Section 12

Thematic Reviews

12.1. Climate Change

State of the Climate Indicators in 2019

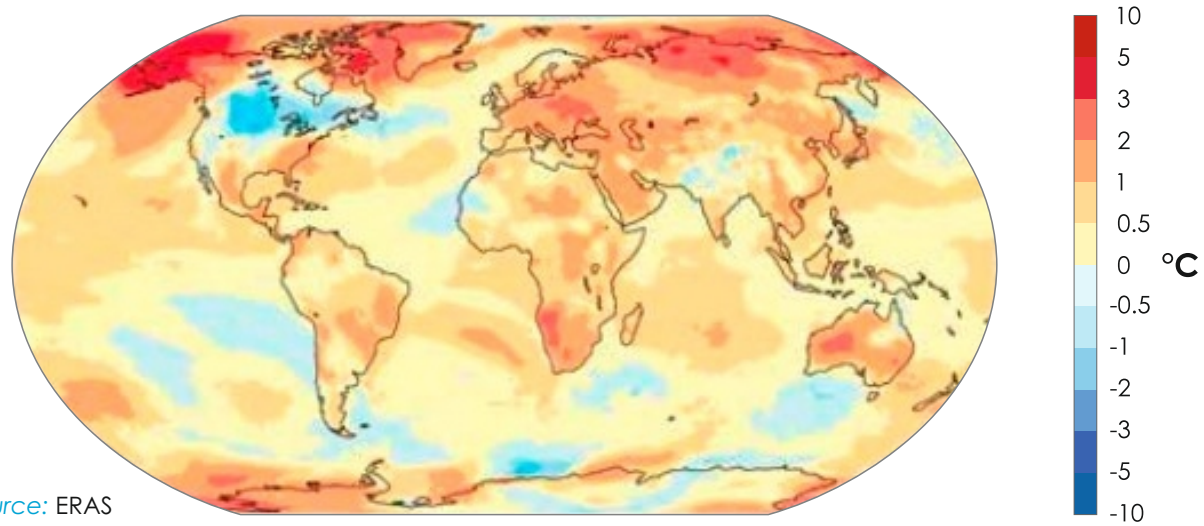
The WMO Statement on the State of the Global Climate in 2019 provides the following key climate indicators.

Temperature. 2019 was the second warmest year in the instrumental record. 2015-2019 are the five warmest years on record, and 2010-2019 – the warmest decade on record. Since the 1980s, each successive decade has been warmer than any preceding decade since 1850.

2019 ended with a global average temperature of 1.1°C above estimated pre-industrial levels, second only to the record set in 2016, when a very strong El Niño event contributed to an increased global mean temperature atop the overall warming trend.

Greenhouse gases. A preliminary projection of global fossil CO_2 emissions using data from the first three quarters of 2019 suggests that emissions would grow +0.6% in 2019 (with a range of –0.2% to +1.5%).

Surface-air temperature anomaly for 2019 with respect to the 1981-2010 average



Source: ERAS

Oceans. More than 90% of the excess energy accumulating in the climate system as a result of increased concentrations of greenhouse gases goes into the ocean. In 2019, ocean heat content down to a depth of 2 kilometers exceeded the previous record highs set in 2018. In 2019, the ocean experienced on average nearly 2 months of unusually warm temperatures. At least 84% of the ocean experienced at least one marine heatwave. In the decade 2009-2018, the ocean absorbed around 23% of annual CO_2 emissions, cushioning the impacts of climate change but increasing ocean acidity. Since the middle of the last century, there has been an estimated 1-2% decrease (77 billion-145 billion tons) in the global ocean oxygen inventory. Deoxygenation alongside ocean warming and acidification is now seen as a major threat to ocean ecosystems and the wellbeing of people that depend on them. Coral reefs are projected to decline to 10%-30% of former cover at 1.5 °C warming, and to less than 1% at 2 °C warming. In 2019, the global mean sea level reached its highest value on the record.

Ice coverage. The continued long-term decline of Arctic sea ice was confirmed in 2019. The September monthly average extent (usually the lowest of the year) was the third lowest on record with the daily minimum extent tied for second lowest.

The Greenland ice sheet has recorded nine of the 10 lowest surface mass balance years in the last 13 years. And 2019 was the 7th lowest on record. The loss in 2019 was 329 Gt, well above the average.

Glaciers. Preliminary results from the World Glacier Monitoring Service indicate that 2018/19 was the 32nd consecutive year of negative mass balance for selected reference glaciers. Eight out of the ten most negative mass balance years were recorded since 2010.

Climate-related Impacts

The report devotes an extensive section to weather and climate impacts on human health, food security, migration, ecosystems and marine life.

Health. In 2019, record-setting high temperatures from Australia, India, Japan, and Europe negatively affected health and well-being. In Japan, a major heat wave event resulted in over 100 deaths and an additional 18,000 hospitalizations. In France, over 20,000 emergency room were recorded for heat-related illnesses between June and mid-September and during two major summer heatwaves, there were a total of 1,462 excess deaths in the affected regions. In 2019, the world experienced a large increase in dengue cases.

Food Security. The food security situation deteriorated markedly in 2019 in some countries of the Greater Horn of Africa due to climate extremes, displacement, conflict and violence. By late 2019, about 22.2 million people, (6.7 million in Ethiopia, 3.1 million in Kenya, 2.1 million in Somalia, 4.5 million in South Sudan, 5.8 million in the Sudan) were estimated to be severely food insecure.

Displacement. More than 6.7 million new internal disaster displacements were recorded between January and June 2019, triggered by hydrometeorological events such as Cyclone Idai in Southeast Africa, Cyclone Fani in South Asia, Hurricane Dorian in the Caribbean, and flooding in Iran, the Philippines and Ethiopia. This number was forecast to reach close to 22 million in 2019, up from 17.2 million in 2018.

High impact events

Floods. More than 2,200 lives were reported to have been lost in various flooding episodes in India, Nepal, Bangladesh and Myanmar during the monsoon season, which started late but finished with rainfall totals above the long-term average. There was major flooding in northern Argentina, Uruguay and southern Brazil, with losses in Argentina and Uruguay estimated at US $2.5 billion. The Islamic Republic of Iran was badly affected by flooding in late March and early April.

Drought. Drought affected many parts of South-East Asia and Australia, which had its driest year on record, influenced by the strong positive phase of the Indian Ocean Dipole. Southern Africa, Central America and parts of South America received abnormally low precipitation amounts.

Heatwaves. Australia finished the year where it started: with extreme heat. The 2018-2019 summer was the hottest on record. Australia's seven hottest days on record, and nine of the 10 hottest, occurred in 2019.

Wildfires. It was an above-average fire year in several high-latitude regions, including Siberia (Russian Federation) and Alaska (US), with fire activity occurring in some parts of the Arctic where it was previously extremely rare.

The severe drought in Indonesia and neighboring countries led to the most significant fire season since 2015. The number of reported fires in Brazil's Amazonia region was only slightly above the 10-year average, but total fire activity in South America was the highest since 2010, with Bolivia and Venezuela among the countries with particularly active fire years.

Australia experienced an exceptionally prolonged and severe fire season in the later part of 2019 with repeated major outbreaks.

Tropical cyclones. Tropical cyclone activity globally in 2019 was above average. The Northern Hemisphere had 72 tropical cyclones. The 2018-19 Southern Hemisphere season was also above average, with 27 cyclones.

Tropical Cyclone Idai made landfall in Mozambique on 15 March as one of the strongest known on the east coast of Africa, resulting in many casualties and widespread devastation. Idai contributed to the complete destruction of close to 780,000 ha of crops in Malawi, Mozambique, and Zimbabwe, further undermining a precarious food security situation in the region.

One of the year's most intense tropical cyclones was Dorian, which made landfall with category 5 intensity in the Bahamas.

Typhoon Hagibis made landfall west of Tokyo on 12 October, causing severe flooding.

Source: WMO, https://library.wmo.int/doc_num.php?explnum_id=10211

Climate Change Agreement

As of February 2020, the Paris Agreement, which entered into force on 4 November 2016, has been ratified by 189 Parties[84]. On October 17, 2019, following the ratification by Kyrgyzstan, all Central Asian countries became parties to the Agreement.

The 25th Conference of the Parties (COP25) to the United Nations Framework Convention on Climate Change was held in December 2-13, 2019 in Madrid, Spain under the chairmanship of Chili. The final document "Chile Madrid Time for Action" calls for urgent and ambitious global climate action; stresses the urgency of enhanced ambition in order to ensure the highest possible mitigation and adaptation efforts by all Parties; re-emphasizes the urgent need to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. It also recalls the commitment made by developed country Parties, in the context of meaningful mitigation actions and transparency on implementation, to a goal of mobilizing jointly US $100 billion per year to address the needs of developing country Parties. COP26 is to be held from 9 to 20 November 2020 in the UK in partnership with Italy. Signatory countries will be asked to raise their commitments on climate action. It's the end of the first 5-year cycle under the "ratcheting up" mechanism, designed to boost emissions cuts over countries' initial pledges.

Reports on Climate Change

IPCC New Report

The Intergovernmental Panel on Climate Change (IPCC) presented its new report "Climate Change and Land: IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems" (August). This report shows that better land management can contribute to tackling climate change, but is not the only solution. Reducing greenhouse gas emissions from all sectors is essential if global warming is to be kept to well below 2°C, if not 1.5°C. Agriculture, forestry and other types of land use account for 23% of human greenhouse gas emissions. At the same time, natural land processes absorb carbon dioxide equivalent to almost a third of carbon dioxide emissions from fossil fuels and industry. Roughly 500 million people live in areas that experience desertification. Drylands and areas that experience desertification are also more vulnerable to climate change and extreme events including drought, heatwaves, and dust storms, with an increasing global population providing further pressure. The report sets out options to tackle land degradation, and prevent or adapt to further climate change. It also examines potential impacts from different levels of global warming.

Summary for Policymakers:
https://ipcc.ch/report/srccl

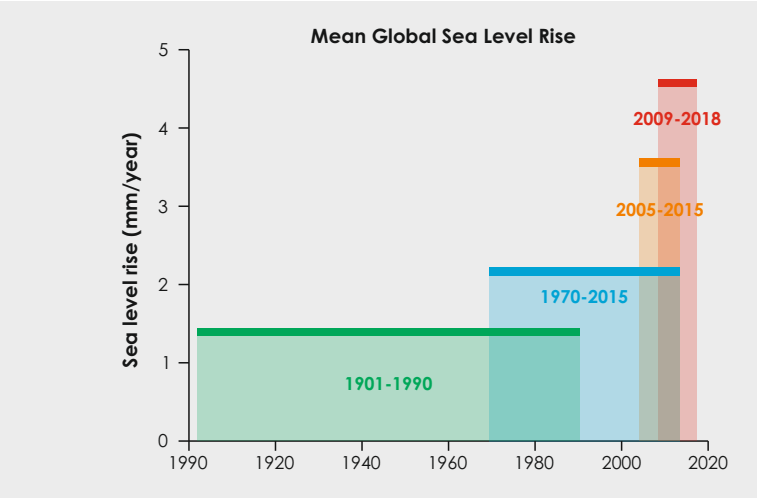
The 10 New Insights in Climate Science 2019 (full report) intends to take up the latest and most essential scientific findings published in an extraordinary year – the climate science year in review.

1. The world is not on track: (1) Greenhouse gas emissions continue to increase and the gap between current trends and agreed climate targets has widened; (2) Existing fossil-based infrastructure will, if operated during its full lifecycle, take the world above 1.5°C global warming; (3) The use of coal has slowed down and is declining in many countries but oil and natural gas is still growing; (4) Carbon Dioxide Reduction in some form is likely needed but shouldn't be viewed as a substitute for mitigation.

2. Climate change is faster and stronger than expected: (1) Observations show signs of continuing warming, while sea level rise is accelerating; (2) Greenland and parts of Antarctic ice sheets are showing signs of destabilizing much sooner than expected; (3) Further impacts on ice sheets and sea level rise have probably been underestimated in the latest IPCC Assessment Report; (4) High sea-level events that used to happen every 100 years could be experienced every year in megacities around the world by 2050.

3. Climate change leaves no mountain summit behind: (1) Glaciers are on average estimated

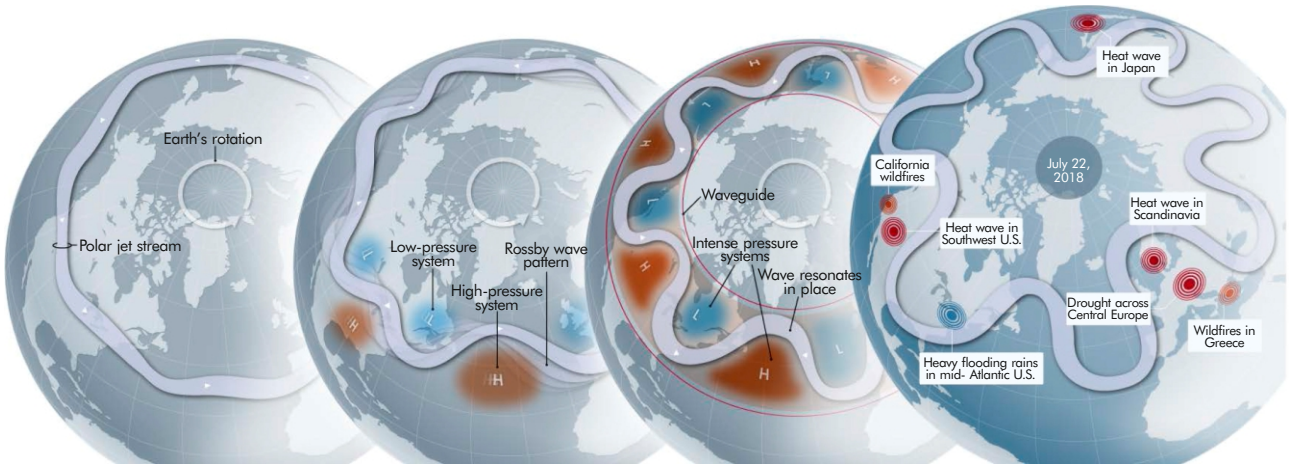
[84] https://www.climatechangenews.com/2020/08/13/countries-yet-ratify-paris-agreement/



to have lost about half a meter in thickness per year in 2006-2015; (2) Changes to glaciers, snow and ice in mountains will likely influence water availability for over a billion people downstream by mid-century; (3) Climate change irreversibly affects mountain ecosystems and their biodiversity, reducing the area of biodiversity hotspots and causing species to go extinct; (4) Adaptation to climate change is possible but its effectiveness is severely constrained if high emissions continue.

4. Forests are under threat, with global consequences: (1) The World's forests are a major CO_2 sink, absorbing about 30% of anthropogenic CO_2 emissions, forest fires driven by human land-use alternation has been reducing major CO_2 "sinks"; (2) Climate change globally amplifies wild forest fires; (3) "CO_2 fertilization" increases forest photosynthesis capacity, but is increasingly offset by temperature increases that cause tree mortality; (4) Fighting deforestation and encouraging reforestation, along with sustainable forest management and other natural climate solutions are important and cost-effective options for reduced net emissions.

