LANDSHIFT

Community-Led Creation of Living Spaces in Shifting Landscapes for Climate-Resilient Land Use Management and Supporting the New European Bauhaus

Establishing regional climate baselines and trusted quality control practices

The Earth's climate is governed by a delicate equilibrium between incoming shortwave solar radiation and outgoing longwave terrestrial radiation. Anthropogenic climate change is essentially a sustained positive radiative forcing, an imbalance where the planet traps more energy than it radiates back into space (Myhre et al., 2013). While natural internal variability and external forcings play a role, the current era of "Global Warming" is characterized by the rapid accumulation of Greenhouse Gases (GHGs) in the atmosphere. To assess the uncertainty of human activities into future climate change, the scientific community utilizes the so called Shared Socio-economic Pathways (SSPs). Unlike the older Representative Concentration Pathways (RCPs) which focused purely on GHG concentrations (van Vuuren et al. 2011), SSPs integrate socio-economic narratives such as population, economic growth, education, and technological advancement, with climate outcomes (Riahi et al. 2017).

In LandShift project, the assessment of the evolution of climate change and future projections at the regional scale within the participating regions empowers the development of tools for climate adaptation and mitigation and sustainable land management. To identify distinct climatic zones across the five LandShift Living Spaces (LSs), namely Occitanie (FR), Basilicata (IT), Macedonia–Thrace (GR), Kyiv (UA), and Mazovia (PL), a climate change assessment framework was adopted. This framework follows internationally recognized climate-data quality assurance principles consistent with the operational recommendations of the World Meteorological Organization (WMO) and the uncertainty-assessment methodologies proposed by the Intergovernmental Panel on Climate Change (WMO, 2017; IPCC, 2021). Given that regional climate projections increasingly support environmental governance, land-use planning, and adaptation policy, ensuring methodological robustness and reproducibility constitutes a critical prerequisite for evidence-based decision making (IPCC, 2022).

The use of multi-scenario SSP analysis aligns with IPCC AR6 guidance concerning uncertainty characterization and scenario-based climate-risk assessment (IPCC, 2021). Rather than relying on a single deterministic future, the study evaluated a spectrum of socio-economic trajectories ranging from sustainability-oriented development (SSP1) to fossil-fuel intensive growth pathways (SSP5) (Riahi et al., 2017; Meinshausen et al., 2020). This ensemble approach improves resilience-oriented planning by identifying both probable and unavoidable climate transitions. Emphasis was placed on the identification of "Consensus Hotspots", namely regions where Köppen-Geiger climate transitions emerge consistently across all SSP scenarios (Beck et al., 2018). The application of the Köppen-Geiger climate classification system provides a scientifically validated framework for translating meteorological variability into policy-relevant ecological and land-use indicators (Beck et al., 2018). WMO climate-data standards emphasize that climate products intended for adaptation planning should remain interpretable by both scientific and policy communities (WMO, 2017). In this regard, climate-zone transition mapping offers an operational bridge between atmospheric science, biodiversity management, agricultural planning, and territorial governance. According to risk-governance principles promoted by the IPCC climate adaptation frameworks, these areas represent high-confidence zones of systemic environmental transformation requiring immediate adaptation-oriented policy intervention (IPCC, 2022).

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The projected climate-zone transitions across the five Living Spaces reveal that climate change is no longer expressed solely through gradual atmospheric warming, but through structural transformations of regional land systems (IPCC, 2021; IPCC, 2022). The progressive northward expansion of Mediterranean climatic conditions, the collapse of cold "Dfb" climates in the Mozavia and Kyiv Region, and the emergence of semi-arid "BSh" conditions in Basilicata Region indicate that future land-use regimes may become increasingly incompatible with current agricultural, forestry, and water-management practices (Loarie et al., 2009). From a European climate-governance perspective, the identified "Consensus Hotspots" should be interpreted as priority adaptation territories requiring immediate integration into regional resilience planning frameworks. The consistency of projected climate transitions across multiple SSP scenarios significantly reduces uncertainty regarding the direction of change, even if uncertainties remain regarding magnitude and timing. Consequently, maintaining "business-as-usual" land-management strategies in these regions may increase exposure to ecosystem degradation, water scarcity, agricultural instability, biodiversity loss, and socio-economic vulnerability (IPCC, 2022).

The findings strongly support the strategic objectives of the European Commission LULUCF framework and the broader climate-neutrality targets of the European Green Deal (European Commission, 2021). Climate-zone migration directly affects forest productivity, carbon sequestration capacity, wildfire susceptibility, and soil stability, all of which are central components of the Land Use, Land-Use Change and Forestry sector (IPCC, 2022). In transitional regions such as East Macedonia and Thrace and Occitanie, increasing aridification and warming may reduce ecosystem resilience while intensifying pressures on water resources and agricultural production systems.

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Authors
Stergios Kartsios, Marios Mermigkas, Vassilis Amiridis
Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS), National Observatory of Athens, 10560 Athens, Greece

Contact Information
skartsios@noa.gr
mmermigk@noa.gr
vamoir@noa.gr

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