



Food and Agriculture Organization  
of the United Nations



# StateO

5-7 May 2026 | ESA-ESRIN | Frascati (Rome), Italy



## Quantifying Period-Selection Uncertainty in EO-Derived Deforestation Baselines for Carbon Accounting

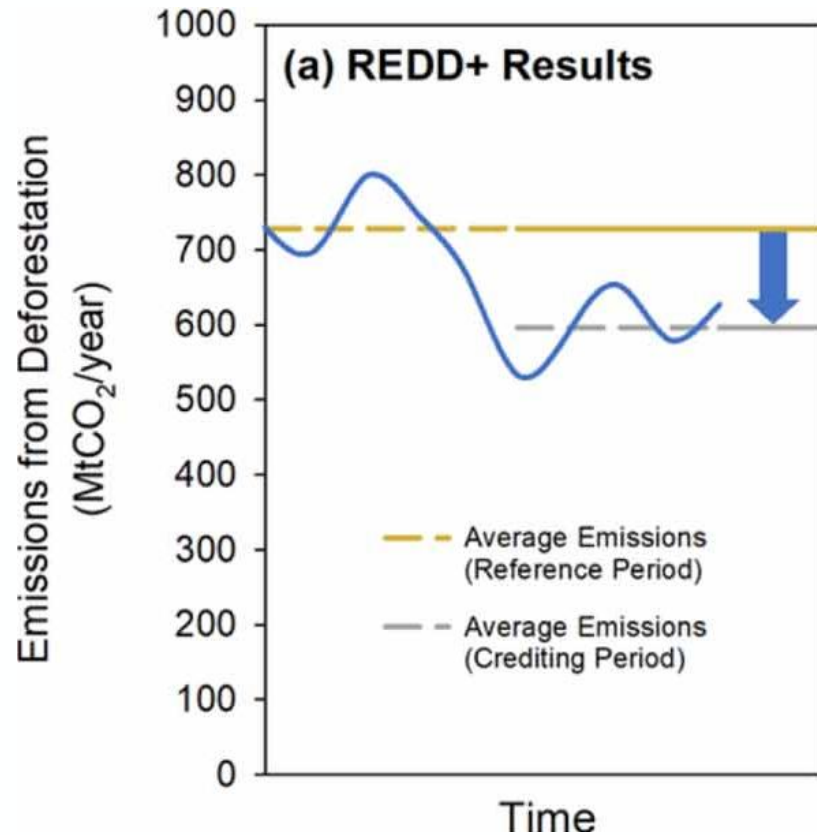
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# The Policy Problem: Does Period Duration Matter?

- **Jurisdictional REDD+ baselines are set as historical averages, but over what time window?**
- **Carbon standards disagree**



Carbon standard or reporting framework	Reference period	Crediting period
FCPF Carbon Fund	10 yrs mostly	Flexible, often 5 yrs
ART-TREES	5 yrs	5 yrs
Verra's VCS-JNR	4-6 yrs	4-6 yrs
REDD+ reporting (UNFCCC)	Flexible, often 10 yrs	Flexible, often 5 yrs

- **The choice is not neutral:** a reference period capturing unusually high or low deforestation biases the baseline and inflates or deflates claimed emission reductions

Yanai et al. (2020). *Environmental Research Letters*, 15(12), 124002.

