Key drivers for biodiversity loss and financing conservation in Central Asia

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This publication was developed by Zoï Environment Network in cooperation with the Organisation for Economic Co-operation and Development (OECD). The purpose of this publication is to describe the authors' preliminary findings and ongoing research, and to stimulate discussion at the Annual Meeting of the GREEN Action Task Force, 16–17 April 2024, Chisinau, the Republic of Moldova, and to obtain feedback from interested audiences. It also provides a broad picture of how different stakeholders and funding sources can be involved in the Biodiversity Plan.

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Contents

1. Key drivers for biodiversity loss and trends

The area of Central Asia (4 mln km²) is slightly bigger than the Western Europe (3.8 mln km²). Population of the region is growing: there are 75 million people, compared to 50 million 30 years ago, and by 2050 may cross the benchmark of 100 million. Infrastructure is booming, and pressures on nature in and around populated areas, as well as in some remote natural areas, are increasing.

Traversed by the ancient trade routes known as the Silk Road which linked China and Asia Minor, the region is now expanding the modern connections from China to the Caucasus and Europe, as well as energy export links to Asia. This potentially increases habitat fragmentation and pollution, but application of biodiversity safeguards lessens these risks [59, 61, 62]. Trade also increases the risk of invasive species and genetically modified organisms (GMOs), while increasing food demand leads to higher grazing pressure and more frequent wildlife-cattle contact, increasing the risk of zoonotic diseases [60, 64]. Conditions for preservation of local genetic resources and agrobiodiversity remain fragile.

Climate impacts on biodiversity include habitat changes and alterations in conditions in the Caspian and Aral seas as well as in mountains, while droughts in the southern parts of the region negatively affected nature reserves such as Koytendag in Turkmenistan and wetlands along the Amu Darya [3, 53, 60, 64, 66, 77]. Forests and steppes of Kazakhstan are exposed to higher wildfire risk due to temperature rise associated with climate change [3, 60].

Ecological footprint is one of resource accounting tools that combines greenhouse gas emissions, other human pressure and land use indicators and biocapacity to express in global hectares how cities or countries perform and balance. It currently shows ecological deficits (in the range of −0.5 to −1 ha/person) for all Central Asian countries, meaning that they are demanding more from nature than their ecosystems can regenerate. A positive sign is that while biocapacity has remained stable, the ecological footprint per person has declined over the years [80]. If countries continue to make progress in restoring landscapes and forests, reducing emissions and waste, and expanding renewable energy capacity and use, they can move from a negative to a positive footprint.

The state of biodiversity of the past 10 years (2013–2023) was generally stable [4, 9–26, 39, 40, 42, 72, 88]. Forest areas did not decline, and thanks to afforestation efforts, in several countries tree-covered areas expanded, especially in the Aral Sea region [9–26, 39, 40, 42, 65, 88]. Some tree plantations are appearing on non-forest lands, and due to harsh weather conditions and lack of care, the survival rate of the trees is not high [101].

Populations of several endangered flagship species — snow leopard, Marco Polo sheep, markhor goat and saiga have generally recovered [1, 9–26, 38, 39, 40, 42, 72, 82, 88]. New technologies for species monitoring, such as Spatial Monitoring and Reporting Tools (SMART), are helping scientists and rangers alike. However, the status of many species remains poorly understood due to a lack of comprehensive monitoring and fragmented data [9–26, 38, 39, 40, 72, 82]. Conditions for other threatened species — particularly plants — have deteriorated due to overgrazing and riverbed development by the extractive and construction industries.

Fish catch levels recovered in the northern Aral Sea thanks to the Kokaral Dam, which keeps the sea level stable. In the southern Aral Sea, environmental conditions and fishery remain precarious, but wetland conservation and forest plantations are helping to stabilise the situation [9–26, 29, 30, 52, 60]. While the root causes of the Aral Sea crisis remain to be addressed, both Uzbekistan and Kazakhstan have managed to stabilise the local socio-economic and environmental situation through special programmes and funds, green plantations, water infrastructure, wetlands, fish ponds and dams.

The level of the Caspian Sea has fallen in recent years; despite this, fisheries in the northern Caspian in Kazakhstan have remained productive enough [9, 60]. There are concerns that rising temperatures and increased evaporation due to climate change will contribute to further decline and adverse impacts on ecosystems of the Caspian Sea [8, 60].

Indicators	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Population and infrastructure growth	↗	↗	↗	↗	↗
Habitat fragmentation and pollution	↔	↔	↔	↔	↔
Climate change impacts	↗	↗	↗	↗	↗
Over-exploitation of biodiversity, over-grazing	↔	↗	↗	↔	↗
Challenges of alien invasive species and biosafety	↗	↗	↗	↗	↗
Ecological footprint	↘	↘	→	↘	→
Forest and other wooded land, area	↗	↗	↗	↗	↗
Change in status of threatened species	→	→	→	→	→
Population size of endangered (flagship) species	↗	→	↗	→	→
Genetic resources of agrobiodiversity	→	→	→	→	→
Fish resources and catch: marine (Aral Sea, Caspian Sea)	↗	▭	▭	→	↘
Fish resources and catch: freshwater, including the fish ponds	→	→	→	▭	→

Positive or stable trends:

- ↗ increase, improvement
- ↘ reduction of pressures

Negative trends:

- ↗ growing pressures
- ↘ deteriorating capacities, efficiency or conditions

- ↔ Mixed trends
- ▭ No data
- → No negative changes

Country responses to reduce and reverse biodiversity loss have generally been advanced. Ongoing developments in the formulation of national biodiversity strategies, updates of national Red Lists and forest inventories, and the improvement and publication of biodiversity data are helping to inform decision-making and the general public. Participation in international agreements on biodiversity and Memoranda of Understanding (MoUs) on migratory species and environmental cooperation between countries contribute to conservation.

Countries are currently re-assessing the effectiveness of measures and revising national biodiversity strategies, targets and reporting to align with the Kunming-Montreal Global Biodiversity Framework. In addition, the recent 14th Meeting of the Conference of the Parties (CoP-14) to the Convention on Migratory Species (CMS) in Samarkand in February 2024 drew global attention to Central Asia and contributed to increased bilateral and regional cooperation on migratory species.

In Kazakhstan, Kyrgyzstan and Uzbekistan, the diversity and coverage of protected areas has increased [9–26]. Tajikistan already has the highest share (22 per cent) of protected areas in Central Asia over the past 20 years, while Turkmenistan, which still has no national park, has an exemplary conservation tradition and management of the existing reserves [10, 12, 17, 60]. While management effectiveness tracking tool (METT) scores[1] improved for many protected areas, especially where projects provided capacity building with support from the Critical Ecosystem Partnership Fund and the Global Environment Facility [77, 79], there are still many gaps and the situation varies.

The forest management situation varies from country to country. Forest fire and disease control and forest inventory appear to be more developed and adequately funded in Kazakhstan. On the contrary, Tajikistan has not carried out forest inventory for many years, and overgrazing is a major challenge. Kyrgyzstan, with the support of international development partners, is quite advanced in forest accounting, valuation and pilots on payments for ecosystem services and community-based management. Uzbekistan and Turkmenistan are expanding their desert and urban plantations [12, 17, 19, 23].

Ex-situ conservation in zoos, wildlife sanctuaries, botanical gardens and nurseries is generally recovering from the dramatic decline of the 1990-2000s. Snow leopard rehabilitation centres exist in Kyrgyzstan and Tajikistan, and wildlife conservation and birds of prey centres operate in others.

There is an increasing number of key biodiversity areas (KBAs), including wetlands of international importance and other sites with or without formal protection status and category, game reserves and hunting concessions, community-managed forests and micro-reserves. However their vague legal status, limited public awareness and attention limit conservation efforts [9–26, 39, 40].

Both locally registered and international civil society organisations active in the region remain important conservation actors. However, their status, situation in the countries and future operations are uncertain due to geopolitical changes in Eurasia and operational constraints.

[1] METT is a widely used assessment system for protected area management effectiveness. For further information, see www.protectedplanet.net/en/thematic-areas/protected-areas-management-effectiveness-pame?tab=METT

Indicators	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Agricultural and forest areas under sustainable management	→	→	→	→	→
Protected areas (number, coverage)	↗	↗	→	→	↗
Protected areas: management and conservation efficiency	→	→	→	→	→
Key biodiversity areas, wetlands of international importance	→	→	→	→	→
Cross-border biodiversity cooperation, including migratory species	↗	→	↗	→	↗
Botanical gardens, nurseries, ex-situ conservation	→	→	→	→	↗
National biodiversity strategies and goals: implementation progress	→	→	→	→	→
Civil society participation in target setting and conservation	→	↔	↔	→	↔
Biodiversity monitoring, use of digital innovation, data sharing	↗	↗	↗	→	↗
Forest inventory	→	→	▭	→	→
Afforestation, landscape restoration	↗	→	→	↗	↗
Forest fire and diseases control	→	→	→	→	→

Positive or stable trends:

- ↗ increase, improvement
- ↘ reduction of pressures

Negative trends:

- ↗ growing pressures
- ↘ deteriorating capacities, efficiency or conditions

- ↔ Mixed trends
- ▭ No data
- → No negative changes

Regional biodiversity problems became apparent about 50 years ago with the disappearance of tigers (due to shrinking habitats and hunting), reduction of forests and water resources (due to agricultural expansion), and a number of other alarming trends [60]. The Aral Sea region is emblematic of all the environmental problems, but other water ecosystems, such as the Caspian Sea or Lake Issyk-Kul in Kyrgyzstan, have experienced a decline in fishing, an increase in invasive species and pollution [60].

Both the historical record of impacts on its ecosystems and current trends affecting them today show that Central Asia's water ecosystems, agro-ecosystems and natural pastures, together with certain types of forests (e.g. tugai and riparian forests), are among the most vulnerable to human influences [9–26, 60]. Habitat change and over-use of nature remain the two types of pressures that have been historically strong and continue to affect species and ecosystems today. Mountain regions, natural lowland and mountain pastures, fruit-and-nut forests and riparian forests are under increasing pressure from population growth, food demand and trade [9–26, 39, 40, 60].

Many of the harmful and long-lasting human impacts on Central Asia nature occurred during the decades of Soviet rule: shrinking the Aral Sea due to excessive water withdrawal, inefficient irrigation systems with salt and pesticide-contaminated run-off affecting water quality, overgrazing of pastures, conversion of grasslands, industrial pollution from uranium, mercury and other mining [60].

