



Annualization challenge for forestry GHG reporting in Czech Republic

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Agenda

- Recalling Heikkinen *et al.* 2012
- Current GHG estimates in CZ
- New activity data (stand-wise vs. statistical NFI)
 - Forest area
 - Increment
 - Loss (harvest, *residual mortality*)
- Independent annual and periodic estimates
 - Carbon stock change in living biomass
- Solutions to annualization challenge

**Freshly new NFI-based
Czech FAO FRA report***

Heikkinen et al. 2012

Interpolating and Extrapolating Information from Periodic Surveys for Annual Greenhouse Gas Reporting

Juha Heikkinen, Erkki Tomppo, Alexandra Freudenschuss, Peter Weiss, Gerald McRoberts, Ronald McRoberts, Gerald Kändler, Emil Cienciala, Hans Petersson, and G

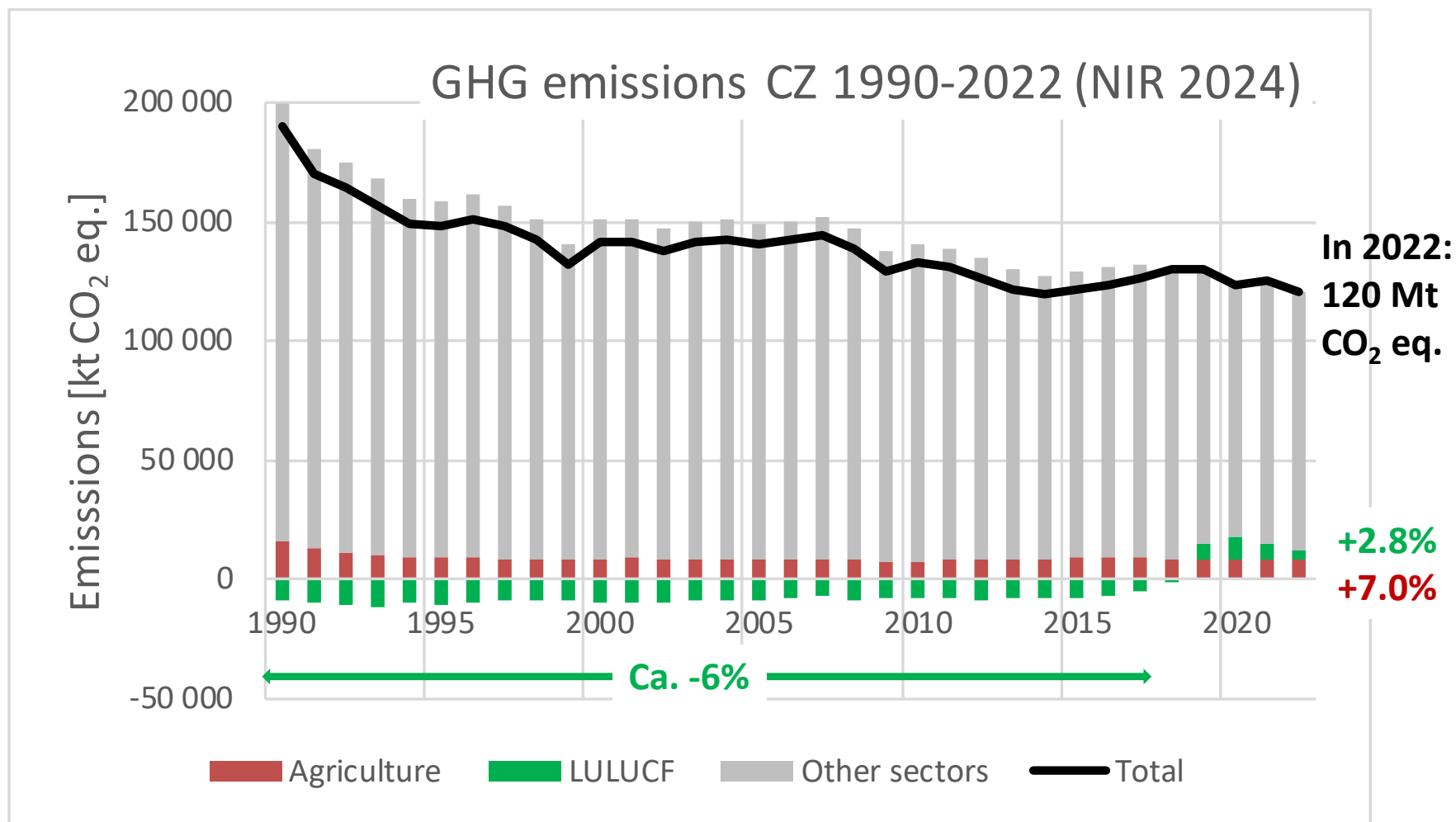
Abstract: National forest inventories (NFIs) are an important source of data for reporting emissions and removals for the Land Use, Land-Use Change, and Forestry sector as required by the United Nations Framework Convention on Climate Change and its Kyoto Protocol. A major limitation is that resources are generally not sufficient for producing reliable information on year-to-year variations. Interpolation, extrapolation, smoothing, and/or aggregation of data from several years are therefore needed to meet reporting requirements for a specific year. Various methods for accomplishing this task were evaluated based on data and experiences from the NFIs of six countries, concentrating on the stem volume of living trees as a surrogate for tree biomass. Six main conclusions were drawn: (1) data for the target years only were not sufficient for reliable estimation of annual stock change; (2) whole inventory cycles (typically 5 years) could be estimated with reasonable precision; (3) moving average estimators of stock are problematic in the estimation of changes; (4) interpenetrating permanent sample plots are desirable from the point of view of inter/extrapolating and changing data on annual growth variation and harvests are important and can be used directly in the default method based on differences between increment and drain; and (6) time gaps between NFI surveys lead to significant errors in the estimation of stock changes. *FOR. SCI.* 58(3):236–247.