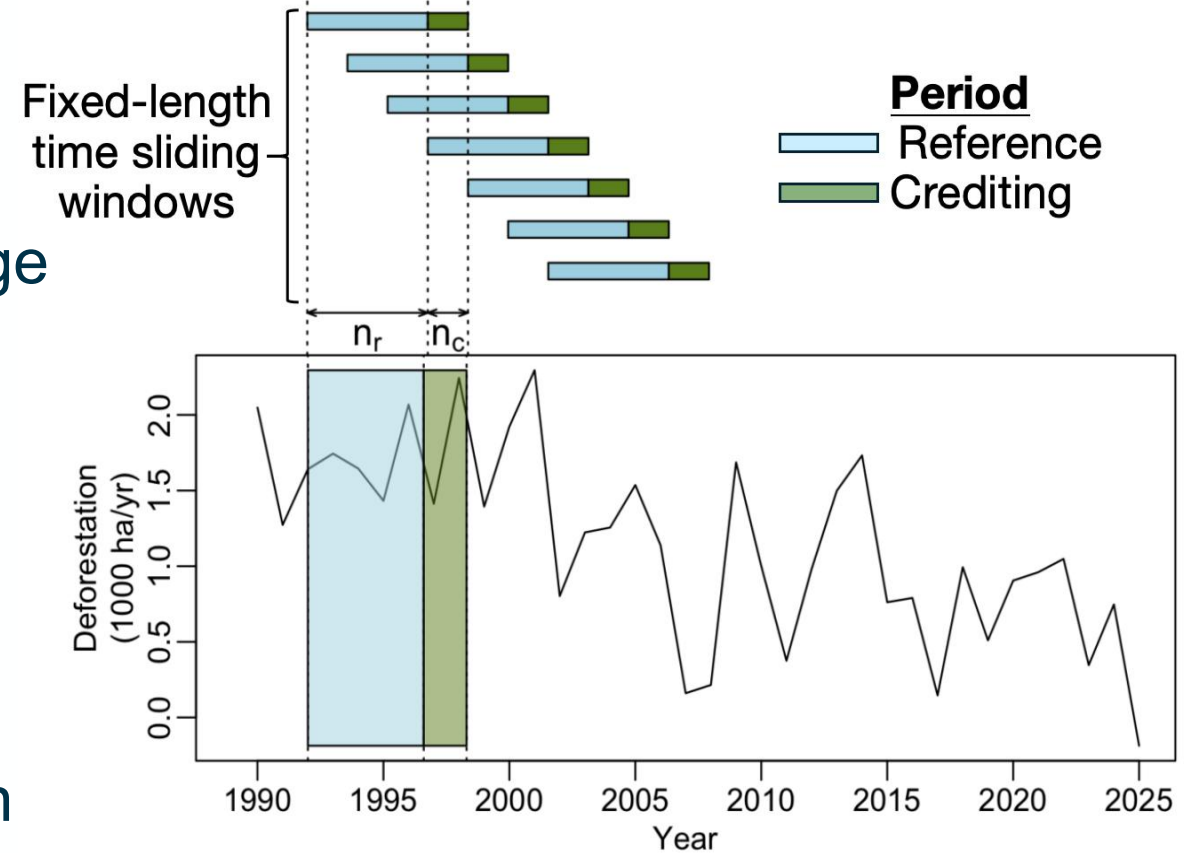
- **JRC Tropical Moist Forest dataset**  
71 countries and territories, 1990–2025 (36 years), TMF v2023/v2024

- **Sliding window approach**

For every possible pair of reference and crediting period lengths, compute the average absolute difference between the two period means, expressed as a fraction of the crediting period mean

- **Reference-Crediting Period Discrepancy:**

The resulting quantity measures how much the apparent emission reduction depends on which years are chosen, not on real mitigation



