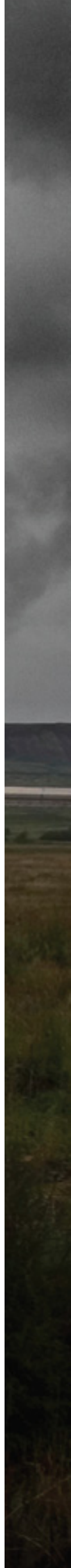
Natural Resources, Environment, and Poverty



The price of economic growth in Central Asia, perhaps more than anywhere else in Asia, has been paid by the environment. Particularly during the Soviet period, when massive agricultural and industrial enterprises, together with gigantic infrastructure that straddled the region, were put in place, environmental concerns were considered to be less important than development goals. These enterprises were nearly all based on exploitation of natural resources—oil and gas beneath deserts, sea, and steppes; cotton and wheat agriculture on converted steppe and desert land; mining for many metals in all terrains; and underpinning everything, diversion of precious water from the region's sparse rivers.

The first inklings of the enormity of these environmental costs were seen when the Aral Sea in the west began to shrink in the 1960s. The consequences for the environment stretched all the way across the region to the mountains in the east. And from those mountains and along the plains came pollution from agriculture, drilling, and mining whose effects were felt in turn as far as the westernmost parts of the region.

Virtually every aspect of natural resource development in the region has resulted in enormous and sometimes irreparable environmental damage. "Unsustainable" describes the present state of regional economic development.

Overstretched Water Resources

Water scarcity has been Central Asia's fundamental concern for millennia; its mismanagement is now equally fundamental. The use of water—for energy and especially for irrigation—is greater than the capacity of the water resources to satisfy both human and ecosystem needs, making current water-use practices unsustainable. Use of excessive water from Soviet times until today has caused both reparable and irreparable damage, affecting the quality of the region's air, soil, and biodiversity, and of the water itself. Water misuse has reduced productivity of natural land areas, rivers, and reservoirs. It has transformed topography and climate. And in the face of expected negative effects on water sources from climate change, continued mismanagement and misuse of water will result in far greater consequences.

DIVERSION OF WATER RESOURCES

Water diversion in the region's main water sources, the Amu Darya and Syr Darya basins, primarily results from the regulation of rivers by reservoirs to store water for irrigation and power generation. Under Soviet authority, water was allocated between the countries of the region by quota. This water-use quota system remains to a degree. However, without a "central authority,"

Industrial complex in Shymkent, the "City of Grass," Kazakhstan. Upper left: Camels graze where fish used to swim—the dried Aral Sea. Lower right: Dump site in the former Aralsk harbor in the Aral Sea.

Upper: A hydropower station in Tajikistan. **Lower:** A boy in need of water fills out a bottle from the river near Kurgan Teppa in Tajikistan.

differences in country priorities make coordination of rational water allocation between upstream and downstream users difficult.

Between 1960 and 2000, farmland grew enormously in the Amu Darya and Syr Darya basins. To service this land, vast irrigation and drainage networks were built. By the 1980s, overall water consumption had begun to exceed available river water resources. The difference has been made up by using return water from drainage such that in the Amu Darya and Syr Darya basins, 100%–110% and 130%–150%, respectively, of available water resources are used.

Poor construction in Soviet days and lack of maintenance have led to infrastructure deterioration. A history of inappropriate management led to high water application, which reduced farmland quality by raising water tables and increasing salinization. Reduced crop production creates a vicious cycle because the labor-intensive practice of using large amounts of water to flush out salt only serves to increase the damage. Over the years, poor irrigation practices have caused millions of hectares of land to be taken out of production, and according to some reports, have resulted in direct crop losses across the region of $1.7 billion annually. Moreover, as farm revenues decline, less money becomes available for irrigation infrastructure maintenance.

REDUCTION OF FRESHWATER SUPPLIES

A significant portion of available water resources comes from irrigation drainage waters and industrial and domestic wastewater. Some return flow water is used repeatedly for irrigation. More than half of irrigation water is discharged into rivers and a third into natural depressions. Irrigated waters contain high levels of salt, pesticides, fertilizers, and other minerals and toxic substances, which pollute surface water and groundwater, reducing clean water supplies and creating water shortages.

Mineralization has affected lakes, rivers, and reservoirs; in some cases, killing biota and rendering water unfit for fishing. Poor quality and

lack of freshwater have hindered industries that need water to operate as well. This is especially true in the Aral Sea area, where businesses have been forced to close down, causing unemployment and migration away from the area. Because water quality and quantity affect the spread of disease, freshwater shortages have also contributed to health risks.

Land Degradation

No hard and fast definitions for land degradation exist. Put simply, it is reduction in the capacity of soil to support life, and is caused by damage to the physical, chemical, or biological properties of soil, which contributes to an unsustainable ecosystem. Land degradation in Central Asia is severe. Years of heavy exploitation have brought untold damage to the region's fragile lands. Most common forms of degradation are caused by improper irrigation practices, overgrazing, overcultivation, and pollution.

Degradation manifests itself in salinization, waterlogging, water and wind erosion, soil compaction, depletion, and the process of desertification, which in turn add to a degradation cycle. While reliable estimates of the economic costs of land degradation are not available, they are estimated to be in the billions of dollars. Dependence of the poor on the productivity of natural resources makes people living on the margin especially vulnerable to land degradation.

Top: Land degradation by livestock overgrazing is a major problem in the region. **Middle:** Livestock drinking from a well in a remote pasture area of Kazakhstan, showing the overgrazing effect near such watering areas. **Bottom:** Grass bunds have been widely planted to promote sand dune stabilization.

