

These are notes from the five breakout groups regarding the topics related to *Session 3: Annual estimates – the challenge to report emissions when they occur*. They are unedited, so all views expressed by the participants remain intact. The purpose of this exercise is to allow experts and authorities to look into the need of estimate emissions and removals at the moment when occur, and if so, to further identified the most adequate methodologies to implement it.

Discussion topic: What about the terminology: annualization/timeliness/ interannual variability?

What would be the best term to describe what is needed among annualization/ timeliness/ interannual variability? It may not matter much. All three terms fit. Annualization is the term used (in the UK). Timeliness preferred in Germany but all terms fit.

Drought in 2018 is changing the estimates drastically and we need to be prepared for similar events in the future, as they are likely to get more frequent.

Annualization of data to improve timeliness of reporting and better reflect the interannual variability.

Annualization was preferable of most participants (often periodic data is converted to annual values). It was mentioned that IAV was something you wanted to get rid off.

Reporting real annual values may lead to huge interannual variations that may not be better than current methods for reporting and accounting.

Noted that annualisation is one challenge. The challenge for repeated inventories is more to get mor reliable data in time and to avoid large recalculations when next round of data is available.

Annualization of biomass increment is considered as relevant (due to climate effects and other external forces like markets) but not always annualized (only Austria currently annualizing)

None of them matches, maybe “Representation of Annual variation”. “Annualization” means making an average. Annualization means to get annual values from averages.

It is well recognized that LULUCF shows much higher variability what we measure compared to other sectors.

For LULUCF the long-term trend is more relevant than value of single years.

Timeliness of estimates is important to show changes in trend, for timely information for policy makers.

Timelines is related to provide information on time (e.g. according to legislation).

Discussion topic: What annualization methods do you have experience with? Among the available methods for annualization (e.g. direct measurements, ancillary data) which one you suggest/implement and why?

Combining methods may be a way forward. Combining stock difference with gain-loss may be an improvement to include some annual variations. Gains can be based on repeated measurements of stocks while losses are more linked to human interventions than gains. Note that.

Important that auxiliary data, i.e. annual data (harvest statistics) is accurate enough in relation to the basic data used (NFI).

Bad auxiliary data may harm more than help and there is also a risk of adding noise to the data.

Not recommended to use annual climate data for modelling. It may result in large IAV which is not useful for reporting.

How can we annualise other pools? Dead wood, stumps, soils carbon etc. No concrete examples.

Difficult to annualise emissions from pools that use emission factors today (organic soils) but efforts are ongoing to develop models (Finland, Latvia).

What about activity data? The real change in land use may not be verified until several years after the change. No concrete examples.

Harvest annualization is done by most countries with different approaches (different moving averages (e.g. 3 to annualize harvest).

Differences between harvest reported in NFIs and Harvest statistics need to take into account bark and logging residues. Once calibrated, annual harvest statistics can be used to annualize NFI data (also within stock-change approach, e.g. Germany).

Promising Approaches: RS as a tool to complement/integrate sample-based surveys or NFI (and viceversa).

Caution should be taken on what is REALLY needed to hit the target (reliable data) without asking the impossible.

Promising Approaches: Remote sensing, mainly optical, but not fully used to annualized. Except Estonia that counts on 4-year full coverage LIDAR, under development.

Climate is relevant for mortality and not yet fully accounted.

Increment is considered relevant for climate change responses.

Promising Approaches: DE: new RS product => map of forest damages =>possible use in the future.

Promising Approaches: CH: annualization of NFI data with FAO, growth not annualised, DW/LT/soil by Yasso = annual, HWP => FAO stat = annual.

Promising Approaches: NFI measurements best option combined with additional data (e.g. indices) to annualise data.

Soil:

- for land remaining in the same category model approach is used for annual values.
- DK: agricultural soils modelled based on future crop production: moving average of past period => this trend is projected.

Which is the best scale? plot by plot, tree level, by regions, or country level?

- Depends on the data (aggregation level).
- what is the best spatial scale for RS based model, for capture trend for growth better on tree level, harvest/disturbance also works with higher level.