5. Weather Extremes – a "new normal" in 2019: (1) Some extreme weather continues to become more likely and more severe; (2) Increasing number of extremes events but impacts are region-specific; (3) Europe has seen a particularly strong increase in heat extremes; (4) The duration of extreme weather events is anticipated to increase in a 2 °C world; (5) Synchronous extremes are risky in a globally-connected world; (6) Societies often don't have time to fully recover from extreme events before another one hits; (7) Ambitious mitigation can curb risks, but with 1.5 °C warming regionally dangerous levels will be reached.



6. Biodiversity – threatened guardian of Earth's resilience: (1) 14% of local land species could be lost already at 1-2 °C warming – more than one third in a business-as-usual scenario; (2) With 2 °C warming at least 99% of coral reefs will disappear due to ocean acidification, heatwaves and other pressures; (3) In freshwater, fish die-offs may double by 2050 due to extreme summer temperatures; (4) Natural Climate Solutions are an essential contribution to mitigation, but nowhere near enough to ensure climate stability.

7. Climate change threatens food security and the health of hundreds of millions: (1) Undernutrition will be the greatest health risk of climate change with declining agricultural productivity; (2) Increasing concentrations of carbon dioxide will reduce the nutritional quality of most cereal crops, affecting hundreds of millions of people; (3) Climate change and the rise in carbon dioxide concentrations are projected to result in a 20% reduction in the global availability of protein by 2050; (4) Global fish stocks are set to further decline with climate change, with an additional 10% of the global population facing micronutrient deficiencies as a result.

8. Most vulnerable and poor hardest hit by climate change: (1) Vulnerability to climate change impacts is high in countries and parts of the

population with low incomes; (2) Failure to address and adapt to climate change will have disastrous consequences for hundreds of millions of people and will hinder development in developing countries; (3) Failure to mitigate and adapt could push 100 million people below the poverty line by 2030; (4) Climate change 'hotspots' will push tens to hundreds of millions to migrate, mainly within borders by 2050.

9. Equity and equality pivotal to successful climate change mitigation and adaptation: (1) Success and failure of climate policies highlight importance of addressing social issues; (2) Social justice is an important factor for societal resilience in the face of climate change, vital for both local and global cooperation to facilitate mitigation and adaptation.

10. Time may have come for social tipping points on climate action: (1) An increasing number of citizens in various countries are seriously concerned about climate change; (2) History shows that 21-25% of a population need to change their behavior to enact significant system-level changes; (3) Deep and long-term transformations driven by a great diversity of actors are needed to meet the Paris Agreement and the SDGs; (4) Recent massive civil protests are getting close to the thresholds where we could expect "tipping" of some socio-economic systems.

Source:
https://futureearth.org/publications/science-insights/10-new-insights-in-climate-science-2019/

Adapt Now: A Global Call for Leadership on Climate Resilience. On 10 September, the Global Commission on Adaptation (GCA), headed by Ban Ki-moon along with Bill Gates and Kristalina Georgieva, launched its report on "Adapt Now: A Global Call for Leadership on Climate Resilience". It is becoming increasingly clear that in many parts of the world, our climate has already changed and we need to adapt with it. "We are the last generation that can change the course of climate change, and we are the first generation to live with the consequences," said Mr. Ban Ki-moon at the launch of the Report in Beijing. The Report provides for investing US $1.8 trillion globally from 2020 to 2030 in five areas of climate adaptation:

1. Early warning systems for storms, tsunamis and other extreme weather events to save lives as much as possible;

2. Climate-resilient infrastructure. All construction works (roads, houses, bridges, etc.) should comply with the highest quality standards;

3. Mangrove forest protection. Forest restoration and avoided deforestation should protect from landslides and storms, especially in coastal and mountainous areas;

4. Improved farming by switching to drought-resilient crops. Scientists also recommend abandoning those crops that have a negative impact on the soil;

5. Increased volume of fresh water. In addition to effectively saving available resources, developed countries need to launch projects to increase freshwater sources, including technical assistance for developing countries to support nature-based adaptation measures at scale.

Report available on:
https://cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf

UNEP issued the 10th edition of the UN Environment Emissions Gap Report (26 November). It assesses the latest scientific studies on current and estimated future greenhouse gas emissions and compares these with the emission levels permissible for the world to progress on a least-cost pathway to achieve the goals of the Paris Agreement. It includes the following key conclusions:

1. GHG emissions continue to rise, despite scientific warnings and political commitments.

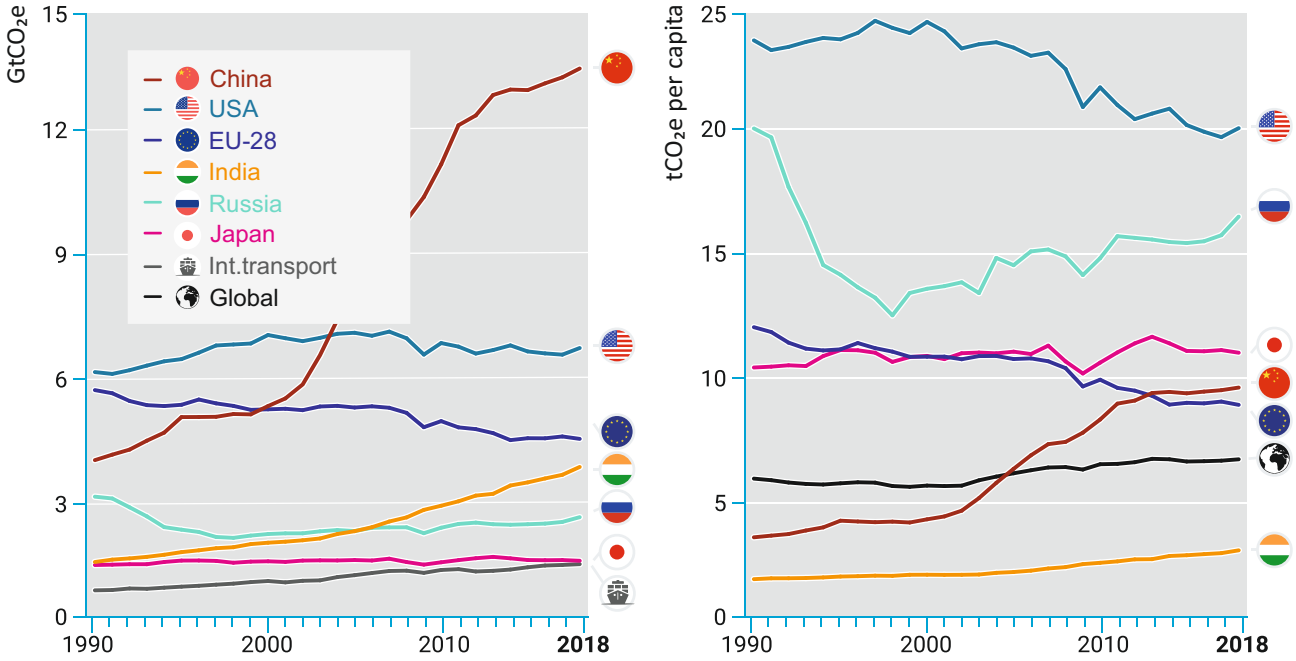
2. G20 members account for 78% of global GHG emissions. Collectively, they are on track to meet their limited 2020 Cancun Pledges, but several countries (Canada, Indonesia, Mexico, the Republic of Korea, South Africa, the United States of America) are currently not on track to meet 2030 NDC commitments, and for a further three (Argentina, Saudi Arabia and Turkey), it is not possible to say.

3. Although the number of countries announcing net zero GHG emission targets for 2050 is increasing, only a few countries have so far formally submitted long-term strategies to the UNFCCC.

4. The emissions gap is large. In 2030, annual emissions need to be 15 Gt CO_2e lower than current unconditional NDCs imply for the 2 °C goal, and 32 Gt CO_2e lower for the 1.5 °C goal.

5. Dramatic strengthening of the NDCs is needed in 2020. Countries must increase their NDC ambitions threefold to achieve the well below 2 °C goal and more than fivefold to achieve the 1.5 °C goal.

Top greenhouse gas emitters, excluding land-use change emissions due to lack of reliable country-level data, on an absolute basis (left) and per capita basis (right)



6. Enhanced action by G20 members will be essential for the global mitigation effort.

7. Decarbonizing the global economy will require fundamental structural changes, which should be designed to bring multiple co-benefits for humanity and planetary support systems.

8. Renewables and energy efficiency, in combination with electrification of end uses, are key to a successful energy transition and to driving down energy-related CO_2 emissions.

9. Demand-side material efficiency offers substantial GHG mitigation opportunities that are complementary to those obtained through an energy system transformation.

Executive Summary:
https://wedocs.unep.org/bitstream/handle/20.500.11822/30798/EGR19ESEN.pdf?sequence=13

The "Yearbook of Global Climate Action 2019" provides an assessment of actions by non-Party stakeholders, defined as regions and cities, businesses and civil society. The Yearbook highlights the launch of the Climate Ambition Alliance; highlights the importance of individual behavior in moving towards climate neutrality; recommends addressing five challenges: (1) viewing climate action holistically to realize increased cooperation across sectors and between actors; (2) removing barriers to implementation and moving away from subsidies and incentives for fossil fuel-related areas and towards incentives for renewable and sustainable solutions; (3) continuing and strengthening the Global Climate Action agenda within the post-2020 UNFCCC process; (4) aligning finance flows with finance needs; (5) strengthening the reporting of results from climate action to inspire others to act.

Major and Significant Events

UNSC held an open debate on the "Addressing the Impacts of Climate Related Disasters on International Peace and Security" (January 25) and an open Arria-formula meeting on the "Protection of the Environment during Armed Conflict" (December 9) (see "Security Council").

The UN Climate Action Summit 2019 was held in New York (September 23) and brought together participants from nearly 200 countries. Building on the momentum of the UN Climate Action Summit, GCA is launching a Year of Action. More than 75 governments, institutions, civil society organizations, and private sector actors join as partners to advance eight Action Tracks provided further. The findings will be presented in October 2020 at the Climate Adaptation Summit hosted by the Netherlands.

In 2019, a 16-year-old Swedish schoolgirl, Greta Tunberg, was the face of climate protests. On 20 August 2018, she sat on the steps of the Swedish

1. Food Security and Rural Livelihoods

Increase resilience to climate change for smallholder farmers in low-income countries

2. Finance

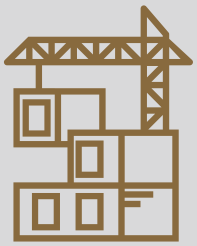
Scale up finance for adaptation and de-risk financial flows (to avoid future costs)

3. Cities

Improve resilience of cities to climate shocks and stresses

4. Infrastructure

Ensure new infrastructure investments are climate-proof



5. Natural Environment

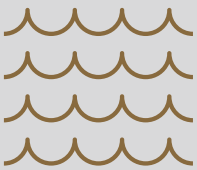
Increase the use of nature-based solutions to help communities adapt to climate change

6. Locally Led Action

Mobilize finance for small-scale adaptation needs

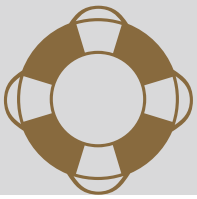
7. Water

Manage water better to boost the resilience of cities, agriculture, and nature



8. Disaster Risk Management

Preventing hazards from becoming disasters



parliament for the first time holding a sign that read "School Strike for Climate". This marked the beginning of the "Friday for the Future" movement of schoolchildren concerned about climate change. The idea is that on Fridays, instead of going to schools, schoolchildren take to the streets in an effort to draw attention of politicians and the public to the climate crisis. In the course of the year, Greta spoke at various international events, including the UN Climate Action Summit on September 23, 2019 in New York. Thunberg has received both strong support and strong criticism for her efforts from politicians and the press. She has received a number of awards and became TIME's 2019 Person of the Year.

Human rights and environmental NGOs believe that forming a climate friendly image of hydropower neglects negative environmental and social consequences of HPPs. A joint statement "The False Promises of Hydropower: How dams fail to deliver the Paris Climate Agreement and the UN Sustainable Development Goals" was launched by Civil Society Organizations on the 13th of May on occasion of the 2019 World Hydropower Congress in Paris, France. On 10 December, 276 civil society organizations from around the world called upon the Climate Bonds Initiative to abandon the certification of destructive hydropower projects as climate-friendly.

Global trends in climate change litigation in 2019. Climate change litigation continues to expand across jurisdictions as a tool to strengthen climate action, influence policy outcomes and corporate behavior. Climate change cases have been brought in at least 28 countries, with the top countries based on recorded cases are the United States (1,023 cases), followed by Australia (94), the United Kingdom (53), New Zealand (17), Canada (16), and Spain (13). Despite significant capacity constraints, the number of legal cases in low- and middle-income countries has been growing in quantity and importance. These include cases in Pakistan, India, the Philippines, Indonesia, South Africa, Colombia and Brazil. In the United States, an analysis of outcomes of 873 climate lawsuits between 1990 and 2016 found that, for those which have been decided and for which data is available, more outcomes favored 'hindering' positions compared with 'favorable' positions, with a ratio of about 1.4:1. Outside the United States, 43% of the 305 cases brought between 1994 and May 2019 have led to an outcome that is considered favorable to advancing climate change efforts, while 27% of cases analyzed have hindered climate change efforts – a ratio of about 1.6:1. The majority (aro-

und 80%) of cases focus on mitigation rather than adaptation. The majority of climate-related cases are brought by citizens, corporations and NGOs against governments but lawsuits are increasingly targeting the highest greenhouse-gas-emitting companies. Climate change-related claims are also being pursued by investors, activist shareholders, cities and states.

Source: Setzer J and Byrnes R (2019) Global trends in climate change litigation: 2019 snapshot. London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science. www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/07/GRI_Global-trends-in-climate-change-litigation-2019-snapshot-2.pdf

Databases on Climate Change Law and Litigation. Climate Change Laws of the World and Climate Change Litigation of the World are open-access databases collected by Grantham Research Institute on Climate Change and the Environment and Sabin Center for Climate Change Law. Climate Change Laws of the World Database covers national-level climate change legislation and policies. Climate Change Litigation of the World Database features climate litigation cases from over 30 countries.

The datasets are available on: https://climate-laws.org/

Juliana v. United States climate change lawsuit. The first case of its kind, Juliana v. the United States continued in 2019. 21 American teenagers aged from 9 to 20 filed a lawsuit against the US Government. Their complaint asserts that, through the government's affirmative actions that cause climate change, it has violated the youngest generation's constitutional rights to life, liberty, and property, as well as failed to protect essential public trust resources[85]. At a hearing in the case held by the Ninth Circuit Court of Appeals [a US federal court preceding the Supreme Court] on 4 June 2019, a three-judge panel remained skeptical of whether the court had any role to play in dealing with the landmark case. Their decision could have important implications on whether or not the courts can be used to pursue climate action in the US.