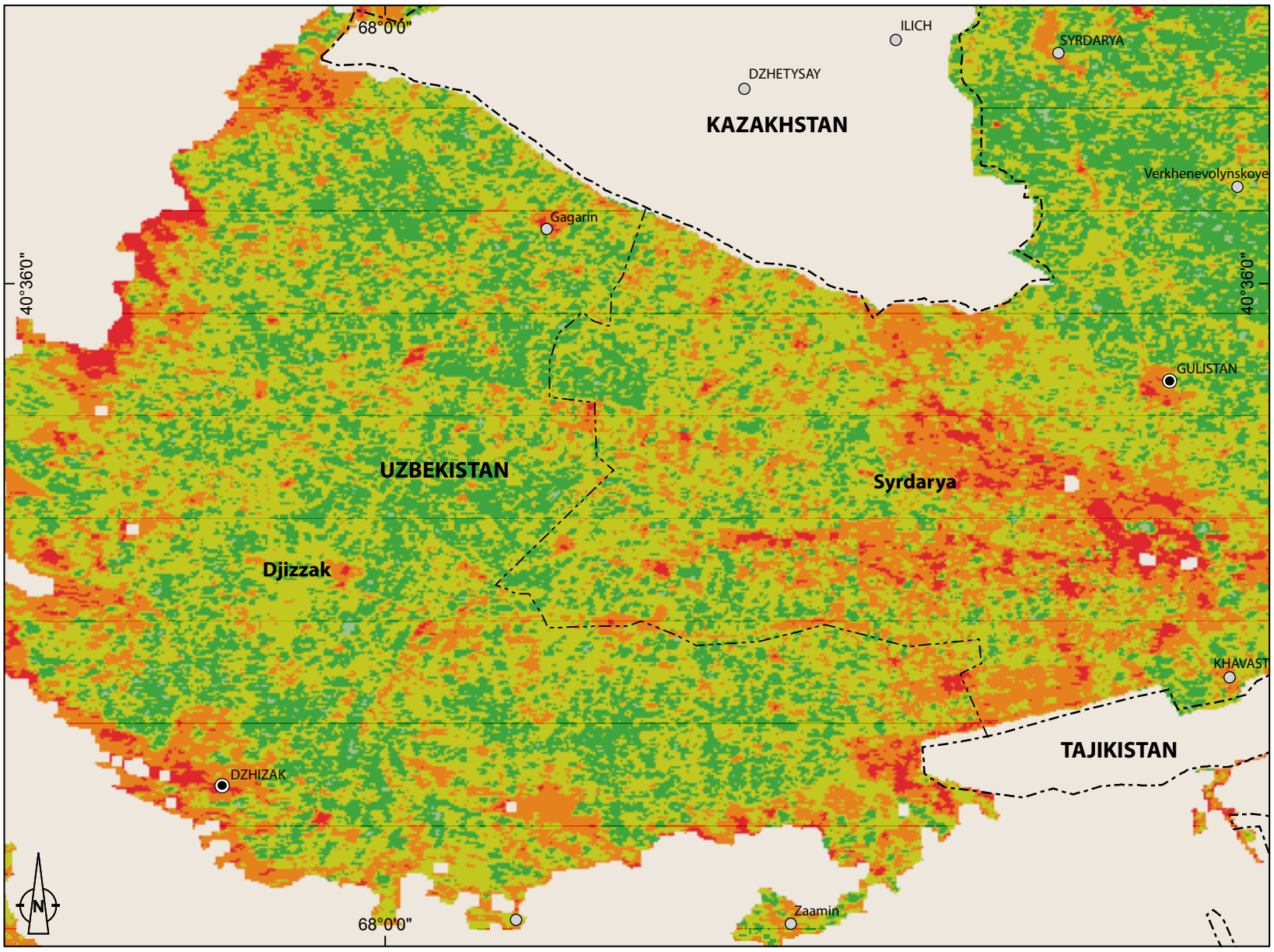
Upper and lower: Abandoned lands due to secondary salination of soil in irrigated areas of the Syr Darya River basin.

SALINIZATION

Vast stretches of land in the Amu Darya and Syr Darya basins and in the region of the Aral Sea are either spoiled or badly degraded because the soil has become salty or waterlogged. The level of salts in both rivers has steadily increased as salt-carrying drainage water has been discharged into the rivers. More than one-half of Central Asia's irrigated land is estimated to be salinized and/or waterlogged. Land that is moderately to heavily damaged by salt reaches up to 35% of irrigated land in Tajikistan and 80% in Turkmenistan. The Kyrgyz Republic, too, suffers from a high degree of salinization. The causes are many and include shoddy construction and poor maintenance of irrigation infrastructure, as well as poor water management.

Uzbekistan has the most extensive irrigated areas in the region. About 10% of the land is intensively cultivated and irrigated. Nearly 60% of the land potentially suitable for irrigation is subject to natural salinization and about half the croplands suffer from secondary salinization. Annually, 20,000 hectares are abandoned due to high soil salinization and waterlogging. The map next page shows the salinity level of the Golodnaya Steppe based on the 2008 annual maximum Normalized Difference Vegetation Index as a surrogate to the Maximum Attainable Yield model.

Soil Salinity Mapping - Golodnaya Steppe



7 3.5 0 7 Kilometers

1:650,000

- Provincial capital
- City
- Oblast boundary
- International boundary

Dataset used: Annual Maximum NDVI of MODIS (MOD13Q1), 2008
Projection: Geographic, WGS84

Prepared by C. Y. Ji, 2009

Salinity Indicator

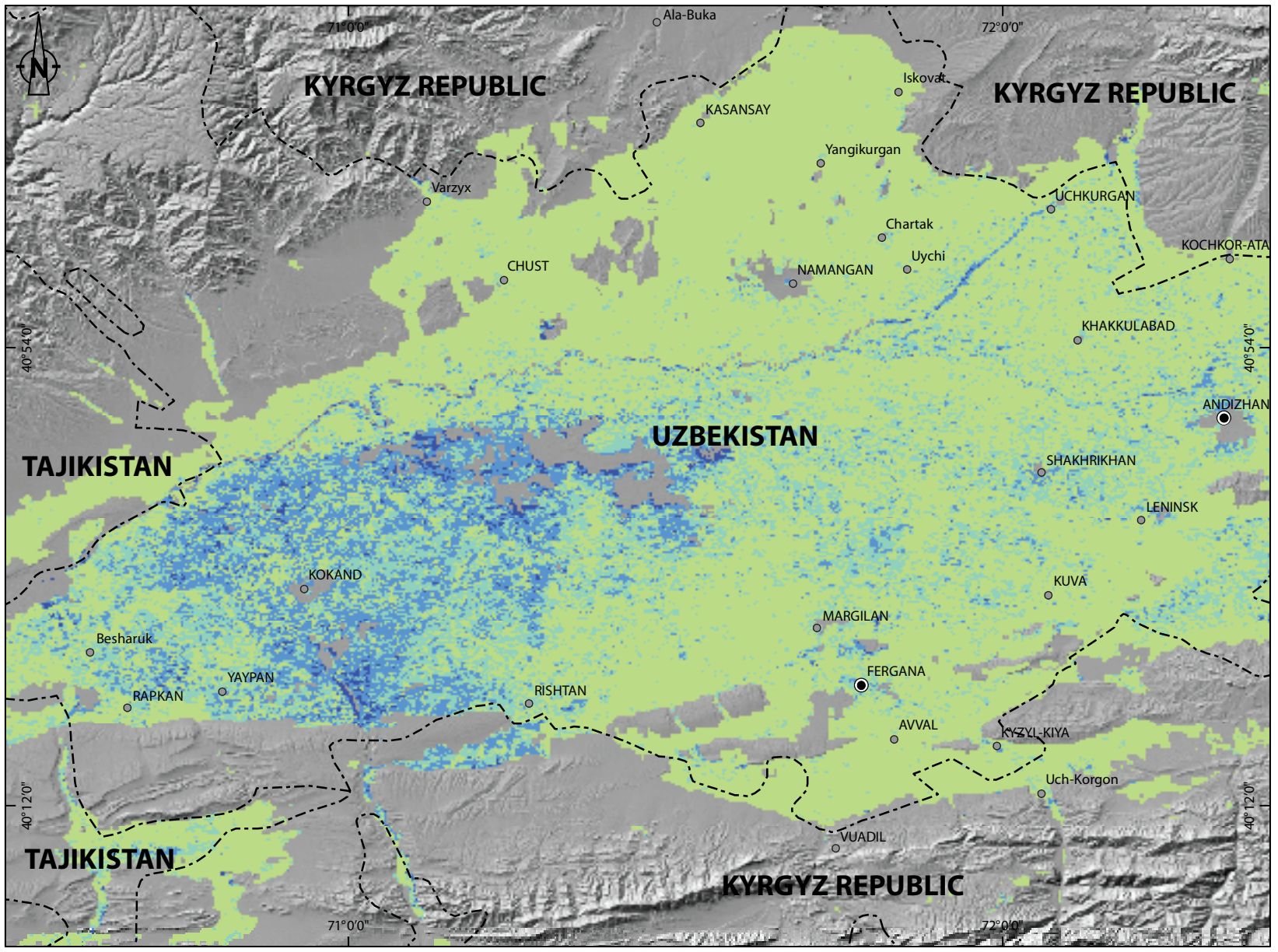
- Very high
- High
- Moderate
- Slight
- None