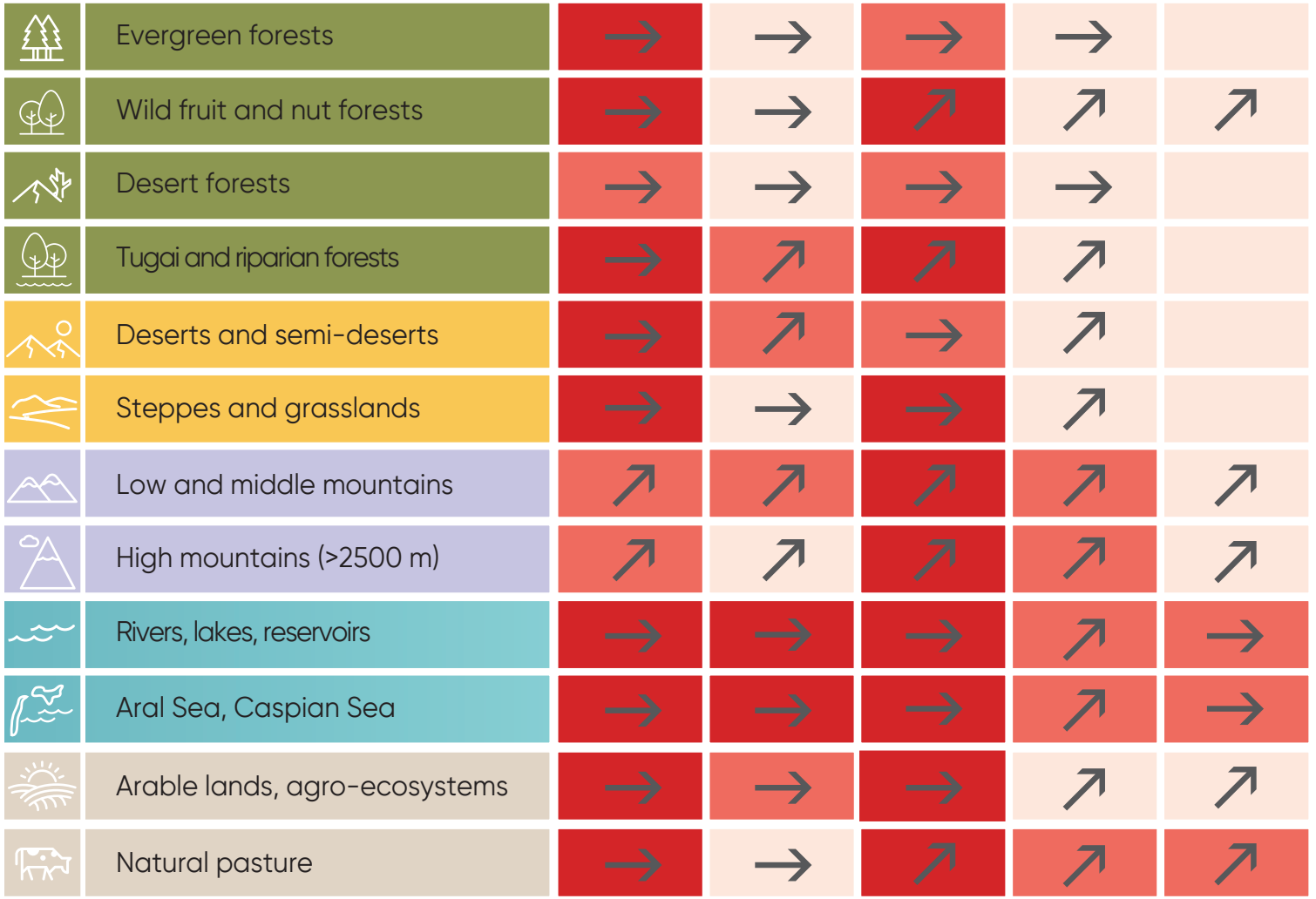
In addition to these drivers, climate change is now a growing pressure on almost all types of ecosystems in Central Asia, and invasive species and biosecurity risks are also increasing [9–26, 39, 40, 60]. Pollution risks grow in areas where infrastructure and extractive industries are expanding — in mountains and semi-deserts. These factors also pose major risks to riparian forests survival — gravel extraction and vegetation clearance for mining, roads and construction. Some CSOs express concerns about planned and ongoing hydropower and irrigation canals expansion projects [95].

The map of environmental concerns on the following page shows the human footprint as a background, sensitive areas and impact clusters [86, 89]. It is highest in the densely populated intermountain and river valleys of southern Central Asia, with many irrigated lands, and in rainfed cropland of northern Kazakhstan. Areas with a low human footprint are mainly the cold deserts and semi-deserts in the middle part of Central Asia. In this region several sites have been designated recently as UNESCO natural world heritage sites [48]. In the remote Pamir mountains of Tajikistan, wilderness covers almost half of the country — there are twice as many glaciated areas as forests. Compared to assessments of the human footprint 20 years ago, there is some increase in pressure, but not dramatic [86, 89].

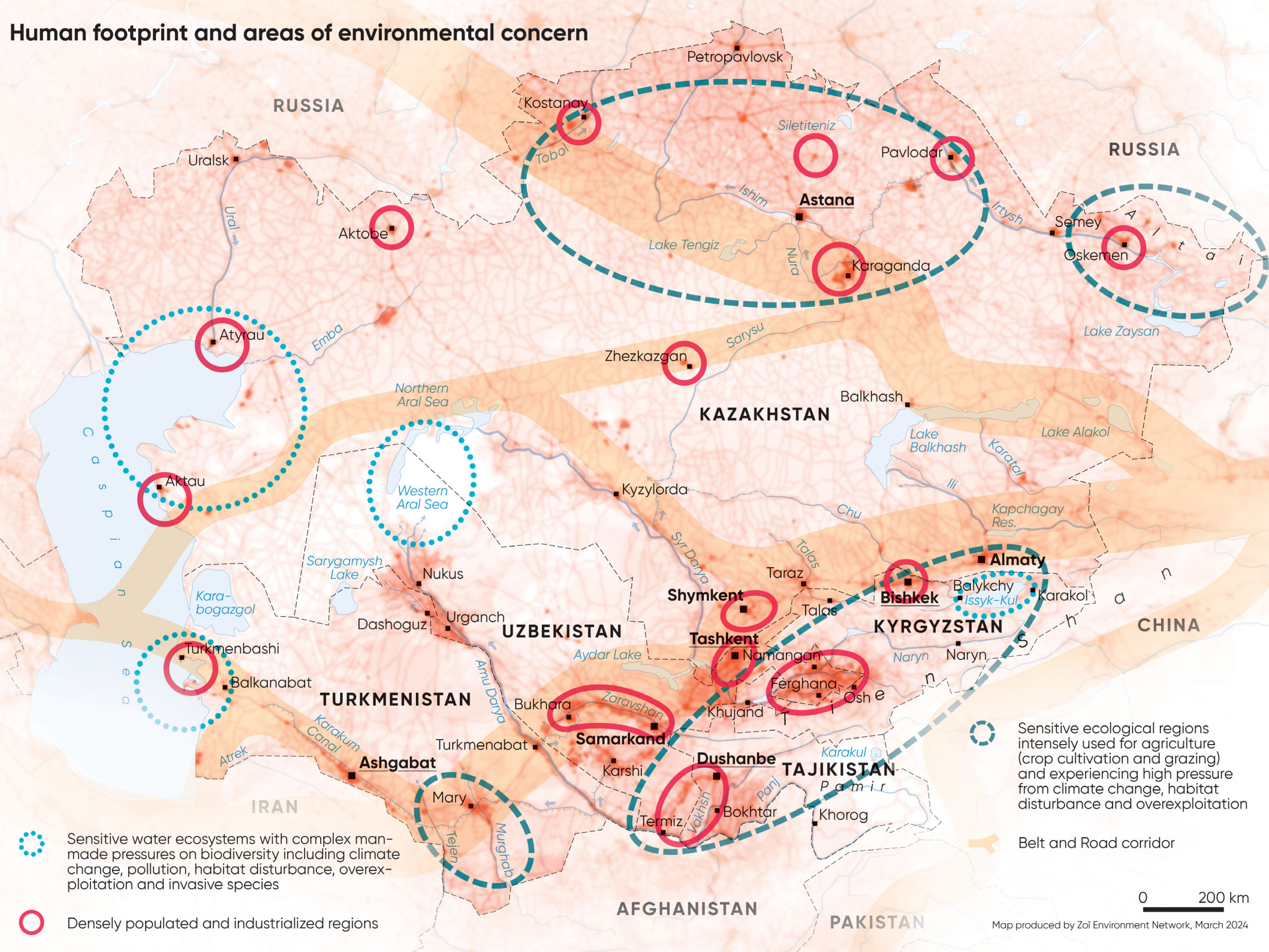
In the shallow northern part of the Caspian Sea, biodiversity is threatened by sea-level fluctuations, uncertain river inflows, increased shipping and industrial activity, pollution and poaching [9, 52, 60]. The southern parts of the Aral Sea basin are affected by climate change and water scarcity. Lake Issyk Kul — one of Kyrgyzstan's tourism and biodiversity jewels — is facing over-tourism in the summer, and road expansion is likely to increase pressures in the future [60, 64]. Over the last 10 years the lake level has been falling, in part due to weather factors and partly due to the use of water for irrigation from the rivers that feed the lake [102]. Invasives and plastics are ongoing problems for the lake [60, 77, 94].

Many mountain regions of Central Asia — Kopetdag and Koytendag in Turkmenistan, Nuratau in Uzbekistan, Pamir and Tien Shan in Kyrgyzstan and Tajikistan as well as Altai in the east of Kazakhstan are sensitive to over-grazing and habitat disturbance [39, 40, 60, 66]. Soil compaction, reduction of vegetation and increased erosion of mountain slopes also contribute to higher sediment formation and silt loading of the rivers with implications for the useful life and effectiveness of the reservoirs and canals. In the northern and central parts of Kazakhstan, infrastructure expansion is adding pressure on biodiversity, while fenced borders and roads are obstacles for migratory species [76].

Relative importance of impacts on ecosystems and trends



Human footprint and areas of environmental concern



Map produced by Zoï Environment Network, March 2024

2. Review of financial instruments and mechanisms for biodiversity protection

In all countries of Central Asia, governmental budget is the main source of regular funding for biodiversity conservation. According to BIOFIN[2] estimates for several countries, around 60–80% of funding is allocated for the salaries of staff working on biodiversity within government bodies, with the remainder for basic operational expenses. Most of the funding goes to the network of protected areas and forestry [67–71].

Additional sources of funding include hunting fees, pasture and forest use fees, which, depending on the country, context and regulations, are channelled into the national budget or dedicated government ecological funds and programmes. Penalties, fines and other payments related to the environment may also be used or linked with biodiversity conservation or recovery measures. Self-generated funds (from haymaking, tourism) of protected areas or forestry units are generally marginal (1–5%) in total volume, but can be important locally [67].

