



# Land abandonment and recultivation in Central and Eastern Europe

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## Objectives

- CEEC differed considerably among each other before and after 1989/90 and later due to different EU accession scenarios -> diverse LCLUC trajectories
- Limited understanding from case study evidence, bigger picture missing

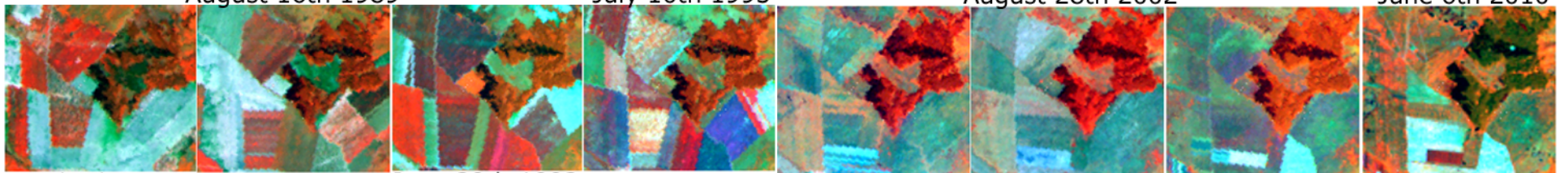


August 16th 1989

July 10th 1993

August 28th 2002

June 6th 2010



April 4th 1986

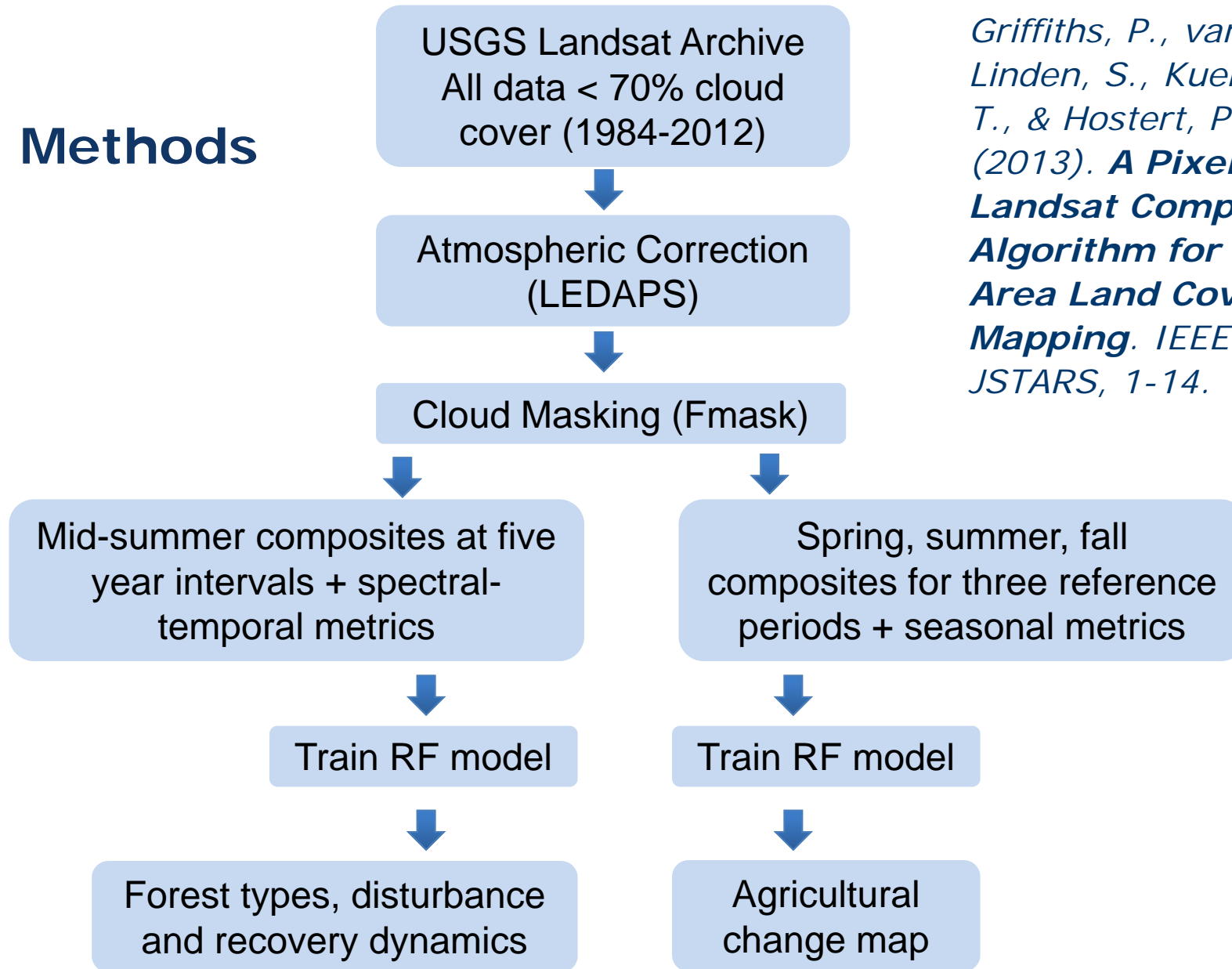
