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FOREST-HUMAN-MACHINE INTERPLAY

From forest data to policy impact: European forest data for bioeconomy and climate governance

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Contents

- 1) Why we need European forest data
- 2) The Need for data for policy planning – case EU LULUCF regulation
- 3) Monitoring the impact of policies – cases Forest Europe C&I and EU Forest Restoration Regulation
- 4) How we can improve availability of European level forest data?
- 5) Conclusion



Why we need European forest data?

- For **planning** forest-related policies: forestry, rural development, environment, climate
 - Forest policy is not EU's mandate but many policies have impact on forestry and forestry plays a role in Member State economies
- For **monitoring** forest-related policies
 - Indicators

We do not need European level forest data for planning forest operations

Policy planning – case EU LULUCF regulation

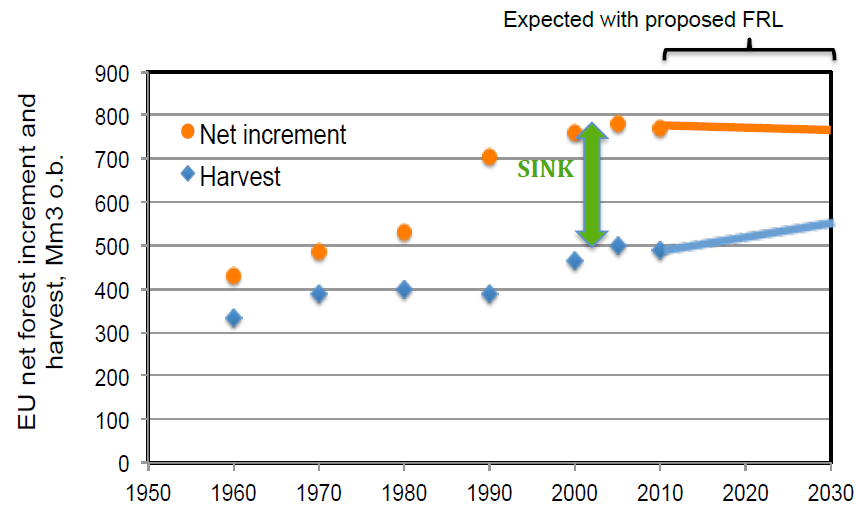


Figure 2 Comparison of historical forest net annual increment and harvest at EU level (data from Nabuurs et al. 2013), with the sink representing the difference between net increment and harvest, and their expected evolution up to 2030, according to JRC estimates with the proposed FRL approach.

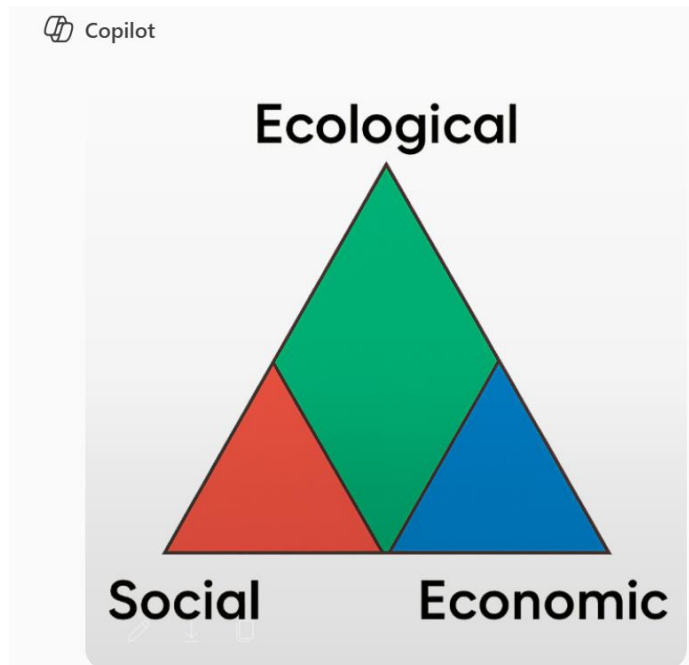
From: Grassi G; Pilli R. Method applied by the JRC for projecting forest GHG emissions and removals based on the "continuation of current forest management". EUR 28623 EN. Luxembourg (Luxembourg): Publications Office of the European Union; 2017. doi:10.2760/844243

- Analyses what will happen in the future, if we select a certain forest management strategy
 - In this case, continuing with the sustainable forest management practices of years 2000 - 2009
- First analyses: JRC
- Next step: Scenarios estimated by Member States (National Forestry Account Plans)