Salinization Causes and Effects

Primary or natural salinization occurs where soil is rich in soluble salts or there is a shallow saline groundwater table and inadequate rain to remove (leach) soluble salts from the soil. Secondary, usually human-caused, salinization occurs when irrigation is applied without adequate drainage for salts, causing them to stay in the soil when water evaporates. These salts accumulate over time and destroy soil fertility. In a natural state, salt-tolerant plants evolve. When natural flora are removed and irrigated crops introduced, an artificial equilibrium is created that must be maintained or salinization results.

Other causes of salinization include waterlogging, improper cropping patterns and rotations, and chemical contamination from heavy use of mineral fertilizer. Because salt inhibits a plant's ability to absorb nutrients, salinization renders soil infertile. Salinized land is less productive and often abandoned. In the worst case, soil becomes so salty that nothing can grow.

Mapping Waterlogging of Irrigated Areas - Fergana Valley



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City

International boundary

Dataset: MODIS (MOD13Q1, 250m)
Image Acquisition Date: Day193, 2008
Projection: Geographic, WGS84

Waterlogging Index

- None
- Slight
- Moderate
- Heavy

The image above, made in July 2008, used MODIS data to create a simple waterlogging index using the near infrared (Band 2) and a middle infrared (Band 7) based on 16-day composite data.

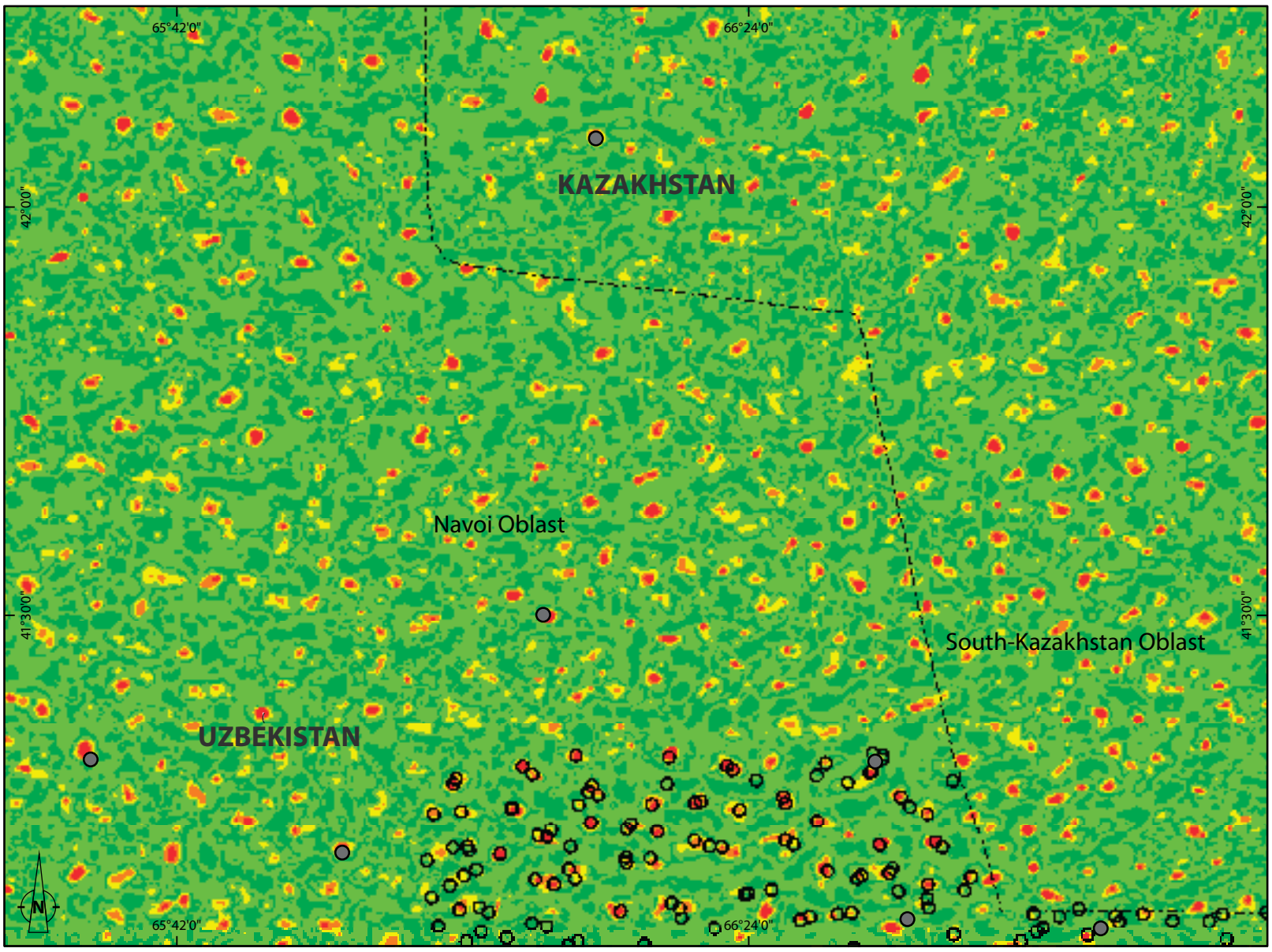
Prepared by C. Y. Ji, 2009

■ Waterlogging caption needed.

