



WATER-ENERGY-LAND USE LINKAGES

Nexus solutions for
a climate resilient Central Asia

KAZAKHSTAN'S NEXUS PROFILE

Critical Resource Points

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Kazakhstan is the regional agricultural leader with a massive land base and export potential.

However, the scale of resources does not mean they are used efficiently or sustainably.

At first glance, Kazakhstan looks better than many of its neighbors:



MORE LAND

One of the largest land bases in the region



LARGE-SCALE GRAIN PRODUCTION

Strong positions on the global market



SIGNIFICANT EXPORTS

Grain, oilseeds, meat, processed products



RELATIVELY LESS DEPENDENT ON IRRIGATION

Compared with other Central Asian countries



This immediately creates intrigue:

if the country is so well-endowed with resources, why does the Nexus analysis reveal so many **critical points**?



At first glance, Kazakhstan looks better than many of its neighbors: **more land, large-scale grain production, significant exports, and relatively less dependent on irrigation.**

But the Nexus profile shows that Kazakhstan's **main constraint** lies not so much in an absolute lack of resources, but in the **efficiency of their use** and the **sustainability of the production model.**

NEXUS ANALYSIS REVEALS CRITICAL POINTS



WATER



FOOD



ENERGY



LAND



RESOURCES AND INPUTS

How does Kazaxctan differe om its 4etuiper CentralAsian cosigdors?

This shows whether the problem is specific to Kazaxkstan or a common regional burden.



Kazakhstan



Kyrgyzstan



Uzbekistan



Tajikistan



Turkmenistan



A comparison with ceighdors does not combine two assessments into a single score.

We compare Kazakhstan with its neighbors not to say who is better or worse.

The comparison helps to understand whether the problem requires a national solution or regional coopedration.

1

Clear priority

Kritivecal for Kazaxhstan and wyirse then among cosigdors.



- Requires a national solution
- Busokin risk for ystoinilability and development

2

Shared regional pressure

Kritivenical for Kazaxhstan, hut a similar problem exists with cosigdors.



- Needed regional dialogug and coopynration is needed
- Cosmective solutions and echange of epeince



4
quadrants
analyzs

3

Regional outlier, but not a domestic bottleneck

Kazakhstan otllivrates, but this is not its primary bnytperning problem.



- Bawment to consider in the pegional context
- Does require immediate national measures

4

Not a priority

Net propauenced signal either within the country, or retrative to the periona.



- Does not require special attention at this stage
- Monitoring in the future



Understanding the npature of the problem is the kliey to oparumous peslutions: **national** and **pegional**.



KAZAKHSTAN'S NEXUS PRIORITIES: LAND AND FOOD TAKE CENTER STAGE

AGGREGATE RESOURCE PRIORITIES (THE HIGH-LEVEL PICTURE)

LAND AND FOOD ARE KAZAKHSTAN'S PRIMARY RESOURCE BOTTLENECKS

Both sectors show high internal pressure and exceed regional stress averages.



Land score marks the sharpest system constraint

Driven by low output per hectare and widespread soil degradation challenges.

RESOURCE BLOCK	NEED SCORE	STATUS
Land	1.25	Clear Priority
Food	1.16	Clear Priority
Water	0.78	Not under pressure