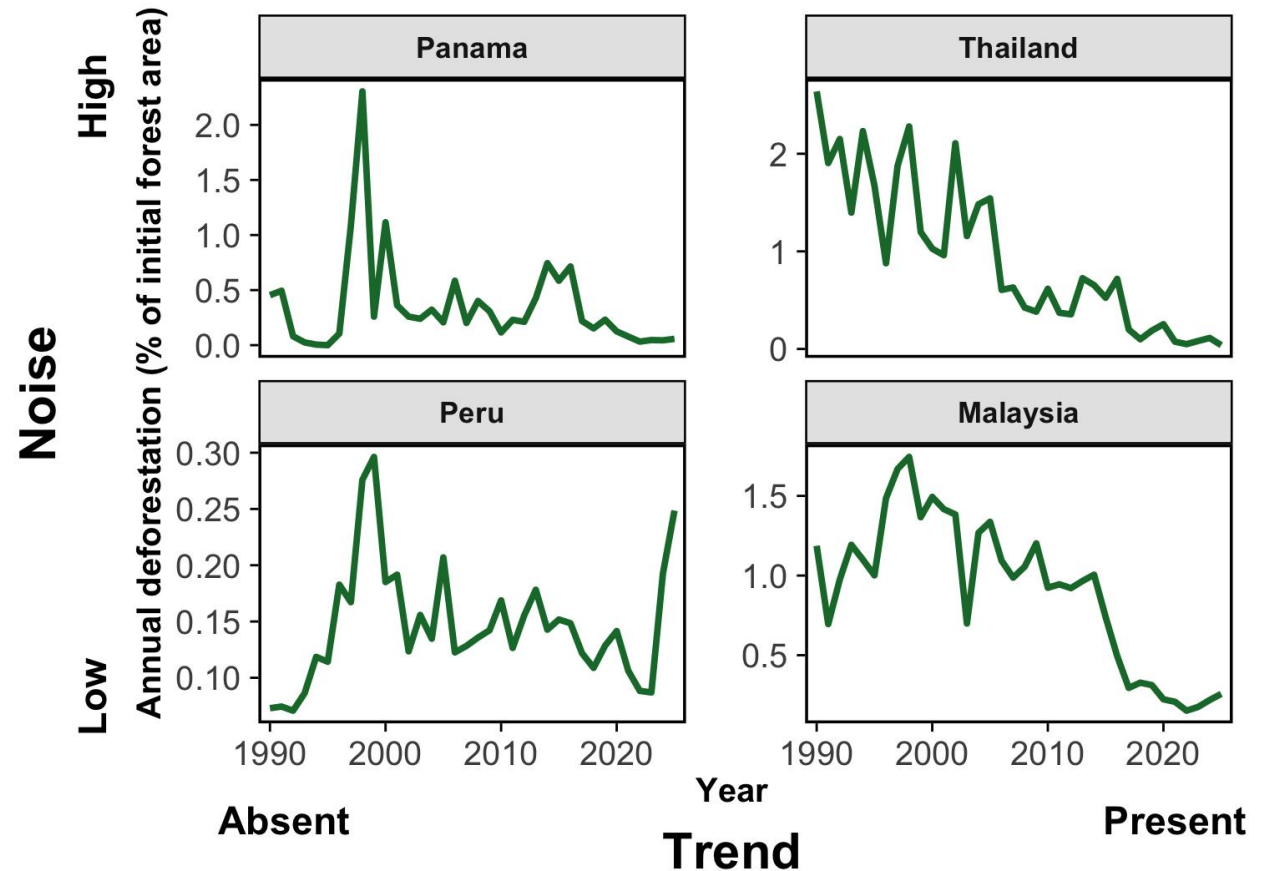
# Two Sources of Period-Selection Error

- **Noise**

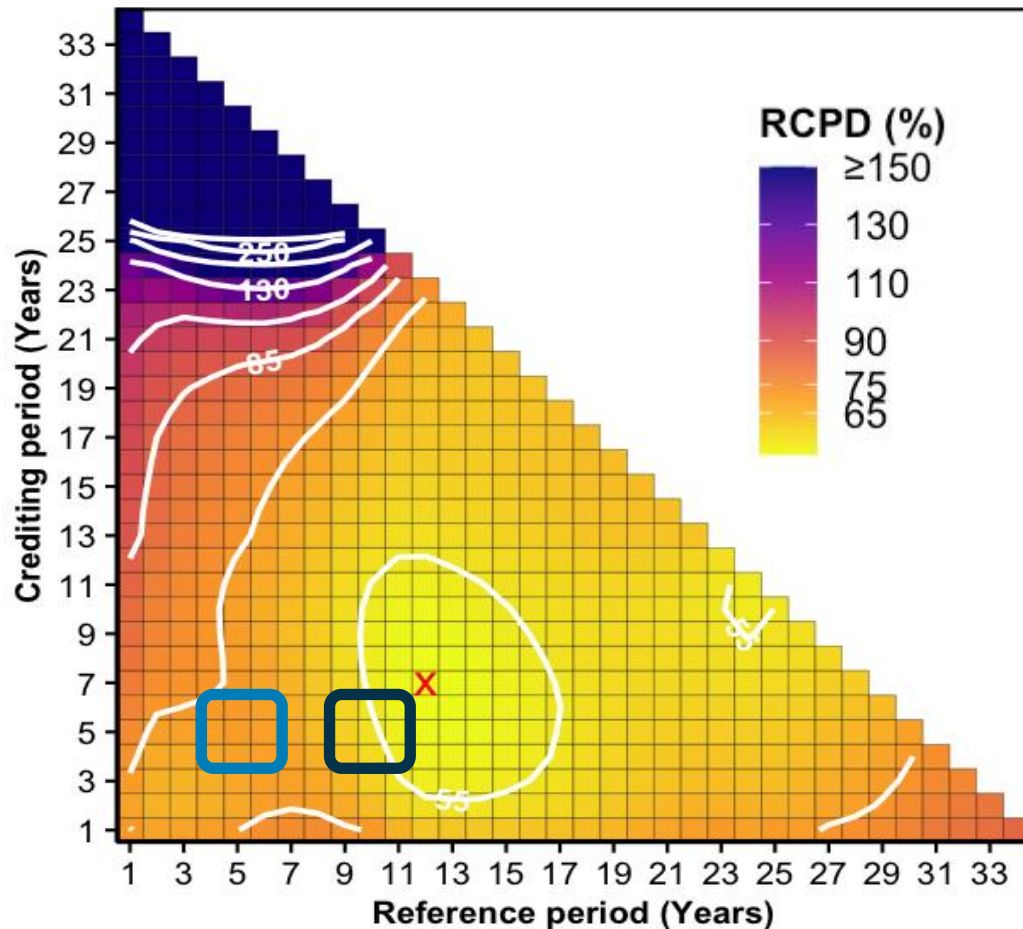
Year-to-year variability in deforestation rates means any short window may be unrepresentative of the long-run average, regardless of direction

- **Trend**

A systematic rise or fall means older reference period years become outdated as baselines, favouring shorter reference periods