WATERLOGGING

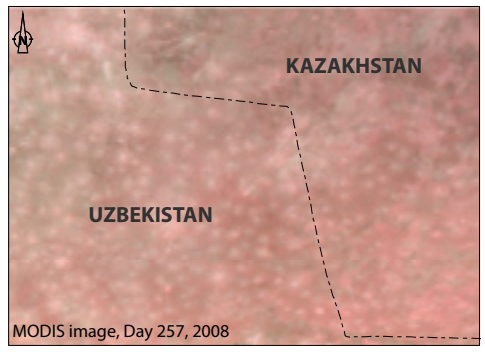
When drainage is not adequate or there is too much irrigation, waterlogging may occur—excess water raises water tables, bringing salt and other toxic substances to the surface. In Uzbekistan, the groundwater table is less than 2 meters below the surface in about one-third of irrigated lands. The area of waterlogged lands varies from 40% in the Fergana Valley, as shown in the image here, to 80% in downstream Amu Darya.

Mapping Grazing Gradients - Navoi Oblast, Uzbekistan and South-Kazakhstan Oblast, Kasakhstan



Dataset used: Annual Maximum NDVI of MODIS (MOD13Q1), 2008
Projection: Geographic, WGS84

Prepared by C. Y. JI, 2009



Grazing gradients are based on local statistical measures of Normalized Difference Vegetation Index (NDVI). Gradients 1 and 2 are areas considered not degraded, while gradients 3, 4, and 5 are slightly, moderately, and severely degraded areas, respectively. This MODIS image acquired on day 257, 2008, shows degraded pastureland as bright, circular-shaped areas (loss of vegetation).

OVERGRAZING

Overgrazing by livestock on pastures with poor fodder capacity is a primary cause of rangeland degradation. Overgrazing causes native perennial grasses to be consumed and trampled (compacted). Overgrazing also destroys native lichen and algae, which are important for fixing nitrogen and holding water. Their loss further depletes the land, reducing its ability to replenish itself and remain stable. Erosion often follows, increasing the chances of desertification.

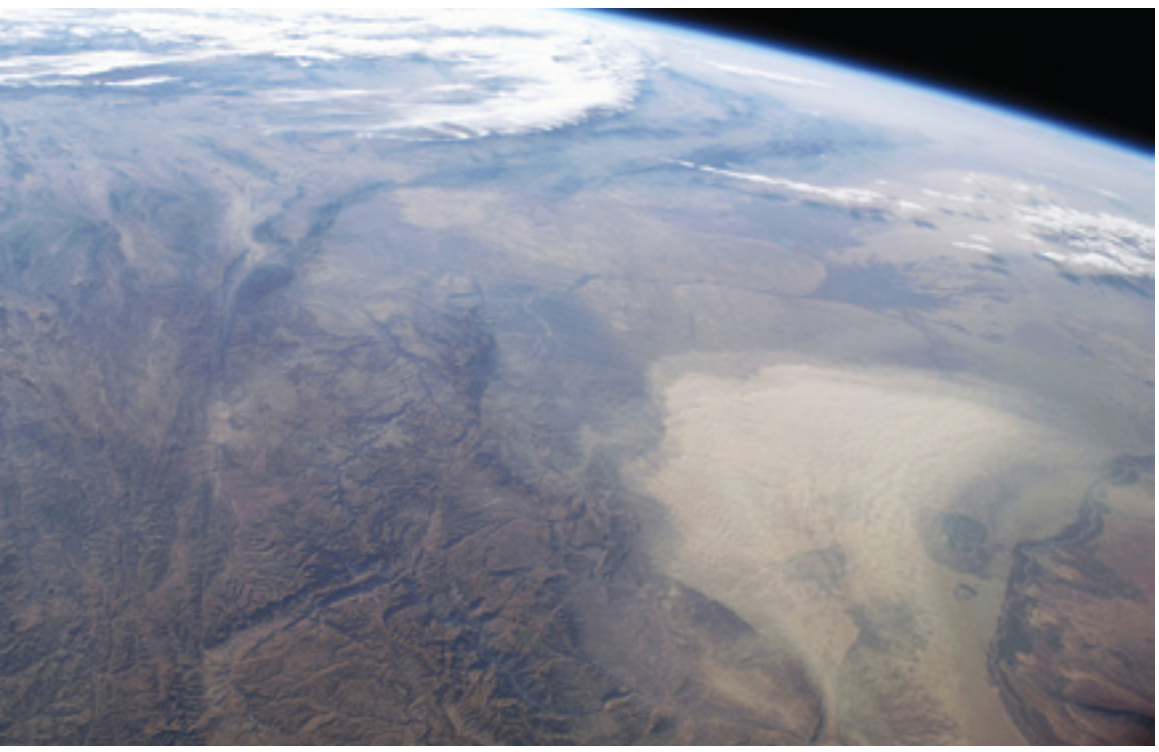
As this remote-sensing image shows in Navoi Oblast, Uzbekistan, and part of South Kazakhstan Oblast, Kazakhstan, degradation is most profound close to populated areas, such as towns and villages and watering holes, where many small-scale herders do not have the resources to transport animals to more distant pastures. In Uzbekistan alone, 7.3 million hectares of pastureland have been affected.

Overgrazing leads to degraded pasture lands; in Naryn, Issyk-Kul.

Sandstorms

Vast sandy and *solonchak* deserts, both natural and human caused, combine with Central Asia's windy climate to make wind-blown dust, salt, and sand frequent and debilitating problems. As moisture evaporates, upper soil layers become loose, making them prone to wind damage. Summer winds, which are particularly strong, often create dust storms that carry away huge amounts of soil. Karakum and Kyzlkum dust storms last an average of 20–40 days a year, blanketing fields in sand and dust, and lowering crop yields. In highly salinized areas, dust salt is also spread. Mineralization of the Aral Sea has made things worse. Salt, chemicals, and other pollutants blow from the dry sea bed to form white dust storms and sandstorms that influence the climate, degrade the landscape, and affect the economy of the area as well as people's health.

A youth protects his brother's eyes from wind-blown sand in the Karakum Desert in Turkmenistan. Sand and dust storms are health hazards in arid and semi-arid areas.



A huge dust storm in Turkmenistan seen from the International Space Station. Winds blowing down the Amu Darya River Valley whipped up the storm, which appears as the light brown mass extending toward the center of the photo from the lower right.