At the European level, the first litigation was initiated by a group of ten families from eight countries – France, Portugal, Romania, Italy, Germany, Sweden, and also Kenya and Fiji – in May 2018. The plaintiffs of the People's Climate Case took the European Parliament and the Council of the European Union to the European General Court (EGC) for having allowed too high a level of GHG emissions. According to a press release from the People's Climate Case in April 2019, the plaintiffs called on EU leaders to reduce GHG emissions by 55% by 2030 (compared to 1990), instead of the target of 40%. According to them, the currently set target is "inadequate with respect to the real need to prevent dangerous climate change and far from what is needed to protect our fundamental rights of life, health, occupation and property". While recognizing that climate change affects all Europeans in different ways, the EGC dismissed the case on procedural grounds in May 2019, saying the plaintiffs did not have a right to go to court to challenge the EU's 2030 climate target. The families who initiated the lawsuit plan to appeal to the European Court of Justice.

12.2. Sustainable Development Goals: Tracking the Progress

Global Sustainable Development Report-2019: Science for Achieving Sustainable Development

The report "The Future is Now: Science for Achieving Sustainable Development", is the first quadrennial Global Sustainable Development Report prepared by an independent group of scientists appointed by the UN Secretary-General. Despite considerable efforts, we are not on track to achieve the SDGs by 2030 (see picture below).

The currently available evidence shows that no country is on track in reconfiguring the relationship between people and nature in a sustainable manner. No country is yet convincingly able to meet a set of basic human needs at a globally sustainable level of resource use. This is illustrated in figure below, which shows the sta-

[85] https://www.ourchildrenstrust.org/juliana-v-us

Projected distance from reaching selected targets by 2030 (at current trends)

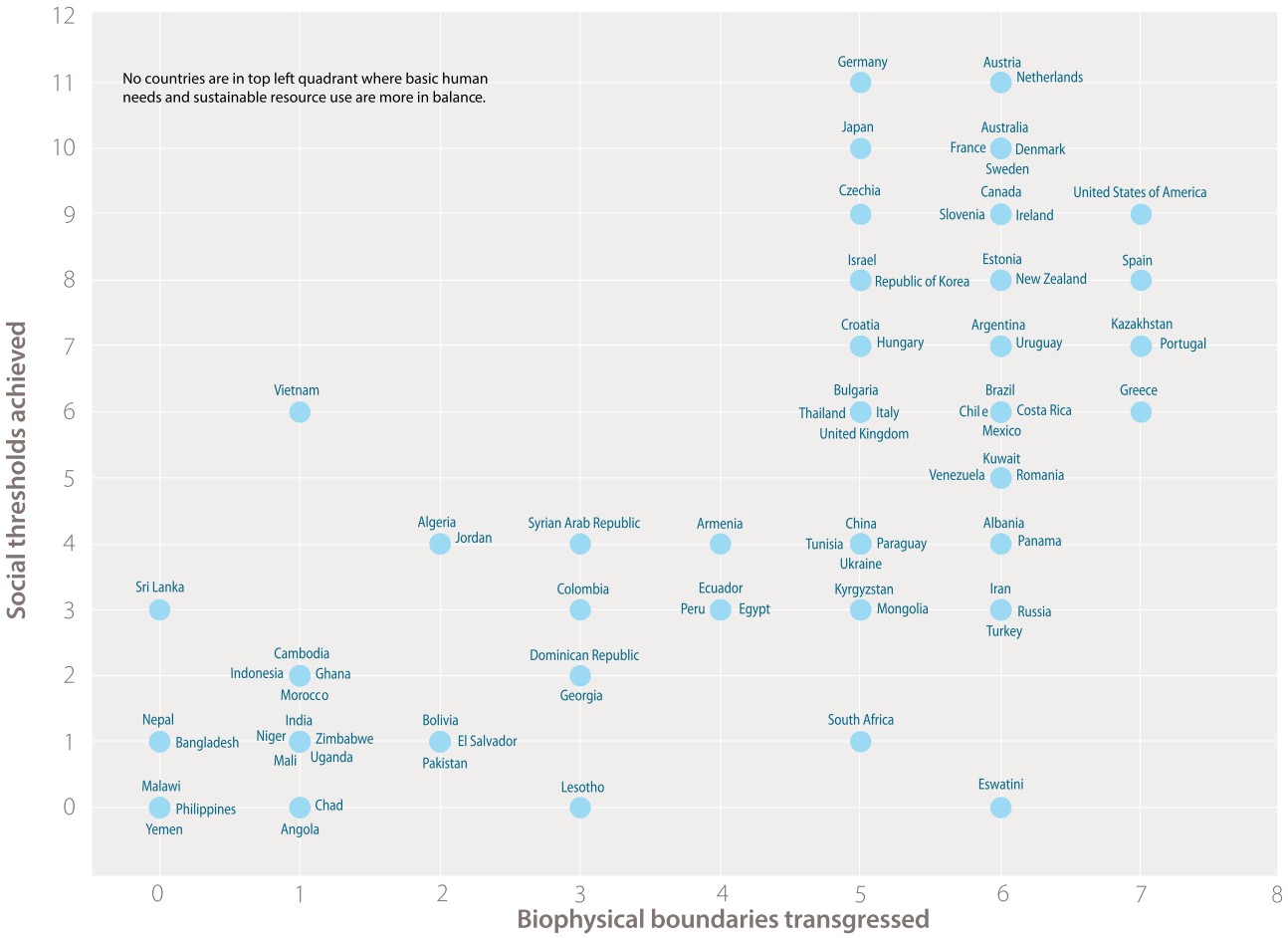
GOAL	WITHIN 5%	5–10%	>10%	NEGATIVE LONG-TERM TREND
Goal 1		1.1. Eradicating extreme poverty	1.3. Social protection for all	
Goal 2		2.1. Ending hunger (undernourishment)	2.2. Ending malnutrition (stunting) 2.5. Maintaining genetic diversity 2.a. Investment in agriculture	2.2. Ending malnutrition (overweight)
Goal 3	3.2. Under-5 mortality 3.2. Neonatal mortality		3.1. Maternal mortality 3.4. Premature deaths from non-communicable diseases	
Goal 4	4.1 Enrolment in primary education	4.6 Literacy among youth and adults	4.2. Early childhood development 4.1 Enrolment in secondary education 4.3 Enrolment in tertiary education	
Goal 5			5.5. Women political participation	
Goal 6		6.2. Access to safe sanitation (open defecation practices)	6.1. Access to safely managed drinking water 6.2. Access to safely managed sanitation services	
Goal 7		7.1. Access to electricity	7.2. Share of renewable energy 7.3. Energy intensity	
Goal 8			8.7. Use of child labour	
Goal 9		9.5. Enhancing scientific research (R&D expenditure)	9.5. Enhancing scientific research (number of researchers)	
Goal 10			10.c. Remittance costs	Inequality in income
Goal 11			11.1. Urban population living in slums	
Goal 12				12.2. Absolute material footprint, and DMC
Goal 13				Global GHG emissions relative to Paris targets
Goal 14				14.1. Continued deterioration of coastal waters 14.4. Overfishing
Goal 15				15.5. Biodiversity loss 15.7. Wildlife poaching and trafficking
Goal 16			16.9 Universal birth registration	

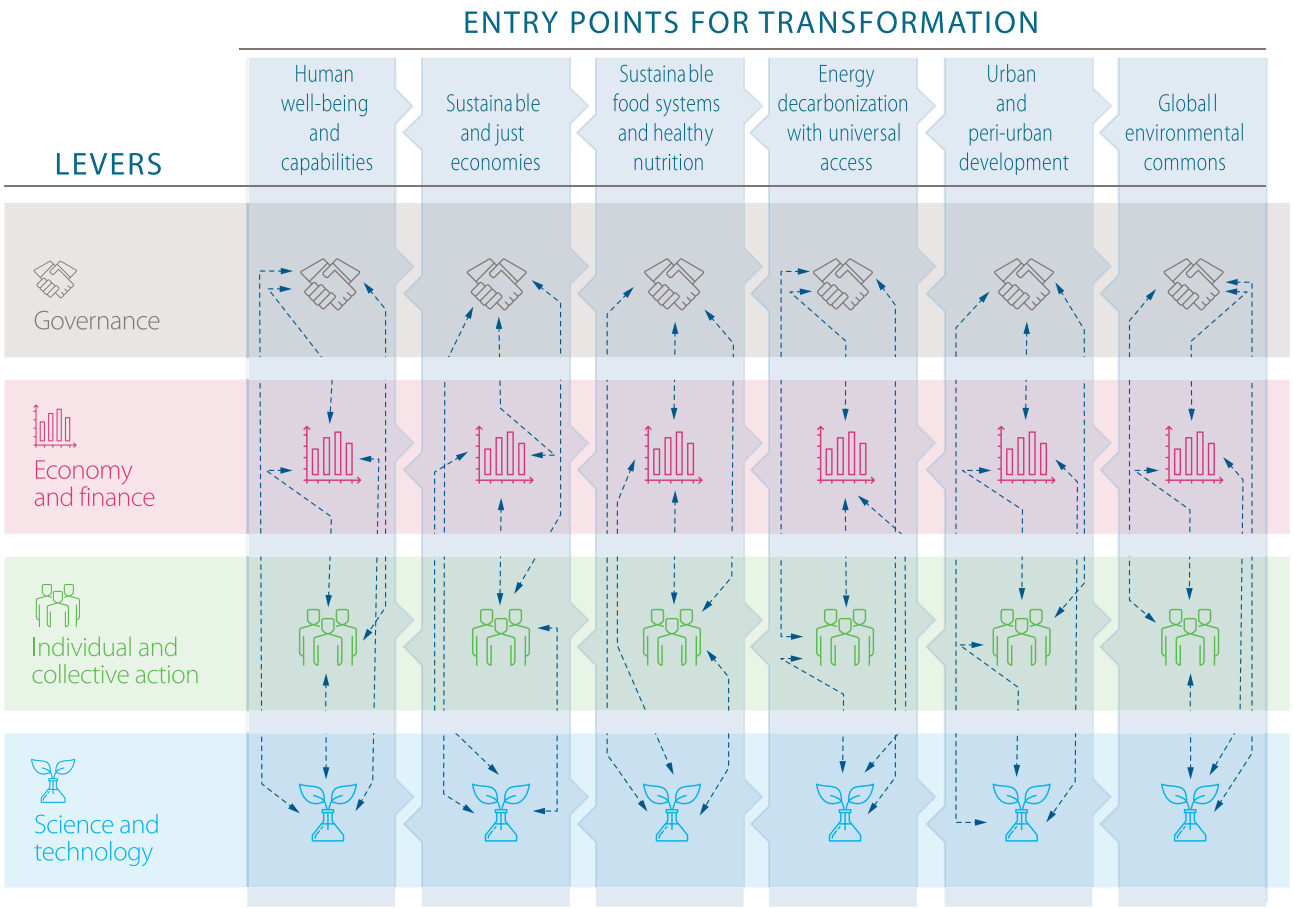
tus of countries according to the extent to which they are meeting social thresholds – that is, minimally acceptable levels of individual and social well-being along multiple dimensions – while transgressing biophysical boundaries – that is, multidimensional assessments of environmental impact. Most of the richer countries are clustered in the top right quadrant, while poorer countries are in the bottom left quadrant. The ideal position – based on national averages, but neglecting intra-country distributions – is the top left quadrant, where countries would be meeting or exceeding social thresholds without transgressing biophysical boundaries.

Science is our great ally in the efforts to achieve SDGs. The Global Sustainable Development Report 2019 presents an objective assessment of where we are falling short and what needs to be done. The present Report considers how science can best accelerate the achievement of SDGs. It argues in favor of a sustainability science as a new way for science to contribute directly to sustainable development.

The Report identifies **six entry points** that offer the most promise for achieving the desired transformations at the necessary scale and speed. These include: (1) Strengthening human

Striking the balance: no country is meeting basic human goals within biophysical boundaries





well-being and capabilities; (2) Shifting towards sustainable and just economies; (3) Building sustainable food systems and healthy nutrition patterns; (4) Achieving energy decarbonization and universal access to energy; (5) Promoting sustainable urban and peri-urban development; (6) Securing the global environmental commons. These are not entry points into individual or even clusters of Goals, but rather into the underlying systems.

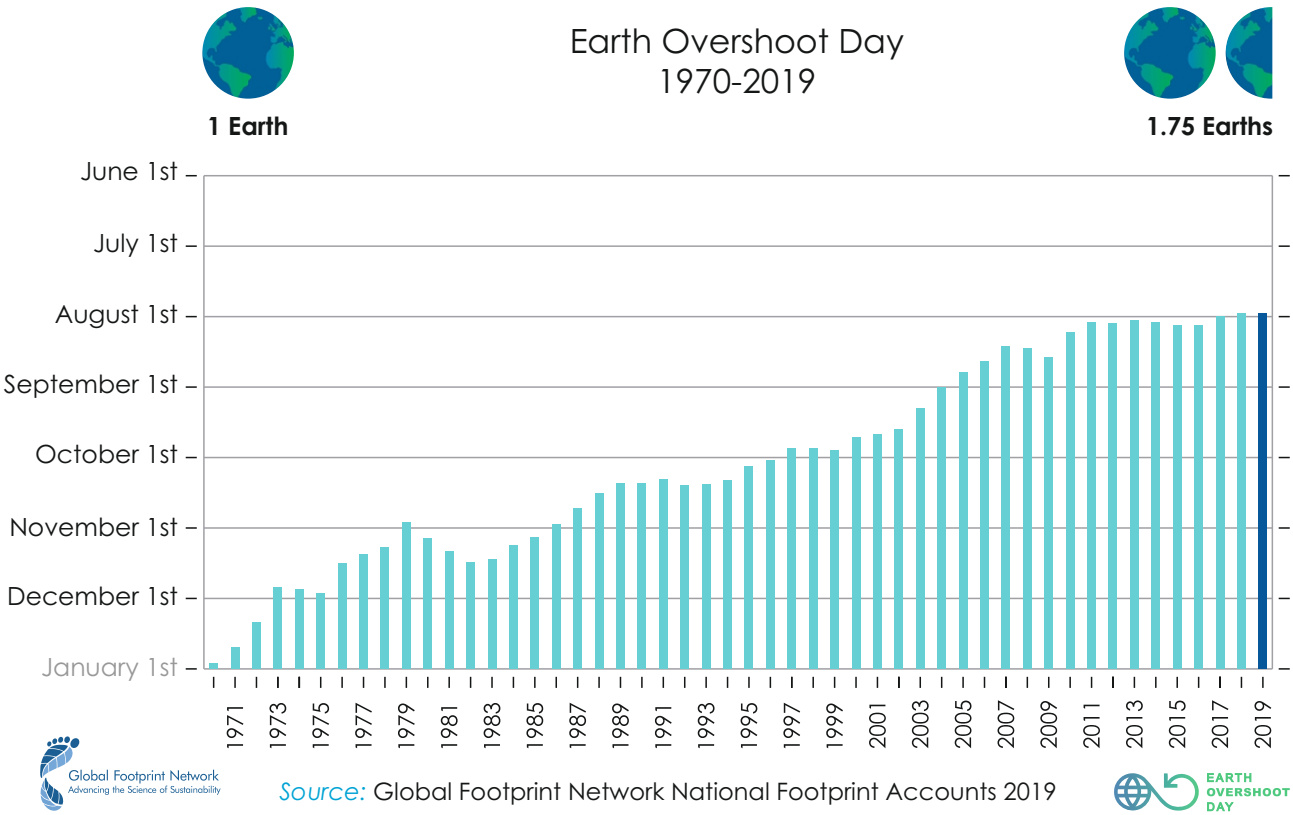
The Report also identifies **four levers**, which can be coherently deployed through each entry point to bring about the necessary transformations: (1) Governance; (2) Economy and finance; (3) Individual and collective action; (4) Science and technology. The levers are related to the means of implementation characterized in Goal 17, but are also different, in that they accommodate the multiple, complementary roles that individual actors and entities play in bringing about change. Each lever can contribute individually to systemic change; however, the present Report argues that it is only through their context-dependent combinations that it will be possible to bring about the transformations necessary for balancing across the dimensions of sustainable development and achieving the 2030 Agenda. As illustrated in the figure above, those combinations are integrative pathways to transformation, which underlie the call to action issued in the Report.