Remote sensing (RS): combination of RS (activity data) with NFI (carbon stocks) is ideal approach, can be used for disturbances, difficult to derive information on increment from RS;

- measure growth reliably only with airborne LIDAR (specially designed for forest monitoring).
- Copernicus/sentinel can be used as predictor for growth, spatial patterns are detected well, but not timely patterns.
- Forest definition often use small minimum areas, not captured by field measurements, RS could help.

What annualization **methods do you have experience with?**

- Simple interpolation/extrapolation from limited years.
- Testing on the use of RS but nothing operational.
- Upscale from local samples to regional/country level (due to homogeneity of the forests which are planted).
- Include LPIS?

Which is "most challenging" data item in terms of timeliness?

- Natural disturbances.
- CSC data to verify models.

Countries have different data at hand, so there is likely no one-size-fits all solution. Instead, it seems clear that countries can learn from each others' experiences. The presentations in the previous session were very inspiring and show that things are really moving forwarding on this front.

Forest management plans as a basis for forest data, forest managers obliged to provide data on an annual basis already. Harvest from here, increment from yield tables. Only two cycles of NFI now so difficult to assess validity of the current data used in the GHGI.

Gain-loss method taken up now, growing stock model uses inventory data from the past five years. From the plot measurement time the stock is projected to the reporting year. Annual losses of stem volume are reported as an average over the last three harvest seasons.

Spain and Belgium have an NFI based on permanent sample plots remeasured every 10 years. Spain working towards designing the system for annual data. Belgium shared information: e.g., SIMREG, a tree-level distance-independent model to simulate forest dynamics and management from national forest inventory (NFI) data.

Right now, Germany uses harvest statistics to annualize NFI data. Considering and testing remote sensing and process-based models. Strong pressure from national politics (see German Climate Protection Act) to report developments in a timelier manner. Also important for quality and forecast accuracy of projections.

Soils is more of a challenge than Biomass. No known method to accurately measure SOC changes annually. Methodologically difficult. Run models to give annual estimates. Model predictions at very high-resolution climate data renders very large variation which might reflect reality because there are large interannual variations. Forest management impacts on soils easier to predict but other land use classes are more challenging. Challenge on measuring impacts of mitigation measures: rewetting and restoration because remote sensing does not help directly.

Discussion topic: Approximated inventory (Y-1) provides a possible training for the annualization methods. Which methods have been used? Where the estimates confirmed afterwards?

Most MS extrapolate the data from the previous year.

Finland uses harvest statistics to adjust the approximated year.

Do we really need the approximated inventory? It leads to more continuous updates of data sets that may confuse the public and decision makers.

Only few countries report it for LULUCF.

Question of resources, a lot of effort (AT).

Use partially updated data base (FR).

Extrapolation of previous inventory (CZ).

Approximated inventory (Y-1): no experience.

Some countries do it, but not clearly described in NIR.

Mandated by national legislation. 15 March to be published. Some statistics don't exist yet (e.g. land use yes, but not harvest statistics) and data needs to be

extrapolated using an average of the last three years. Can consider using RS but getting the data in just 1 or 3 months is not feasible. Remote sensing needs checks and validation. Large differences between Y-1 and the following submission if there are strong changes in trends and recalculations (smaller than methodological changes but still exist).

Managers data is annual (half the year) and is used for the preparation of strategies.

Implementing a system with RS may not be operational now but will improve in time.

Discussion topic: Transparency on the annualization methods: is it described sufficiently in your GHG inventory?

- Good examples of explaining the annualization: AT, DE (NID).

Discussion topic: What data or methodological improvements, **how JRC can help?**

- Urgent need for models for drained organic soils!
- Being available when needed.
- JRC: help on CC impacts on forests, on checks on anomalies in the time series.
- Connecting people to share challenges and solutions, and learn from each other.
- With all these uncertainties in data, there are concerns for the cost of the commitments for the MS.
- Help with using RS data to provide more timely and accurate annual data especially on harvest - can that be made more robust and really comparable between the MS?