June 29th 1992

August 22nd 2000

July 17th 2007

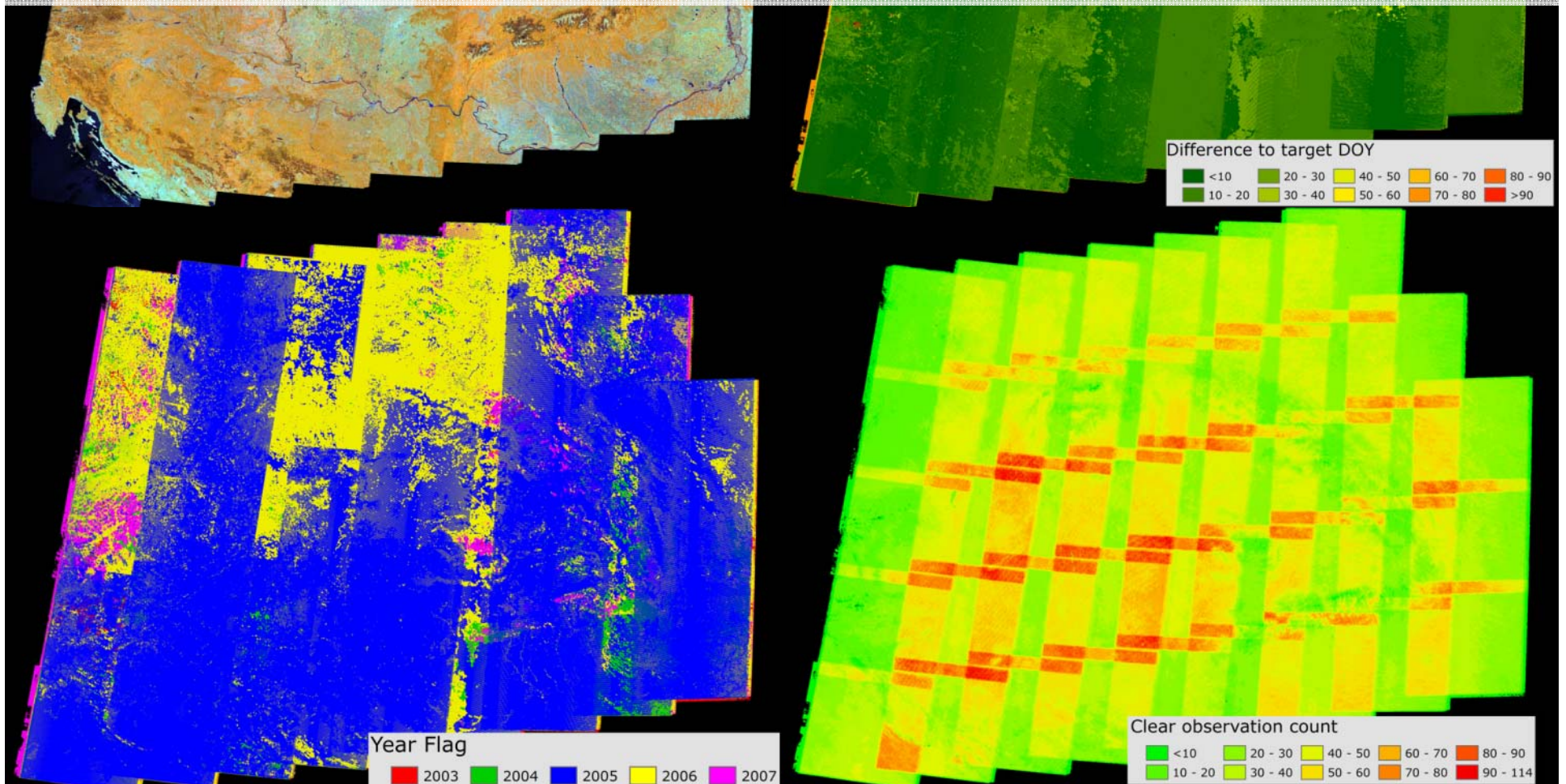
- Objective 1: Reconstruct forest & agricultural dynamics across the CEEC (Landsat-scale, 25 years)
- Objective 2: Deeper understanding of more recent abandonment / recultivation for Europe (MODIS-scale, since 2000)

## Methods

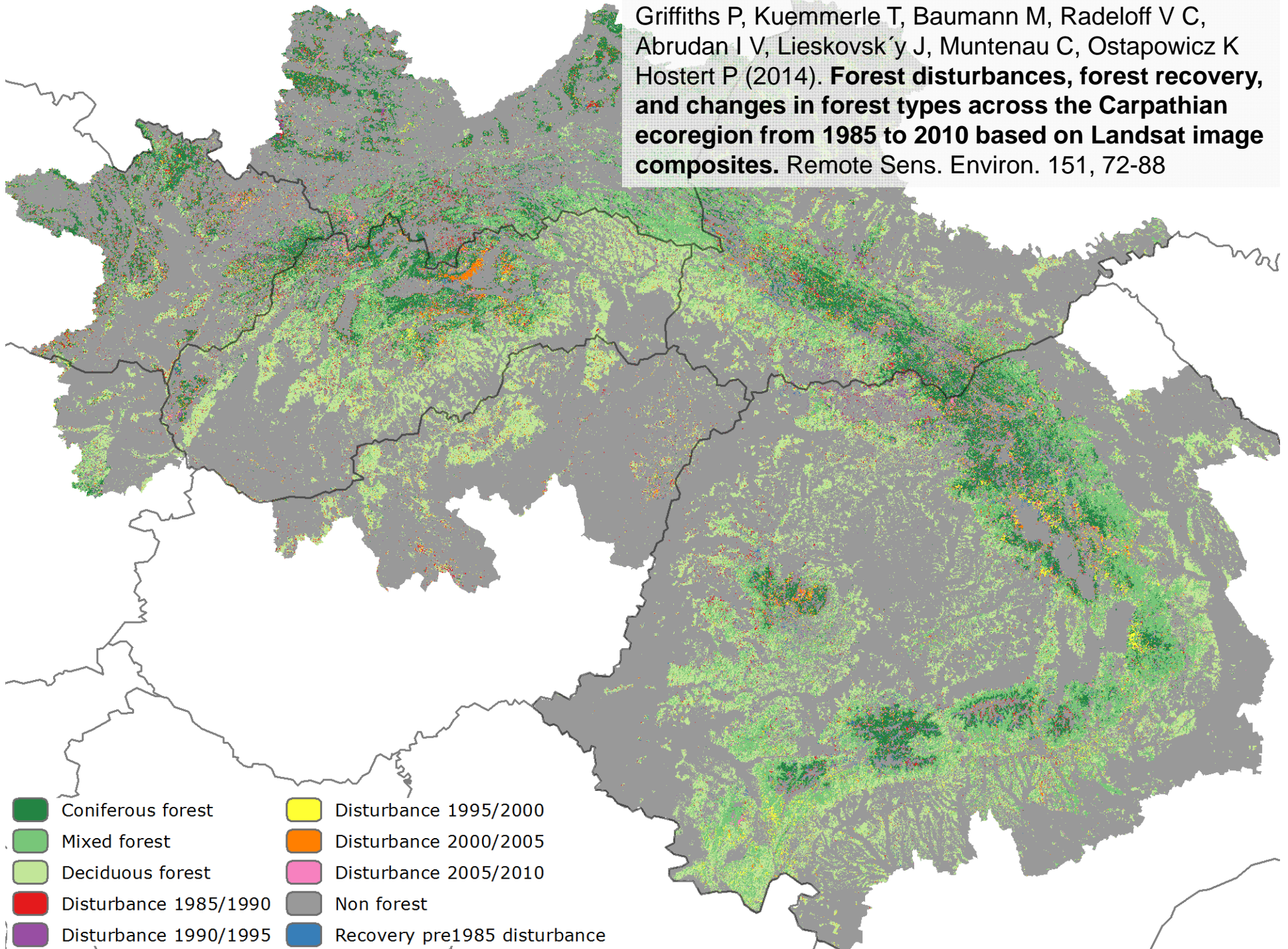


*Griffiths, P., van der Linden, S., Kuemmerle, T., & Hostert, P. (2013). A Pixel-Based Landsat Compositing Algorithm for Large Area Land Cover Mapping. IEEE JSTARS, 1-14.*