Monitoring the impact of policies – Forest Europe C&I of SFM

The Forest Europe (Ministerial Conference on the Protection of Forests in Europe) has since 1990 developed a system of Criteria & Indicators for following sustainability of forest management



- Criterion 1:** Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles
- Criterion 2:** Maintenance of Forest Ecosystem Health and Vitality
- Criterion 3:** Maintenance and Encouragement of Productive Functions of Forests (Wood and Non-Wood)
- Criterion 4:** Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems
- Criterion 5:** Maintenance and Appropriate Enhancement of Protective Functions in Forest Management (Notably Soil and Water)
- Criterion 6:** Maintenance of other Socioeconomic Functions and Conditions

Monitoring the impact of policies - Forest Europe C&I of SFM



All 6 Criteria include several Indicators, totalling to 34 Quantitative Indicators and 5 Qualitative Indicators

Criterion 4: Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems ^

Indicators

4.1 Diversity of tree species

4.2 Regeneration

4.3 Naturalness

4.4 Introduced tree species

4.5 Deadwood

4.6 Genetic resources

4.7 Forest fragmentation

4.8 Threatened forest species

4.9 Protected forests

4.10 Common forest bird species

C.4: Policies, institutions and instruments to maintain, conserve and appropriately enhance the biological diversity in forest ecosystems

Monitoring the impact of policies - Forest Europe C&I of SFM



Data collection via national correspondents in connection with Global Forest Resource Assessment

- cycle of 5 years
- SoEF2025 report published March 2026 based on data collected in 2023, original data older than that
 - Time lag between collection of original data and publication in some cases more than 5 years





Monitoring the impact of policies – Nature Restoration Regulation

Regulation includes indicators for monitoring success of restoration – each Member State sets the ‘satisfactory level’ for each indicator



No need for international standardization or harmonization of indicators, important is to monitor those indicators in a consistent manner over time

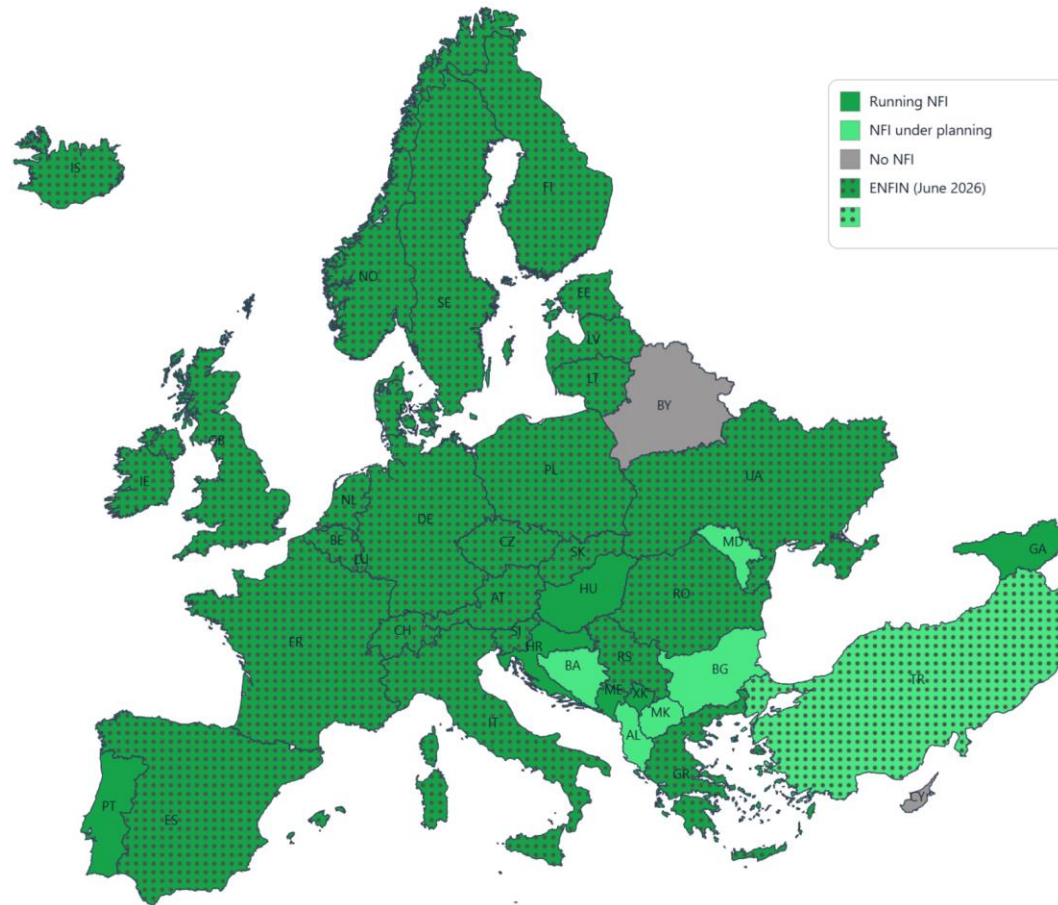
3. Member States shall achieve an increasing trend at national level of at least six out of seven of the following indicators for forest ecosystems, as further specified in Annex VI, chosen on the basis of their ability to demonstrate the enhancement of biodiversity of forest ecosystems within the Member State concerned. The trend shall be measured in the period from 18 August 2024 until 31 December 2030, and every six years thereafter, until the satisfactory levels as set in accordance with Article 14(5) are reached:

- (a) standing deadwood; $\sqrt{\text{NFI}}$
- (b) lying deadwood; $\sqrt{\text{NFI}}$
- (c) share of forests with uneven-aged structure; $\sqrt{\text{NFI}}$
- (d) forest connectivity; **IDP or $\sqrt{\text{NFI}}$ & RS**
- (e) stock of organic carbon; $\sqrt{\text{NFI}}$
- (f) share of forests dominated by native tree species; $\sqrt{\text{NFI}}$
- (g) tree species diversity. $\sqrt{\text{NFI}}$

4. The non-fulfilment of the obligations set out in paragraphs 2 and 3 is justified if caused by:

- (a) large-scale *force majeure*, including natural disasters, in particular unplanned and uncontrolled wildfire; or
- (b) unavoidable habitat transformations which are directly caused by climate change.

National Forest Inventories for European level forest data



EU Member States are running National Forest Inventories capable to fulfil numerous information needs. Challenges for European scale applications:

- Different time frames/cycles
- Varying definitions



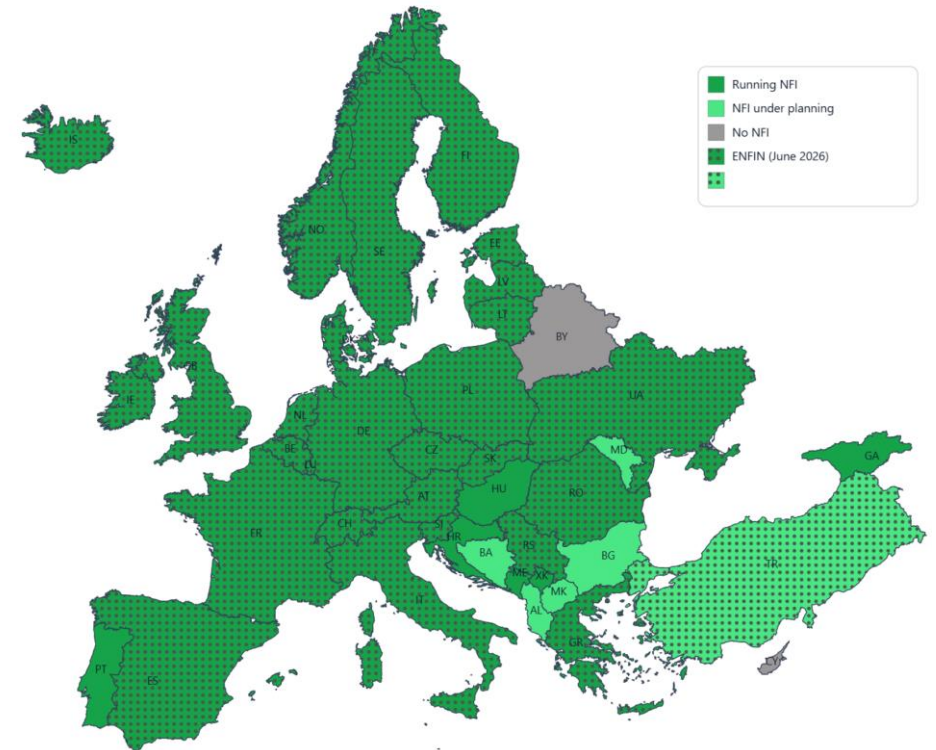
How we can improve – ENFIN

ENFIN network (2003) established as association at IGN/France in 2024

- Harmonisation of data
- Method development
- Information sharing

Ongoing Horizon projects

- PathFinder and MoniFun  
- Forest Partnership starting 2026





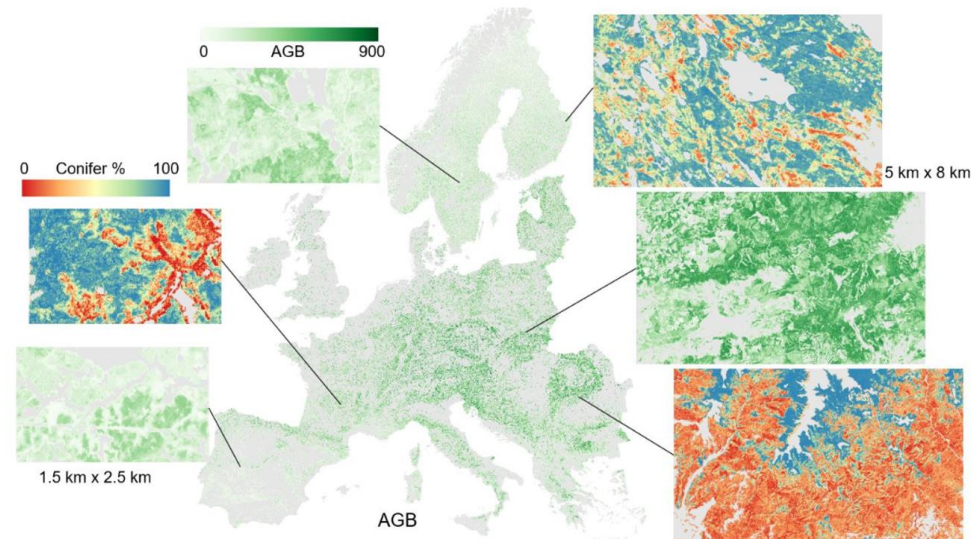
How we can improve – Methods to merge NFI and Remote Sensing data


Mapping and estimation

Maps and estimates

- Forest C stock change
- Biodiversity
- Bioeconomy

- Pan-European maps combining NFI and satellite data for 2020
- 10 m resolution
 - Miettinen et al. (2024a)





[Invitation](#) Registration form Program Contact

Welcome to the Final PathFinder Conference

Forest in Focus: Science, Policy and the Future of EU Forest Monitoring

Date: 16 June 2026
Duration: One full day (10:00–18:00)
Format: In-person and online (streaming)

The Final Conference of the PathFinder project aims to present and discuss the project's scientific results, policy-relevant outputs, and practical implications for European forest monitoring. The event will showcase the innovative forest monitoring and pathway assessment system developed within PathFinder, highlighting its contribution to consistent EU greenhouse gas reporting in the LULUCF sector.

Please register your participation via this platform. The registration deadline is 22 May.

A participation fee of NOK 120 (~EUR 10) will be charged to cover daily costs, including coffee and lunch.

Venue:
Consejo Superior de Investigaciones Científicas (CSIC), Brussels CSIC house of science
Rue du Trône 62, 1050 Ixelles, Brussels