Local authorities are important actors in the management of local natural resources, including protected areas of local importance, but they usually have little, or no, funding or expertise for conservation activities [68]. Often, local authorities are responsible for restoration of pasture lands and environmental rehabilitation of damaged areas (post mining or disaster impacts), but their financial resources and technical capacities are limited [64, 66, 68].

Science actors are crucial for biodiversity conservation, monitoring, education and awareness. Each country in Central Asia has botanical and zoological research institutes, datasets, natural science faculties at universities, and cooperation with international partners. They provide data and proposals for species red listing, international nominations, expansion or creation of protected areas, regulation of grazing pressures, solutions for nature recovery, and participate in environmental impact assessments.

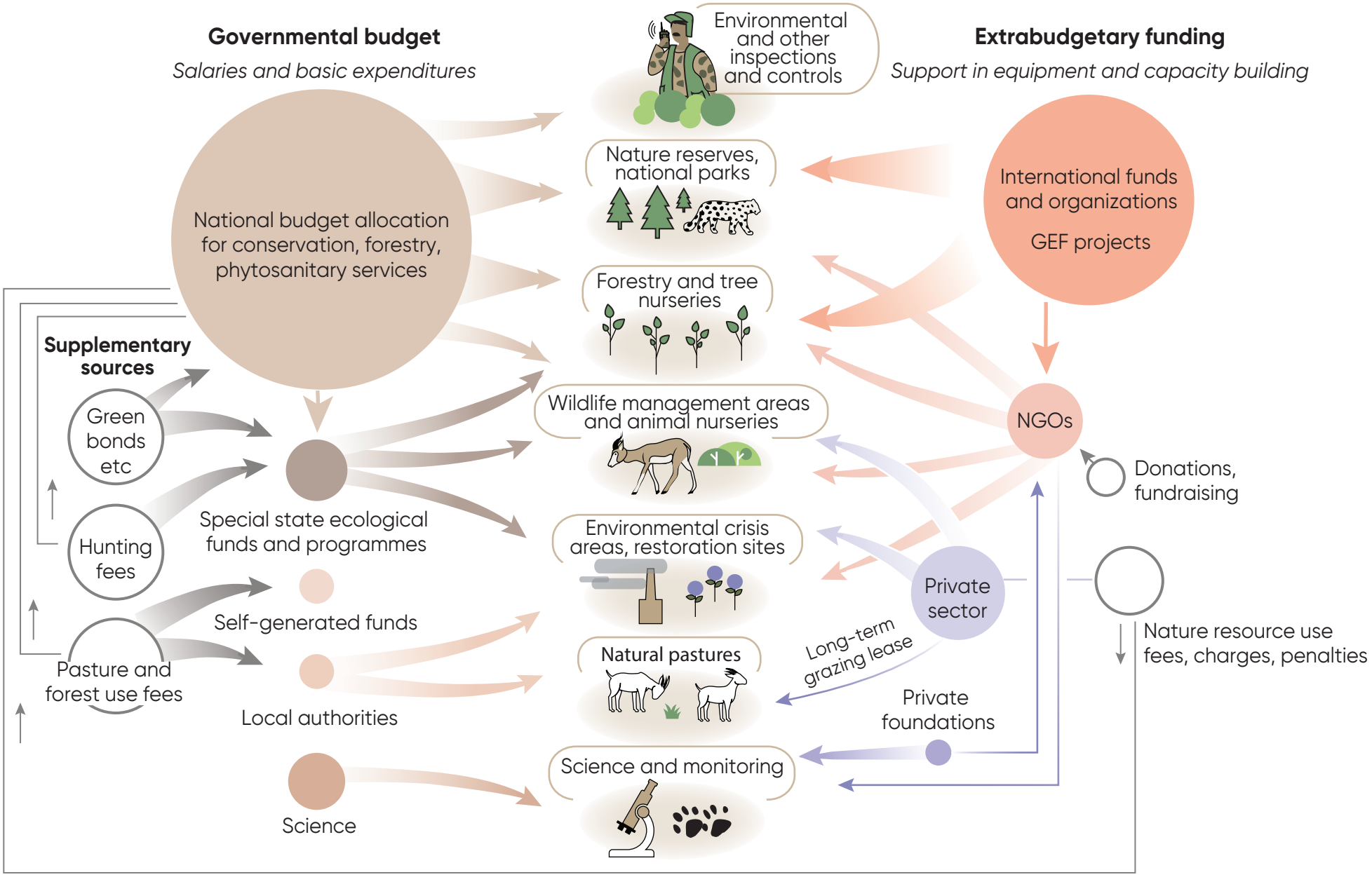
Private sector entities are responsible for the funding of environmental remediation and compensation for damage to sites for which they are responsible. In the past, mining sites were often abandoned without remediation, leaving local authorities or national emergency or environmental agencies to pay the bill or do the work [60]. For complex problems, international organisations have stepped in with their expertise and funding, such as the clean-up of mercury-contaminated sediments in the Nura River and persistent organic pollutants in Kazakhstan or the rehabilitation of uranium mining legacies in the Ferghana Valley — supported by the World Bank, the EBRD, the International Atomic Energy Agency (IAEA), RosAtom and others [48, 55]. Now the extractive industries seem more cautious.

Some wildlife sanctuaries and hunting concessions are also funded by the private sector, while much grazing land is leased on a long-term basis to local entrepreneurs or businesses. Fees, charges and penalties imposed on the private sector are collected by the national or local governments, and part of these funds can be used for biodiversity conservation or recovery.

Bilateral and multilateral providers of development finance as well as international organisations are the main source of ‘extrabudgetary’ (from the perspective of national authorities) funding, which is essential for new technologies, innovation, equipment support and capacity building for conservation in Central Asia. Many nature reserves and forest areas in the region benefited from such extrabudgetary financing. One of the key funding sources for conservation is the GEF, where states usually provide co-financing. In 2016–2021 (for 6 years), the official development assistance (ODA) funding allocated to biodiversity of Central Asia is estimated at $60 million (or $10 million per year), while the total for the environment at $200 million [87] .

[2] The Biodiversity Finance Initiative (BIOFIN) was launched by the United Nations Development Program (UNDP) in 2012. BIOFIN is a global partnership, currently available in 30 countries addressing the biodiversity finance challenge. In Central Asia, BIOFIN assessments have been conducted in Kyrgyzstan, Kazakhstan and Uzbekistan.

Schematic illustration of conservation funding flows in Central Asia



The size of the circles and arrows is a generalisation

While the main part of extrabudgetary funding provided via international organizations is supporting national authorities and projects, some funding is also going to the civil society organizations (CSOs). CSOs collaborate with or complement the activities of scientists, for example in the monitoring of migratory species, the introduction of new tools and technologies and "translation" of scientific or regulatory information for the general public [39, 40, 66].

For example, the Critical Ecosystems Partnership Fund (CEPF), focusing on the conservation of key biodiversity areas and priority species in the Mountains of Central Asia, allocated $7 million for 2020–2024 (5 years) [77], in addition to other funding sources for CSOs, such as philanthropy, foundations, fund-rising campaigns.

While estimates vary by methodology (including BIOFIN Kazakhstan studies for 2008–2014), years and extent of coverage, it is reasonable to imply that in Kazakhstan about 80–85% of biodiversity funding comes from the state, up to 5% are so-called "self-generated funds" *(usually income from hay-making and tourism)* and 15% from a combination of the private sector, civil society and international organisations [67].

Overall, BIOFIN studies in Kazakhstan demonstrate that state financing of biodiversity conservation constitutes 0.4–0.8% of governmental expenditures and makes less than 0.1% of the Gross Domestic Product (GDP). Biodiversity funding in Kazakhstan is estimated to be in the range of $75–100 million per year, while average funding per hectare of protected area has declined over the past 10 years, from $8/ha in 2012 to $2.5 recently [70].

Kazakhstan, with the support of the UNDP-GEF project, established in 2007 the Biodiversity Conservation Fund of Kazakhstan (FSBK.KZ), which currently acts both as a charity fund and as a CSO. The first extra-budgetary fund for biodiversity of Kazakhstan (Kazakh-Saudi Arabia Ecological Fund — KAZSAEF) was set up in 1994 in connection with falcon hunting and prey species conservation. In Uzbekistan, similar cooperation with the United Arab Emirates led to the creation of several wildlife rehabilitation centres and aviaries. These activities have been reported to improve the conservation of the red listed Houbara Bustard and its habitat [99].

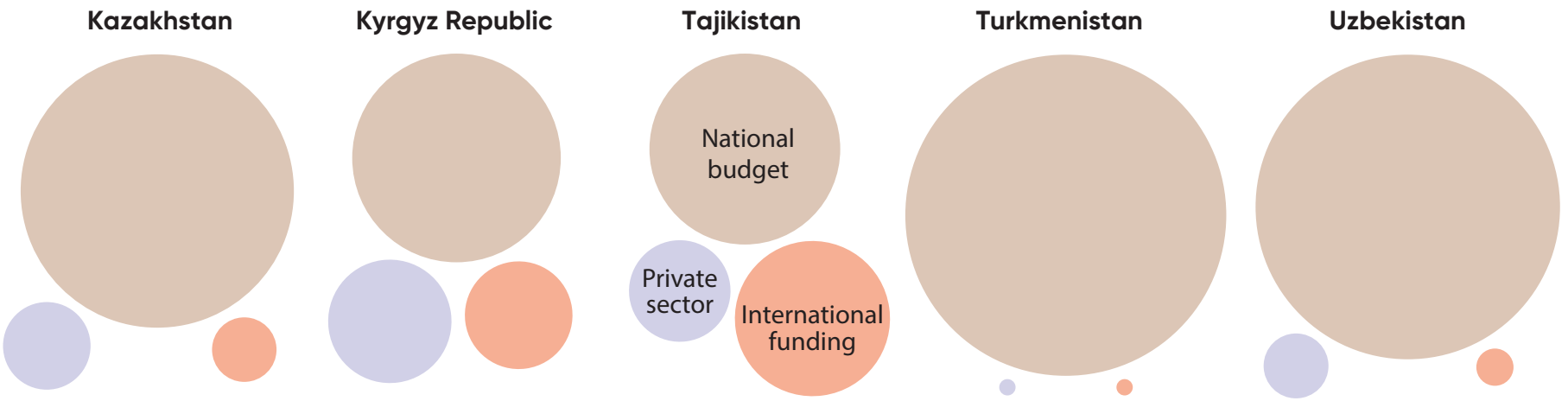
Estimates by the BIOFIN study in Kyrgyzstan show that environmental expenditures in the country make on average $20 million per year, including for biodiversity conservation $8 million/year or $40 million for 5 years (2011–2016) [68]. More than half of environmental spending (55%) comes from government budgets, about 25% from the private sector, and the rest from a combination of international funds and civil society organisations [68]. About 80% of all government funding goes to salaries, the rest to operating costs (fuel for survey vehicles, maintenance of infrastructure, etc), with little or no funding for capacity development. The National Academy of Sciences is the second largest recipient of government biodiversity funding after the Ministry of Natural Resources, Ecology and Technical Supervision (formerly the State Agency for the Environment and Forestry).