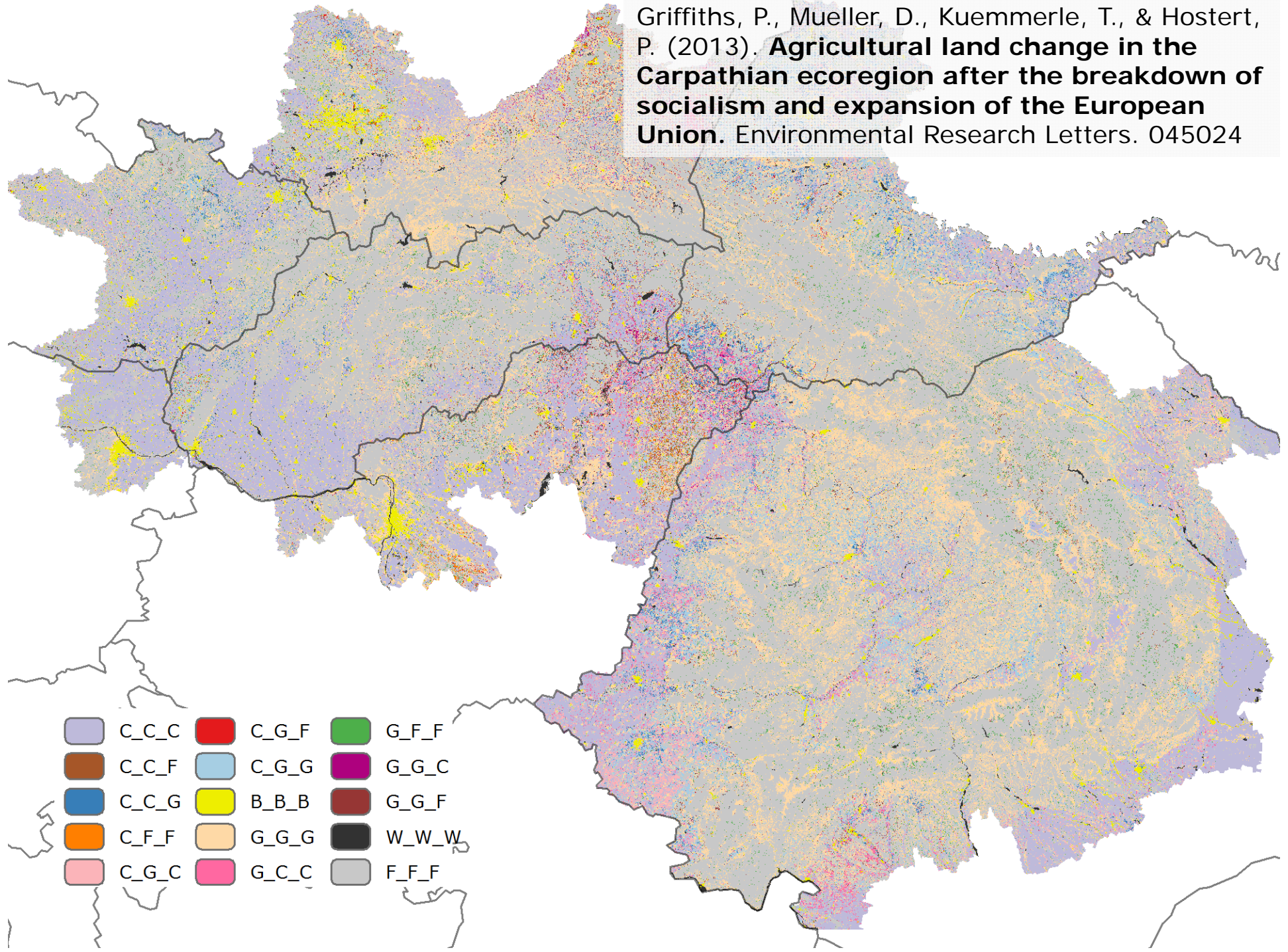
- Six five-yearly mid-summer composites and pixel-wise statistical features from entire image stacks for forest analysis (1985 to 2010)
- Three seasonally tuned composites (spring, summer, fall) for agricultural analysis (1985, 2000, 2010)



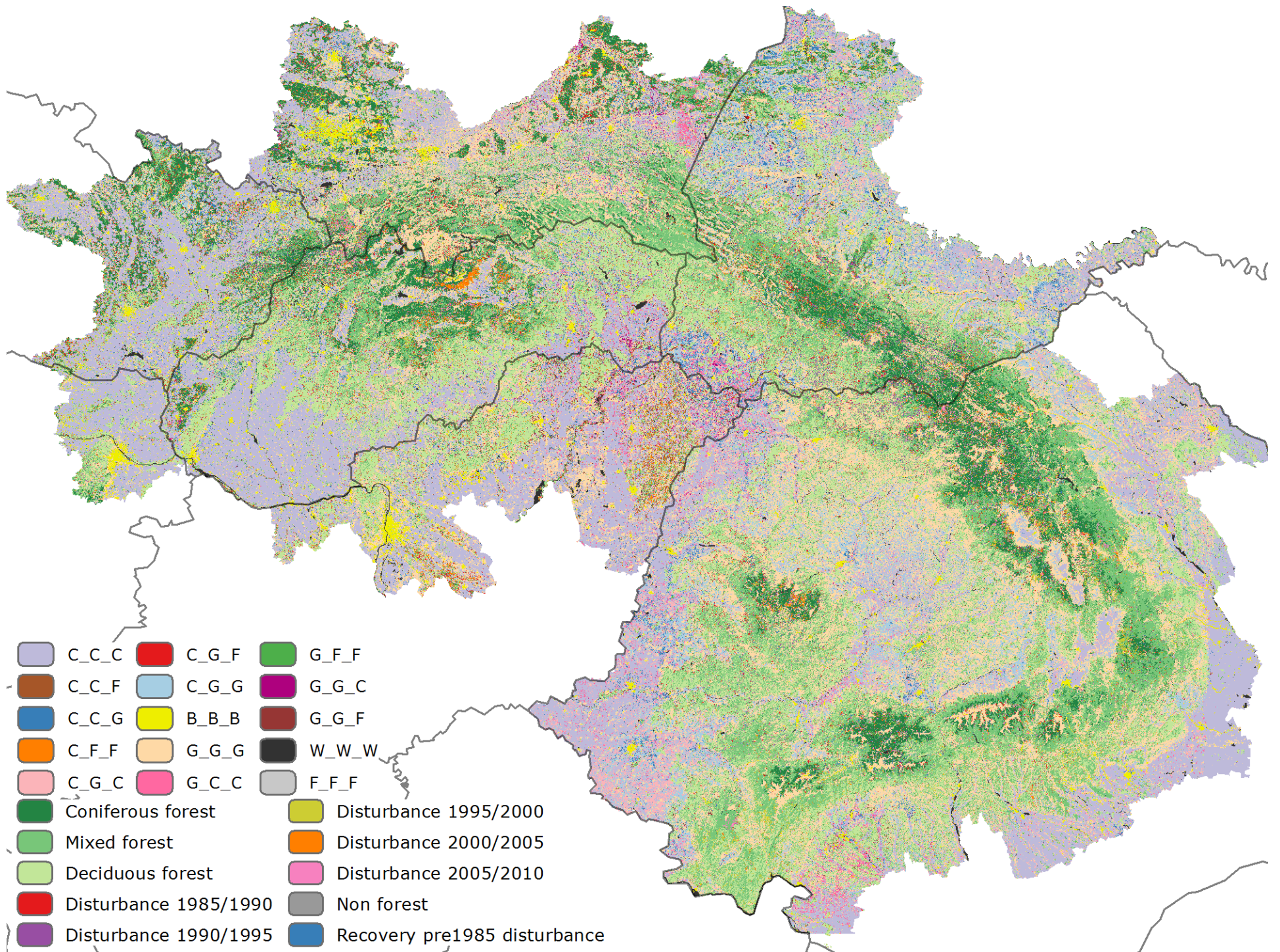
Griffiths P, Kuemmerle T, Baumann M, Radeloff V C, Abrudan I V, Lieskovsk´y J, Muntenau C, Ostapowicz K Hostert P (2014). **Forest disturbances, forest recovery, and changes in forest types across the Carpathian ecoregion from 1985 to 2010 based on Landsat image composites.** Remote Sens. Environ. 151, 72-88