WIND AND WATER EROSION

Wind blows away small particles of soil, which lowers the land and denudes it of nutrients. Blown particles can abrade plant tissues, allowing pathogens to enter them. Wind erosion not only reduces agricultural yields but can also lead to irreparable land damage. Potential for wind erosion in Central Asia is probably greatest in pastureland and arid and semi-arid steppes. Reports from the 1990s stated that wind erosion affected as much as 45 million hectares of Kazakhstan's plowed land and rangeland. In Tajikistan, wind erosion affects almost one-quarter of its agricultural land. Turkmenistan's and Uzbekistan's vast deserts are especially susceptible to wind erosion once land is disturbed.

Water erosion is responsible for washing away millions of tons of soil material each year from the region's irrigated and rainfed land, especially on mountain slopes and piedmont plains.

SOIL DEPLETION

Although overcropping (or overplanting) and monocropping—repeatedly planting a single crop—are different, they have the same negative result: reduced land fertility. Overcultivation exhausts soils, decreasing the activity of biological organisms, which slows down the accumulation of nutritive elements and decreases crop productivity. Inadequate crop rotation in Central Asia's cotton- and grain-growing areas has forced vast tracts of land to be taken out of cultivation. In some cases, millions of tons of soil have been imported to replenish lost nutrients, but this is a costly and wasteful process, and of little use unless followed by sound crop rotation.

DESERTIFICATION

Desertification does not mean extension of the desert, but degradation of soil leading to conditions characteristic of deserts. It is a process that often begins in times of severe drought, when land

Desertification, as defined by the Food and Agriculture Organization (FAO) of the United Nations, is "the sum of the geological, climatic, biological and human factors which lead to the degradation of the physical, chemical and biological potential of lands in arid and semi-arid zones, and endanger biodiversity and the survival of human communities."

cannot adequately balance human pressures and overuse pushes the land to the brink. In humid climes, desertification is gradual. In arid Central Asia, when factors go especially wrong, it can engulf land at an accelerated pace. Drought and desertification affect all countries in Central Asia, as much as 66% of the land area of Kazakhstan, 97% of Tajikistan, and 80% of Turkmenistan and Uzbekistan. Moreover, nearly 90% of Kyrgyz Republic's agricultural land is said to be degraded and exposed to desertification.

Industrial, Transport, and Urban Pollution

Oil, gas, and mineral extraction all come with negative ecological by-products. Oil extraction practices in Kazakhstan and Turkmenistan are contaminating the Caspian Sea and inland areas. Gas exploration, gas flaring, and aging gas infrastructure in Kazakhstan, Turkmenistan, and Uzbekistan result in escaped methane, a highly potent greenhouse gas. Extraction of minerals causes land upheaval and pollution from tailings throughout the region. And mining of the uranium ore has its own set of disturbing consequences.

Manufacturing is also taking its toll. Large segments of Central Asia's manufacturing base are resource intensive, making them anything but environment-friendly. Increasing quantities of untreated solid and liquid industrial waste are released. The motor transport sector is significantly affecting the environment as well, the result of aging fleets, substandard maintenance, and low-quality motor oil.

As its industry and population grow, Central Asia's air quality becomes an increasing concern. Chief sources of air pollutants are coal burning, inefficient power plants, industry, and transport. A cocktail of ammonia, benzene, carbon dioxide, chlorine, dust, formaldehyde, hydrogen fluoride, hydrogen sulfide, lead, nitric oxide, ozone, phenol, sulfur dioxide, and other toxic compounds is causing widespread respiratory tract and circulatory and digestive system diseases. In Almaty, Kazakhstan, and in Bishkek, Kyrgyz Republic, respiratory diseases are said to affect more than 40% of the inhabitants. In Kazakhstan, these diseases cost the country on average $56 per person each year, equivalent to $60 per ton of emissions into the air.

While toxic compounds affect the health of the population directly, emissions of certain gases, especially carbon dioxide and methane, have a more insidious effect—by contributing to global climate change.

Upper: View of one of the main streets of Oskemen, Kazakhstan, flanked by a towering industrial complex. **Lower:** Termitau, Kazakhstan, one of the world's largest steel factories, built in Soviet days.

The Fedchenko glacier in Tajikistan, the largest glacier in Central Asia, is said to be shrinking due to climate change.

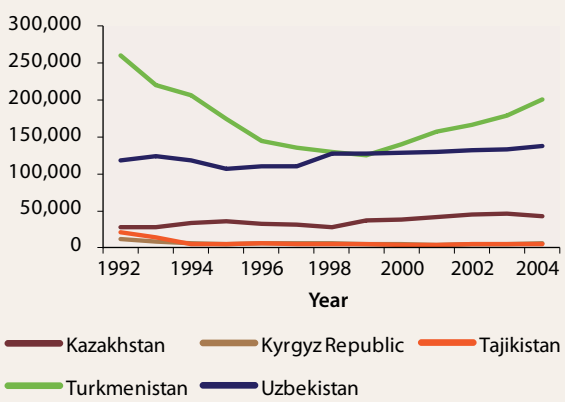
Climate Change

Climate change, in the form of higher temperatures, changing rainfall patterns, and more violent weather, is beginning to affect Central Asia, adding a new dimension to the young countries' struggle toward sustainable development. While the primary cause of climate change—increasing amounts of greenhouse gases in the atmosphere—is a global problem, the region is by no means blameless.

GREENHOUSE GASES

Central Asia generates large amounts of greenhouse gases, mainly carbon dioxide but significant methane emissions as well, the energy sector being the largest emitter. Kazakhstan is the 30th largest carbon dioxide emitter in the world. Its emissions slowed in the 1990s but began to increase again in the 2000s as the country's economy has improved and are expected to more than double over the next decade.

Carbon Dioxide Emissions in Central Asia, thousand metric tons



Source: Carbon Dioxide Information Analysis Center as cited by UN Millennium Development Goals. http://mdgs.un.org

Greenhouse Gas Emissions in Central Asia, Gg $C0_2$ equivalent

	1990	Latest available year per country
Kazakhstan (2004)		
Carbon dioxide (CO_2)	236,929.2	168,804.1
Methane (CH_4)	1,224,650.9	640,105.0
Nitrous oxide (N_2O)	8,323,559.8	3,387,423.9
Non-CO_2	9,548,210.7	4,027,528.9
Total GHG	9,785,139.9	4,196,333.0
Kyrgyz Republic (2000)		
Carbon dioxide (CO_2)	29,100.7	11,697.5
Methane (CH_4)	5,869.9	3,078.2
Nitrous oxide (N_2O)	1,149.8	275.9
Non-CO_2	7,019.7	3,354.1
Total GHG	36,120.4	15,051.6
Tajikistan (2008)		
Carbon dioxide (CO_2)	19,294.5	22,000.0
Methane (CH_4)	3,234.0	1,890.0
Nitrous oxide (N_2O)	1,147.0	1,200.0
Non-CO_2	4,381.0	1,900.0
Total GHG	23,675.5	4,284.4
Turkmenistan(1994)		
Carbon dioxide (CO_2)	—	31,859.1
Methane (CH_4)	—	20,325.2
Nitrous oxide (N_2O)	—	125.3
Non-CO_2	—	20,450.5
Total GHG	—	52,309.5
Uzbekistan (1994)		
Carbon dioxide (CO_2)	114,559.0	102,157.0
Methane (CH_4)	37,737.0	41,811.0
Nitrous oxide (N_2O)	10,850.0	9,920.0
Non-CO_2	48,587.0	51,731.0
Total GHG	163,146.0	153,888.0