Similar to Kazakhstan, Kyrgyzstan's biodiversity expenditure represents 0.4–0.8% of the national budget and 0.1–0.2% of GDP [68]. The latest 2022 data from the National Statistical Committee (stat.kg) of the Kyrgyz Republic estimate state budget expenses for environmental protection at 1 188 million KGS ($14 million), including 275 million KGS ($3.5 million) for conservation and 485 million KGS ($5.7 million) for chemical protection of crops, veterinary survey and epizootic risk reduction [24].

Frequent changes of the Kyrgyz state institutions, funding allocations and new sources make it complex to estimate the current levels. Considering high indebtedness (mainly to China), Kyrgyzstan is exploring options for an "debt for nature" swap mechanism, including the possibility of establishing a multi-partner conservation trust fund [103]. Previously, mismanagement led to the closure of state-managed environmental funds in the country [107].

In Kyrgyzstan and Tajikistan, mountain countries with smaller economic sizes and budgetary capacities, the role of the international development finance and the private sector is higher than in the rest of Central Asia, but still smaller compared to governmental funding. Trophy hunting plays an important economic and conservation role at the local level in both countries, but this business is often not transparent.

Biodiversity funding sources and actors in Central Asia

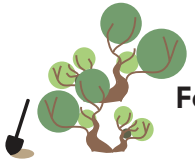


Estimated allocations, based on BIOFIN studies 2008-2018 for Kazakhstan and Kyrgyzstan, GEF and ODA projects overview, other sources

National budget, state actors | **Private sector, industries and businesses** | **International funding, public organizations**

Forest fire prevention

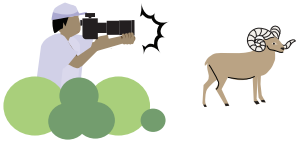
Protected areas management



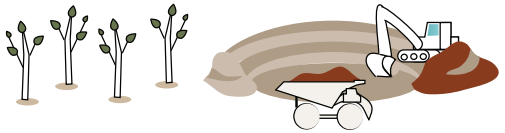
Forest plantations and inventory

Control of plants, animals, soils

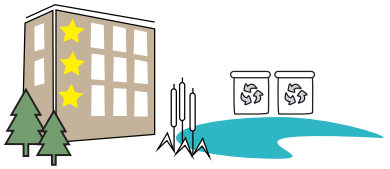
Science and eduction



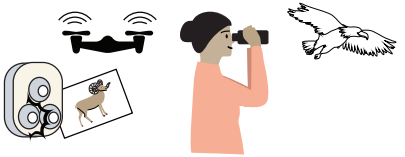
Species conservation, game reserves



Reforestation, ecosystem recovery



Water protection



Innovations, capacity building

Community-level forestry

Waste clean-up

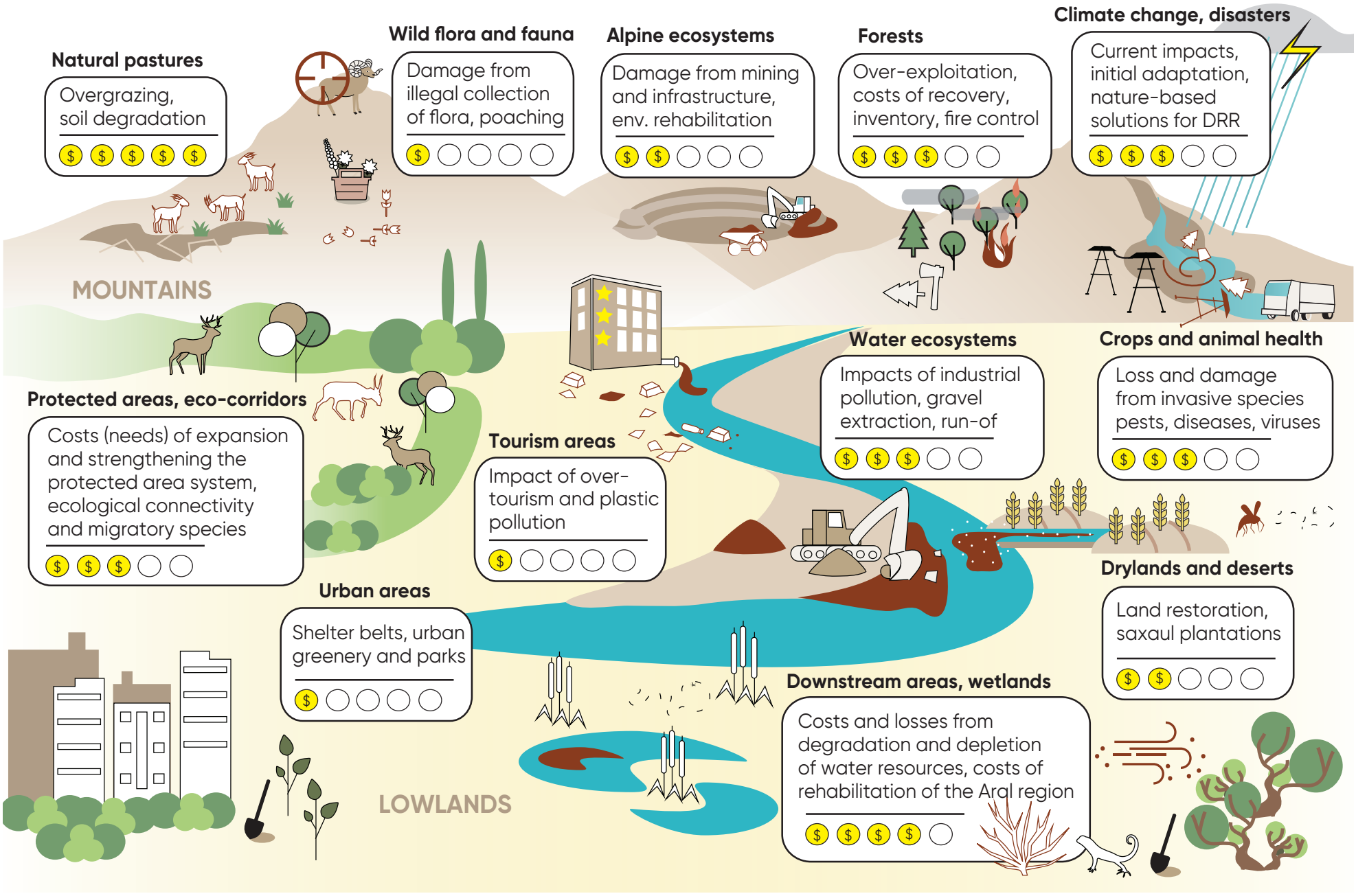
Due to its low GDP, Tajikistan is eligible for many grant mechanisms, so international grant funding for climate and biodiversity actions is high. Zoï and CAREC analysis indicate that over the past decade, Tajikistan has received about $450 million from international climate funds, including co-financing [34]. OECD ODA database indicates Tajikistan as the largest recipient of ODA for biodiversity ($95 million) in Central Asia in 2016–2021 [87]. The National Biodiversity Strategy of Tajikistan (2016) estimated the annual ecological and economic benefits from the use of biodiversity at $110 million per year [16]. Conservation expenditures in Tajikistan are likely to be similar to Kyrgyzstan in the range of $5–10 million per year, with significant portion of international funding. The level of financial needs could even be higher if broader definitions are considered, e.g. landscape restoration, climate adaptation and disaster risk reduction measures using nature-based solutions.

In Turkmenistan, most of the funding (95–99%) comes from the state, with sectoral ministries and state-owned enterprises typically sponsoring tree planting and other activities [author estimates]. OECD ODA database and analysis of the GEF biodiversity-related projects indicates $2–4 million over the past 5 years [87].

Uzbekistan is similar to Kazakhstan, with a high proportion of government funding, but a visible and growing contribution from the private sector and international development finance. The Multi-Partner Human Security Trust Fund for the Aral Sea Region (MPHSTF) under the UNDP management and public-private partnership projects have been established. Since 2019 Uzbekistan and donors have contributed $16 million to the MPHSTF [28].

National budget supports primarily state actors — protected area and forest management, forest fire prevention, tree planting campaigns in urban and desert areas, including the Aral Sea, control of plants, animals and soils, promotion of science and education, among others. The private sector is engaged in species conservation, game reserves, indirect ecosystem protection (wastewater treatment plants, waste recycling, etc). Often, international funding and NGOs catalyse innovations, build capacity and expertise, support community-level conservation and forestry, contribute to waste clean-up.

Estimated costs of nature degradation and restoration needs in Central Asia



Some scholars estimate the annual cost of rangeland degradation in Central Asia at $4.6 billion, and the cost of deforestation at $0.3 billion — 15 times less [6]. Indeed, rangelands are the most extensive type of agricultural land use and land cover in the region, and in most areas, they suffer from over-grazing and are highly exposed to desertification [6, 9–26, 35, 39, 40, 60].

Cost-Benefit Assessment (CBA) for the ROAM-prioritized areas for landscape restoration in the Naryn River basin of Kyrgyzstan indicates a cost-benefit ratio 2.4 for the investments: $2.4 is generated from the investment of $1 [56]. Blended financing is recommended to cover the up-front costs of $45 million to restore 50 000 ha, of which 40 000 ha pastures and 9 000 ha forests [56]. Riverbank protection offers the greatest benefits from avoided damage. In forest lands, afforestation with nut trees (walnut, pistachio) provides multiple benefits. Some types of forests — such as slow-growing juniper or spruce forests — are very difficult and costly to restore.

Uzbekistan is currently implementing an ambitious reforestation programme. Yashil Makon (Green Space) aims to increase the country's tree cover from the current 8% and plant 1.2 billion trees [101]. The annual cost of the programme, financed from the national budget, is 500 billion Uzbek sum ($40 million). Cities of Central Asia are paying attention to reforestation and the creation of green belts and parks, mainly funded from the state and local budgets.

While countries have established penalties for poaching of red listed species, harming and illegally collecting flora and fauna, many environmental crimes of such types are likely to be under-reported, and the costs of losing a snow leopard ($15 000–50 000 penalty [100]) or unique red-listed tulips are difficult to estimate.