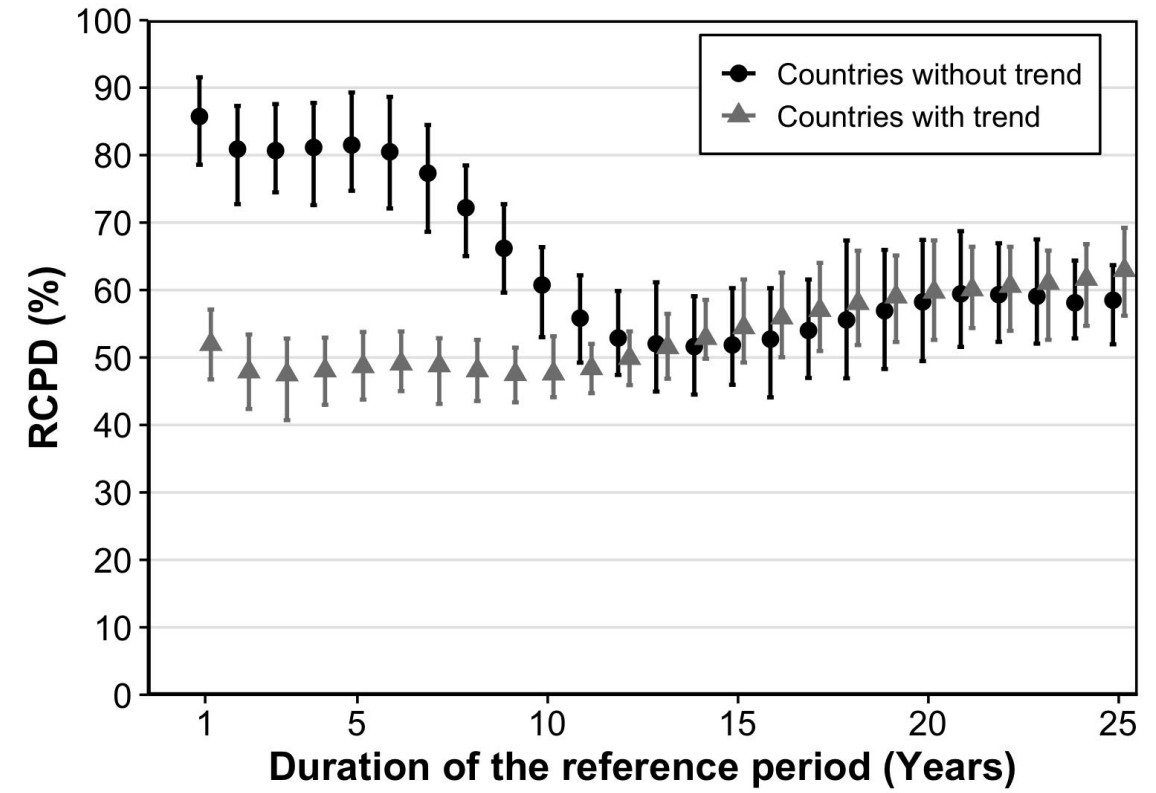
**Is there a single combination of reference period years that performs well across this full range of country behaviours?**



- **Global optimum:** RP=12, CP=7 at 51% — but the error surface is relatively flat within the RP=11–16, CP=4-9 yr zone
- **10-year/5-yr standard combination:** 56% — only slightly worse than the optimum, validating current FCPF and UNFCCC standards
- **Error rises steeply for high CP values.**

# Does Tailoring Periods to Country Circumstances Help?

- **Directional finding is intuitive:** trending countries benefit from shorter reference periods; non-trending countries from longer ones
- But the **gain from stratifying is small:** separating by trend status reduces average discrepancy from 51% to 50% — only 2 percentage points
- **Country-specific tailoring** could reach 11% — but allowing free period choice creates incentives for opportunistic baseline selection that outweigh the precision gain



- **10–5 year reference and crediting periods minimise discrepancies globally:** Current FCPD and UNFCCC standards are well-calibrated and should be maintained
- **The dominant error source is interannual variability in deforestation rates, not trends:** Improving EO data temporal consistency would help, but genuine year-to-year variation is irreducible and any carbon accounting framework must contend with it
- **Discrepancy is of the same order of magnitude as reported emission reductions:** It belongs in uncertainty analyses and is currently absent from carbon accounting frameworks

## Future Work

- ▶ **Extend to forest degradation**  
Discrepancies for degradation-based emissions is unquantified; degradation dominates in many tropical countries
- ▶ **Test sensitivity to EO product choice**  
Do results hold under GFC Hansen, PRODES, national products? ESA BIOMASS P-band opens a new EO-derived baseline input
- ▶ **Develop country-level decision tools**  
Translate global optima into practical guidance for countries designing or updating FRELs under UNFCCC and voluntary standards

## Recommendations for R&D & Policy

- 01 | Standardise period-selection uncertainty reporting**  
IPCC and carbon standards mandate uncertainty reporting for EFs and AD but not for period selection. R&D should pilot a consistent method for reporting period-selection error as a required component of FREL submissions.
- 02 | Invest in longer, consistent EO time series**  
Interannual variability is the dominant error source. Longer, methodologically consistent EO archives directly reduce period-selection uncertainty. Continuity and reprocessing of the historical record should be a core R&D priority.
- 03 | Keep medium periods as the default standard**  
10–5 yr periods minimise error globally. Free period choice does not improve accuracy but creates cherry-picking incentives.