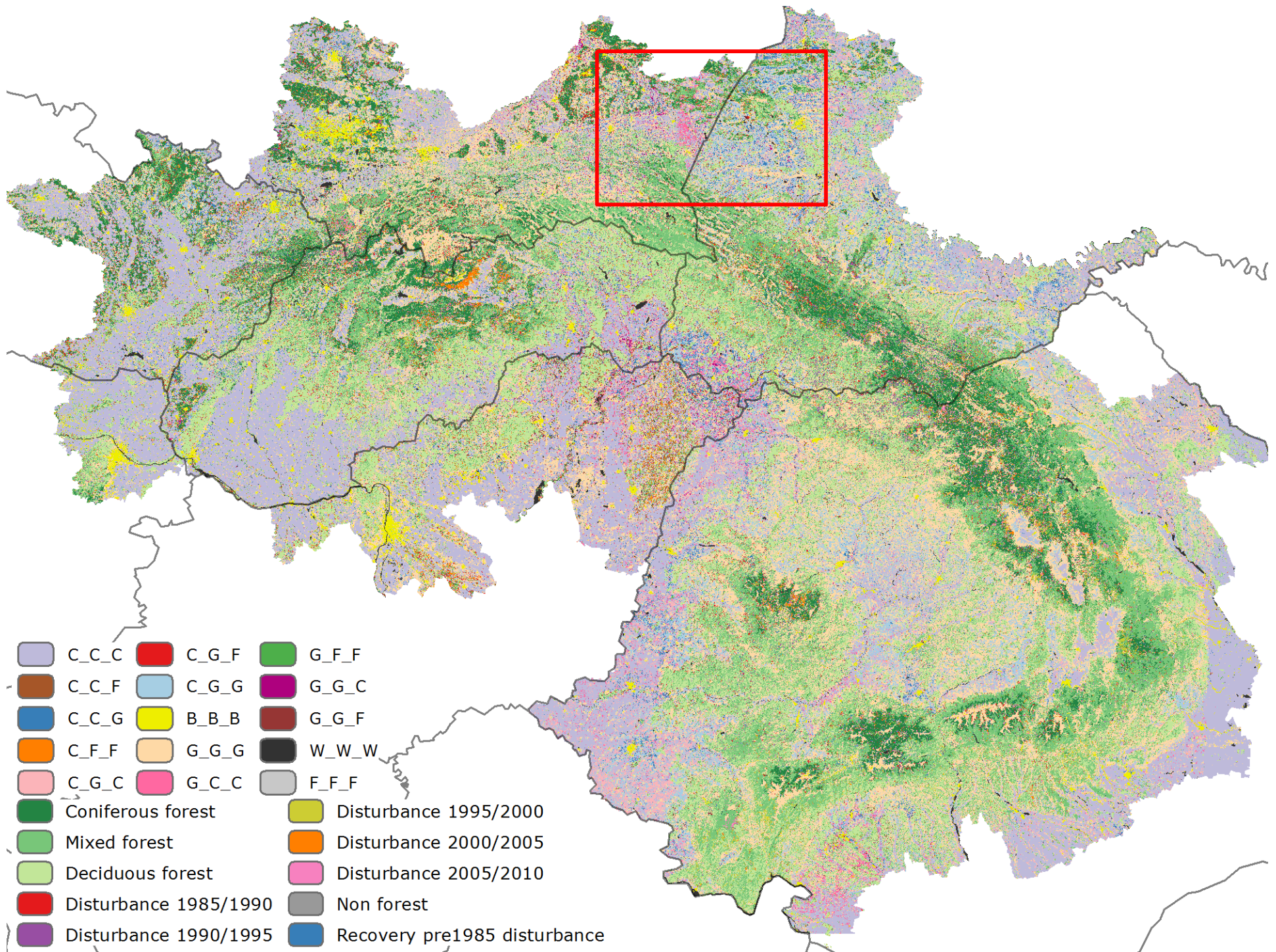


Griffiths, P., Mueller, D., Kuemmerle, T., & Hostert, P. (2013). **Agricultural land change in the Carpathian ecoregion after the breakdown of socialism and expansion of the European Union.** Environmental Research Letters. 045024

