Supplementary Materials

Title: Coupling Coordination Analysis of Cultivated Land Quality Evolution and High-Standard Farmland Construction in Arid Oasis Agricultural Areas: A Case Study of Wensu County, China

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Table S1. Evaluation standards and membership assignments for conceptual indicators in the Cultivated Land Quality (CLQ) evaluation.

Evaluation Factor	Evaluation Value					
Topsoil Texture	Medium Loam	Light Loam	Heavy Loam	Clay	Sandy Soil	
Membership Value	1	0.9	0.8	0.7	0.6	
Soil Profile	Clay over Sand	Uniform Loam	Uniform Clay	Sandy Middle Layer	Sandy Leakage	Uniform Sand
Membership Value	1	0.8	0.7	0.6	0.5	0.4
Salinization Degree	Non-salinized	Slight	Moderate	Severe		
Membership Value	1	0.8	0.6	0.4		
Topographic Position	Middle Alluvial-Proluvial Fan	Upper Alluvial-Proluvial Fan	Lower Alluvial-Proluvial Fan	Hills	Piedmont Slope	Desert Margin
Membership Value	1	0.7	0.7	0.6	0.5	0.4
Desertification Degree	Non-desertified	Desertified				
Membership Value	1	0.5				
Irrigation Capacity	Excellent	Good	Fair	Poor		
Membership Value	1	0.75	0.5	0.3		
Farmland Shelterbelt	Four-side Shelter	Three-side Shelter	Two-side Shelter	One-side Shelter	No Shelterbelt	
Membership Value	1	0.8	0.6	0.4	0.3	

Table S2. Membership function models and parameters for numerical indicators in the Cultivated Land Quality (CLQ) evaluation.

Function Type	Indicator	Membership Function	a	c	u
Ascending Type	Organic Matter	$Y=1/[1+a\times(u-c)^2]$	0.00077416	55.4	0.5<u<55.4
	Available Potassium	$Y=1/[1+a\times(u-c)^2]$	0.000014	437	29<u<437
	Available Phosphorus	$Y=1/[1+a\times(u-c)^2]$	0.0004958	69.7	1.1<u<69.7
	Available Nitrogen	$Y=1/[1+a\times(u-c)^2]$	0.0000524	231.9	20.9<u<231.9
	Effective Soil Depth	$Y=1/[1+a\times(u-c)^2]$	0.000072	200	20<u<200
Descending Type	Slope	$Y=1/[1+a\times(u-c)^2]$	0.00373	0	0<u<25

Table S3. Evaluation standards and membership assignments for conceptual indicators in the High-Standard Farmland Construction Suitability (HSFCS) evaluation.

Evaluation Factor	Evaluation Value					
Soil profile configuration	Mengkin type	General loam	General clay	Sandy waist type	Leaky sand type	General sand
Membership degree	1	0.8	0.7	0.6	0.5	0.4
Topographic position	Middle part of alluvial-proluvial fan	Lower part of alluvial-proluvial fan	Upper part of alluvial-proluvial fan	Intermoun tain valley		
Membership degree	1	0.85	0.7	0.5		
Irrigation guarantee rate	Excellent	Good	Fair	Poor		
Membership degree	1	0.75	0.5	0.3		
Farmland shelterbelt network	Four-side sheltered	Three-side sheltered	Two-side sheltered	One-side sheltered		
Membership degree	1	0.8	0.6	0.4		
Farmland property	Basic farmland	General farmland				
Membership degree	1	0.6				
Farmland utilization pattern	Paddy field	Irrigated land	Dry land			
Membership degree	1	0.8	0.6			

Table S4. Membership function models and parameters for numerical indicators in the High-Standard Farmland Construction Suitability (HSFCS) evaluation.

Function Type	Indicator	Membership Function	a	c	u
Ascending type	Organic matter content	$Y=1/[1+a\times(u-c)^2]$	0.00077671	55.310001	5.624<u<20.43
	Available potassium content	$Y=1/[1+a\times(u-c)^2]$	0.00001388	437	82.54<u<323.561
	Available phosphorus content	$Y=1/[1+a\times(u-c)^2]$	0.00049583	69.7	5.4<u<24.312
	Effective soil layer thickness	$Y=1/[1+a\times(u-c)^2]$	0.00007202	200	33.004<u<97.294
Descending type	Slope gradient	$Y=1/[1+a\times(u-c)^2]$	0.00373546	0.007	0.007<u<14.201
	Topsoil salt content	$Y=1/[1+a\times(u-c)^2]$	0.00262751	0.19	0.19<u<15.1
	Distance to major roads	$Y=1/[1+a\times(u-c)^2]$	0.0000001925	2.5	2.5<u<5071.2
	Distance to rivers	$Y=1/[1+a\times(u-c)^2]$	0.000000289	1.25	1.25<u<10703.491
	Distance to urban areas	$Y=1/[1+a\times(u-c)^2]$	0.00000001093	162007	162.007<u<39133.323

	Road accessibility index	$Y=1/[1+a\times(u-c)^2]$	0.00000001027	0	0<u<24738.06309

Table S5. Classification standards for Cultivated Land Quality (CLQ) based on the Natural Breakpoint method.

Cultivated land quality Grade	Comprehensive Index (IFI)	Quality Level	Description
Grade I	≥0.80	Excellent	High-quality farmland with optimal conditions
Grade II	[0.72, 0.80)	Good	Well-conditioned farmland with minor limitations
Grade III	[0.64, 0.72)	Moderate	Moderately productive farmland
Grade IV	[0.26, 0.64)	Fair	Lower-quality farmland with constraints
Grade V	≤0.26	Poor	Low-quality farmland with significant limitations

Table S6. Classification standards for High-Standard Farmland Construction Suitability (HSFCS) based on the Natural Breakpoint method.

Suitability Grade	Suitability Level	Comprehensive Index (IFI)	Interpretation
Grade I	Highly suitable	≥0.8	Optimal conditions for high-standard farmland construction
Grade II	Moderately suitable	[0.75, 0.8)	Good conditions with minor constraints
Grade III	Suitable	[0.7, 0.75)	Acceptable conditions for development
Grade IV	Marginally suitable	[0.65, 0.7)	Limited suitability with significant constraints
Grade V	Moderately unsuitable	[0.6, 0.65)	Poor conditions requiring major improvements
Grade VI	Unsuitable	≤0.6	Unfavorable conditions for construction