Damage to biodiversity from extractive industries and infrastructure, and associated rehabilitation costs, can partly be inferred from the known costs of environmental remediation projects and compensation claims. Cost of remediating uranium mining legacy in mountainous areas of Central Asia exceeds $100 million, financed mainly from international sources [48, 97]. There are many extractive industry sites — both abandoned and active — that require either immediate risk reduction or adequate funds for post-mining care, likely exceeding $1 billion [author estimates].

The costs of climate change and disasters in Central Asia are high, with estimates ranging from $1 billion to $10 billion or more, depending on the climate projections considered [32, 46]. International donors and mechanisms support a range of climate actions, some of which include nature-based solutions.

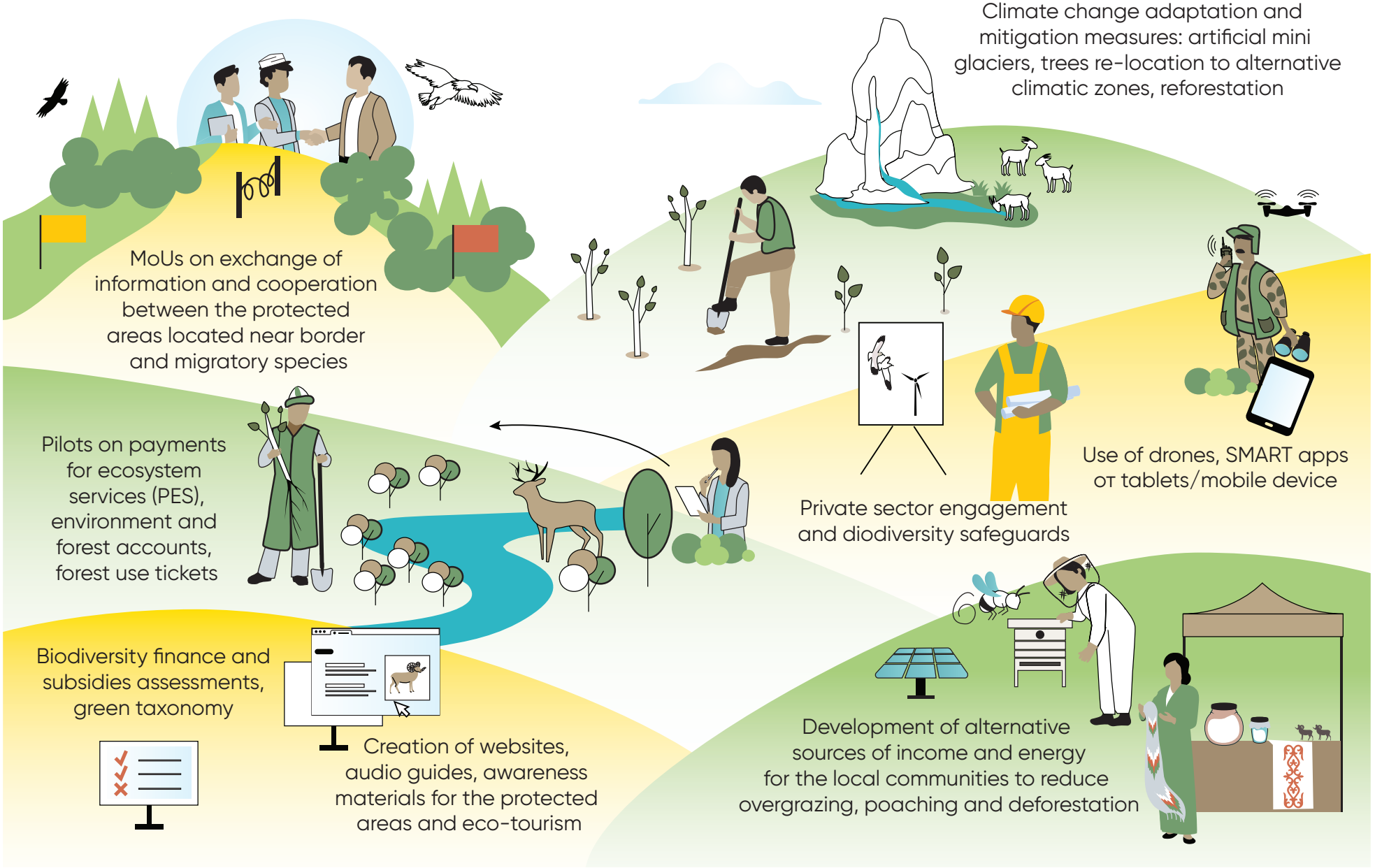
As countries revise their national biodiversity strategies in line with the Kunming-Montreal Global Biodiversity Framework, the expansion of protected areas and the creation of eco-corridors will require substantial increases in funding, as will the cost of biodiversity safeguards to reduce pressure on migratory species. Kazakhstan and Turkmenistan have a lower proportion of protected areas coverage than their neighbours and higher GDP. If they set high ambition to increase protected areas over the next 20–30 years, each hectare of additional protected area will cost them at least $2–4 per year [author estimate, based on BIOFIN baseline data]. By conservative estimate, Central Asian countries will need to increase their funding to the expanded and enhanced protected area network by an additional $100 million/year to meet the global biodiversity targets [authors estimate].

Biodiversity around tourism sites suffer from overtourism and plastic pollution, but the eco-tourism is growing. There is hope that public-private partnerships can reduce tourism pressures, bring economic benefits and compensate for biodiversity impacts.

Downstream areas and wetlands are among the most affected ecosystems and natural resources of Central Asia. The cost of ongoing projects under the Aral Sea Basin Programme (ASBP-4) for the period 2021–2030 is estimated at $0.5 billion, in addition to the previous phases of the programme [29–31]. Some of those projects, such as wetland monitoring and restoration, are directly relevant to biodiversity. There are significant needs in funding and technology to make irrigation systems more efficient and less polluting, improve urban wastewater treatment and restore wetlands.

Damage from diseases that circulate between wild nature and human systems in Central Asia, as well as from pests and invasive species, is significant — conservatively more than $100 million annually. A "One Health" approach, annual pest control, biosafety measures and veterinary services help reduce costs. This area of work is becoming more important after the COVID-19 pandemic and requires more technical and financial resources [106].

New approaches and agreements on biodiversity conservation in Central Asia



In addition to the traditional conservation approaches in Central Asia, such as protected areas and forest management, new approaches on biodiversity conservation are emerging. These include climate adaptation and mitigation measures, including artificial mini glaciers, plantation of trees in alternative geographic-climatic zones with consideration of vertical and other shifts in climate [53], reforestation campaigns to reduce sand and dust storms and improve urban microclimate.

MoUs on exchange of information and cooperation between the protected areas located near border and migratory species are emerging as useful tools for joint work and shared vision on conservation.

Biodiversity finance (BIOFIN) assessments in Kyrgyzstan, Kazakhstan and Uzbekistan help in understanding of biodiversity finance flows and gaps [67–71]. Introduction of the state financial planners and managers, including ministries of finance and economy, to green taxonomy principles, pave the way for more environmentally-oriented state budget [105].

Central Asian Regional Environmental Centre (CAREC) has implemented several pilots on payments for ecosystem services (PES) in different areas of Kyrgyzstan and found that biodiversity and carbon regulation services accounted for 80% of the total value. Recommendations included the need to adopt a unified ecosystem classification and standards for biodiversity monitoring, to introduce the term "ecosystem" and PES-related concepts, including biodiversity offsets, into relevant legislation and regulations on the environment and nature use. Training and education programmes are also needed to promote and explain the concept [41].

Another concept introduced in Kyrgyzstan by the World Bank through the Wealth Accounting and the Valuation of Ecosystem Services (WAVES) partnership is Natural Capital Accounting (NCA) — part of the System of Environmental-Economic Accounting (SEEA). It estimates the value of timber and non-timber forest products, provisioning and ecosystem services by forests at $156 million per year [57].

The Critical Ecosystem Partnership Fund (CEPF) has introduced a novel concept of Key Biodiversity Areas (KBAs) to the region in 2016–2017, when the Global Standard on KBAs has just been published. CEPF identified around 150 KBAs in its Ecosystem Profile [38], covering 150 000 km² in 7 countries — parts of the Mountains of Central Asia global biodiversity hotspot, including China's Tien Shan and Afghanistan's Wakhan Valley. Then, CEPF launched a grant programme (2020–2025) for civil society organisations, funding around 100 smaller and larger projects involving 70 partners [77].

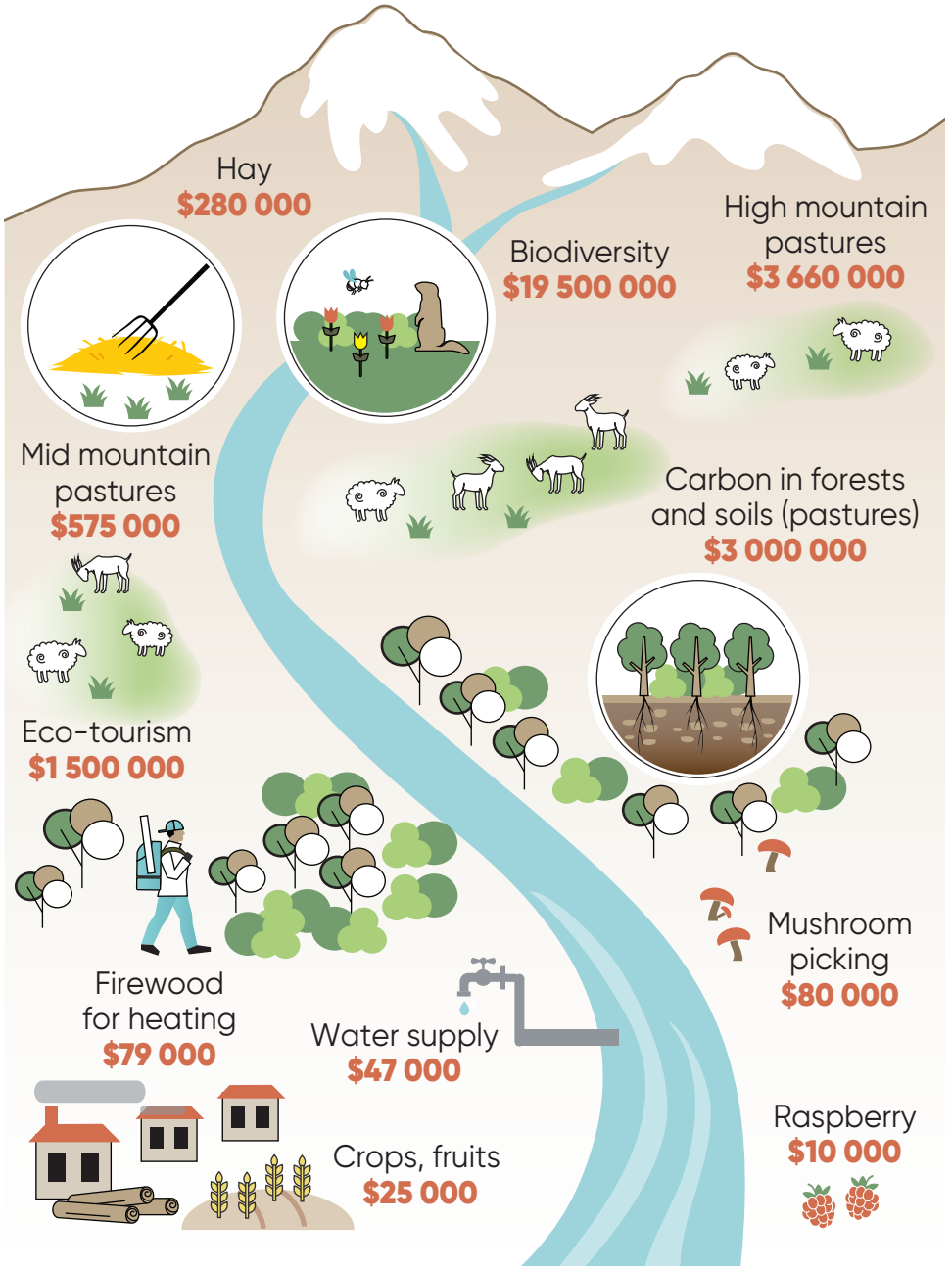
CEPF grantees have introduced many innovations in biodiversity monitoring, worked with protected areas to reduce pressures in and around them, contributed to eco-tourism development and public awareness. KBAs are now being used by companies and project financers in biodiversity safeguards and environmental impact assessments through the Integrated Biodiversity Assessment Tool (IBAT) and others. They are also integrated into Global Environment Facility (GEF) projects and could be used in the expansion of the protected areas and eco-corridors [62, 81, 83].