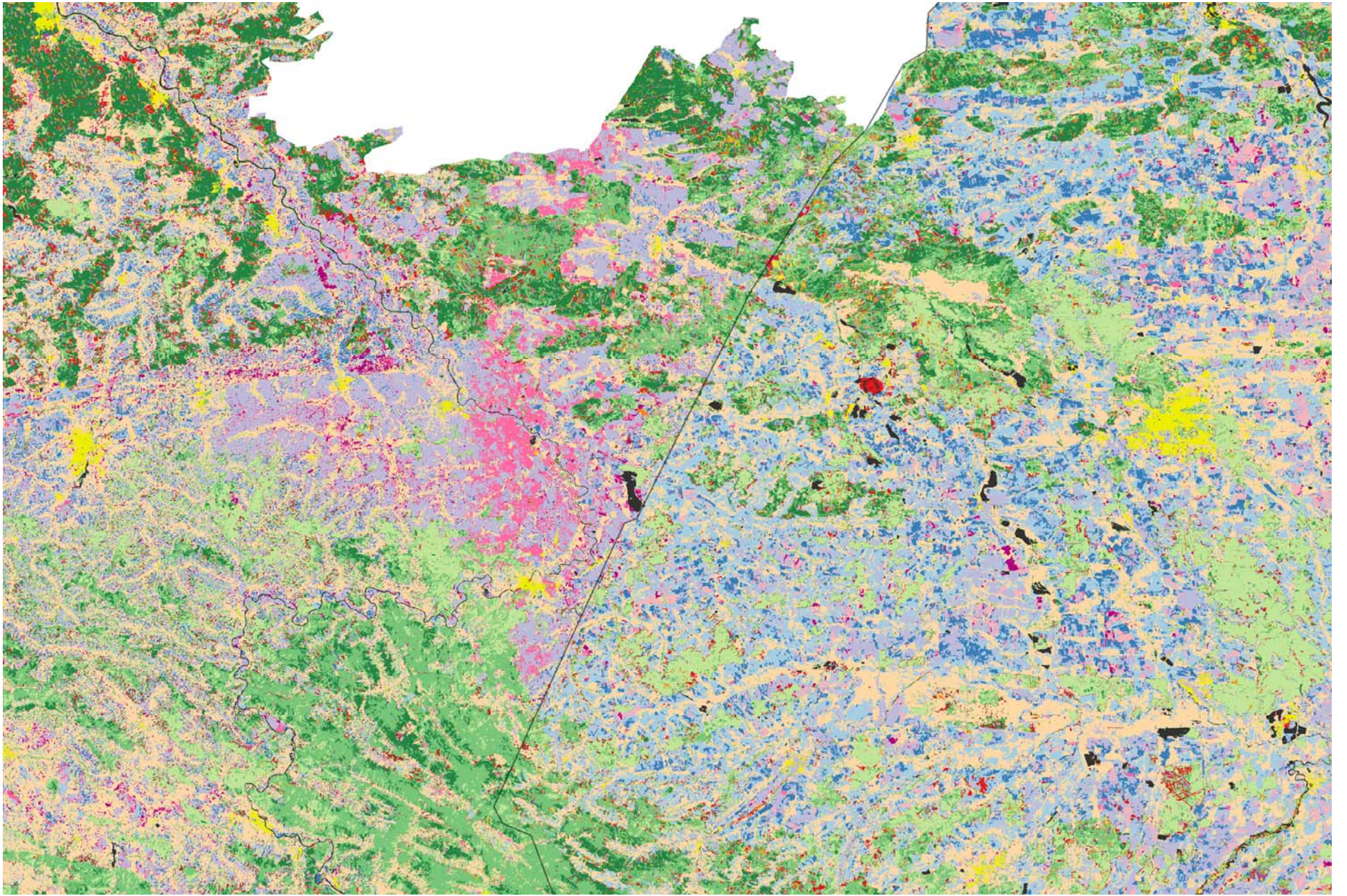


- |         |         |         |
|---------|---------|---------|
| □ C_C_C | □ C_G_F | □ G_F_F |
| □ C_C_F | □ C_G_G | □ G_G_C |
| □ C_C_G | □ B_B_B | □ G_G_F |
| □ C_F_F | □ G_G_G | □ W_W_W |
| □ C_G_C | □ G_C_C | □ F_F_F |