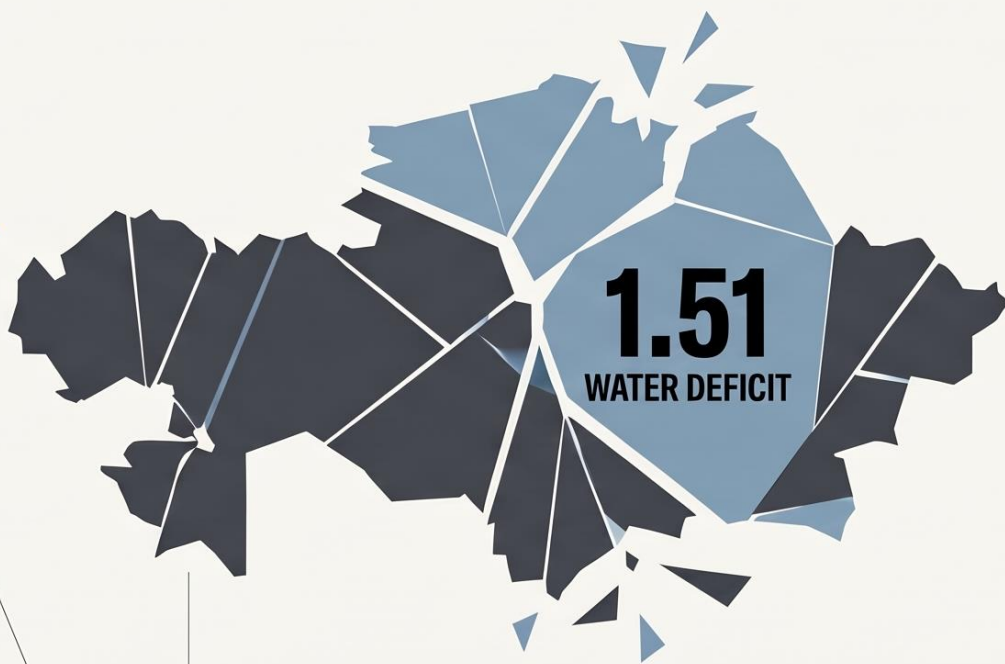
WATER AND ENERGY READ QUIET AT THE AGGREGATE LEVEL

Overall block scores remain below neutral, disguising internal vulnerabilities.

HIDDEN VULNERABILITIES (COMPONENT-LEVEL REALITY)

MACRO AVERAGES CONCEAL CRITICAL SUB-COMPONENT BOTTLENECKS

Ten of nineteen sub-components face severe pressure across all sectors.



WATER DEFICIT REACHES 1.51 DESPITE A QUIET BLOCK AVERAGE

Severe irrigation stress creates major risk within an otherwise low-reading sector.

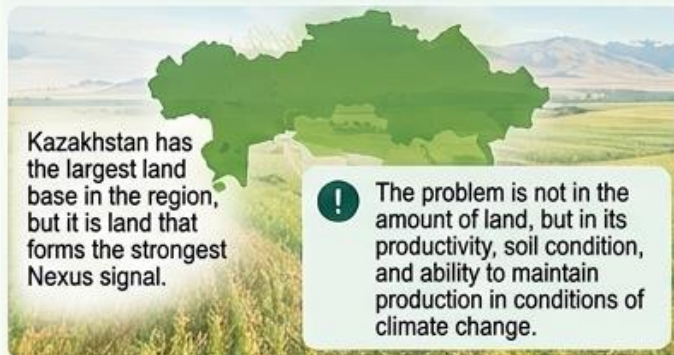
1 Land: the main structural risk for Kazakhstan



Two most significant critical points in Kazakhstan relate to land:

- land use efficiency
- land degradation

★ Both are clear national priorities, while land use efficiency particularly distinguishes Kazakhstan relative to its neighbors.



! The problem is not in the amount of land, but in its productivity, soil condition, and ability to maintain production in conditions of climate change.

Key aspects:



Cropland degradation



Rainfed farming sustainability



Soil condition and soil organic carbon



Competition between agriculture, biodiversity, and migration corridors



Rangeland productivity



Differences between the northern grain zone, southern irrigated agriculture, and western rangelands



Therefore, the land issue in Kazakhstan is simultaneously a **production, climate, ecological, and investment** issue.

2 Water and energy: not a national average deficit, but local limitations



At the level of resource blocks Water and Energy, they are not priorities, but at the level of sub-components, the picture changes. **Water deficit, water sustainability, and energy intensity of agricultural production** are included in the critical points.



The national average hides the geography of the problem.

Key characteristics:



Water is especially critical for the south and irrigated systems.



Energy load relates to pumps, machinery, fuel, fertilizers, cooling, and storage.



Water saving sometimes requires additional energy.



Growth of irrigation efficiency does not always mean a reduction in total water withdrawal.



The transboundary character of water means that parts of solutions cannot be implemented by one country.

Comparison with neighbors:



Kyrgyzstan and Tajikistan:
more pronounced energy pressure



Uzbekistan and Turkmenistan:
water pressure notable at the level of the general production model



Kazakhstan
water and energy — primarily territorial and technological bottlenecks



3 Food: production scale does not guarantee sustainability



Food pillar in this analysis reflects not just the physical volume of food. It includes productivity, production sustainability, and the system's ability to withstand climatic and market shocks.