The Report proposes the strategies and call to action for each of the six entry points for transformations, and for improving the role of science in implementing the SDGs.

Source: Independent Group of Scientists appointed by the Secretary-General, Global Sustainable Development Report 2019: The Future is Now– Science for Achieving Sustainable Development, (UN, New York, 2019). https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf

12.3. Earth Overshoot Day 2019

In 2019, the Earth Overshoot Day fell on July 29. It is the date when humanity's annual demand on nature exceeds what Earth can regenerate over the entire year. It is coming earlier each year; for instance, it fell on the end of September in 2000. Humanity is currently using nature 1.75 times faster than our planet's ecosystems can regenerate. This is akin to using 1.75 Earths. This indicator also depends on levels of consumption in different countries. If all people consumed resources as intensively as in Qatar, the Earth overshoot day would come on February 11. Indonesia runs out of annual resources only by December 18. Russia has been living on "debt" since April 26.



Source: Global Footprint Network National Footprint Accounts 2019

The World Wildlife Fund stresses that to shift the Earth overshoot to December 31 it is needed firstly to reduce carbon dioxide emissions. Cutting CO_2 emissions by 50% would move the date to October. Reducing the consumption of animal proteins in half will move that day forward by another 15 days. If the ecological footprint remains the same, then by 2030 humanity will need two Earths, and the Earth overshoot day come at the end of June[86].

12.4. Biodiversity: Key trends and events in 2019

According to the 2019 Global Risks Report, decision makers consider biodiversity loss and ecosystem collapse one of the ten greatest risks facing society today (WEF, 2019). Although biodiversity loss is as great a challenge as climate change, it has received substantially less attention on the political agenda. From ground-breaking research to high-level political engagement, 2019 was an important year for biodiversity. In this review the key moments that made a difference in 2019 are summarized, as well as key findings of the most recent assessments on the state of biodiversity in the world are provided.

What is biodiversity?

Biological diversity (biodiversity) is "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (UN, 1992). In other words, biodiversity is the diversity within species, between species and of ecosystems.

"Biodiversity is the living fabric of our planet - the source of our present and our future. It is essential to helping us all adapt to the changes we face over the coming years" said Audrey Azoulay, UNESCO Director-General

Recent assessments: IPBES, OECD, FAO

In 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[87] approved the four regional assessments on biodiversity and ecosystem services covering the Americas, Asia and the Pacific, Africa, as well as Europe and Central Asia that were written by more than 550 leading experts, from over 100 countries. OECD prepared a report for the French the Group of Seven (G7) Presidency and the G7 Environment Ministers' Meeting of 5-6 May 2019 highlighting the economic and business case for the G7 and other countries to take urgent and ambitious action to halt and reverse global biodiversity loss. FAO launches the first-ever global report on the state of biodiversity that underpins our food systems. It is based on information provided specifically for this report by 91 countries, and the analysis of the latest global data.

This review draws on the findings of these reports.

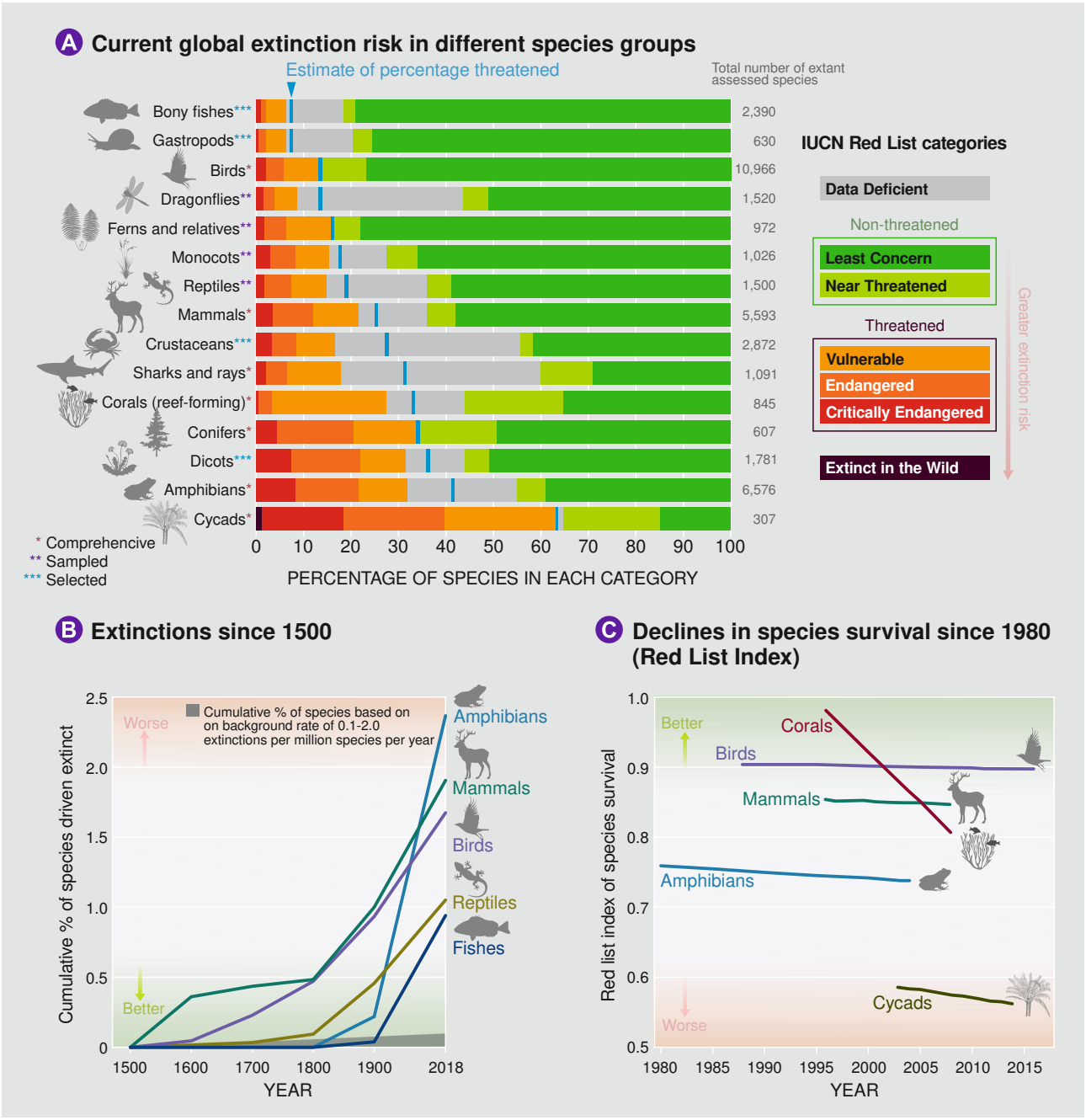
The key trends in the state of biodiversity

Loss of species and populations

The planet is facing its sixth mass extinction. The current rate of species extinction to be as much as 1,000 times higher than the natural background (pre-human) rate. In the 20th century alone, 477 vertebrates are known to have gone extinct. Between 0.01 and 0.1% of all species will become extinct each year. Species extinction not only represents an irreversible loss of global diversity and its inherent value, it has negative knock-on effects for ecosystem function, productivity and resilience.

The widespread and frequent loss of populations, and declines in the numbers of individual species within remaining populations, are also cause for concern. Species abundance, not just diversity, is an important determinant of ecosystem function and resilience, and the delivery of ecosystem services. The Living Planet Index, which synthesizes trends in vertebrate populations, shows that species have declined rapidly since 1970, with reductions of 40% for terrestrial species, 84% for freshwater species and 35% for marine species.

[86] https://www.overshootday.org/
[87] IPBES has 129 State Members and four UN Institutional Partners: UNESCO, UNEP, FAO and UNDP



Alteration of terrestrial, marine and other aquatic ecosystems across the globe

Global forest cover continues to decline as demand for food and land increases: global forest area is now approximately 68% of the estimated pre-industrial level. Planted forests have increased, but this increase has been offset by a decline in natural forests, which tend to be more biodiverse. Natural forest area declined by 10.6 million ha per year from 1990 to 2000, and by 6.5 million hectares per year from 2010 to 2015 (FAO, 2019). While the rate of forest loss has slowed globally since 2000, this is distributed unequally. Across much of the highly biodiverse tropics, 32 million ha of primary or recovering forest were lost between 2010 and 2015 (IPBES, 2019). Around 12 million ha of tropical forest worldwide were lost in 2018, with the Amazon alone losing approximately 17% of its size over the last 50 years. The Amazon now absorbs around a third less carbon than it did a decade ago, and a recent study found that increasing dryness in the atmosphere is leaving ecosystems even more vulnerable to fire and drought. The rapid disappearance of more of the rainforest could exacerbate the effects of climate change: if 20% to 25% of the forest is lost, scientists warn that the Amazon could pass a tipping point where a vicious cycle of drought, fire and canopy loss takes hold that cannot be stopped. The destruction of the forests of Borneo offer an ominous precedent: mass deforestation and fires there have led to the loss of over 50% of lowland tropical rainforest (WEF, 2020).

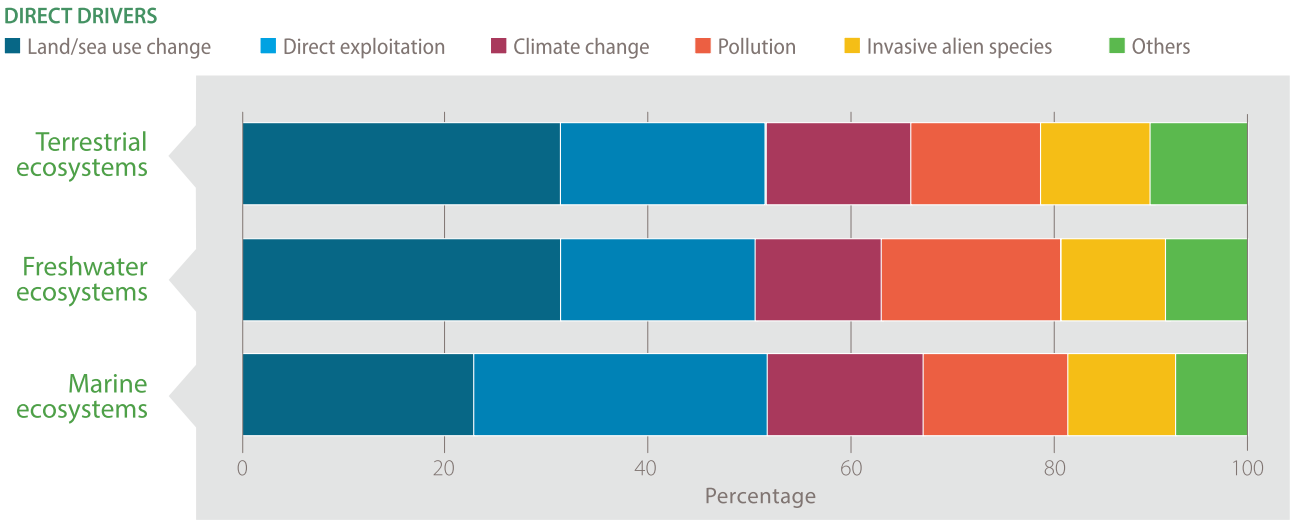
Inland waters and freshwater ecosystems show among the highest rates of decline. Only 13% of the wetland present in 1700 remained by 2000; recent losses have been even more rapid (0.8% per year from 1970 to 2008) (IPBES, 2019). Natural wetland coverage has declined by an estimated 35% over 1970-2015, and continues to decline at a rate of 0.85-1.6% per year (OECD, 2019).

The state of marine and coastal ecosystems has also deteriorated. Global mangrove area declined by about 20% between 1980 and 2005 and the coverage of seagrass declined by 29% over the last 100 years (OECD, 2019). Approximately half the live coral cover on coral reefs has been lost since the 1870s.

How does human activity endanger biodiversity?

The root cause of biodiversity loss is the growing demand for food, fuel, water and land, combined with inefficiencies and resource misallocation in global production and consumption systems. According to the Global IPBES assessment (2019), the global loss of biodiversity is mainly due to five causes related to human activities *(in decreasing order of impact)*: (1) changes in land and sea use, (2) direct exploitation of organisms, (3) climate change, (4) pollution, and (5) invasive alien species *(see picture)*.

Human activities drive biodiversity loss



For terrestrial and freshwater ecosystems, **land-use** change due to agricultural and industrial expansion and urbanization has had the largest relative negative impact on nature since 1970, leading to altered 75% of land surface and the loss of 85% of wetlands. The **world's oceans** has been also impacted, including through direct exploitation, land- and sea-based pollution, and land-/sea-use change, including coastal development for infrastructure and aquaculture.

Direct exploitation of organisms, in particular overexploitation, of animals, plants and other organisms, mainly via harvesting, logging, hunting and fishing is a second powerful threat to biodiversity. Unsustainable fishing remains a major threat to marine ecosystems, with over 30% of fish stocks fished at biologically unsustainable levels (FAO, 2018).

Climate change exacerbates biodiversity loss, negatively affecting species distribution, phenology, population dynamics, community structure and ecosystem function, which is, in turn, reduces nature's resilience to climate change.

Air, water and soil **pollution** have continued to increase in some areas, leading to habitats being destroyed by untreated urban and rural waste, pollutants from industrial, mining and agricultural activities, oil spills and toxic dumping.