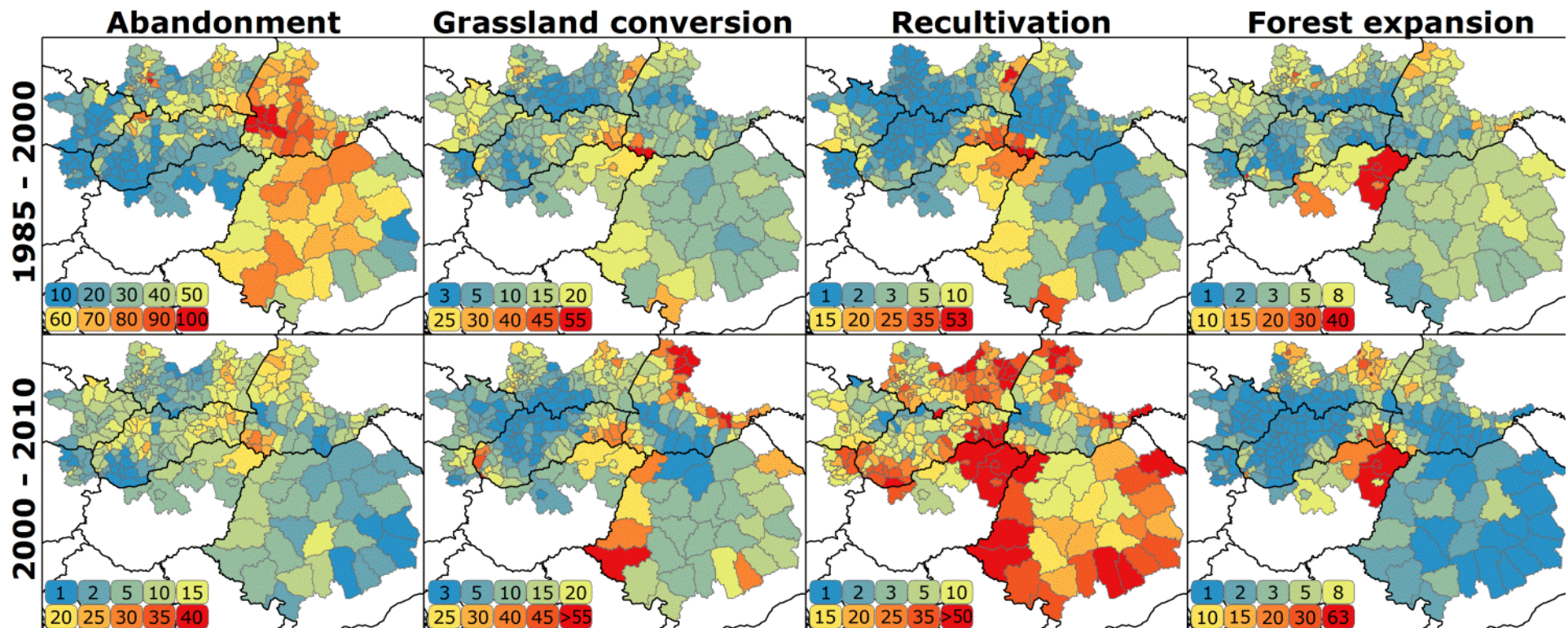






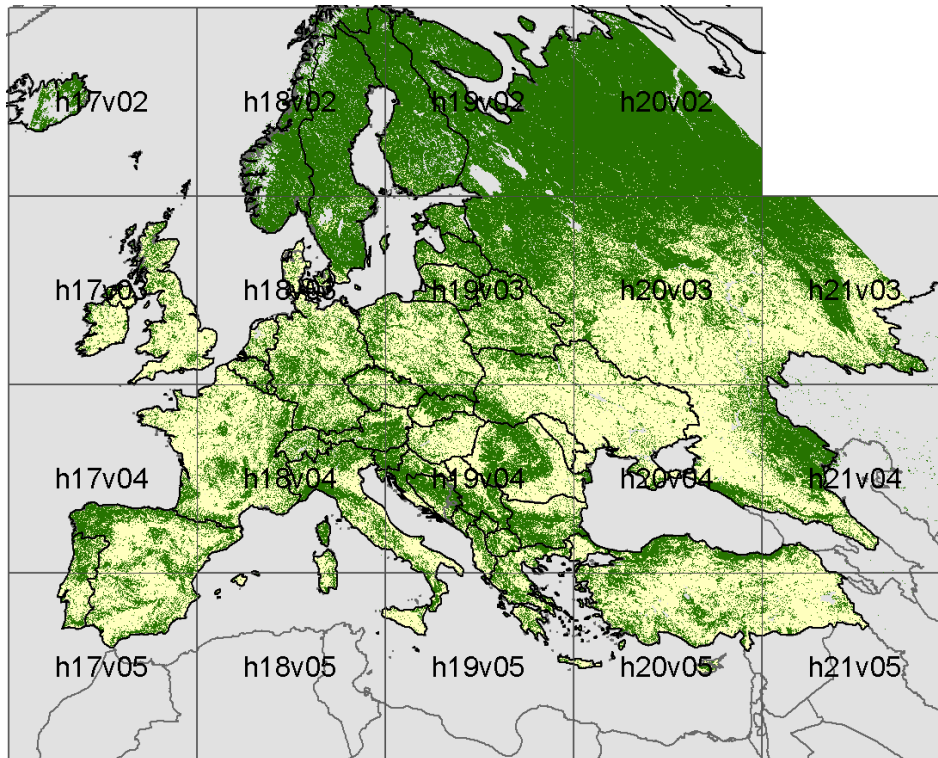


## Agricultural change mapping

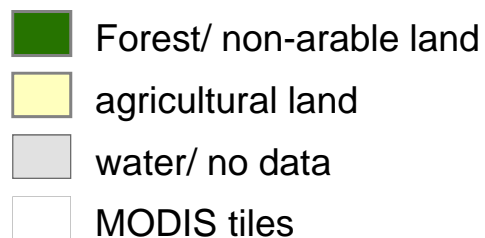


- Widespread abandonment (~24%) after 1989/90
- About 18% of abandoned cropland recultivated over last decade (effects of CAP and global commodity prices)
- Forest expansion due to natural succession and afforestation

