Forest Cover Change Detection (1985–2025)

Regression-First Approach with CORINE Taxonomy

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1 Overview

This Google Earth Engine script detects multi-decadal forest change using a **regression-first** approach: computing vegetation trends for all pixels before applying classification thresholds. This enables detection of active succession at any vegetation stage.

2 CORINE-Aligned Taxonomy

Classification thresholds align with the European standard CORINE Land Cover (CLC) system:

NDVI	CORINE Class	Description
≥ 0.60	3.1 Forest	Closed canopy (≥30% cover)
0.45–0.60	3.2.4 Transitional Woodland-Shrub	Young trees, dense shrub
0.25–0.45	Open/Sparse	Grassland, sparse vegetation
< 0.25	Bare/Agriculture	Exposed soil, active farming

Table 1: Vegetation classification thresholds

3 Trend Analysis

Linear regression is computed for **all pixels** using summer NDVI (June–September) from 2015–2025:

$$\text{NDVI}(t) = \text{slope} \times t + \text{intercept}$$

Slope (per year)	Classification
$> +0.005$	Gaining — active regeneration
-0.005 to $+0.005$	Stable — no significant change
< -0.005	Losing — degradation

Table 2: Trend classification thresholds

4 Change Classes

Class	Transition	Trend Requirement
Deforestation	Forest → Open/Bare	—
Degradation	Forest → Woodland	Losing
Regeneration (Open)	Open → Woodland	Gaining
Regeneration (Woodland)	Woodland → Forest	Gaining
Forest Densification	Forest → Forest	Gaining
Afforestation	Open → Forest	5-year epoch

Table 3: Change classification matrix

5 Afforestation Epochs

For pixels that reached forest status (NDVI ≥ 0.60), the script identifies the **first 5-year epoch** when this occurred:

1990–94 · 1995–99 · 2000–04 · 2005–09 · 2010–14 · 2015–19 · 2020–25

6 Data Sources

All Landsat Level-2, Collection 2, Tier 1 Surface Reflectance:

- Landsat 5 TM (1984–2012)
- Landsat 7 ETM+ (1999–present)
- Landsat 8/9 OLI (2013–present)

7 References

- CORINE Land Cover. Copernicus Land Monitoring Service. https://land.copernicus.eu/
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- Ferrara, C., et al. (2017). Geography of forest cover in Italy. *Forest Policy and Economics*, 75, 12–22.