The use of drones, SMART (Spatial Monitoring and Reporting Tool) apps on tablets and mobile devices helped improve and modernize biodiversity monitoring. The private sector engagement in biodiversity safeguards complements the efforts of the state in prevention and reduction of the loss and damage to biodiversity, especially in infrastructure projects.

Creation of websites, audio guides, awareness materials for the protected areas and eco-tourism can act as enablers for protected areas to plan and receive environmentally conscious visitors and broaden options for self-income. While the development of alternative sources of income and energy nearby protected areas and forests help reduce overgrazing, poaching and deforestation pressures.

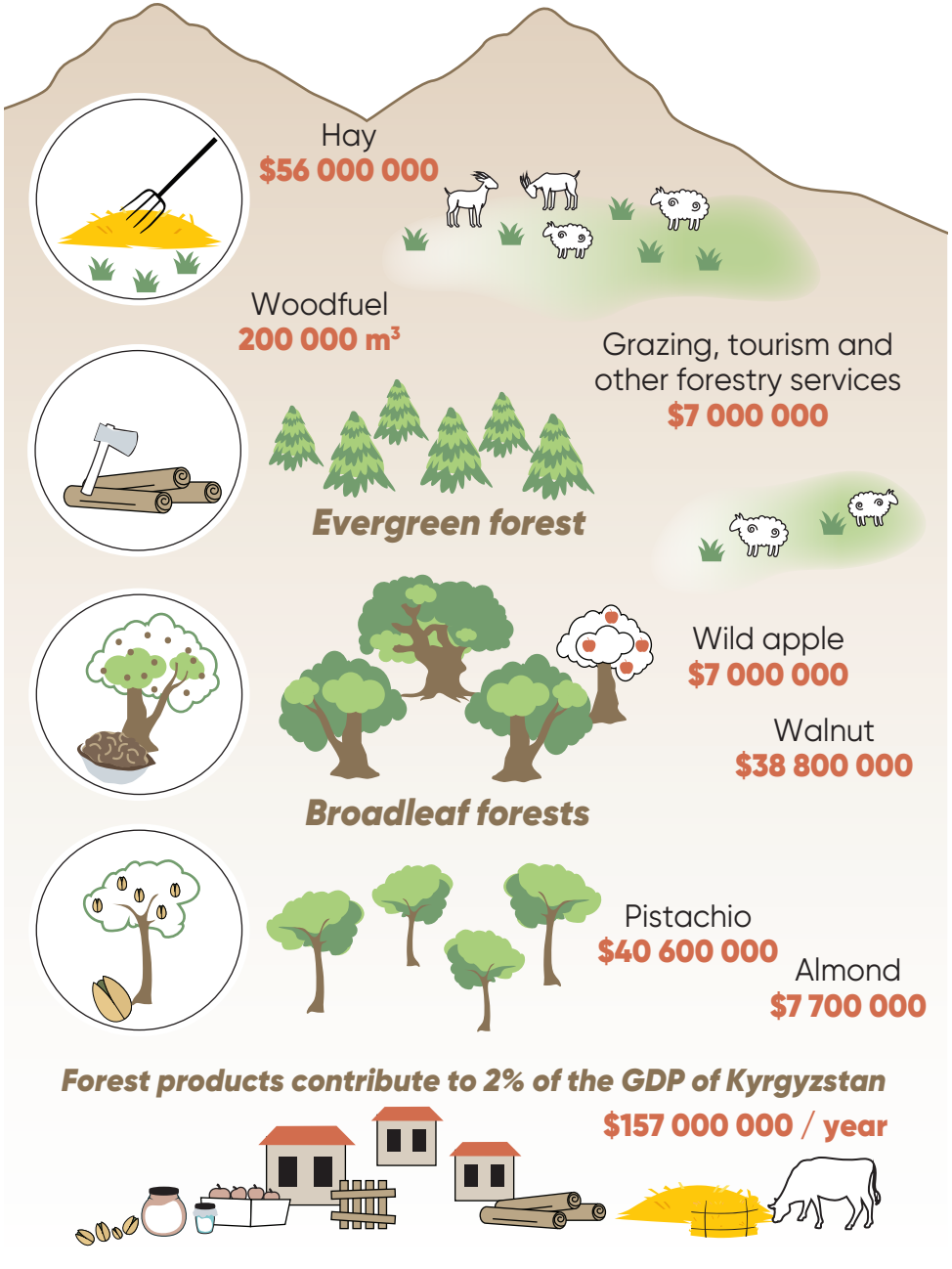
Estimated value of ecosystem services and forest products in Kyrgyzstan

Chon-Aksu river basin, northern Issyk-Kul region



Source: Assessment of Ecosystem Services in Kyrgyzstan, CAREC-FAO (2020)

Forests and forest fund of the Kyrgyz Republic



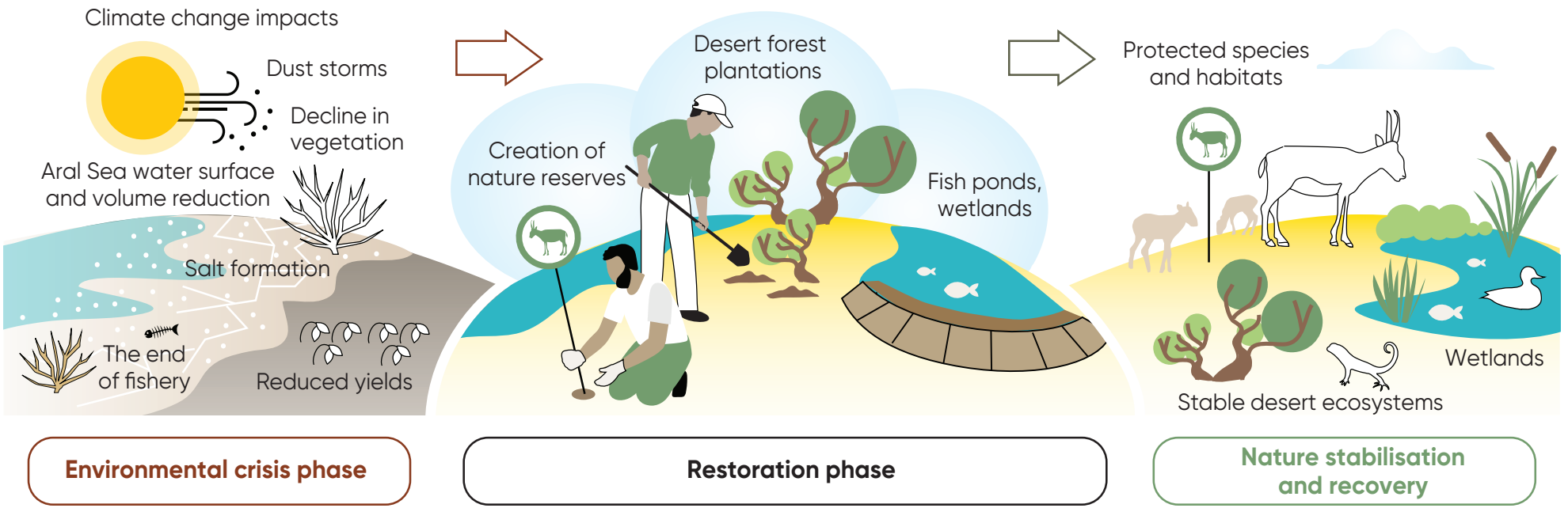
Source: Forest Accounts of the Kyrgyz Republic, the World Bank (2020)

The Issyk-Kul Lake clean up and recovery

Issyk-Kul Lake (In Kyrgyz it means "hot lake" — it never freezes.) lies in north-east Kyrgyzstan. Issyk-Kul, with a surface area of 6 236 km² is the region's largest mountain lake located at an altitude of 1 608 meters above sea level. It is on the Ramsar Convention's list of globally significant wetlands and forms the core of the Issyk-Kul biosphere territory. Once it was a flourishing fishing ground. In the last two decades, however, fisheries declined to negligible levels, and many fish, including endemic species, are threatened by over-fishing and introduced species. Poorly treated wastewater from urban and tourist areas around the lake pose pollution risk, while more than a million of tourism coming to the lake each summer create a lot of plastic waste.

Community-based and eco-friendly tourism is growing around the lake. The restoration of the lake's ecosystem depends in large part on the restocking of the lake with juvenile endemic fish from hatcheries and on tighter control of illegal fishing and invasives. Regular anti-poaching campaigns, fishing nets ban starting at customs, plastic waste clean-up and wild nature conservation stations and reserves help in Issyk-Kul Lake preservation. The dedicated fund for the development of the Issyk Kul Province financed from the Kumtor mine operations supports local socio-economic and some ecological projects. However, new roads, more tourists, increased construction and multi-seasonal destinations are creating new pressures. The conservation of the Issyk Kul Lake enclosed basin and ecosystem needs more attention and funding.