Keywords: climate change, Kyoto Protocol, tree biomass, national forest inventories

- 1) NFI data from target years insufficient for annual stock change estimation
- 2) Changes between 5-year cycles OK
- 3) Moving average problematic
- 4) Interpenetrating panel design OK
- 5) Annual growth and harvest vital for default method
- 6) Time gaps between NFI surveys may lead to errors...

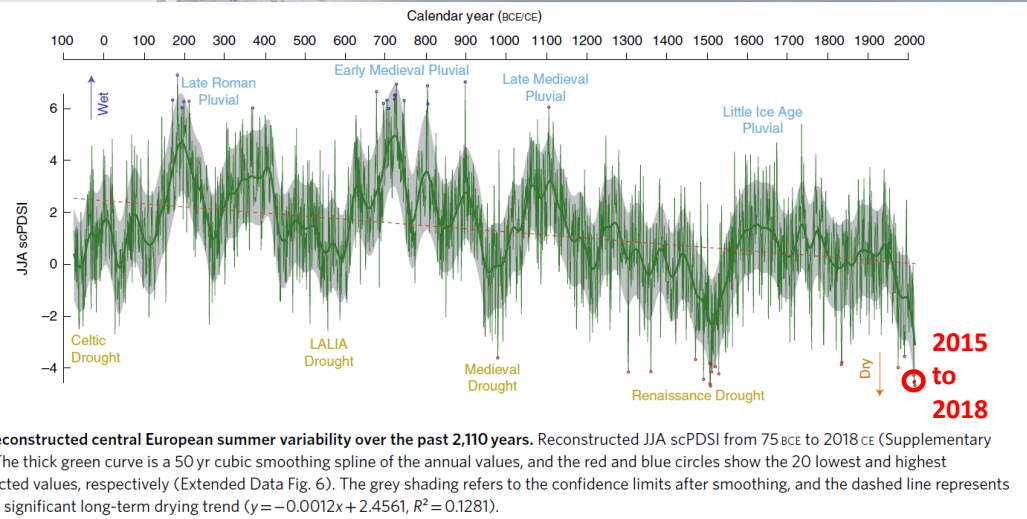
National GHG emissions

- total + share of **Agriculture** and **LULUCF**

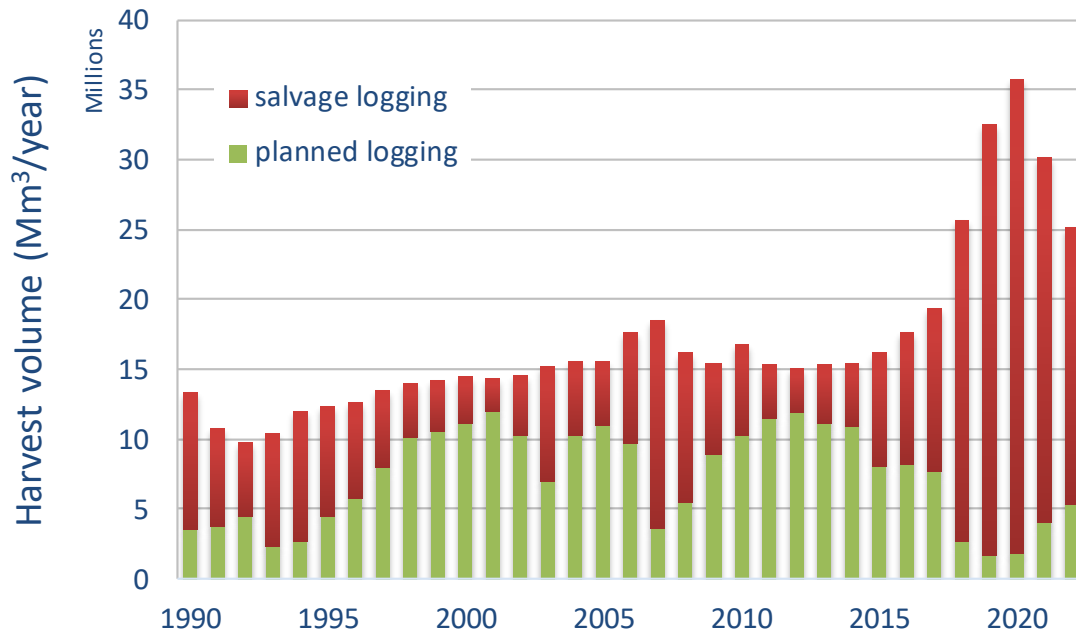


Czech Republic: Extreme drought- induced bark beetle calamity...

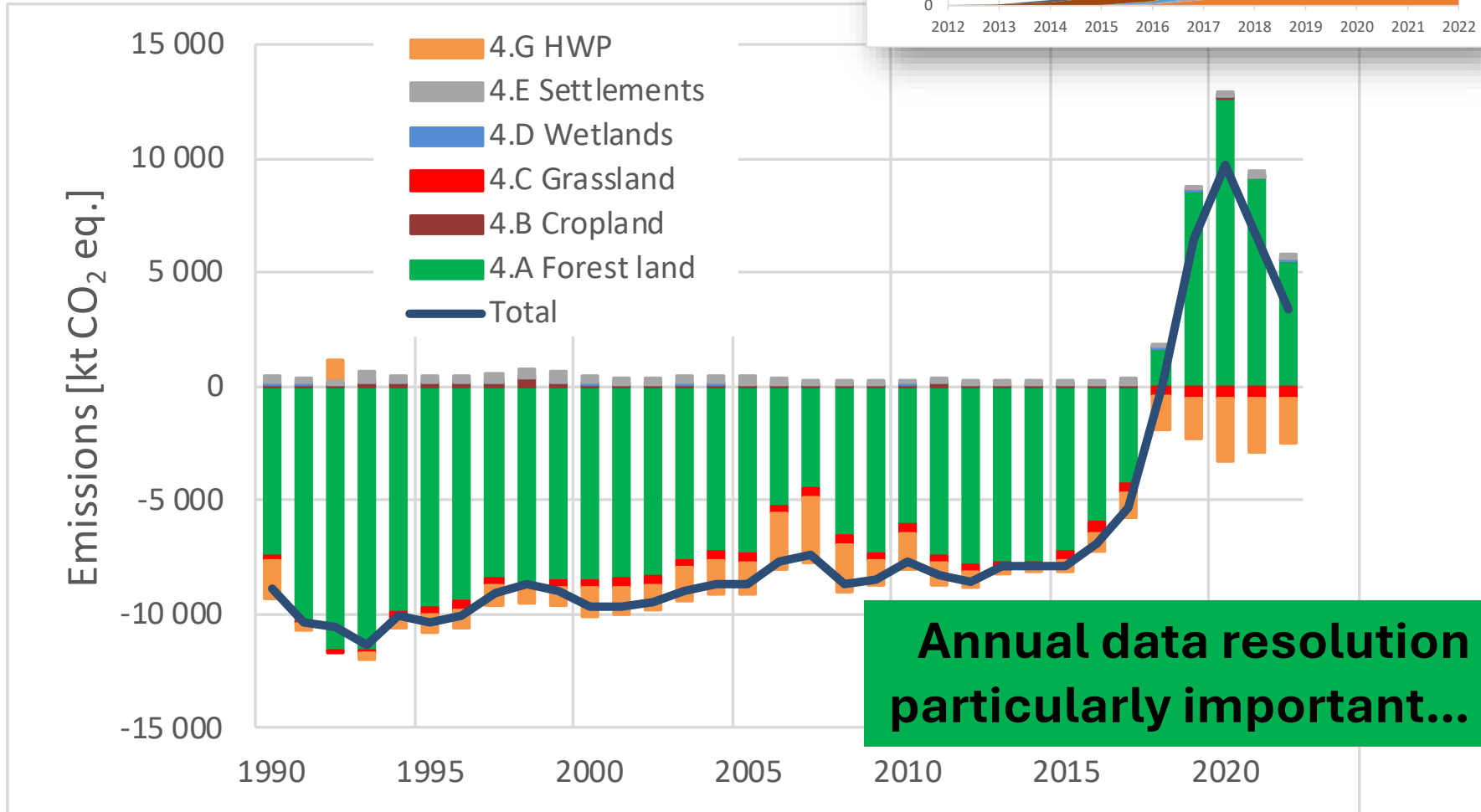
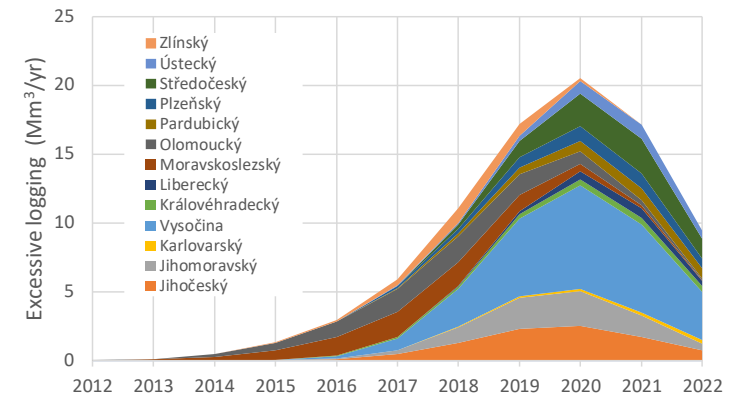
- Increased sanitary harvest and total wood extraction