— = data not available, Gg = giga (billion) grams, GHG = greenhouse gas.
Note: Figures exclude Land Use Change and Forestry.
Sources: UNFCCC. GHG Emission Profiles. http://unfccc.int/ghg_data/ghg_data_unfccc/ghg_profiles/items/3954.php
Republic of Tajikistan. 2008. *Statistical Annual Yearbook*. www.stat.tj

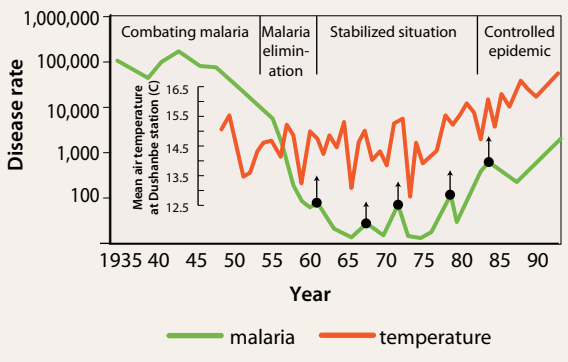
The Kyrgyz Republic's emissions also fell in the 1990s. The country lost the subsidies on oil and gas that it enjoyed in the Soviet period and turned to clean hydropower. Nevertheless, its greenhouse gas emissions were expected to grow 25% in the first decade of the 2000s. Tajikistan produces few greenhouse gases, relying largely on hydropower for its energy needs and with a relatively small industry sector. Offsetting this advantage to some extent, however, is carbon dioxide emissions through deforestation.

Turkmenistan is a moderate greenhouse gas producer but its emissions are expected to increase, mainly as a result of the planned increases in oil and gas production activities. Uzbekistan is the world's most carbon-intensive economy, with greenhouse gas emissions comparable to those of its much larger neighbor Kazakhstan. More than a quarter (27%) of these gases is methane, generated by mining, transport of natural gas, production of oil and coal, and from agriculture—rice cultivation and intestinal fermentation in ruminant livestock.

EFFECTS OF CLIMATE CHANGE

Climate change will most likely bring higher temperatures to the region, which will result in major environmental, economic, and social disruptions. Glaciers are shrinking—those in the Tien Shan, Gissaro-Alai, Pamirs, and Dzhungarskiy and Zailiyskiy Alatau have been decreasing by about 1% each year in recent decades. This means that water availability in the major rivers, Syr Darya and Amu Darya, which depend on annual glacier melt to some degree, may decline by up to 30%–40% in the future. Increasing frequency of drought and lower grain productivity are also very likely to occur. For example, in Kazakhstan, according to the Kazakhstan Scientific Research Institute of Environment and Climate, the winter wheat crop may fall by more than a quarter. Harvests from natural forage lands may decline by 30%–90% and this, along with the direct effect of increased hot weather on animals, would seriously affect livestock production.

Malaria Incidence and Climatic Factors in Tajikistan



Source: Kayumov A. and A. Lizenko as cited by Tajikistan 2002. *State of the Environment Report.*

Public health will be affected directly by more extreme weather across the region, such as deaths from heat waves, mudslides, and floods. Mudslide occurrences in Kazakhstan are predicted to increase by a factor of 10 if temperatures rise 2–3°C; social and economic centers in lowland areas could become environmental disaster zones. Cardiopulmonary diseases will increase and insect-borne infections will extend their range. For example, in Tajikistan, malaria is on the increase as average air temperatures have slowly been rising over recent decades.

Most analyses agree that it is already too late to stop global warming over the medium to long term even if greenhouse gas emissions could be drastically reduced now. Thus, while it is most important to reduce these emissions, adaptation measures to lower or prevent the worst-predicted impacts of climate change are also vitally needed.

For the Central Asian countries, especially those dominated by deserts—Kazakhstan, Turkmenistan, and Uzbekistan—adaptation to climate change will need many changes. In agriculture, it will mean strengthening existing ways of combating drought and desertification, using crops that need less water or have a growing season more suited to the changing conditions, using advanced methods of fertilization and pest control, and managing pasturelands better to prevent overgrazing and to rehabilitate degraded pastureland.

For water resources, adaptation measures needed include minimizing water losses in irrigation and transport canals, more efficient irrigated farming, transferring water-using businesses away from low-water areas, improving sanitary and industrial practices near open-water and groundwater sources, and better protection of watersheds from degradation and contamination.