Cumulative records of **invasive alien species** have increased by 40% since 1980, associated with increased trade and human population dynamics and trends. Nearly one fifth of the Earth's surface is at risk of plant and animal invasions.

Risks for societies, economics and environment

Biodiversity and ecosystem services underpin the global economy and human well-being. The dramatic loss of biodiversity brings serious

risks for societies, economies and the health of the people and the planet. Conserving, sustainably using and restoring biodiversity is vital to water and food security, human health, climate-change mitigation and adaptation, disaster risk reduction.

Water security. The mismanagement and degradation of ecosystems is a root cause of water insecurity. To tackle water insecurity, governments must tackle biodiversity loss. Healthy soils, forests, wetlands, grasslands and other ecosystems provide vital hydrological services that can reduce water-related disaster risks, and improve water availability and quality (OECD, 2019).

Food security. Many key components of biodiversity for food and agriculture at genetic, species and ecosystem levels are in decline: the proportion of livestock breeds at risk of extinction is increasing, and that, for some crops and in some areas, plant diversity in farmers' fields is decreasing and threats to diversity are increasing. Nearly a third of fish stocks are overfished and a third of freshwater fish species assessed are considered threatened. Also, increased carbon-dioxide levels are lowering the nutritional value of food staples such as rice and wheat (IPCC, 2019).

Biodiversity lays the foundation of economic development and human well-being

The economic value of biodiversity's contribution to food systems is considerable. Pollination from bees, birds, bats and other species contributes directly to between 5% and 8% of current global crop production. The annual market value of these crops is US $235-577 billion (IPBES, 2016). The dramatic decline in the abundance of bees and other insects, therefore, poses a considerable economic risk. The loss of all animal pollinators would result in an estimated annual net loss in welfare of US $160-191 billion globally to crop consumers, and an additional loss of US $207-497 billion to producers and consumers in other markets (IPBES, 2016; OECD, 2019). Biodiversity is also important to control pest outbreaks. Reducing pesticide use and supporting biological control would help reduce one of the primary threats to bee and other insect populations, while also increasing the efficiency of farms (OECD, 2019). Genetic and species diversity among crops and livestock (and the wild varieties of domestic species) is fundamental to ensuring agricultural systems' resilience to drought, flood, pests and disease. Maintaining genetic diversity allows farmers to adapt their livestock breeds and crop varieties to changing environmental conditions, reducing the vulnerability of farmers and the global food system (OECD, 2019).

Human health. Well-functioning ecosystems support human health by providing clean air and water, a source of medicines and opportunities for recreational and therapeutic activities. An estimated 50,000-70,000 plant species are harvested for traditional or modern medicine, and around 50% of modern drugs were developed from natural products. In many cases, natural molecules for medical treatments are so complex that scientists are not yet able to chemically synthesize them, so they must harvest and store plants and seeds (WEF, 2020). The most profitable drug to date, atorvastatin (Lipitor), is a cardiovascular drug descended directly from a microbial natural product that posted annual sales of US $12-14 billion between 2004 and 2014 (OECD, 2019). Biodiversity helps to regulate air quality, reducing morbidity and mortality. OECD estimates the welfare cost from premature deaths stemming from exposure to outdoor fine particles and ozone at US $5.3 trillion globally in 2017. Investing in nature can help reduce this burden. Trees and forests in the conterminous United States, for example, removed 17.4 million tons of air pollution in 2010, providing health benefits (avoidance of human mortality and incidences of acute respiratory symptoms) valued at US $6.8 billion (OECD, 2019). Finally, recreational and therapeutic activities such as access and proximity to nature and green spaces correlate with reductions in mortality, cardiovascular disease and depression, and increases in perceptions of well-being (WHO and SCBD, 2015). The physical and mental-health benefits of natural environments (e.g. parks, woodlands and beaches) in the UK are estimated at £ 2 billion a year (OECD, 2019).

Climate-change mitigation, adaptation and disaster risk reduction. Countries need to decrease greenhouse gas emissions by 25% by 2030 compared to 1990 levels to achieve the 2 °C target of the Paris Agreement and 55% to reach the 1.5 °C target. Conserving, sustainably managing and restoring ecosystems can provide a substantial and cost-effective contribution to these efforts. Plants and soils in terrestrial ecosystems absorb an estimated 9.5 billion tons of carbon dioxide equivalent every year. Griscom et al. (2017) estimate that conservation, restoration and improved management of forests, grasslands, wetlands and agricultural lands could deliver 23.8 Gt CO_2 of cumulative emission reductions by 2030 (OECD, 2019). In addition to mitigation, biodiversity and ecosystem services play an important role in adapting to the

impacts of climate change, and reducing the risk of climate-related and nonclimate-related disasters. For example, floodplains and wetlands can protect communities from floods. Coral reefs, seagrass and mangroves buffer coastlines from waves and storms. Forested slopes stabilize sediments, protecting people and their assets from landslides. Healthy, connected and biodiverse ecosystems also tend to be more resilient to the effects of climate change than degraded ecosystems.

Socio-economic case for action

According to OECD Assessment (2019), the socio-economic case for more ambitious biodiversity action is clear: **ecosystem services** delivered by biodiversity, such as crop pollination, water purification, flood protection and carbon sequestration, **are worth** an estimated **US $125-140 trillion per year**, i.e. more than one and a half times the size of global GDP. The nature provides the multiple benefits. For example, coral reefs contribute to the livelihoods of at least 500 million people worldwide, generate US $36 billion per year for the global tourism industry, and provide vital protection from coastal flooding and storm surges (WEF, 2019).

Between 1997 and 2011, the **world lost** an estimated **US $4-20 trillion per year in ecosystem services** owing to land-cover change and **US $6-11 trillion per year from land degradation**. Specifically, biodiversity loss can result in reduced crop yields and fish catches, increased economic losses from flooding and other disasters, and the loss of potential new sources of medicine (as the majority of drugs used for healthcare and disease prevention are derived from biodiversity).

The benefits derived from biodiversity and ecosystem services are considerable, but are systematically undervalued or unvalued in day-to-day decisions, market prices and economic accounting. Conventional accounting approaches and measures of economic performance (such as GDP) provide only a limited picture of an economy's health, and generally overlook the costs of ecosystem degradation.

Business and financial organizations can have adverse impacts on biodiversity and ecosystem services through their operations, supply chains and investment decisions, but their valuing of biodiversity impacts remains limited. These organizations depend on biodiversity and ecosystems services for the production of goods and services. Coral reefs alone generate US $36 billion per year for the global tourism industry. Biodiversity loss can have direct implications on business operations and value chains, e.g. by increasing input costs. The conservation, sustai-

Table 8. Biodiversity and ecosystem values

Scale	Good or service	Estimated annual value
Global	Seagrass nutrient cycling	US $1.9 trillion
Global	Annual market value of animal pollinated crops	US $235-577 billion
Global	First sale value of fisheries and aquaculture	US $362 billion
Global	Coral reef tourism	US $36 billion
Europe	Ecosystem services from Natura 2000 protected area network	€223-314 billion
Canada	Value of commercial landings from marine and freshwater fisheries	CA $3.4 billion
France	Recreational benefits of forest ecosystems	€8.5 billion
Germany	Direct and indirect income from recreational fishing	€6.4 billion
Italy	Habitat provision	€13.5 billion
Japan	Water purification from tidal flats and marshes	¥674 billion
UK	Physical and mental-health benefits of the natural environment	£2 billion
USA	Air purification from trees and forest (avoided morbidity and mortality)	US $6.8 billion

Source: OECD, 2019

nable use and restoration of biodiversity can provide significant business opportunities, including long-term viability of business models; cost savings and increases in operational efficiency; increased market shares; new business models, markets, products and services; and better relationships with stakeholders. The global organic food and beverage market, for instance, is expected to grow 16% per year, to reach US $327 billion by 2022. Business impacts on biodiversity can result in "responsible business conduct" risks to society and the environment. Biodiversity impacts and dependencies also create risks to business and financial organizations. Relevant risks to business and financial organizations include ecological risks, i.e. operational risks related to biodiversity impacts and resource dependency, scarcity and quality; liability risks, i.e. risk of legal suits; regulatory risks; reputational and market risks, linked to stakeholders' pressures or preferences changes; and financial risks.

There is a major gap in the finance needed to halt biodiversity loss. Partial data on domestic finance on biodiversity-relevant activities, as reported to the CBD Clearing House Mechanism by 40% of the Parties, was estimated at approximately US $49 billion in 2015. This estimate is based predominantly on finance from central (and in some cases, state and local) government budgets.

Legal and Policy Response

Biodiversity-related Conventions. Several international conventions focus on biodiversity issues: the Convention on Biological Diversity (1993), the Convention on Conservation of Migratory Species of Wild Animals, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1975), the International Treaty on Plant Genetic Resources for Food and Agriculture (2004), the Ramsar Convention on Wetlands (1971), the World Heritage Convention (1972) and the International Plant Protection Convention (1952). Biodiversity-related conventions work to implement actions at the national, regional and international level in order to reach shared goals of conservation and sustainable use. In meeting their objectives, the conventions have developed a number of complementary approaches (site, species, genetic resources and/or ecosystem-based) and operational tools (e.g., programs of work, trade permits and certificates, multilateral system for access and benefit-sharing, regional agreements, site listings, funds). Participation of the Central Asian countries in key biodiversity related conventions presented in Table 9.

The Convention on Biological Diversity (CBD), the key agreement on biodiversity issues, entered into force on 29 December 1993. It has three main objectives; (1) The conservation of biological diversity; (2) The sustainable use of the components of biological diversity; (3) The fair and equitable sharing of the benefits arising out of the utilization of genetic resources. The Conference of the Parties (COP) has established seven thematic programs of work which correspond to some of the major biomes on the planet: Agricultural Biodiversity; Dry and Sub-humid Lands Biodiversity; Forest Biodiversity; Inland Waters Biodiversity; Island Biodiversity; Marine and Coastal Biodiversity; Mountain Biodiversity.

In decision X/2, the COP-10 held from 18 to 29 October 2010 adopted a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for the 2011-2020 period. This Plan provided an overarching framework on biodiversity, not only for the biodiversity-related conventions, but for the entire UN system and all other partners engaged in biodiversity management and policy development. The Strategic Plan consists of five strategic goals, including twenty Aichi Biodiversity Targets:

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society;

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use;

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity;

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services;

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building;

To implement the Strategic Plan, the Parties are reviewing, and as appropriate, updating and revising their national biodiversity strategies and action plans (NBSAPs); developing national targets, using the Strategic Plan and its Aichi Biodiversity Targets as a flexible framework, and integrating these national targets into the updated NBSAPs; using the updated NBSAPs for the integration of biodiversity into national development, accounting and planning processes; monitoring and reviewing implementation of the NBSAPs and national targets, using indicators.

Table 9. Key biodiversity related conventions and Central Asian countries (2019)

	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
1. Convention on Biological Diversity (CBD) adopted 5 June 1992, in force 29 December 1993 (www.cbd.int)					
Signature	09.06.92				
Ratification/ Accession	06.06.94	06.04.96	29.10.97	18.09.96	19.07.95
National Biodiversity Strategies & Action Plans	1999 NBSAP	2016 NBSAP (v.3) up to 2024	2016 NBSAP (v.2) up to 2020	2018 NBSAP (v.2) up to 2023	
National Reports	1st (01.11.01); 2nd (30.07.02); 3rd (04.01.06); 4th (08.07.10); 5th (21.05.14); 6th (27.02.19)	3rd (27.02.06); 4th (03.02.09); 5th (18.01.16); 6th (19.03.19)	1st (27.02.04); 2nd (01.02.06); 3rd (28.07.06); 4th (30.03.09); 5th (25.04.14); 6th (24.08.19)	1st (16.01.03); 2nd n.a.; 3rd (19.03.07); 4th (20.08.09); 5th (28.09.15)	1st (10.02.98); 2nd n.a.; 3rd (10.03.06); 4th n.a.; 5th (17.08.15)
1a. Cartagena Protocol on Biosafety to CBD adopted 29 January 2000 , in force 11 September 2003 (http://bch.cbd.int/protocol/)					
Accession	08.09.08	05.10.05	12.02.04	21.08.08	25.10.19
National Reports	1st n.a.; 2nd (2011); 3rd (2015)	1st n.a.; 2nd (2011); 3rd (2015)	1st n.a.; 2nd n.a.; 3rd (2018)		
1b. Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to CBD adopted 29 October 2010 , in force 12 October 2014					
Signature			20.09.11		
Ratification/ Accession	17.06.15	15.06.15	12.09.13		
1c. Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety adopted 15 October 2010, in force 5 March 2018					
non-parties yet					
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITIES) adopted 3 March 1973, in force 1 July 1975 (www.cites.org/)					
Accession	20.01.00	04.06.07	30.03.16		10.07.97
National Reports		02/11/18e (2015-2017)			01/11/12e (2009-2010); 11/01/12e (2010-2011); 31/10/15e (2013-2014)
Convention on Conservation of Migratory Species of Wild Animals adopted 6 November 1979, in force 1 November 1983 (www.cms.int/)					
Accession	May 2006	May 2014	February 2001	–	September 1998
Latest National Reports	Report COP13 (2019)	Report COP12 (2017)	Report COP13 (2019)	Non-partly Report (2015)	Report COP13 (2019)
International Plant Protection Convention adopted 6 December 1951, in force 3 April 1952 (www.ippc.int/en/)					
Accession	13.09.10	11.12.03	04.10.10		13.01.20
International Treaty on Plant Genetic Resources for Food and Agriculture (IT PGRFA or International Seed Treaty) adopted 3 November 2001, in force 29 June 2004 (www.fao.org/plant-treaty/overview/en/)					
Accession		01.07.09			
World Heritage Convention adopted 16 November 1972, in force 17 December 1975 (https://whc.unesco.org/en/convention/)					
Accession	29.04.94	03.07.95	28.08.92	30.09.94	13.01.93
Ramsar Convention on Wetlands adopted 2 February 1971, in force 21 December 1975 (www.ramsar.org)					
Accession	02.05.07	12.03.03	18.11.01	03.06.09	08.02.02

Unfortunately, most countries, including in Europe, will not achieve the Archi targets for 2020 to protect biodiversity. In 2019, the first round of official discussions for a new post-2020 global biodiversity framework took place in Nairobi. The Parties of the CBD Governments will meet in Kunming, China, next year to establish a plan of action. In 2020 during COP15 in Kunming the CBD intends to adopt a post-2020 global biodiversity framework. In its decision 14/34 the COP14 adopted a comprehensive and participatory process for the preparation of the post-2020 global biodiversity framework.

Important Policy Events in 2019

G7 Environmental ministers signed the Metz Charter on Biodiversity during their meeting (May). Heads of state from the powerful bloc endorsed the Charter during their August Summit, vowing to take action ahead of the UN Biodiversity Conference scheduled for October 2020.

