

Agricultural Land Use and Economic Development in Northern Kazakhstan: a Restoration-Coefficient Approach

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ABSTRACT

This study diagnoses the relationship between agricultural land-use structure, productivity, and restoration need in four northern provinces of Kazakhstan-Akmola, Kostanay, Pavlodar, and North Kazakhstan-over 2015-2025. The authors organize the analysis around a land-productivity-restoration conceptual framework and introduce a district-level restoration requirement coefficient (I_r), derived from a Gauss-based finite-difference formulation of sown-area dynamics, to identify territories where declining cropland should be prioritized for rehabilitation. The methodology integrates province-year panel data on land composition, output, and climate, together with district-level time series of sown area. Crop output is more tightly linked to farmland availability than livestock output; arable land utilization has fallen from 73.2% to 61.8%; and the restoration coefficient reveals substantial spatial unevenness in land contraction. Climate trends-warming of approximately 0.34°C per decade since 1976-create both agronomic opportunities and drought risks. The authors propose a three-tier policy strategy: targeted rehabilitation for high-decline districts, preventive

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measures for moderate-decline areas, and maintenance monitoring for stable territories, with subsidy allocation linked to the restoration coefficient.

Keywords: Land resources, agricultural land, efficiency, restoration coefficient, Northern Kazakhstan, panel data, climate variability

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