C: Büntgen et al. 2021; <https://www.nature.com/articles/s41561-021-00698-0>
**Cumulated drought
unprecedented in 2100 years**

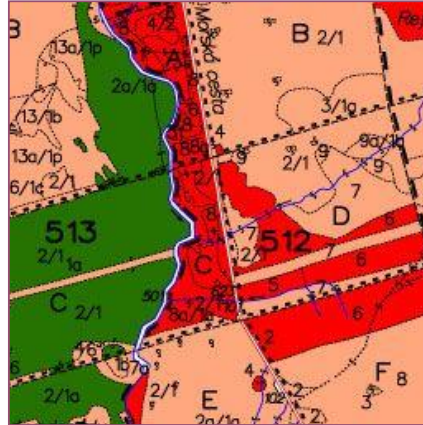
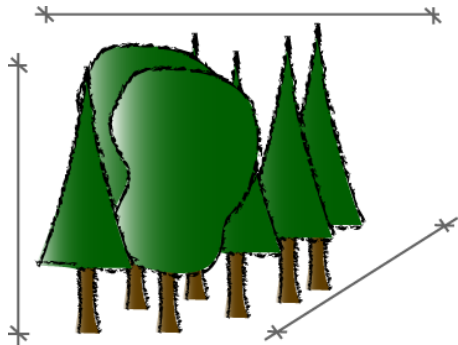


Current GHG data for the **LULUCF** sector



Available activity data

National stand-wise inventory (forest management planning)

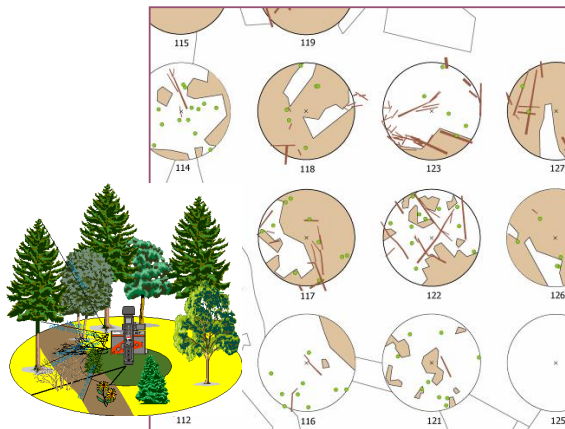
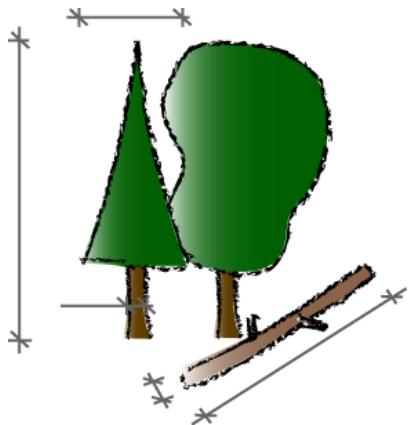


Database updated annually

Official source on forest data in the Czech Republic until 2024

Used in NIR until now...

National Forest Inventory (statistical forest inventory)