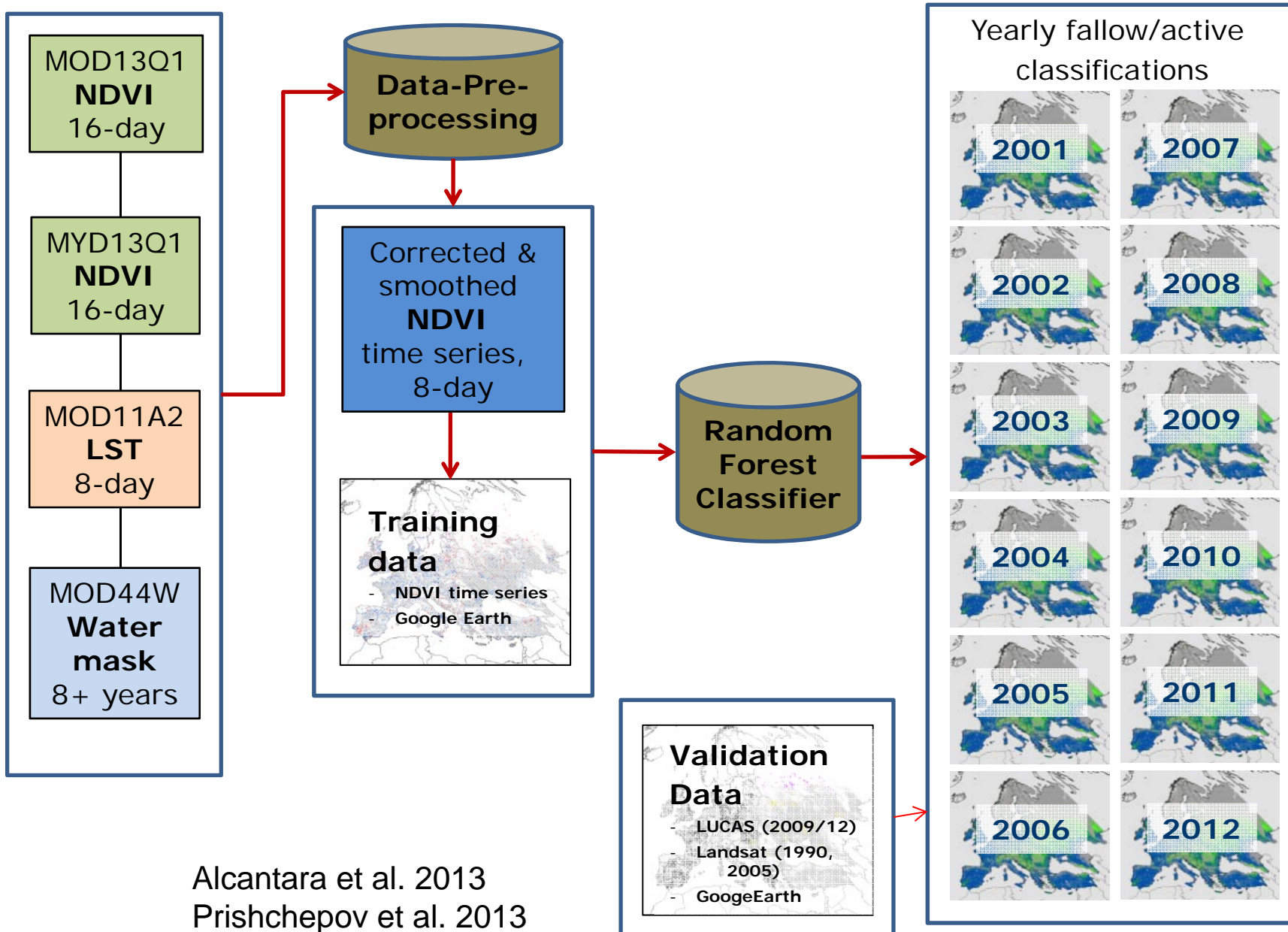
## European LUI mapping



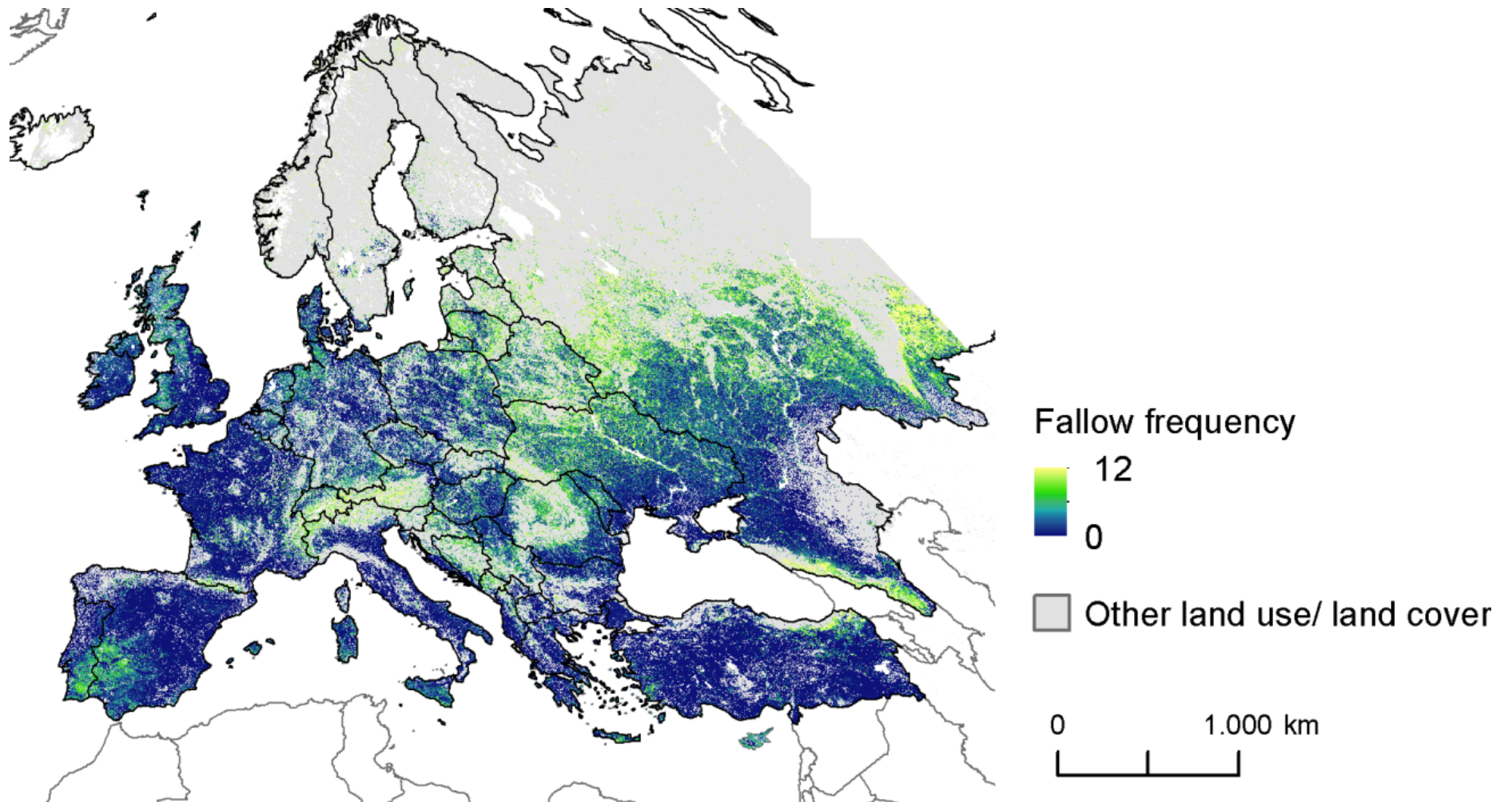
- Agricultural extent from GlobCorine 2005
- MODIS Terra/Aqua NDVI, MODIS LST and MODIS water mask
- 46 yearly composites over 13 years



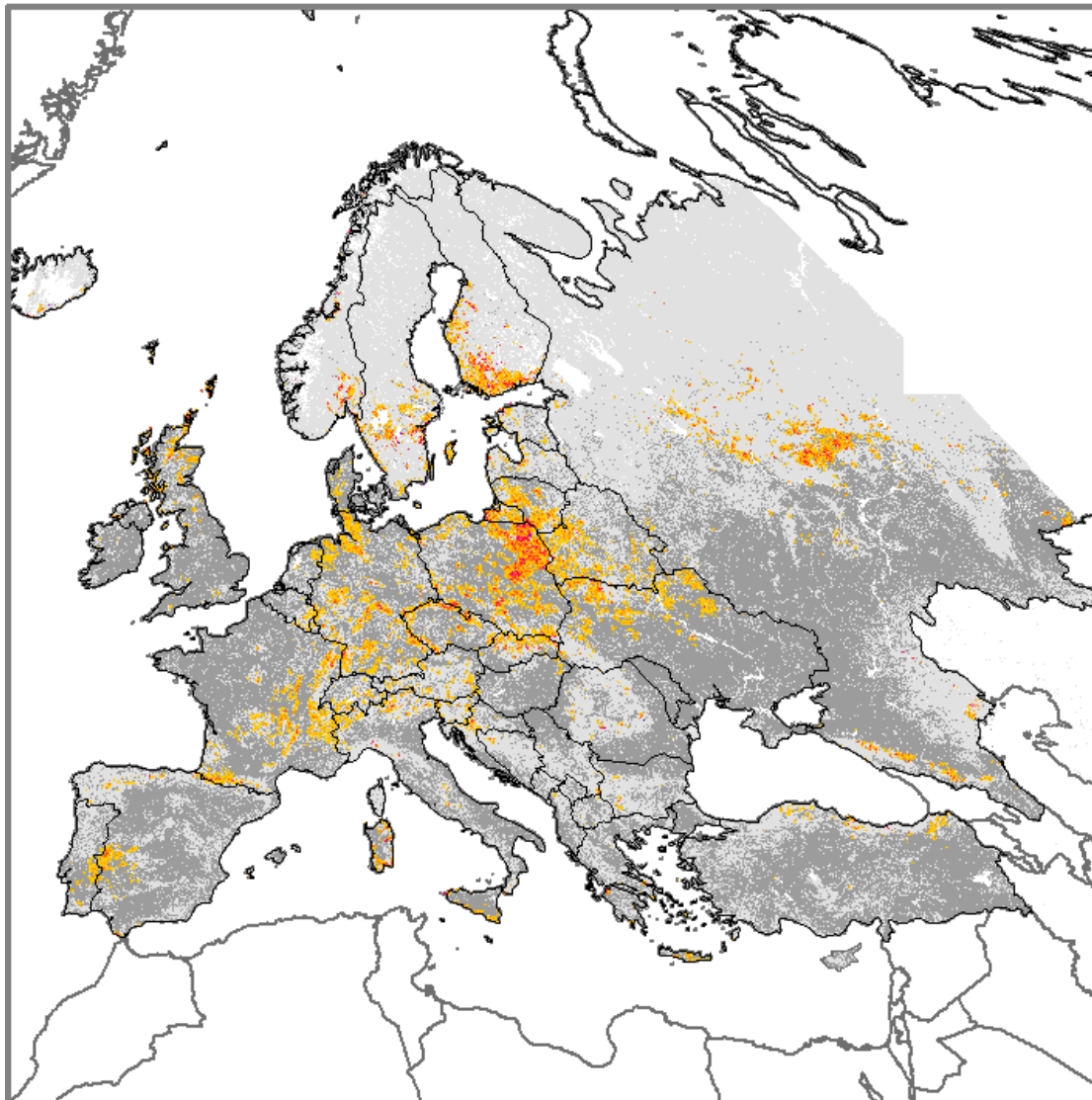
Estel S, Kuemmerle T, Alcantara C, Levers C, Prishchepov A, Hostert P. (in review). **Mapping farmland abandonment and recultivation across Europe using MODIS NDVI time series.**