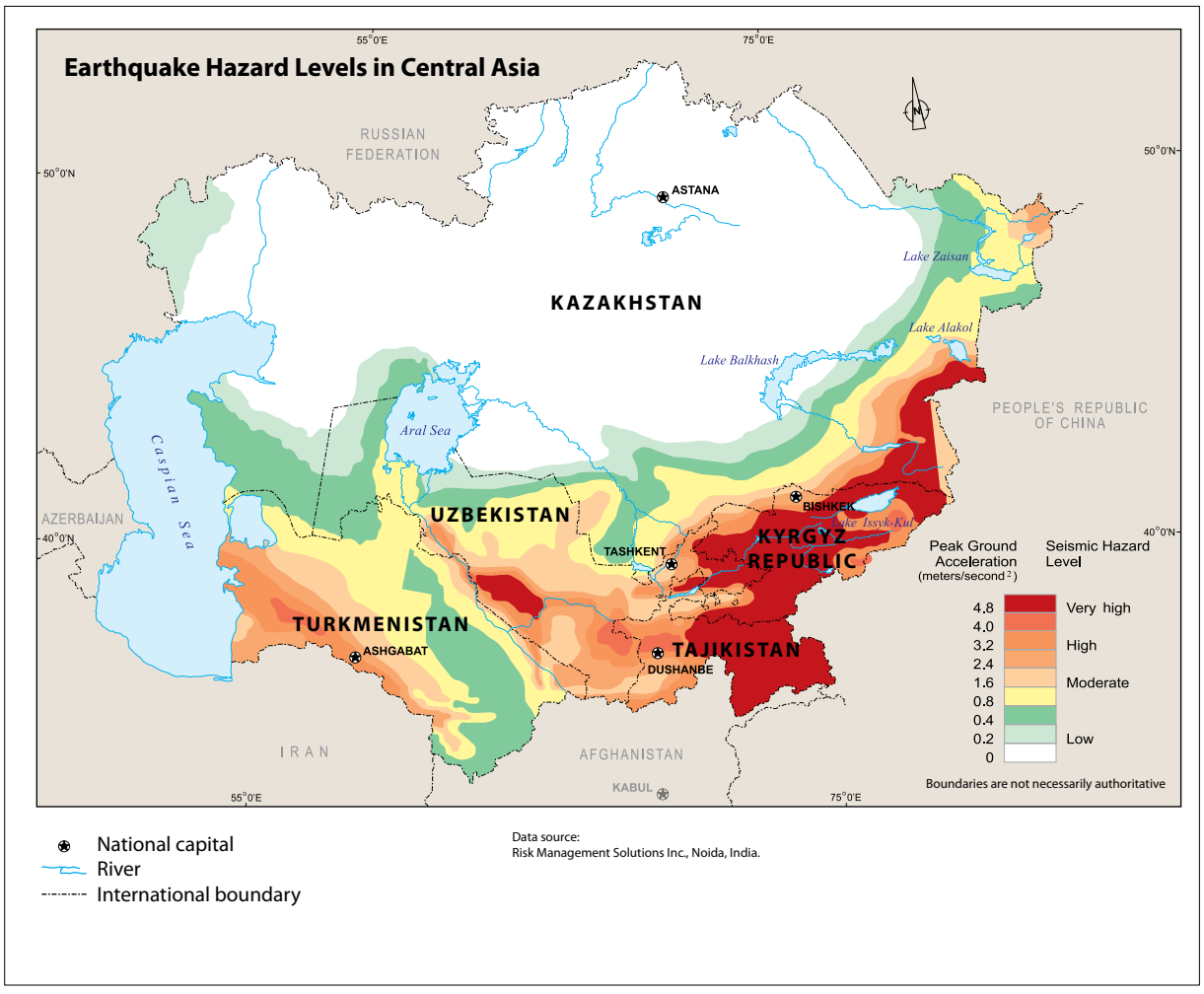
In all these adaptation efforts, cooperation across the region will clearly be to the advantage of all countries: with so many common problems, new solutions will not have to be invented in each country. However, the present standoff with regard to cooperation in water use—a key factor in the survival of the countries themselves—presently impedes their prospect of a sustainable future.

Natural Disasters

Disasters, both natural and human-made, are constant and growing threat to lives, livelihoods, and socioeconomic development across Central Asia. Worst affected by natural disasters in terms of economic vulnerability is Tajikistan, where loss potential is as much as 70% of gross domestic product. Tajikistan each year experiences 50,000 landslides; 5,000 tremors and earthquakes; and hundreds of avalanches and debris flows. In the Kyrgyz Republic, over 1,210 natural disasters were registered during 1992–1999. Both in the Kyrgyz Republic and in Kazakhstan, direct damage from disasters is said to cost on average of about

Top: Kumkol oil field, Kazakhstan. The region's energy sector is the largest emitter of greenhouse gases. **Middle:** *Takir* or *takyr* (a shallow submerged area with heavy clay soil. When it dries out, a crust with fissures due to filamentous algae forms on the surface) in the desert of Turkmenistan. **Bottom:** Abandoned irrigated land near southwest shore of Lake Issyk-Kul, Tong District, Issyk-Kul Oblast, Kyrgyz Republic.

Upper and lower: Landslides in a piedmont area of the Kyrgyz Republic.



$20 million annually, and indirect damage may be up to 10 times that amount. And the frequency and impact of disasters have been rising dramatically worldwide since the early 20th century—more than 800% since the 1960s.

The major risks in all countries are earthquakes, except in Tajikistan where floods are the main hazard. Flooding is the second most important hazard in the other countries, except Turkmenistan, which is more prone to drought.

The most catastrophic natural disasters are earthquakes that have leveled even major cities in the region, sometimes more than once—Almaty, then capital of Kazakhstan, was leveled three times in the late 1800s and early 1900s; Ashgabat, capital of Turkmenistan, was destroyed in 1948; and Tashkent, capital of Uzbekistan, was badly damaged in 1966—and those killed, injured, or otherwise affected have numbered in the hundreds of thousands. The main reason is that the southern part of the region lies in one of the world's most active seismic belts. Nearly all of Tajikistan and the Kyrgyz Republic are under severe earthquake threat, about half of Uzbekistan, and a third of Kazakhstan.

Human-made disasters, like the demise of much of the Aral Sea, overuse of water resources, and land degradation, have cost the region countless billions of dollars over the past century. And further threats abound. Many huge, aging, reservoirs in Central Asia pose threats of major flooding, in some cases across borders. For example, if Lake Sarez—itself formed by a major earthquake—were to burst, it would affect millions of people in Afghanistan, Tajikistan, Turkmenistan, and Uzbekistan.

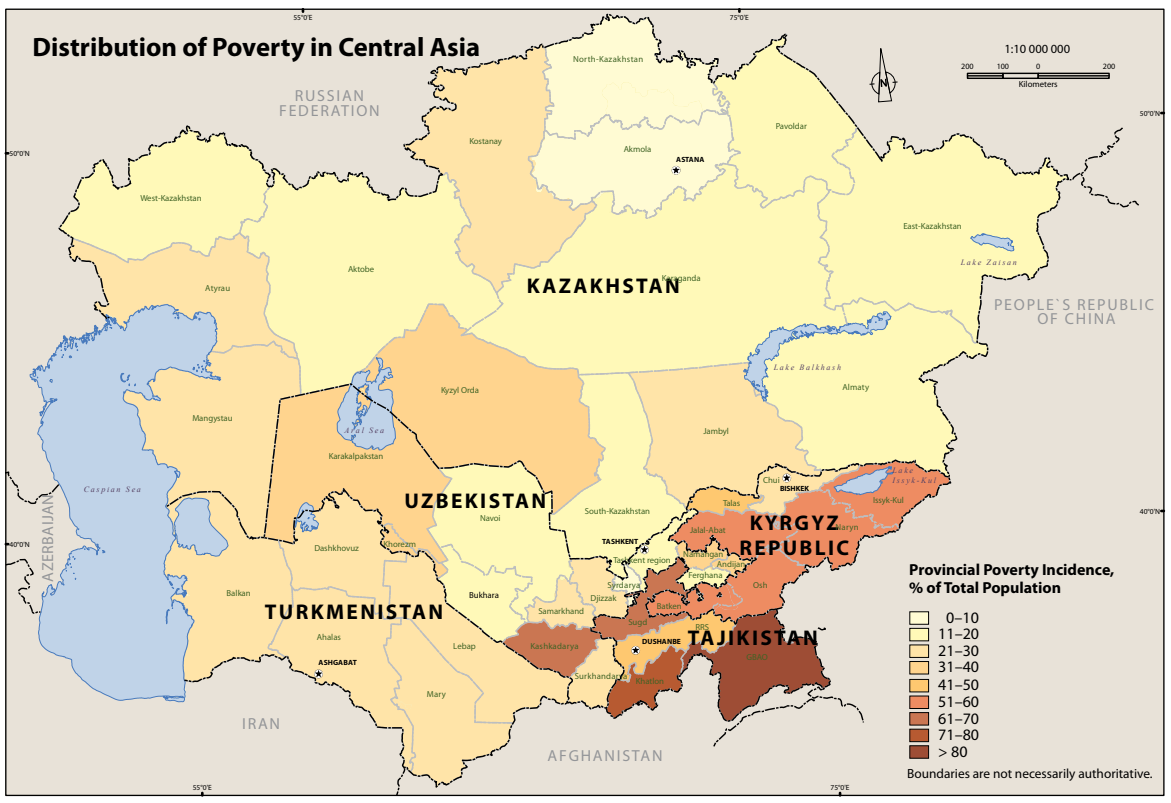
Another threat is the result of past decades of uranium processing, waste dumping, and pesticide storage, which have left a legacy of huge dump sites that are increasingly hazardous to the environment and human life. For example, along most of the length of the Syr Darya, people are at risk from radioactive wastes in the tailing dumps of uranium mines near waterways in upstream Kyrgyz Republic and Tajikistan.