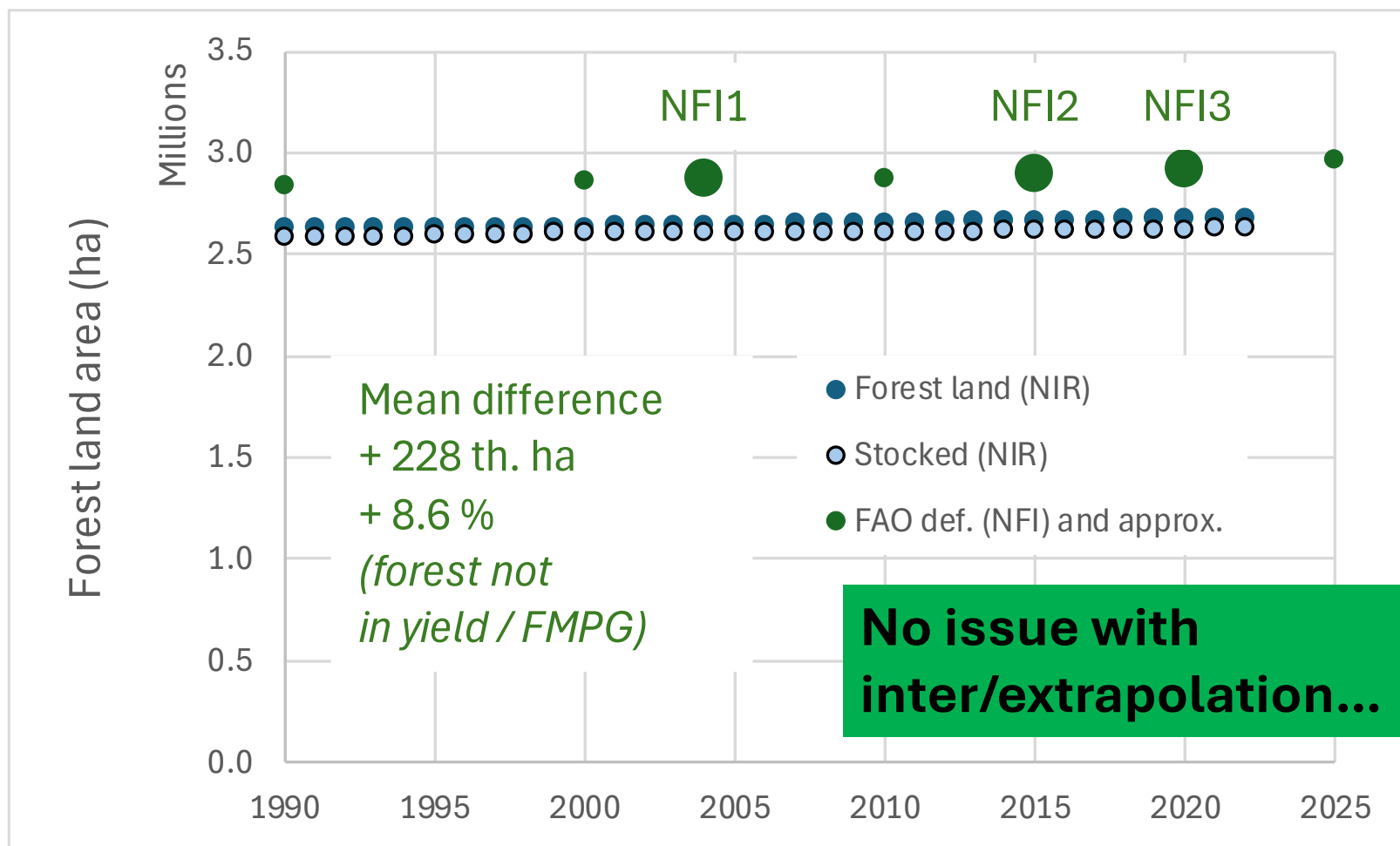
NFI1 (2001-2004)
NFI2 (2011-2015)
NFI3 (2016-2020)
- annualized by 20%
NFI4 (ongoing...)

Reported to FAO since 2024 (this year)