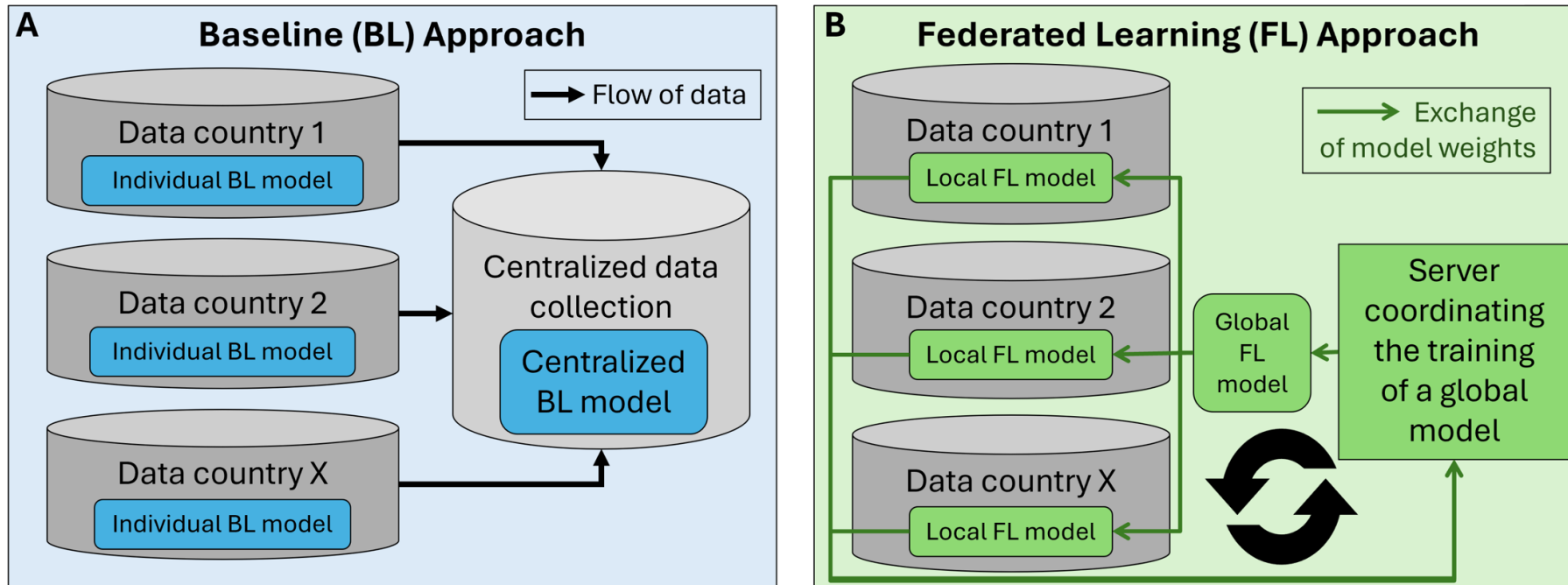
Information
Place Consejo Superior de Investigaciones Científicas (CSIC), Brussels Office ,
Time Tuesday, June 16, 2026 10:00 AM - 6:00 PM
Registration deadline Friday, May 22, 2026 8:00 PM

Please register by **22 May** using the following link:
<https://nibio.pameldingssystem.no/final-pathfinder-conference>



How we can improve – Methods for using NFI data with confidentiality

Model approaches using deep learning

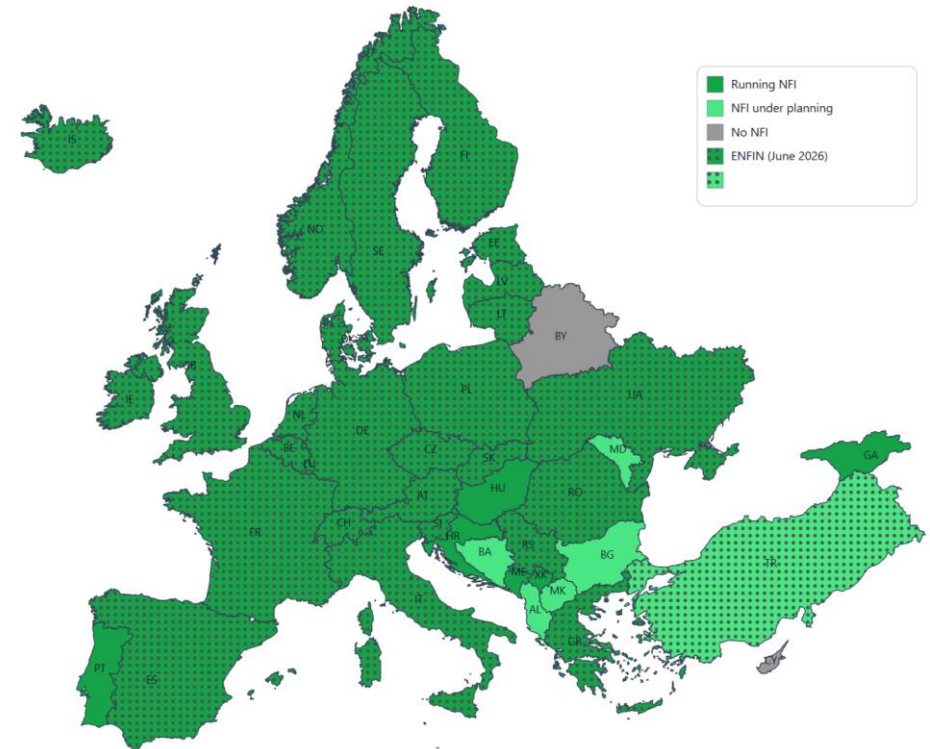


Conclusion



European level data for planning and monitoring forest-related policies are available via NFIs

- Several relevant attributes are already harmonized
 - Not all attributes need to be harmonized
- Timeliness of the data is a challenge, which can be solved by
- Combining NFI and Remote Sensing data
 - Creating incentives to Member States





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Thank you!

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