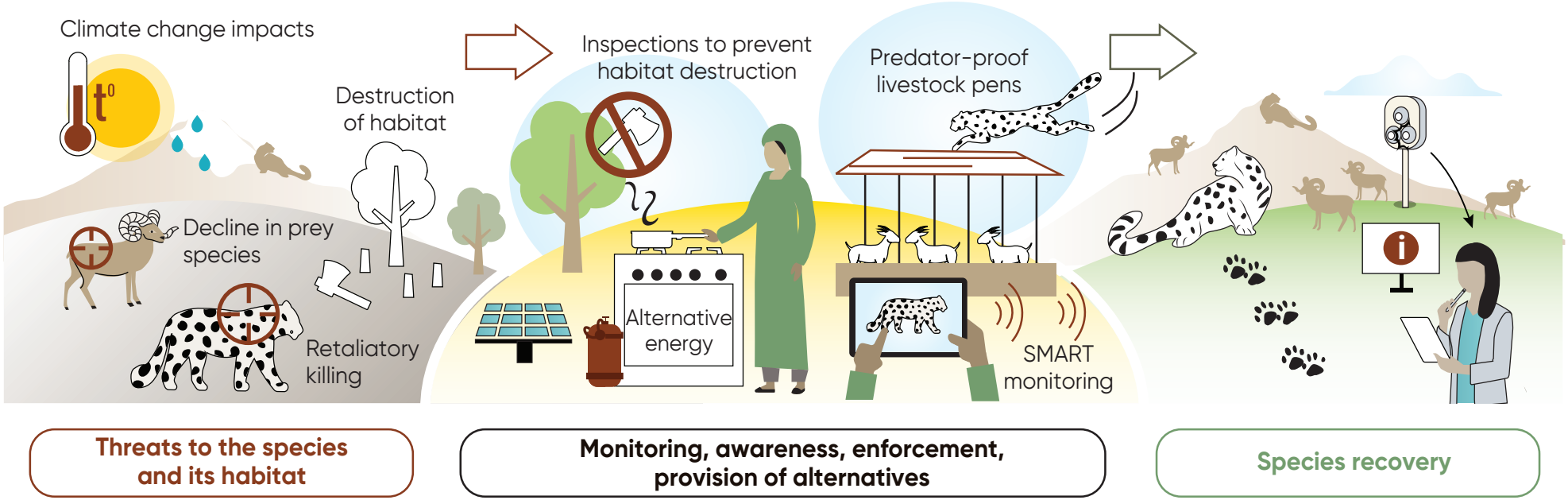
Rehabilitation of the Aral Sea region



The Aral Sea in Kazakhstan and Uzbekistan was suffering a severe environmental disaster. In the early 1960s, the waters of the Amu Darya and Syr Darya rivers that fed the Sea were diverted for irrigation, causing the gradual disappearance of the Sea. By the 1990s it became a globally known environmental crisis area. The exposed seabed has left salt, sand and dust blowing as far as 300 km. Water, land, ecosystems, crops and human health in the Aral Sea region all suffered.

Kazakhstan has managed to restore water levels and fisheries in the northern Aral Sea fed by Syr Darya with an extensive artificial dam, co-financed by the World Bank. In a wider southern part of the Aral Sea, fed by the Amu Darya, wetlands and nature reserves have been created to reduce the high pressure on local biodiversity. Annually conducted reforestation campaign, which already covers 1.5 million ha, is helping to reduce dust storms and stabilise the environment.

Protecting the snow leopard populations and habitats

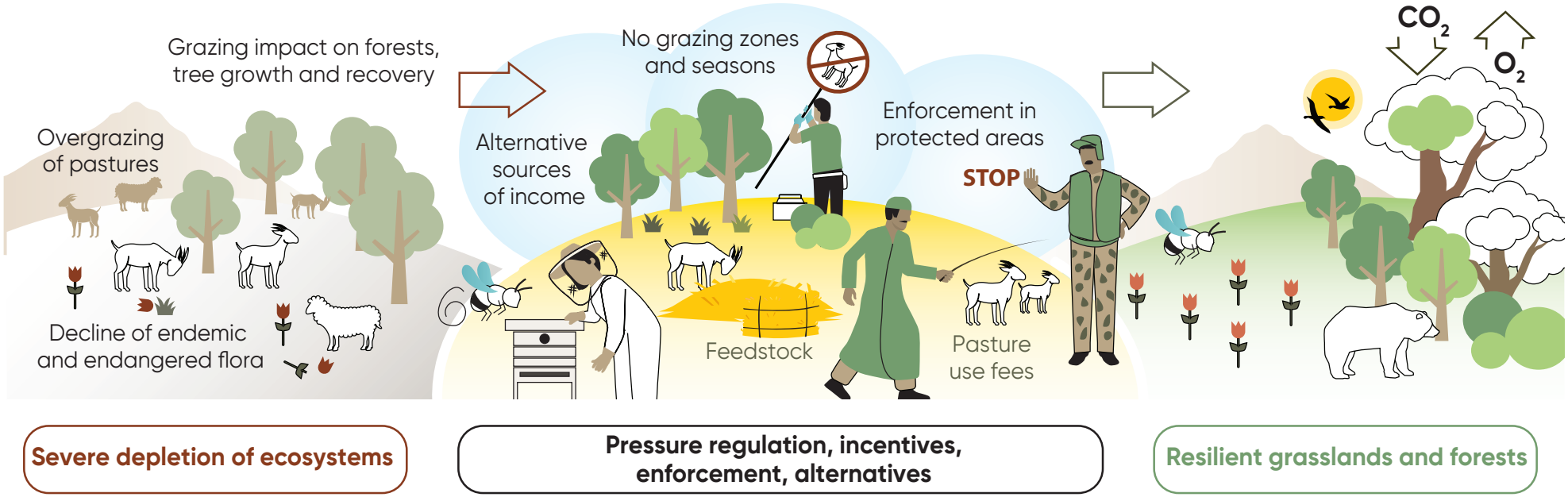


The population of the iconic and endangered snow leopard — symbol of the mountains of Central Asia - was dwindling due to habitat change, the impacts of climate change, the decline of prey species and retaliatory killings. Countries came together to form the Global Snow Leopard and Ecosystem Protection Programme.

These efforts were supported by the GEF, which provided funding for conservation projects at the country level that addressed a number of concerns by providing alternative energy for local people to reduce deforestation, predator-proof pens, and improved inspection and monitoring capacity, including SMART.

The combined efforts of governments, civil society organisations and international organisations led to the stabilisation and recovery of the snow leopard population. The private sector has also contributed its part, from mining companies to hunting concessions at high altitudes. The species' Red List status has been downgraded from Endangered (EN) to Vulnerable (VU) — a positive trend and a hopeful sign.

Reducing grazing pressure on forests and pastures



Central Asia forests and pastures face of overgrazing, which has an impact on forest growth and recovery and lead to a decline in endemic species. Currently it is the number one source of concern of ecologists and local communities. Growth in population and livestock are the key drivers. The cost of environmental degradation in Tajikistan — mainly land degradation of pastures and agricultural lands — was estimated by the Multi-Donor Partnership Program on Forests (PROFOR) at 8% of GDP or over $500 million per year [51].

Authorities and civil society organizations who work on the issue seek to provide local communities with alternative sources of income, establish no grazing areas or seasons, improve grazing regulations and maps, provide sufficient feedstocks to reduce pressure on natural pastures. Enforcement in protected areas is also essential since cattle often enter these areas, which also increases risk of zoonotic diseases. Finally, forest inventory and restoration are essential to reduce soil erosion and disaster risk in the mountains, and make landscapes resilient.

Mining legacies, unrehabilitated sites and unchecked sand and gravel extraction from river beds are a source of local grievances and community mistrust of environmental safety, and create funding gaps for biodiversity restoration — who can pay for this and how? Mining licensing is often detached from protected areas and environmental management. Local scale mining as well as sand and gravel extraction do not require a central level permitting, which lead to many negative developments and conflicting land uses.

Illegal waste dumping and waste mismanagement in general is another major environmental and financial problem. Waste management outside major cities is poorly organised. Thousands of illegal waste dumps are detected by the authorities every year, but few are dealt with. Cleaning up river channels from municipal waste and mountains and lakes from plastic waste, remains a challenge.

While zoonotic risks are managed by authorities and biosafety controls are generally in place, growing trade, livestock numbers and expansion of grazing into wilderness and protected areas are leading to increased wildlife-human conflicts and health risks. The cost of inadequate prevention and monitoring can be extremely high, as the COVID-19 pandemic shows.

Ecotourism has the potential to generate income for protected areas and improve public awareness of ecosystem services; the lack of viable ecotourism approaches in national parks is a gap that needs to be addressed. Kazakhstan, with its greater coverage and typology of protected areas and dynamic legislation, is the leader in eco- and nature-based tourism in Central Asia, with Kyrgyzstan and Uzbekistan catching up.

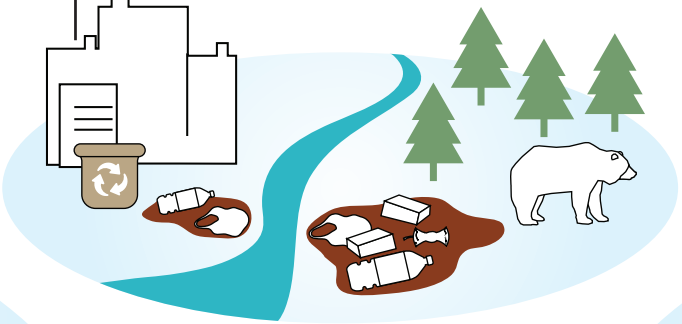
All Central Asian countries have (or used to have) and operate environmental fund(s), financed by fees, fines and other extrabudgetary sources. However, such funds are often inflexible and do not respond to species recovery needs or contribute to pressure reduction. Green taxonomy is only beginning to be explored in Kazakhstan and Uzbekistan, while harmful or traditional subsidies — be it water for irrigation, coal use for heating or import of agrochemicals is often a sensitive topic that authorities prefer not to touch.

Governments have a number of options to improve the allocation of biodiversity funding, catalyse additional financing, optimise existing funding and develop synergies and incentives with the private sector. They can systematically review budgets and subsidies and introduce a green taxonomy. Further elaboration of the “Debt for Nature” swap mechanism, as promoted by Kyrgyzstan, and the pursuit of nature-positive economic growth with the goal of climate and land degradation neutrality can help finance nature and avoid additional costs in the future.

