaun	Kindermann	Thurner
		Selected plots		
N. plots	501	356	502	405
Bias (Mg/ha)	-12	-6	-17	-25
RMSE (Mg/ha)	87	82	88	89
Rel RMSE (%)	63%	72%	64%	64%

Summary (1)

European Commission

Towards a spatially-explicit, harmonized biomass assessment in EU

- **NFI data**
  - Key source of data, reliable stats up to sub-national level
  - Plots: large amounts, statistical sampling
  - Country-specific design, usually provide only growing stock volume
  - Plots: Large amounts, small area, usually not released
- **Harmonized data**
  - Derived from NFI data for 26 countries
  - Harmonized biomass stats and plots at sub-national scale
  - Temporal differences among countries (NFI cycles)
  - Plots: Subset, geolocation @ 1km, not released

Summary (2)

European Commission

- **Biomass maps**
  - Total stocks similar (but lower) compared to statistics
  - Overestimation at low biomass - Underestimation at high biomass
  - Likely due to calibration with mean values, limited sensitivity of satellite signal
  - Differences increase National -> Sub-national -> Pixel

- **Next steps / needs:**
  - ✓ Better integration of NFI data with biomass maps
    - Spatially: maps with higher resolution (1 ha), plots with precise location
    - Temporally: adjust data to a reference year
    - Thematically: consistent forest and biomass definitions
  - ✓ Towards a biomass map consistent with NFI Statistics
  - ✓ Relevance of mapping forest available for wood supply

European Commission