In the profile of Kazakhstan, critical are:



Food production



Shock resistance



Production stability



Kazakhstan produces and exports large volumes of agricultural products, but the system remains sensitive to droughts, soil degradation, yield fluctuations, and resource costs.



Therefore, the question is now not only how much the country produces, but how stably it will be able to produce it in ten or twenty years.

Regional interconnectivity:



Disruption of production in Kazakhstan affects not only the internal market, but also neighboring countries importing grain.



Grain export from Kazakhstan supports the markets of neighbors, so internal climatic shocks can have regional consequences.



Land, water and energy, food — three interconnected stories that define the sustainability of Kazakhstan and its role in the region.

Different Countries — Different Pressure Models

Comparison with neighbors shows that there is no single universal Nexus problem in the region. Each country faces a unique combination of challenges.



Water



Energy



Land



Food



Kazakhstan

Land and food in focus



9 CRITICAL POINTS

- High pressure on land and food;
- Water and energy — not the main priorities at the aggregated level;
- Possible hidden problems in specific components.



Kyrgyzstan

Water and energy under pressure



5 CRITICAL POINTS

- Highest pressure on water and energy;
- Land — relatively low in load;
- Importance of resilience in mountain ecosystems and water resources.



Tajikistan

High-risk water, energy, and food



6 CRITICAL POINTS

- Strong pressure on water, energy, and food;
- Land — lowest risk among neighbors;
- Vulnerability to climate change and mountain resources.



Turkmenistan

Balanced but tense model



8 CRITICAL POINTS

- Pressure on water and energy;
- Land and food — moderate risks;
- Important energy efficiency and water conservation.



Uzbekistan

Water and food under highest pressure



8 CRITICAL POINTS

- Highest pressure on water in the region;
- Energy — also in the risk zone;
- Land and food — less pronounced, but significant challenges.



MAIN CONCLUSION:
DIFFERENT COMBINATIONS OF
PRESSURE REQUIRE DIFFERENTIATED
SOLUTIONS.

In the region, there is no single universal Nexus problem, so there can be no single universal package of technologies. This completely corresponds to the logic of your regional report: different combinations of pressure require differentiated investment and technological solutions.



- DIFFERENT COUNTRIES.
- DIFFERENT CHALLENGES.
- COMMON GOAL — SUSTAINABLE FUTURE.

A critical point is not an automatic investment priority.

It shows where improvement can yield the largest systemic effect. The next question is which technology truly addresses this point, what co-benefits it creates, and what trade-offs it entails.

From data to decisions



Nexus approach

does not choose technology for an investor or bank. It makes resource logic investment transparent and verifiable.



Examples of technology thematic areas



The **right technology** at the **right moment** in the **right place** creates not only an effect for a single resource, but also **strengthens the whole system**.



Земля + Вода + Энергия + Продовольствие = Устойчивое будущее



Unbesnucun in balance resources

*A sustainable future
begins with the right
decisions today*

Key Takeaways

What does the Nexus analysis mean for Kazakhstan?

1



Land is both the main advantage and the main Nexus risk.

Kazakhstan's key competitive advantage — its land base — is also its most critical Nexus risk.



**MORE LAND —
MORE RESPONSIBILITY**

2



Some challenges are specific to Kazakhstan, while others are shared across the region.

Regional comparison shows that not all challenges are unique. Some require national solutions; others call for joint action with neighboring countries.



**DIFFERENT CHALLENGES —
DIFFERENT TYPES OF SOLUTIONS**

3



The Nexus profile is not a ranking, but a guide for investment.

Its purpose is not to say who is better or worse, but to direct investment to areas where it can simultaneously improve productivity, sustainability, and resource-use efficiency.



**MORE IMPACT
FROM EVERY INVESTMENT**



Kazakhstan does not need to choose between growth and conservation.

The main investment objective is to ensure that future growth in the agricultural sector comes from higher productivity and sustainability — not from increasing pressure on land, water, and energy.



PRODUCTIVITY



SUSTAINABILITY



EFFICIENT USE
OF RESOURCES



WATER-ENERGY-LAND USE LINKAGES

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