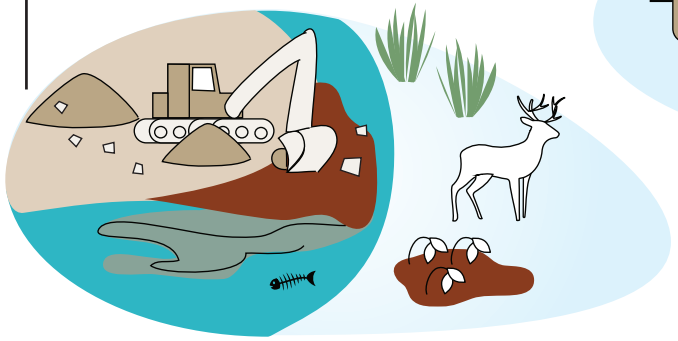
The “One village — One product” concept, initially and successfully tested in Kyrgyzstan with funding from Japan (JICA), has proven to be a financially viable and ecologically sound solution for local communities to develop and market their products. In addition, certified ecological and biological agriculture products from local producers and value chain support in pilot sites of Kyrgyzstan, Tajikistan and Kazakhstan has proven effective and could be replicated. Grants complimentary to investments, blended financing and green bonds are increasingly considered in the region. Finally, payment for ecosystem services (PES) and micro-loans with a strong conservation focus could be applied if enabling conditions are created, supported by a PR campaign.

Gaps and challenges in funding for biodiversity conservation

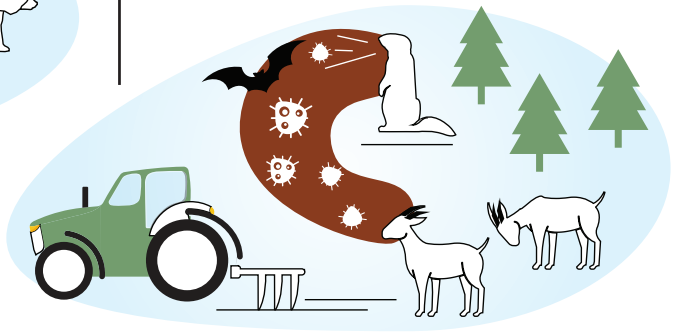
Illegal waste dumping, limited plastic recycling



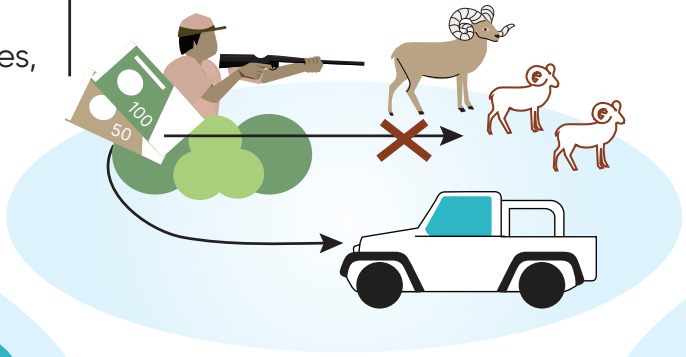
Mining legacies, non rehabilitated sites, unchecked gravel extraction



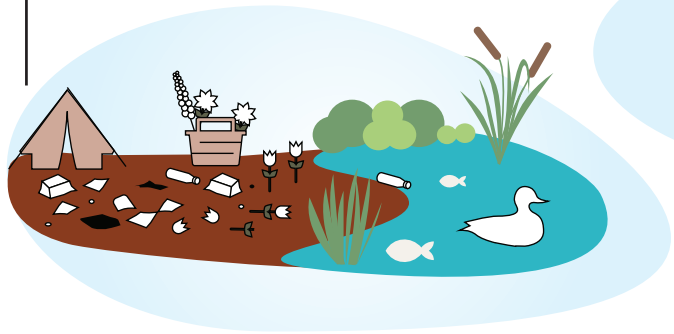
Zoonoses, risk of disease transmission due to reduction of wild nature and its increased accessibility



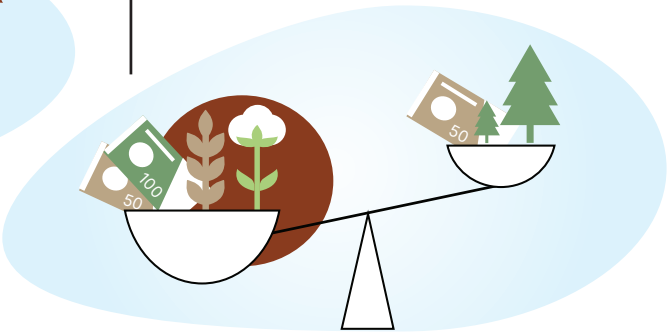
Limitations in state environmental funds, misuse of fees and fines, failure to target species recovery and pressure reduction



Lack of viable ecotourism approaches, limited benefits for managing and preserving nature in national parks

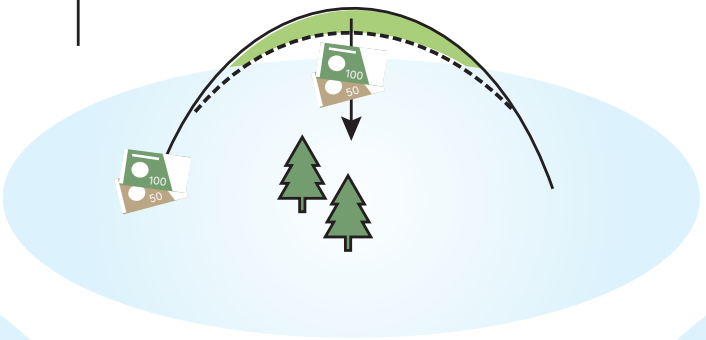


Lack of green budgeting taxonomy and tools: subsidies, taxes, allocations

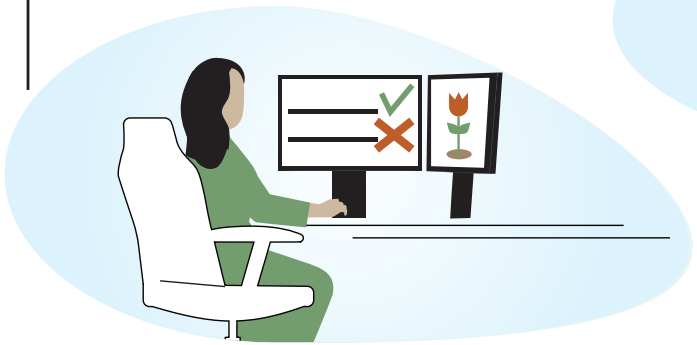


New and innovative approaches to biodiversity financing

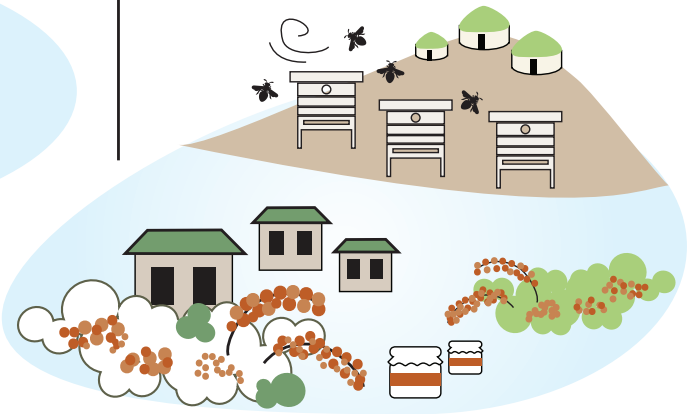
Debt for nature swop,
nature positive growth



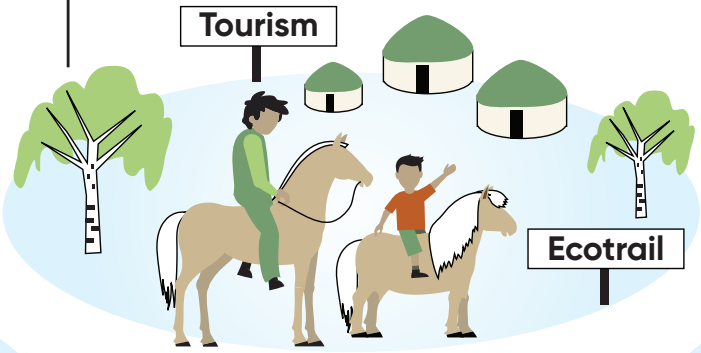
Budget and subsidies review,
introduction of green taxonomy



One village - one product mechanism

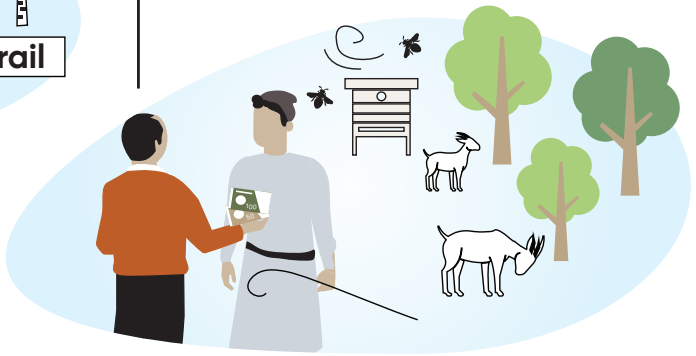


Grants complimentary to investments,
grant co-financing, blended financing



Certified eco and bio products
from local producers, value chain
support

Payment for ecosystem services,
green bonds and micro-loans



Menu of biodiversity finance options for Central Asia

- Pasture and grazing fees
- Hunting permits and concessions
- Taxes and fees in the wildlife management sector
- Eco-tourism incentives and fees
- Entrance fees to protected areas (national parks)
- Water tariffs that promote water efficiency and limit pollution
- Non-timber forest product harvesting licenses and fees
- Taxes, fees and royalties in the forestry sector
- Fisheries quotas and catch limits
- Sustainable products, supply chains, eco-labels, certification
- Natural capital accounting
- Forest and land use carbon finance
- Increase biodiversity component of climate finance projects
- Increase biodiversity-related development assistance
- Green microfinance
- Result based budgeting for protected areas and forestry reserves
- Disaster risk insurance and nature-based solutions for disaster risk reduction
- Debt-for-nature swap mechanism
- Conservation trusts
- Corporate and corporate foundations' donations
- Private philanthropy
- Biodiversity offsets
- Penalties for illegal hunting and collecting
- Penalties and compensation for environmental damage

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Bearded vulture *(Gypaetus barbatus)* lives and breeds on crags in mountains. Photo Relisa Granovskaya

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