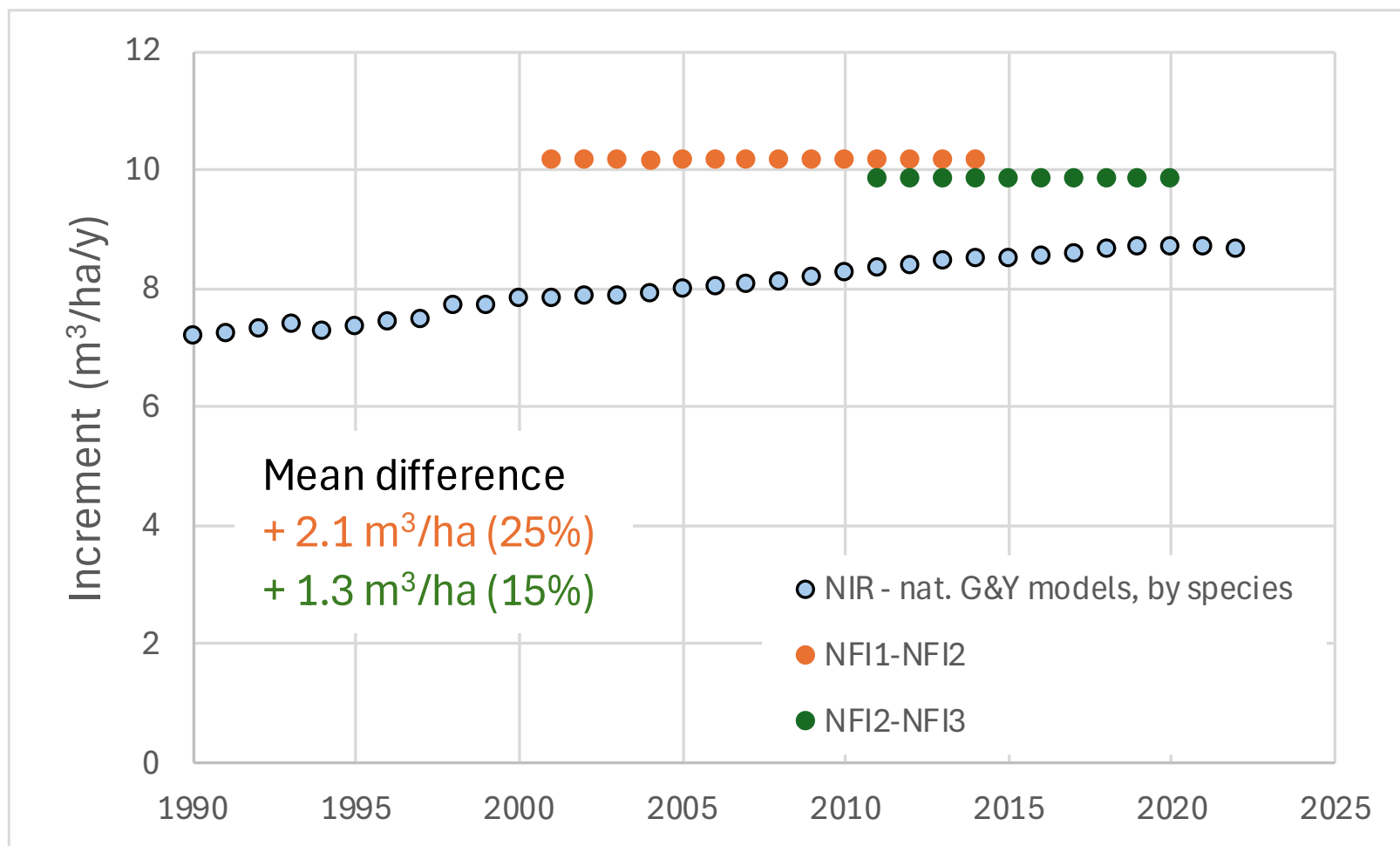
Going to be used in NIR* ASAP...
(once challenges are addressed)

* NIR or NID for the coming years...