The countries are working together on ways to minimize disaster impact because natural and human-made disasters not only affect all the countries but can also cross borders with serious implications for the economy in one or more countries that can reverberate throughout the region.

Poverty and Environment

Unsustainable natural resource development and natural and human-made disasters have exacted a massive toll on the region's environment. But who pays this toll? Undoubtedly, nearly all of the region's populations are suffering in varying degrees from the effects of air and water pollution from industry, agriculture, and toxic dust blown from abandoned agricultural land and from the environs of the Aral Sea.

But it is the rural populations—in farms and fisheries, mines, oil and gas installations, and rangelands—that are closest to and most affected by degraded or damaged environments. And these people are mainly the poor. More than 60% of Central Asia's poor are in the countryside; in the Kyrgyz Republic and Tajikistan, more than three-quarters of the poor live in rural areas.



Note:
The property levels in the map above are based on data from international organizations and while not identical with national poverty data, reflect the same pattern.

Data sources:
ADB. Key Indicators for Asia and the Pacific 2008.
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GIS/Cartography:
V. Sibagatulin, GIS-Service Ltd.
Kyrgyz Republic, 2009

A comparison of the maps on distribution of poverty and earthquake risk in the region illustrates the poverty–environment connection: the highest poverty rates are in the mountainous environments, where natural hazards, particularly earthquakes, are greatest.

The environmental perspective on poverty has come to the fore in recent years. Many people are materially poor because of the physical environment in which they live. There are dryland poor in marginal and desert areas, flood-affected wetland poor in areas of frequent inundation, upland poor in remote upland or mountainous areas, coastal poor along shorelines, and slum poor with high exposure to urban pollutants. Asia-wide, they account for 53% of all extreme poverty. While there is still optimism that overall poverty in its income and social dimensions will decrease in the future, environmental poverty will most likely persist and the proportion of environmentally poor will increase. By 2020, up to 70% of Asia's extremely poor may be the result of their degraded environment.

Health indicators show the human price of degraded environments. For example, infant and child mortality rates increased in Kazakhstan, Turkmenistan, and Uzbekistan between 1980 and 2001 while life expectancy fell in Kazakhstan. A glaring example is the severe recent health situation—compared to that in the 1960s—of those, mainly poor, living near the drying Aral Sea where the severely degraded environment results in 10% of children dying in their first year, 15% increase in deaths from chronic gastritis and kidney disease, doubling of the heart disease rate, ten-fold increase in cancer, 15–fold increase in kidney disease, and 21–fold increase in deaths from tuberculosis. There has been much emigration from the area but the poor cannot afford to move and many presently suffer the consequences.

Region-wide, poverty soared when the republics gained their independence because of the collapse or major restructuring of the large-scale collective and state farms that dominated socioeconomic life in rural Central Asia during the Soviet period. These farms provided agriculture and food products as well as social services such as schools, health services, and housing. Since independence, public utilities (piped water, heating, sanitation) and services (schools, health care, kindergartens, etc.) in rural areas have declined in both numbers and quality, worsening living conditions there. The rural poor mostly lack property rights to land or their houses and so cannot easily borrow money or start their own businesses. All these negative impacts of the transition to market economies have driven the rural poor further into the vicious environment–poverty circle.

Poverty reduction only became the main objective of development efforts by donor agencies in the late 1990s. And even then, environment considerations were often left behind. Nowadays, it is recognized that environmental poverty and environmental degradation can and should be addressed together. Many international, regional, and local efforts are planned or are under way to remediate pollution and restore the region's environment as described in the next chapter.

Hidden Hunger

A natural resource missing from soils in most of the region is an essential micronutrient—iodine. When such micronutrients—vitamins and various minerals—are unavailable in the diet, even if it has enough calories, both physical and mental impairment can result. This "hidden hunger" is prevalent in Central Asia, causing economic losses equivalent to about 1% of annual gross domestic product.

Major micronutrient disorders in the region are not only iodine deficiency disorders (IDD) but also iron deficiency anemia (IDA); and folic acid, vitamin A, and zinc deficiencies. Except for vitamin A deficiency, fortifying staple foods with micronutrients is well known to provide the ideal solution, yet a complex one in practice.

Most salt was fortified with iodine in the former Soviet Union, but by the mid-1990s, goiter, a symptom of IDD, had risen to more than 50% in adults in areas of Kazakhstan and was up to 86% in Tajikistan. Iron deficiency, which tends to be prevalent in wheat-eating populations, such as those in Central Asia because essential micronutrients are lost during wheat milling, had never been addressed.

During 2001–2007, the Asian Development Bank, in partnership with the United Nations Children's Fund (UNICEF), led a regional initiative to help the countries of Central Asia (and Mongolia) fortify all salt with iodine and wheat flour with iron folic acid and zinc. The result to date for iodine deficiency has been to almost halve the numbers of unprotected children in the region. Recovery from iron and folic acid deficiency in women and children has exceeded expectations but is still at a pilot stage. In both cases, however, a solid foundation for eradicating these public health problems has been made and the governments are continuing the effort.

Upper: Locally produced fortified flour makes its debut in the Kyrgyz Republic. Lower: The healthy food logo for fortified foods was widely adopted.