EU adopted Council conclusions on biodiversity to reaffirm that the EU and its member states will lead and step up efforts to halt biodiversity loss and restore ecosystems (December 19). The conclusions provide political guidance for the work towards a post-2020 global biodiversity framework. The Council also calls upon the Commission to develop without delay an ambitious, realistic and coherent 2030 EU biodiversity strategy as a central element of the European Green Deal.

The UN Secretary-General convened a UN Climate Action Summit 2019 that included a special focus on nature-based solutions and their potential to help limit global warming (September 23). "Investing in nature brings multiple benefits: nature helps us adapt to climate change, become more resilient in the face of natural threats, produce nutritious food sustainably, create green jobs and live in cities based on a circular economy model," UN Deputy Secretary-General Amina J. Mohammed said.

Waorani Land Rights Victory. A legal victory for a small tribe in Ecuador sent a resounding message about the rights of indigenous peoples and local communities to participate in decision making related to their ancestral lands. The Waorani Nation had objected to plans to open up its territories in the Amazon for oil exploration. While the government has the right to develop the land, the court ruled that the tribe was not adequately consulted. Activists said the ruling preserves 500,000 ha of Amazon forest and sets a precedent for other indigenous and local communities.

Transformative change is needed

IPBES (2019) proposed five main interventions ("levers") can generate transformative change by tackling the underlying indirect drivers of nature deterioration: (1) incentives and capacity-building; (2) cross-sectoral cooperation; (3) pre-emptive action; (4) decision-making in the context of resilience and uncertainty; and (5) environmental law and implementation. Employing these levers involves the following, in turn: (1) developing incentives and widespread capacity for environmental responsibility and eliminating perverse incentives; (2) reforming sectoral and segmented decision-making to promote integration across sectors and jurisdictions; (3) taking pre-emptive and precautionary actions in regulatory and management institutions and businesses to avoid, mitigate and remedy the deterioration of nature, and monitoring their outcomes; (4) managing for resilient social and ecological systems in the face of uncertainty and complexity to deliver decisions that are robust in a wide range of scenarios; and (5) strengthening environmental laws and policies and their implementation, and the rule of law more generally. All five levers may require new resources, particularly in low-capacity contexts such as in many developing countries. Transformations towards sustainability are more likely when efforts are directed at the following key leverage points, where efforts yield exceptionally large effects: (1) visions of a good life; (2) total consumption and waste; (3) values and action; (4) inequalities; (5) justice and inclusion in conservation; (6) externalities and telecouplings; (7) technology, innovation and investment; and (8) education and knowledge generation and sharing.

OECD (2019) identified ten priority areas where G7 and other countries can focus their efforts: (1) Pursue and advocate for specific, measurable and ambitious targets in the post-2020 global biodiversity framework; (2) Encourage business, financial organizations and other stakeholders to establish and share commitments and contributions to biodiversity through the Sharm El-Sheikh to Kunming Action Agenda for Nature and People; (3) Promote policy coherence across different sectors and areas to harness synergies and reduce trade-offs for biodiversity; (4) Scale up the suite of policy instruments for biodiversity and get the economic in-

centives right to ensure biodiversity is better reflected in producer and consumer decision-making; (5) Scale up and align finance for biodiversity from all sources, public and private; (6) Strengthen finance reporting and tracking frameworks; (7) Reform subsidies harmful to biodiversity; (8) Facilitate integration of biodiversity by businesses and financial organizations; (9) Assess and communicate socio-economic dependencies and impacts on biodiversity at relevant geographic scales; (10) Ensure inclusive and equitable transformative change.

FAO (2019) finds that knowledge of the roles of biodiversity in the ecological processes that underpin food and agricultural production needs to be strengthened, and used to develop management strategies that protect, restore and enhance these processes across a range of scales. Establishing effective policy and outreach measures will be needed to support the uptake of management practices that sustainably use biodiversity to promote food and livelihood security and resilience.

This review was prepared by SIC ICWC on the materials of:

IPBES (2019): The global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services;

FAO (2018): The State of World Fisheries and Aquaculture: Meeting the Sustainable Development Goals;

FAO (2019): The State of the World's Biodiversity for Food and Agriculture, J. Bélanger & D. Pilling (eds.);

FAO Commission on Genetic Resources for Food and Agriculture Assessments. Rome. 572 pp.;

OECD (2019): Biodiversity: Finance and the Economic and Business Case for Action, report prepared for the G7 Environment Ministers' Meeting, 5-6 May 2019;

WEF (2020): The Global Risks Report 2020

12.5. Mountains

Report of the UN Secretary-General "Sustainable Mountain Development". At the 74th session of UNGA on 22 July, 2019, the report of the UN General Secretary "Sustainable Mountain Development" was launched. Covering 27% of the world's surface, mountains are key ecosystems that provide humanity with essential goods and services such as water, food, biodiversity and energy. However, mountain ecosystems are vulnerable to natural disasters, climate-related events and unsustainable resource use. Mountains are home to about 1.1 billion people who are among the world's poorest: half of rural mountain dwellers face food insecurity. Access to services and infrastructure is lower in the highlands than in other areas. Mountain communities are particularly vulnerable to the impacts of natural hazards because of their high dependence on agriculture (encompassing crops, livestock, fisheries, aquaculture and forestry) as their primary source of livelihood. Alone or in combination, these factors make living in mountain areas increasingly difficult and they are often adverse drivers that compel people to migrate. The recommendations contained in the Report are aimed at building resilience to climate change and disasters and protecting biodiversity; improving livelihoods in mountain areas; leveraging international processes in support of mountain development; developing financial mechanisms and partnerships with the private sector; promoting governance and inclusive institutions; enhancing research and data.

Source: https://undocs.org/en/A/74/209

Mountains and SDGs. The 2030 Agenda includes the following three targets directly related to sustainable mountain development:

- SDG 6.6: by 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes;
- SDG 15.1: by 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements;
- SDG 15.4: by 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

UNGA Resolution "Sustainable Mountain Development". On 19 December 2019, during the plenary session, the UN General Assembly adopted the Resolution "Sustainable Mountain Development" (A/RES/74/227) represented by

the Kyrgyz Republic and Italy. 80 UN Member-States cosponsored this Resolution. The Resolution stresses the special vulnerability of mountain ecosystems and people living in mountain environments and recommends adopting holistic approaches to the improvement of livelihood of the local mountain communities and the sustainable use of mountain resources. The Resolution also mentions initiatives by the UN Member-States to promote sustainable mountain development, such as the adoption of the initiative of the Kyrgyz Republic on the International Mountain Day in 2003 and International Year of Mountains in 2002, establishment of the Group of Friends of Mountainous Countries in August 2019 in New York, the International Snow Leopard and Ecosystem Forum in 2017, the third World Nomad Games in 2018 and the fourth World Mountain Forum in October 2018 in Bishkek.

Source: https://undocs.org/en/A/RES/74/227

International Mountain Day. December 11 is the International Mountain Day, which was introduced by resolution of the 57th UNGA session in 2003 to draw attention to the problems of mountains and the need to help mountain communities. FAO is the coordinating agency for the preparation and animation of this celebration and is mandated to lead observance of it at the global level. Since 2004, celebrations of this Day have been dedicated to a specific theme. In 2019, "Mountains Matter for Youth" was the theme of the International Mountain Day. International Mountain Day is a chance to highlight that for rural youth, living in the mountains can be hard. Many young people leave in search of a better life and employment. Migration from mountains leads to abandoned agriculture, land degradation and a loss of cultural values and ancient traditions. Education and training, market access, diverse employment opportunities and good public services can ensure a brighter future for young people in the mountains.

Mountain Partnership. The Mountain Partnership is a UN voluntary alliance of partners dedicated to improving the lives of mountain peoples and protecting mountain environments around the world. Founded in 2002, the Mountain Partnership addresses the challenges facing mountain regions by tapping the wealth and diversity of resources, knowledge, information and expertise, from and between its members. The Partnership operates on a multi-stakeholder basis with active support from 381 members, including 60 governments, 16 intergovernmental organizations, 297 major groups, and 8 subnational authorities, and promotes sustainable mountain development in all three dimensions – economic social and environmental. The Mountain Partnership is supported by a Secretariat which is hosted by FAO in Rome.

Sources: www.mountainpartnership.org; http://www.fao.org/mountain-partnership/en/

Group of Friends of Mountainous Countries. At the initiative of the Kyrgyz Republic in the framework of the UN, a Group of Friends of Mountainous Countries was established in New York in 2019. The Group includes 22 member countries: Afghanistan, Andorra, Albania, Armenia, Austria, Azerbaijan, Bangladesh, Bhutan, Bolivia, Canada, Georgia, Greece, Kyrgyzstan, Lebanon, Liechtenstein, Morocco, Nepal, Norway, Romania, Switzerland, Tajikistan, and Turkey. The first inaugural meeting of the Group took place on 29 August 2019.

Mountain Portal and Interactive Map of Mountain Communities. The Global Mountain Biodiversity Assessment platform provides the Mountain Portal[88], which explores biological richness of more than 1,000 mountain ranges worldwide. In 2018, the Mountain Partnership Secretariat launched the Indigenous Peoples and Local Communities living in Mountain Areas Map[89]. This interactive map aims at raising awareness on indigenous and local mountain peoples by offering a visual representation of where they live and additional information pertaining to their food systems and cultural identities.

WMO convened the High Mountain Summit from 29 to 31 October 2019 at its headquarters in Geneva, Switzerland. The participants identified priority activities to support more sustainable development, disaster risk reduction and climate change adaptation in both high mountains and plains.

Source: https://public.wmo.int/en/events/meetings/high-mountain-summit

[88] www.mountainbiodiversity.org
[89] www.arcgis.com/apps/webappviewer/index.html?id=561ae08b8526458ab9711ca5011dadbd

12.6. Diagnostic Report on Rational Use of Water Resources in Central Asia as of 2019: Summary

In 2019, OECD, with the financial support from Germany, initiated the preparation of the "Diagnostic Report on Rational Use of Water Resources in Central Asia as of 2019". The Diagnostic Report reviews the use and management of water resources in Central Asia over the period from 1998 to 2019. It, particularly, assesses changes in water and land use and management in Central Asia over the past 20 years; identifies future water challenges, development trends and needs for the long-term rational use of water resources and irrigated land; assesses the progress made with implementation of the "Fundamental Provisions of Water Management Strategy in the Aral Sea Basin"; prepares a database of key information and indicators in support of the Diagnostic Report. The Diagnostic Report was prepared by SIC ICWC, with contributions from leading experts from the CA countries. In early 2020, the Report was updated based on the feedback from various agencies and organizations in CA countries. The authors consider the Diagnostic Report as a first step for preparation of a Regional Strategy for Rational and Efficient Water Use in Central Asia, the need for which was voiced by the President of Uzbekistan at the XII Summit of the Heads of IFAS Founder-States in Turkmenbashi in August 2018. The key findings and recommendations of the Report are presented below.

Socio-Economic Characteristics

The total population in Central Asia is 72.9 million as compared to 55.4 million in 2000 and 63.5 million in 2010 (2019). Demographic pressure has been lessened, and the **growth rate has stabilized** at 2% a year in all countries by 2019. An increase in external migration is the main cause of lower population growth. The share of rural population is still high in Central Asia: 56.2% in 2019 as compared to 64.4% in 2000.

Employment is not stable and is characterized, among other things, by a high percentage of temporary labor migration from Kyrgyzstan, Tajikistan and Uzbekistan. Remittances have become increasingly important in the region's economy, equivalent to 48% of GDP in Tajikistan (which was the highest coefficient globally), 31% in Kyrgyzstan, and about 5% in Uzbekistan in 2013. The share of economically active population employed in agriculture is still very high in the riparian countries of the Aral Sea basin.

Since 1991 to 2000, **economic indicators** in the CA countries showed a sharp drop; economies have started to grow since 2000 both by country as a whole and by key sector (industry, agriculture, energy). By 2019, economic development in all the countries, except for Tajikistan, exceeded the level that was in 1990.

Major changes took place in the structure of national income (GDP) in the countries of the Aral Sea basin since independence. The share of agriculture has dropped in national incomes of the riparian countries, particularly in Uzbekistan (by 26.8% in 2017 as compared to 1990) and Kazakhstan (by 12.6 pct). Concurrently, the share of industry increased moderately in Uzbekistan (+4.0 pct) and in Kyrgyzstan (+4.4 pct), grew significantly in Kazakhstan (+45.5 pct) and dropped in Tajikistan (-33.8 pct). At the same time, the services sector has shown dramatic growth in all the countries of the Aral Sea basin. The comparative socio-economic and resource indicators of the Central Asian countries are provided in Tables below.

Water availability, land use and energy supply. The CA countries have relatively equal conditions in terms of unit water supply, except for Turkmenistan, which went far ahead, and Kyrgyzstan dramatically lagged behind. Similar situation is observed regarding irrigated land areas, given that Kazakhstan does not use about 1 Mha of land, which is equipped with irrigation network. As to energy supply, Kazakhstan and Turkmenistan are far ahead against relatively similar situation in other countries. Afghanistan well lags behind in all positions, including water, irrigated land and electricity.

Prospective strategic priorities of the CA countries development are based on natural and socio-economic characteristics of each country. There are also common development tendencies that, in the context of the water sector, can be formulated as follows: (1) enhancement of market relations and support of innovation-based entrepreneurship; (2) improvement of agricultural productivity and increase of crop processing, revival of cooperation and organization of clusters, achievement of food security; (3) development of hydropower and renewables; (4) widespread digitization; (5) regional security.

Table 10. Comparative indicators of the CA countries and Afghanistan *(2018)*

Country	Country area,	Irrigated area,	Population,	GDP,	Water resources formed within the country,	Total water withdrawal of the country,
	Mha	*thsd. ha*	*million*	*billion $*	*km³*	*km³*
Kazakhstan	272.50	1,480.0	18.40	170.50	56.5	18.73
Kyrgyzstan	19.99	1,024.5	6.26	7.95	47.3	5.53
Tajikistan	14.23	760.0	9.13	7.52	64.0	12.31
Turkmenistan	48.81	1,553.1	5.85	40.76	1.4	25.38
Uzbekistan	44.90	4,302.6	33.26	50.50	12.4	50.95
Total in CA	**400.42**	**9,120.2**	**72.89**	**277.23**	**181.6**	**112.89**
Afghanistan	65.24	378.4*	8.20*	20.51	21.2*	3.50*

Note: * The data on irrigated area, population, water formation and water withdrawal of Afghanistan are shown for Northern Afghanistan only (Amu Darya, Harirud and Murghab River basins).

Source: "Water Resources Management in Afghanistan", presentation by Nasim Nuri at the International Economic Forum in Astana (2018).

