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## Spatial variation in determinants of agricultural land abandonment in Europe



Christian Levers<sup>a,\*</sup>, Max Schneider<sup>a,b</sup>, Alexander V. Prishchepov<sup>c,d,e</sup>, Stephan Estel<sup>a,f</sup>, Tobias Kuemmerle<sup>a,g</sup>

<sup>a</sup> Geography Department, Humboldt-Universität zu Berlin, Unter den Linden 6, 10099 Berlin, Germany

<sup>b</sup> Department of Statistics, University of Washington, Box 354322, Seattle, WA 98195-4322, USA

<sup>c</sup> Section of Geography, Department of Geosciences and Natural Resource Management, University of Copenhagen, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark

<sup>d</sup> Institute of Environmental Sciences, Kazan Federal University, Tovarisheskaya str. 5, Kazan 420097, Russia

<sup>e</sup> Institute of Steppe of the Ural Branch of the Russian Academy of Sciences, Pionerskaya str.11, Orenburg 460000, Russia

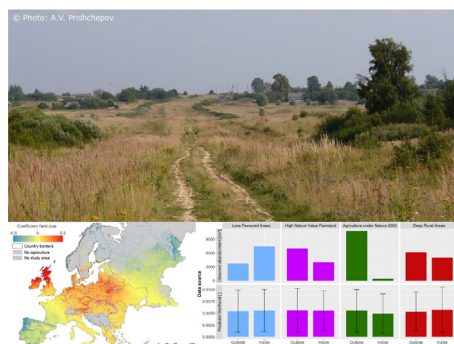
<sup>f</sup> Department of Earth & Environment, Boston University, 685 Commonwealth Avenue, Boston, MA 02215, USA

<sup>g</sup> Integrative Research Institute on Transformations of Human-Environment Systems (IRI THESys), Humboldt-Universität zu Berlin, Unter den Linden 6, 10099 Berlin, Germany

### HIGHLIGHTS

- Agricultural abandonment is a common land-use trend in many regions worldwide.
- We identified the leading spatial determinants of abandonment patterns in Europe.
- We used model-based boosting that accounts for spatial variation in the data.
- Abandonment mainly explained by climate, farm management, and socioeconomic setting.
- Context-specific, regionalised policies needed to mitigate abandonment outcomes.

### GRAPHICAL ABSTRACT



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### ABSTRACT

Agricultural abandonment is widespread and growing in many regions worldwide, often because of agricultural intensification on productive lands, conservation policies, or the spatial decoupling of agricultural production from consumption. Abandonment has major environmental and social impacts, which differ starkly depending on the geographical context, as does its potential to serve as a land reservoir for recultivation. Understanding determinants of abandonment patterns, and especially how their influence varies across broad geographic extents, is therefore important. Using a pan-European map of agricultural abandonment derived from MODIS NDVI time series between 2001 and 2012, we quantified the importance of farm management, climatic, environmental, and socio-economic variables in explaining abandonment patterns. We chose a machine learning modelling framework that accounts for spatial variation in the relationship between abandonment and its determinants. We predicted abandonment probability as well as determinant coefficients for the entire study area and summarised them for regions under selected EU support schemes. Our results highlight that agricultural abandonment was mainly explained by climate conditions suboptimal for agriculture (i.e., low/high growing degrees days). Determinants related to farm management (smaller field size, lower yields) and socio-economic conditions (high unemployment, negative migration balance) also contributed to describing agricultural abandonment patterns in Europe. Several determinants influenced abandonment in strongly non-linear ways and we found substantial spatial non-stationarity effects, although abandonment patterns were equally well-explained by predictors

\* Corresponding author.

E-mail addresses: [christian.levers@geo.hu-berlin.de](mailto:christian.levers@geo.hu-berlin.de) (C. Levers), [maxs15@uw.edu](mailto:maxs15@uw.edu) (M. Schneider), [alpr@ign.ku.dk](mailto:alpr@ign.ku.dk) (A.V. Prishchepov), [estelste@bu.edu](mailto:estelste@bu.edu) (S. Estel), [tobias.kuemmerle@hu-berlin.de](mailto:tobias.kuemmerle@hu-berlin.de) (T. Kuemmerle).