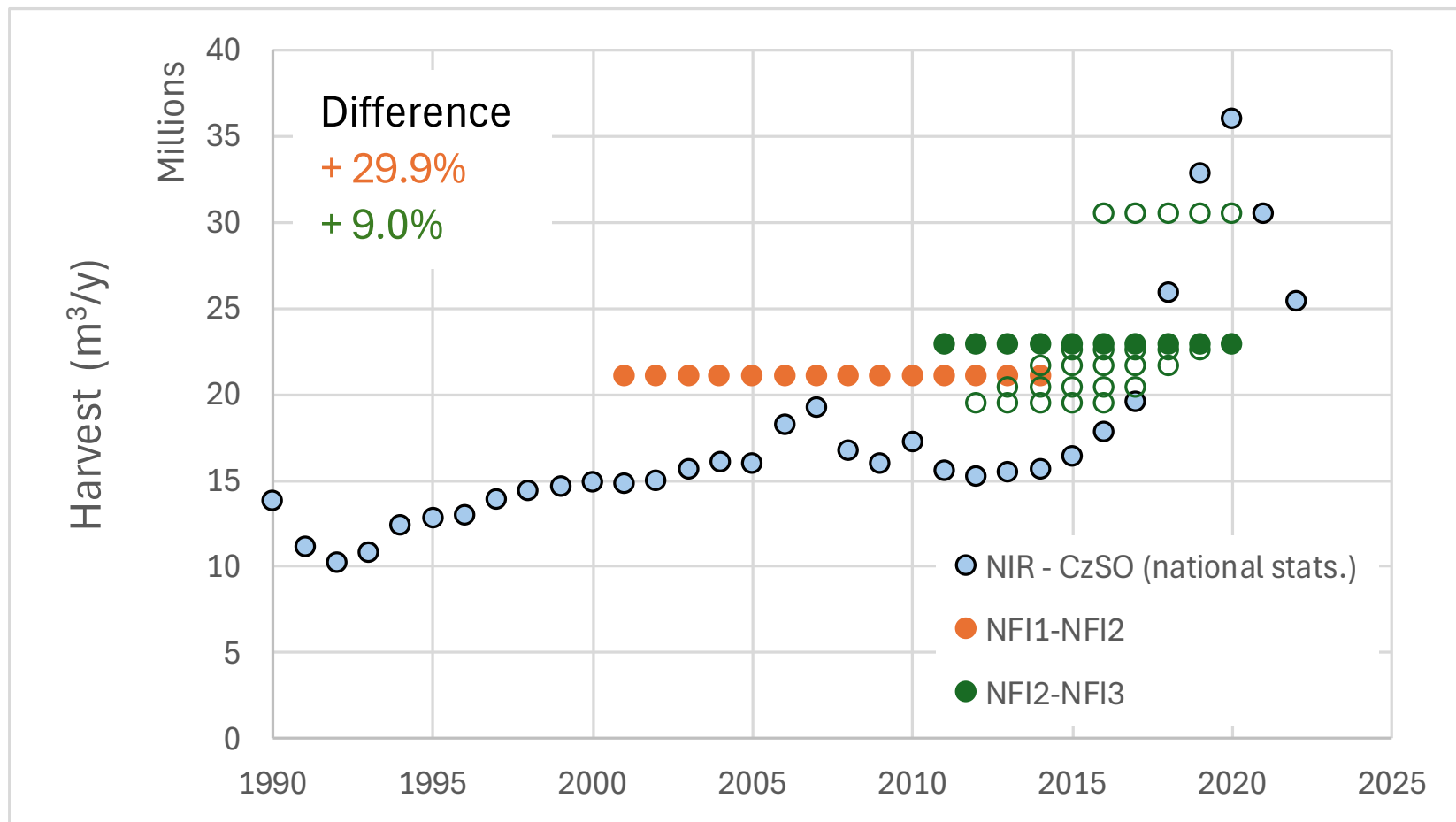
Key activity data – forest area



Key activity data – increment



Key activity data – harvest



“Panel” design for estimating changes

Czech NFI design – re-drawn after Máslo *et al.* 2023*

NFI cycle	NFI 2					NFI 3					
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Change period		11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	
Panel 1		1	1	1	1	1					
Panel 2			1	1	1	1	1				
Panel 3				1	1	1	1	1			
Panel 4					1	1	1	1	1		
Panel 5						1	1	1	1	1	
Weight		1	2	3	4	5	4	3	2	1	
Weight (%)		4	8	12	16	20	16	12	8	4	

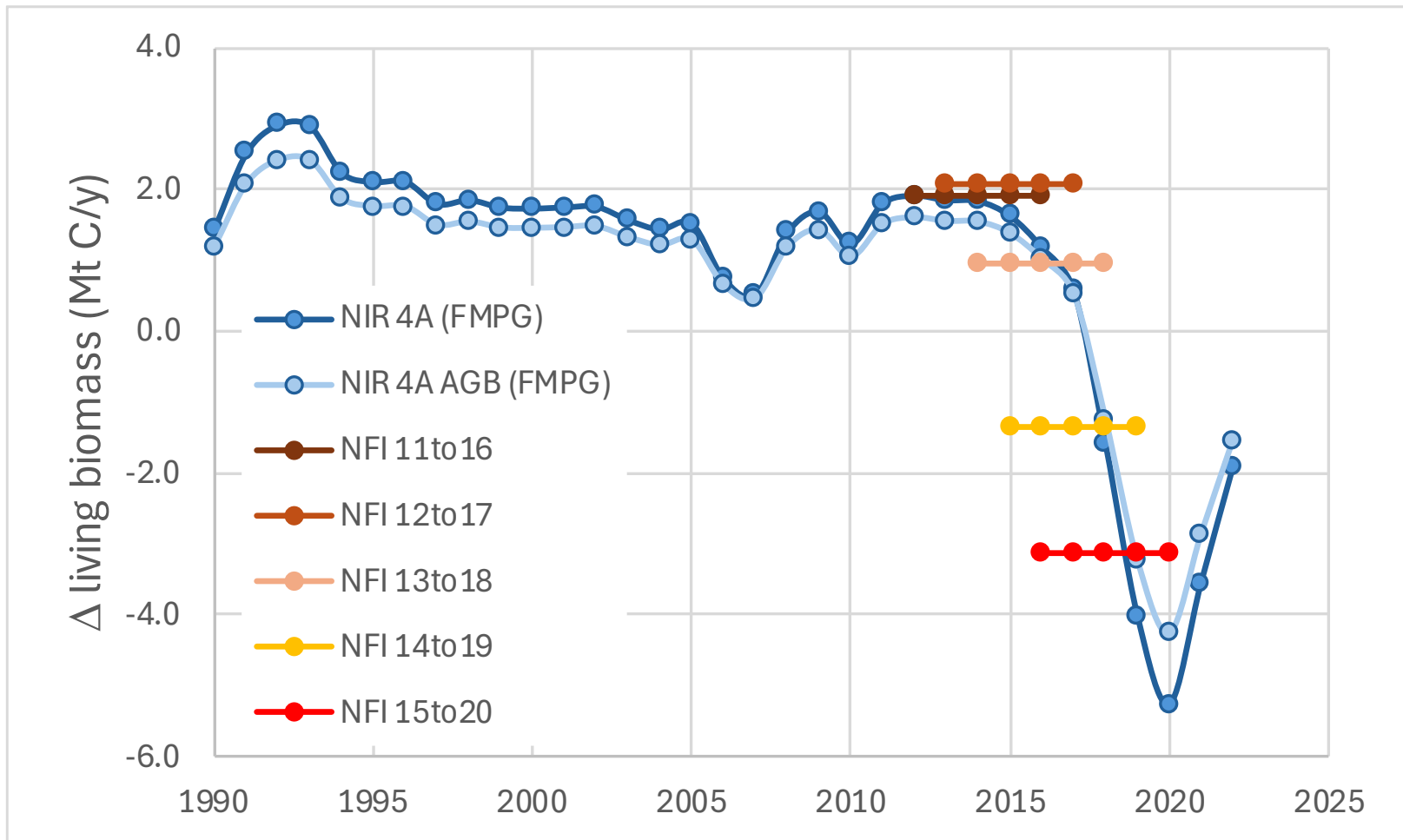
**5 years (seasonal)
resampling for all plots**