Table 11. Specific indicators of water, land, and energy use in CA and Afghanistan, *Mm³ (2018)*

Country	Irrigated area per capita,	GDP per capita,	Water use per capita,	Water withdrawals for municipal water supply,	Electricity production per capita,
	ha/pers	*$/pers*	*m³/pers*	*m³/pers*	*kWh/pers*
Kazakhstan	0.080	9,268.54	1,018.27	48.63	5,822.1
Kyrgyzstan	0.164	1,270.11	883.21	32.60	2,493.3
Tajikistan	0.083	823.97	1,348.79	83.27	2,158.5
Turkmenistan	0.265	6,966.64	4,337.77	95.43	3,623.4
Uzbekistan	0.129	1,518.47	1,531.99	86.30	1,888.4
Total in CA	**0.140**	**3,969.54**	**1,824.01**	**69.25**	**3,197.1**
Afghanistan	0.010	551.83	426*	–	26.3

Note: * The data on per capita water use in Afghanistan are shown for Northern Afghanistan only (Amu Darya, Harirud and Murghab River basins).

Source: The data of CA experts involved in the work on the Diagnostic Report and from the Regional Information System CAWater-IS.

Geopolitics and integration processes. Central Asia is a region at the crossroads of interests of the world's major powers for its high development potential, availability of natural and intellectual resources, and strategic location. Geopolitical influence of the region will depend on the degree of unity of the region's countries, which has being strengthened in the last three years. Among the geopolitical and geo-economic factors that would have their effect on water use in CA are the restoration of peaceful life in Afghanistan and the Chinese Belt and Road Initiative (BRI).

Water Resources in Central Asia

Central Asia has several hydrological basins, the largest of them being the Aral Sea basin. There are number of interstate basins in Kazakhstan (Ural, Irtysh, Tobol, Yesil, Nura), Kyrgyzstan (Sary-Jaz, Issyk-Kul), as well as the Ily River and Chu-Talas basins in the territories of Kazakhstan and Kyrgyzstan. Besides, three interstate basins are located in the territory of Turkme-

nistan, the two of which belong to the Large Amu Darya basin – the Murgab and the Harirud (Tejen). The third basin of the Atrek River is small.

Assessment of surface water resources. The comparison of current assessments and the data for 2001 indicates to lowering of runoff by 0.51 km^3 in the Amu Darya basin and by 0.9 km^3 in the Syr Darya basin. Generally, there was a decrease in inflow in the region outside the Aral Sea basin: by 16.2 km^3 in Kazakhstan, including by 12.1 km^3 along transboundary Black Irtysh, Ili and Ural rivers because of increased water diversions in the upper reaches, particularly within the territories of China and Russia, while the natural inflow into the Irtysh River has slightly increased.

Groundwater. In the Aral Sea basin as a whole, the estimated regional usable groundwater stock – about 400 aquifers – has decreased by 2018 as compared to 1998, through deterioration of aquifer quality in some places. Annual abstractions from the approved resources have decreased by 25-30% in Uzbekistan only. Groundwater resources are maintained at the same level or even increased in other countries; however, water intake from groundwater decreased in all the countries.

Return water. According to SIC's data (regional database, PEER Project[90]), in 2000-2017, 35.78 km^3 of collector-drainage water and wastewater were generated in the Amu Darya and the Syr Darya basins. 15.26 km^3 were generated in the Syr Darya basin and 20.51 km^3 were formed in the Amu Darya basin. Over this period of time, on average 17.67 km^3/year were discharged to rivers and 14.43 km^3 – to lakes and natural depressions. As compared to 1990, the amount of return water decreased by 0.6 km^3 (1.7 %). However, the comparison with 1990-1999 [SPECA 2001 Diagnostic Report] shows that the amount of return water increased by 3.3 km^3 (11%).

Climate change. Variability and intensity of precipitation increase in many areas in Central Asia, however, the river runoff did not undergo substantial transformations in this period of time. There is certain downward tendency for small rivers' runoff, whereas in large river basins a decrease in runoff was minor. At the same time, the frequency and amplitude of extreme floods and water shortages have increased sharply. This necessitates closer attention to multiyear runoff regulation.

Water Use and Flow Regulation

Since the 2000s, the total water withdrawal did not change considerably; although some changes were observed in water uses (see Table 12). In the region as a whole, water withdrawal for drinking and household needs increased by 6.3% and that for industrial needs grew by 25.5%. However, in Turkmenistan and Uzbekistan water withdrawal for drinking and household needs

Table 12. Data on water withdrawal and water consumption in the Aral Sea basin
(comparison of 2002 and 2018)

Country	TOTAL*		Irrigation		Drinking and household needs		Industry		Energy	
	2002	**2018**	2002	2018	2002	2018	2002	2018	2002	2018
Kazakhstan	**13,830**	**18,732**	10,294	12,301	600	895	2,937	5,536	65,430	66,650
Kyrgyzstan	**4,469**	**5,526**	4,264	5,240	128	204	77	82	3,186	2,739
Tajikistan	**12,691**	**12,301**	9,623	10,215	619	760	392	348	n.a.	n.a.
Turkmenistan	**28,334**	**25,380**	24,990	22,385	623	558	1,700	1,523	2,860	n.a.
Uzbekistan	**60,554**	**50,947**	47,434	45,086	3,002	2,870	4,727	4,852	64	130
TOTAL	**119,878**	**112,886**	**96,605**	**95,227**	**4,972**	**5,287**	**9,833**	**12,341**		

Note: * Due to lack of accurate accounting of water withdrawal for energy sector, total water use is estimated excluding the energy sector. The year 2002 is chosen for comparison since 2000 and 2001 were extremely dry. Figures in the Table characterize water withdrawals at province boundaries.

Source: The data of CA experts involved in the work on the Diagnostic Report

[90] Transboundary Water Management Adaptation in the Amudarya Basin to Climate Change Uncertainties project was implemented by SIC ICWC in 2015-2018 with financial support from USAID

decreased. In Tajikistan and Turkmenistan water withdrawal for industrial needs also decreased. Over the 20-year period, irrigation water use virtually did not change in the region as a whole.

In the Aral Sea basin, the water withdrawal has decreased by 12 km^3 from 119 km^3/year right since independence due to the decline in all economic sectors. Over 2000-2018, water withdrawal averaged 106 km^3, including 90.1 km^3 for irrigation. In dry years, water withdrawal decreased to: 100.4 km^3 (81.3 km^3 for irrigation) in 2000 and 96.7 km^3 (77.5 km^3 for irrigation) in 2008. There was also a period of time (2002-2005), when water withdrawal increased to 111-121 km^3/year.

Evaluation of losses. In Master Plans of water resources development and use for the Amu Darya and the Syr Darya, water losses are estimated at 3.15 and 2.74 km^3, respectively, or just about 6 km^3. The current overestimation of total losses mentioned above results partially from errors in water accounting. Therefore, those cannot be considered as losses in full since a portion of water flows back in form of return water, i.e. roughly this amount of almost 15 km^3 should be reduced by the average long-term value of return flow of 4.5-5 km^3 a year. In any case, we should aim to cut those water losses through automation of waterworks facilities.

Drinking and household water supply. The actual average access of population to good quality water is: 62% in Kazakhstan; 45% in Kyrgyzstan; 65.7% in Tajikistan; 63% in Turkmenistan; and, 64.8% in Uzbekistan (Table 13). In all the countries, there is a situation in which households without centralized water supply incur higher costs per cubic meter of water.

Table 13. Drinking and household water supply in CA countries *(2016)*

Country	Access to water,	Actual average water consumption,	Water losses,	Tariff,	Fee collection rate,
	*%**	*l/day/capita***	*%****	*$/m^3*	*rate, %***
Kazakhstan	62.0	220	30	0.10-0.58	85
Kyrgyzstan	45.0	140	50	0.07-0.11	65
Tajikistan	65.7	180	45	0,4-0.8	75
Turkmenistan	63.0	320	55	0.5	70
Uzbekistan	64.8	290	45	0.11-0.25	85

Note: *** Water losses include both technological (leakage in distribution networks and unavoidable losses) and commercial (unauthorized use, etc.) losses.

Source: * Data collected by national experts , ** Asian Water Development Outlook 2016: Strengthening water security in Asia and the Pacific. Mandaluyong City, Philippines: Asian Development Bank, 2016.(Asian Development Bank, 2016).

Irrigated farming remains the largest water consumer in the region and contributes largely to food security. By 2019, all the countries in the region but Afghanistan have achieved food security through changes in cropping patterns, sharply increased production of grain, fruits and vegetables, and reduction of cotton production. Irrigation norms in the Aral Sea basin were decreasing and amounted to the following values in 2017: 9,700 m^3/ha in South Kazakhstan; 7,400 m^3/ha in Kyrgyzstan; 13,300 m^3/ha in Tajikistan[91]; 15,500 m^3/ha in Turkmenistan; and 11,700 m^3/ha in Uzbekistan. The last decade is notable for improved land productivity and new agri-business patterns aimed at the end product (clusters in Uzbekistan, Kyrgyzstan, cooperatives in Kazakhstan).

Industry. Within a short timeframe – about two decades – industrial production has grown 5.1 times in Kazakhstan, 4.1 times in Kyrgyzstan, 3.13 times in Tajikistan, 5.91 times in Turkmenistan and 6.12 times in Uzbekistan. It is characteristic that water intensity of the industrial sector is quite low in Kazakhstan and Turkmenistan (0.0448 m^3 and 0.0438 m^3 per 1$ of output, respectively), highest in Uzbekistan (0.17 m^3) and slightly lower in Tajikistan (0.07 m^3).

Hydropower makes a substantial contribution to regional electricity production by providing one fifth of the total electricity production (21.8% in 2018) and the bulk of electric energy in Kyrgyzstan and Tajikistan. Given enormous hydropower potential (460 TWh/year in the region as a

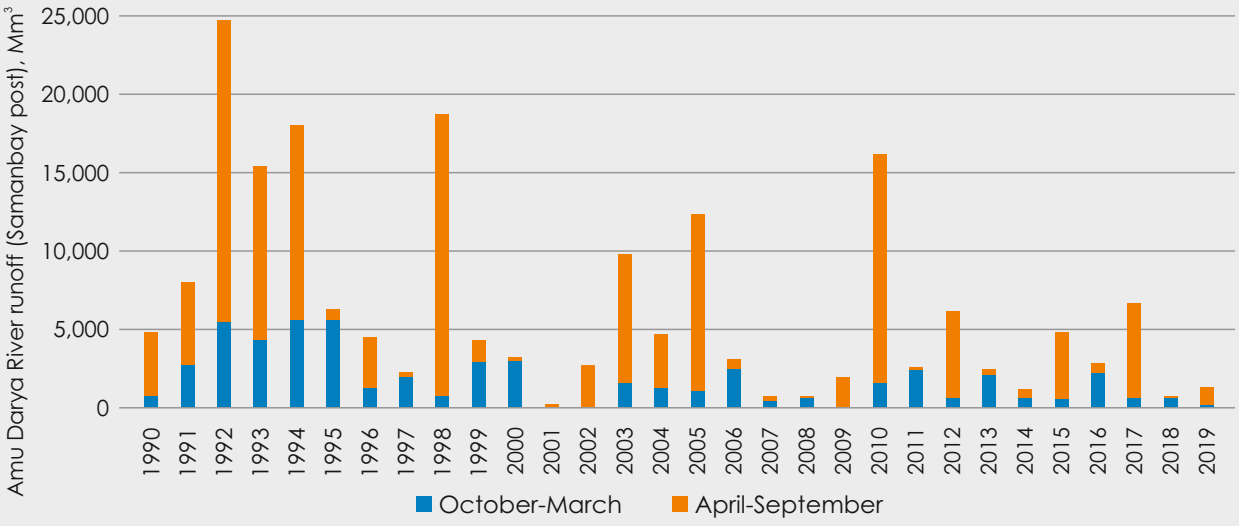
[91] According to the Tajikistan's Agency for Land Reclamation and Irrigation, in 2017, the actual water withdrawal was 7.99 km^3, i.e. the irrigation norm was 10.5 m^3/ha

whole) and relatively cheap energy generated at HPPs, the region has seen an increase in hydropower development over the last 20 years. Since independence, a considerable increase in hydropower generation has been reached by Kyrgyzstan (Kambarata-2 at the Naryn River), Tajikistan (Sangtuda-1, Sangtuda-2, first two aggregates of Roghun project at the Vakhsh River), and Uzbekistan (Tupolang HPS) and reconstruction of Charvak HPS). It should be noted that maximal utilization of energy potential puts irrigation, drinking water and nature needs in jeopardy.

River flow regulation. The main hydroschemes of the Vakhsh and Naryn-Syrdarya reservoir cascades in the Amu Darya and the Syr Darya basins, operation of which was switched in the late 1990s from an integrated regime to energy generation or mixed regime, with the priority of energy generation in winter, continued operating in a modified regime in the past decade. The degree of flow regulation in the main rivers of Central Asia slightly increased through the construction of new hydroschemes on the Vakhsh River and intra-system reservoirs for irrigation purposes on the Syr Darya River. At the same time, a decrease in the reservoir storage capacity was observed due to siltation (Nurek, Tuyamuyun, and Kayrakum reservoirs). Over the last 15 years, there has been a trend towards increased idle discharges from HPPs due to unreliable flow forecasts and the lack of inter-sectoral coordination of water releases regimes.

Environmental requirements of a river are comprised of water releases to its delta and inland water bodies, in-stream flow needs along the river and environmental water releases to some canals. Sanitary water releases along the rivers and environmental water releases to canals to keep continuous flow are basically maintained. Water supply to the Syr Darya and Ili River deltas is ensured. Water supply to the Amu Darya River delta is provided in needed volume in total over the decade; however, it is rather unstable between years and months. This results in periodic drying up of the delta's lakes (see the Figure below).

Instability of water supply to the Amu Darya Delta



Source: UzHydromet

Environmental Matters Related to Water

Aral Sea and the Aral region. The Aral Sea has shrunk to less than 10% of its original volume and has divided into three water bodies: stable Northern Sea, deep Western body, and periodically drying up Eastern body. The Aral region's lakes, sustainable in the north and unstable in the south, maintain biopersistence in the area of the former Aral Sea. Stability of the Northern Sea and the adjacent Aral region is ensured through the stable inflow from the Syr Darya River and a dam in the Berg Strait. As to the exposed seabed and the South Aral region in the territory of Uzbekistan, large-scale afforestation efforts are undertaken there, along with construction of a system of small lakes.

More than half of the land fund in Central Asia is prone to salinization to a greater or lesser degree. Given the total area of the Aral Sea basin of 155 Mha (excluding Afghanistan) and the avai-

lable drained land fund of 32.6 Mha, non-saline land area is 8.6 Mha and saline land area is 23.9 Mha. Although the irrigated land is well equipped with drainage, maintenance of the latter is unsatisfactory. Consequently, 20% of the land is in poor conditions, resulting in low fertility, and requires about 3 km^3 of additional water for leaching.

The unit volume of drainage flow generated in the Amu Darya basin varies from 3,500 to 12,700 m^3 per hectare. This volume ranges from 1,700 m^3 to 8,300 m^3 per hectare in the Syr Darya basin. Moreover, considering the average long-term period, 37% of drainage flow generated in the Amu Darya basin is discharged to the stem stream and reused, 60% is discharged to closed lakes and only 3% is used for irrigation. The picture is different in the Syr Darya basin: 60% of drainage flow is discharged to the stem stream, 21% is discharged to depressions, and 19% is used for irrigation. The envisaged return (collector-drainage) water management that was to strictly limit water withdrawals and the discharge of salts and contaminants, based on dynamics of river salt and pollution balance, has failed.