## From land cover to land use I: Fallow frequency



## From land cover to land use II: Abandonment



Significant hotspots  
and share of class (%)  
across a 5x5km<sup>2</sup> grid

Percentage abandonment

1 - 5

6 - 10

11 - 15

16 - 20

21 - 25

26 - 50

51 - 100

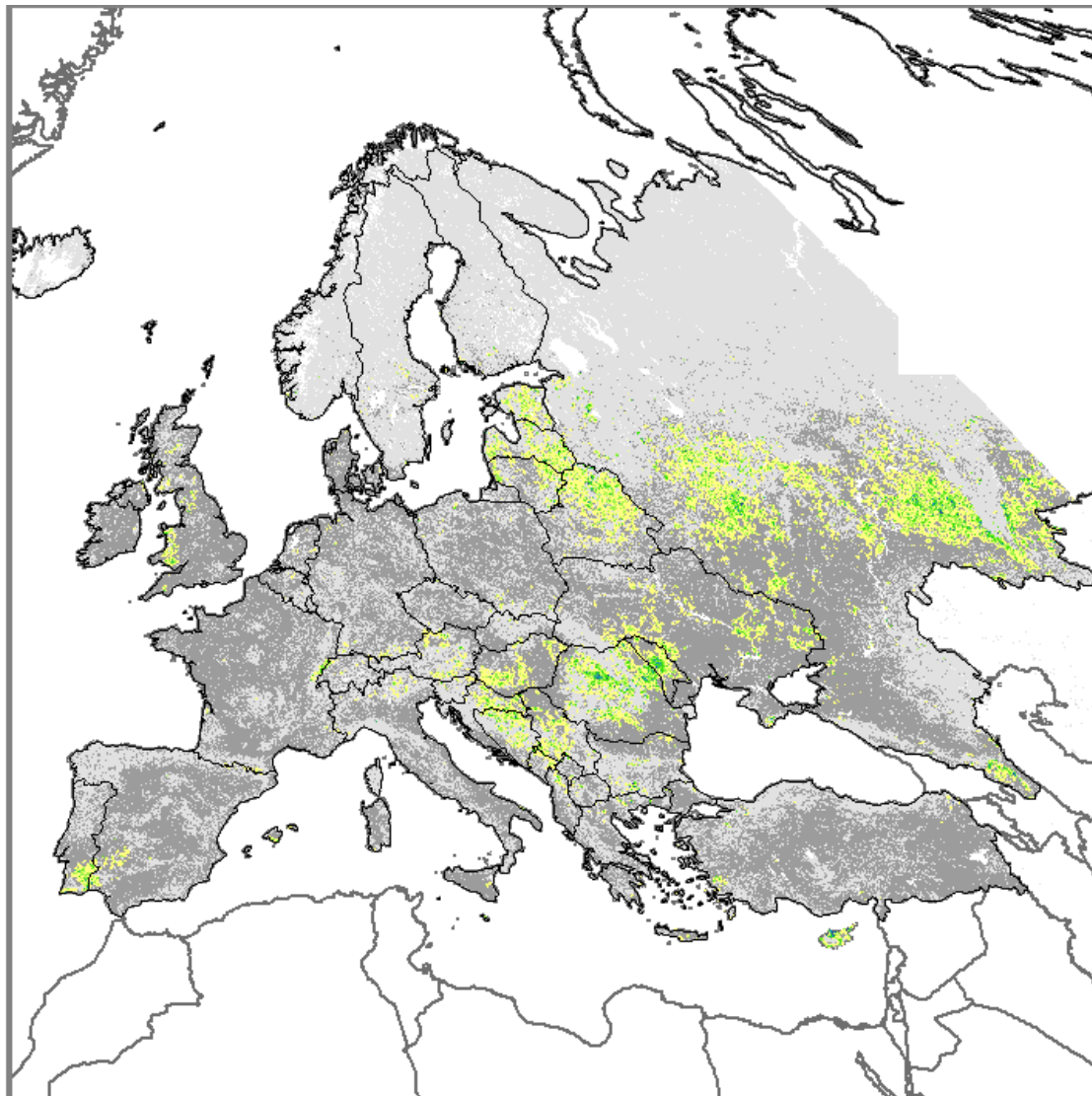
Other land use/ land cover

Farmland extent (no change)

### Definition of abandonment

- at least 4x active in 2001-2006
- 5x fallow in 2007-2012

## From land cover to land use III: Recultivation



Significant hotspots  
and share of class (%)  
across a 5x5km<sup>2</sup> grid

Percentage recultivation

1 - 5

6 - 10

11 - 15

16 - 20

21 - 25

26 - 50

51 - 100

Other land use/ land cover

Farmland extent (no chan

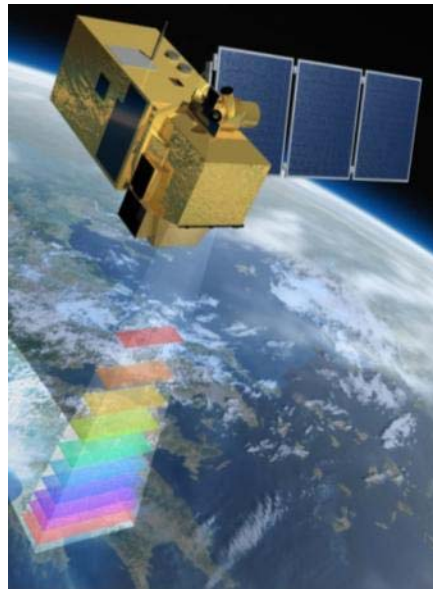
### Definition of recultivation

- 5x fallow in 2001-2006
- at least 4x active in 2007-2012

## Conclusions

- Inferring land use from land cover through temporal contextualization
- Basis for estimating agricultural production and yield gaps, as well as ecological restoration potential and carbon storage
- Next opportunity (and challenge): improved temporal resolution (timeliness, observation density) at appropriate scales
- linking Sentinel2a/b and Landsat!

Sentinel-2, artist's perspective (ESA, 2009; © Astrium)



Launch of Landsat 8 (Photo: NASA, 2013)



**...the time is ripe for an overarching theory of land change that explains the behavior of people as well as land use.**

**(E. Lambin, 2010)**



**Acknowledgments:**

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