* C: Máslo *et al.* 2023 *Lesnická práce* 10, 34-40 (in Czech)
Forest Management Institute, Brandýs n. Labem, CZ

Comparing end-results:

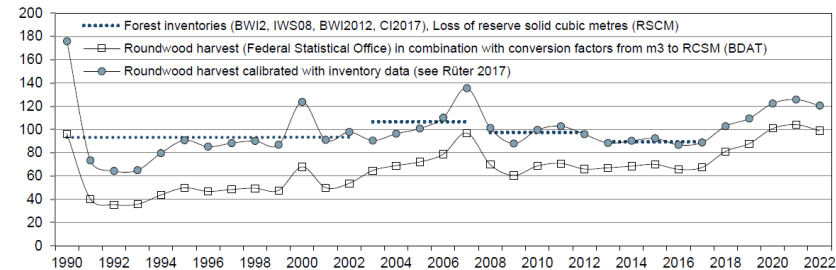
- carbon stock change in biomass (AGB)



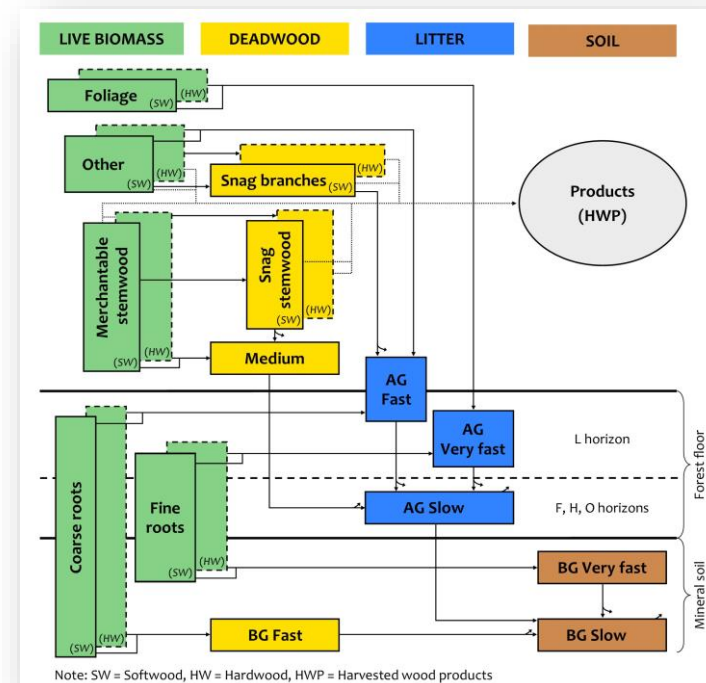
Addressing annualization

- Available annual data allow using “gain-loss” method
- Adequate annual data may be obtained from
 - Combining annual data (e.g., national harvest statistics) with NFI “level” data calibration
 - Model (e.g., CBM-CFS3) calibrated on NFI data - a tool for estimating **annual changes** in all ecosystem carbon pools

Figure 91: National harvest statistics, and their calibration with forest-inventory data on solid wood losses [in millions of solid cubic metres], (Statistisches Bundesamt, FS 3, R 3.3.1) and Chapter 6.4.2.1.1



C: NID 2024 of Germany



Let us have
a fruitful
exchange
on these
issues –
thank you!

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