Water quality. Most surface water bodies in Central Asia refer as moderately polluted. In the upper and middle reaches, the acceptable pollution limits are kept, while in the lower reaches the latter are exceeded by more than 50% in some periods of time. Water quality monitoring in most interstate rivers in Central Asia is performed by one of riparian countries only; the exception is the Karatag-Surkhandarya and the Chu-Talas rivers and the Amu Darya and the Syr Darya (main course). Rivers shared by Kazakhstan, China and Russia are jointly monitored. The indicators of river water salinity for irrigation purposes are systematically estimated and monitored at the transboundary level by BWO Amu Darya and BWO Syr Darya. Water salinity is 0.47-0.58 g/l in upper reaches of the river, increases to 0.69-0.86 g/l in lower reaches close to Tuyamuyun point and exceeds 1.23 g/l at the Nukus city (Samanbai section). The data on salinity in the Syr Darya River indicate to further deterioration of water quality over the last 20 years. On the whole, national systems of water quality standardization in Central Asia contain all the required components to facilitate appropriate monitoring. However, their implementation faces difficulties due to the lack of technical and financial resources.

Upper catchment ecosystems and biodiversity in Central Asia are threatened due to population growth and economic development. Pastures suffer from overgrazing, with consequent deterioration of ecosystem quality. The use of forest timber for heating is another topical problem. Moreover, there is lack of consistent and reliable data on flow formation in highlands. Therefore, systems analysis of current biological resources, ecosystems and biodiversity is needed for highlands. The runoff formation areas are under risks of mudflows, avalanches, landslides and rock-dammed lake breaches. There is a need to assess the current state of snow cover and glaciers, analyze current and future climatic processes in highlands, and forecast glacial and snow cover areas. Uranium tailings storage sites represent another problem in the runoff formation area.

Water Management at National Level

Since gaining independence, almost in all CA countries, the **status of national water agencies has been revised down** from a separate ministry to a department or committee in the structure of different ministries. Since 2018, the countries have started to restore the institutional integrity of water management: Ministry of Water Management in Uzbekistan (2018), State Committee for Water Management in Turkmenistan (2019), and State Agency for Water Resources at the Kyrgyz Government (2019) were established. In 2013, the Ministry of Energy and Industry was re-organized into the Ministry of Energy and Water Resources of Tajikistan assigned with water policy-making and governance.

All the CA countries underwent **several stages of legal reforms** in water management and laid the foundation for implementation of integrated water resources management (IWRM). New water codes that embrace IWRM were adopted in Tajikistan (2000), Kazakhstan (2003), Turkmenistan (2004, 2016) and Kyrgyzstan (2005). Appropriate amendments were made in the Law on Water and Water Use in Uzbekistan (2013). However, the degree of implementation of IWRM in CA countries is still rather low. Two countries – Kazakhstan and Uzbekistan – provided the data on SDG indicator 6.5.1, which tracks the degree of IWRM implementation across four key components: enabling environment; institutions and participation; management instruments; and, financing[92]. Out

[92] http://iwrmdataportal.unepdhi.org/, https://sdg6data.org/country-or-area/Kazakhstan#anchor_6.5.1

of the maximum score of 100, Kazakhstan collected 30 points (low degree), while Uzbekistan collected 45 points (medium-low).

The system of water governance at provincial/district level has undergone multiple changes, especially in water accounting and coordination between hierarchical levels. At the same time, implementation of IWRM (hydrographic principle, public participation, water conservation, and extension services) on an area of 130,000 ha of agricultural land gave an impetus for the improvement of intra-state management. The **lowest level of water management** (Water User Associations) has been remaining the weakest chain in water hierarchy of the CA countries for the last 15 years. As a way out of such situation, it is proposed to introduce mechanisms of public-private partnership to WUAs and establish the cluster-based system.

Irrigation service fees. Kazakhstan, Kyrgyzstan and Tajikistan apply water charges, which partially cover operation and maintenance (O&M) of hydraulic structures at basin (provincial) level. Water users in Kazakhstan, Kyrgyzstan and Tajikistan pay for irrigation services provided by both water-management organizations (WMO) and water user organizations (WUO). In Uzbekistan and Turkmenistan, water users pay for services provided by water user organizations only. Tariff rates for irrigation services differ, depending on service provider and country (Table 14). The collected irrigation service fees in the CA countries are not enough to cover O&M. Therefore, water charges are a weak incentive for better water management here.

Table 14. Tariff rates for irrigation services in Central Asia countries *(2019)*

Country	Service provider	Tariff	
		National currency	US$*
Kazakhstan**	WMO	16.135 tenghe/m^3 (pumped irrigation)	4.15 cent/m^3
		29.5 tyin/m^3 (gravity irrigation)	0.074 cent/m^3
	APC	1,600-2,500 tenghe/ha	4.1-6.43 $/ha
Kyrgyzstan	WMO (DWMA)	3 tiyin/m^3	0.043 cent/m^3
	WUA Union	4 tiyin/m^3	
	WUA	400-800 som/ha	6-11 $/ha
Tajikistan	WMO	2*** diram/m^3	0.21 cent/m^3
	WUA	40-120 somoni/ha	4-12 $/ha
Turkmenistan	PFU	3% of farm's yield	
Uzbekistan	WCA	25-50 thousand soum/ha	2.6-5.2 $/ha

Notes: * Exchange rate: $1=388.62 tenghe (Kazakhstan), $1=70 som (Kyrgyzstan), $1=9.52 somoni (Tajikistan), $1=9,500 soum (Uzbekistan)

** In 2018, Kazakhstan established uniform tariff for all provinces. Earlier, tariffs differed by province. It is planned to raise irrigation service tariffs every year (until 31.07.2023). Here, tariffs are given on WMO (excluding VAT) for 01.08.2019 to 31.07.2020. Kazakhstan also practices tax on water as a resource besides payment for irrigation services.

*** Until 2018, the tariff was equal to 1.5 diram/m^3

Source: Compiled by authors based on interviews and field visits (2019)

Human resources. Because of financial difficulties in the CA countries since gaining independence, water management organizations tended to reduce their staff, while ignoring existing staffing requirements. The water education and training system also needs to be improved cardinally. Graduates that search for work in the water sector often do not meet the requirements of employers: lack of basic knowledge, poor engineering training, lack of skills to design water facilities, make assessment and analysis of problems and propose fully-fledged solutions on land reclamation and irrigated agriculture, taking into account current realities and prospective developments in the sector.

Research and design framework of water management. Substantial budget cuts for research resulted in lowering of research capacity. The majority of design institutes were also destruc-

ted because of the rules for participation in design work on the basis of Western system of tenders. At present, the task is set to rehabilitate this design and research capacity, build new laboratories, provide the institutes with equipment and high-qualified staff.

Development of information systems. Among the CA countries an online national water information system (accessed by authorized users) exists in Kyrgyzstan only. Other countries plan to complete similar systems in the coming years. At the regional level with SDC's support, the Regional Information System on water and land resources in the Aral Sea Basin (CAWater-IS) has been developed and is maintained by SIC ICWC.

Water Management at Interstate Level

The legal framework of transboundary water cooperation in the Aral Sea basin has largely followed water management practices of the Soviet period and **needs to be updated** to account for changing needs and interests. Repeated attempts to improve the existing legal framework have failed because of countries' unwillingness to make mutual concessions.

Joint bodies, first of all, ICWC had an invaluable role in establishing and maintaining transboundary water cooperation in all major river basins of Central Asia. However, all IFAS bodies need institutional, technical and financial strengthening. ICWC was successful in operational water allocation and joint annual planning of water distribution, but did not pay sufficient attention to long-term development and future water availability. Among the key bottlenecks of ICWC activity are the unresolved political, economic, institutional, legal and financial aspects of water use in the region. Also, it is necessary to establish more effective interactions within the IFAS system.

International assistance and Aral Sea Basin Programs. Since 1991 to 2019, different international partners provided assistance to the countries on water and related issues, focusing on institutional reformation, infrastructural, capacity building, research, and policy dialogue projects. Despite significant positive impacts of implemented projects, one should note the duplication of efforts and the lack of focus on action effectiveness from both the side of donors and national agencies. It was expected that the Aral Sea Basin Programs (ASBP) developed jointly by countries and international partners would determine the overall focus of regional projects but it has not always been possible to achieve this in practice. In spite of numerous statements by country representatives and international partners, the issue related to coordination of donors and their aid is still relevant.

Performance Review of Water Management System in the Aral Sea Basin

The water-management system in the Aral Sea basin is comprised of a quite complex set of water hierarchical levels (basin, sub-basin, national intake points, main and distributary canals, WUAs, water users), sectors and their structures and water consumers, as well as controlling systems. Sustainable water security is based on a coherent system of water management at all levels. For effective functioning of the upper (interstate and main-canal) level, it is necessary **to address the following shortcomings:** inaccuracy of annual flow forecasts and absence of long-term forecasts; deviations from the agreed water distribution plans; poor water accounting; idle discharges; lack of harmonization between energy water releases and irrigation needs. **Those, in combination with poor management at the lowest level, result in the coefficient of available water supply of 80% on average, given the water use efficiency of 50-52%.**

Water use sectors take different positions in terms of financial and institutional sustainability. Hydropower and industry are institutionally and financially stronger. Those sectors are in the focus of state agencies that provide financing for re-equipping, reconstruction and maintenance of advanced technical level, which allows for quick and maximal return on investments. They also have the lowest internal water losses and highest charges. Well worse situation is in irrigated agriculture and the household sector, where losses prevail, water charges are not sufficient, and state support through long-term loaning is well lower. There is big difference in irrigation water charges: from 0.043 cent/m^3 in Kyrgyzstan and 0.21 cent/m^3 in Tajikistan to 4.6 cent/m^3 in Kazakhstan under pumped irrigation (Table 14).

Table 15. Characteristics of water-user sectors

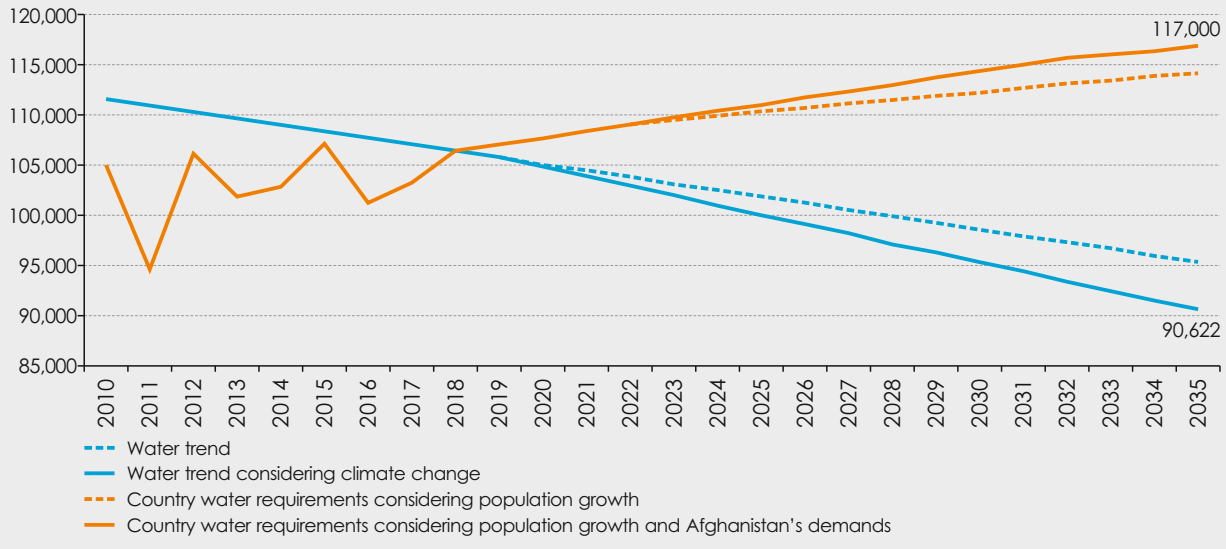
	Key water users					
	Hydropower	Irrigated agriculture	Household sector	Industry	Fishery	Nature
Institutional form	Joint stock company	Farms, clusters	Water utility		Farms	State environmental agency
WMO (water suppliers)	HPP authorities	BO, water-management organizations, WUA	Water utility	Water utility		
Use, % of total water withdrawal	0-80	15-95	1-8	1-6.5	0.1-0.2	7-20
Internal losses, %	3-10	30-65	30-55	Up to 20		
Water productivity, cent/m^3	0.8-40 cent/m^3	6-12 cent/m^3		1.4-12 $/$m^3$		
Water charges paid from budget, cent/m^3		0.66-1.1	0.5-0.9	0.013-0.20		
Water charges paid by users	0.7-4.6 cent/m^3	0.043-4.6 cent/m^3	0.012-0.14 cent/m^3	0.4-0.8 $/$m^3$		

Source: Authors (2019)

Future Water Outlook of Central Asia

Threats of climate change. By 2045, water resources are assumed to be increased in the Irtysh, Ili, and Ural basins because of climate change impact. By 2045 in the Aral Sea basin, in a maximum option it is assumed that climate change impacts are limited by 3-4 km^3 of water a year in the Amu Darya basin and 2 km^3 in the Syr Darya basin (other options give 2.5 km^3 and 0 km^3, respectively). In the Amu Darya basin, climate will have higher impact on river runoff in June-July: the runoff would decrease to 0.8 km^3 in August, 1.3 km^3 in June and 2.7 km^3 in July by 2055. This could add pressure on irrigation water supply. A certain positive effect of climate change found

Comparison of water demand and water availability in ASB, Mm^3



Source: Authors (2019)

in SIC's research in form of increased thermal resources and reduction of crop growing period should be taken into account. This would allow extending double-season crop production and reducing (!) water requirements. Given the crop varieties and soil-climatic conditions in highlands of Tajikistan and Kyrgyzstan, special studies are needed for these countries.

Key factors of water demand growth in the Aral Sea Basin. In the future, the major factors of water demand growth will be demographic growth, industrial production growth, increase in technological inputs for flow regulation, and increase in demand by Afghanistan. The future of regional water supply by 2040-2045 causes serious concerns. In the near future we will lack 17.3 km^3 or 20 km^3 of water a year for direct use in the Aral Sea basin relative to normal year. For dry years, similar to 2008, water deficit would exceed as much as 25-40 km^3!

Potential of decreased river runoff in the Irtysh and Ili basins in the future. By 2045, there will be enough water to cover water needs in the Irtysh and Ili River basins, even given the possible extensive water withdrawal by China. Water management in the Irtysh basin could be challenged by the fall of Zaysan Lake level; separation of Bukhtarma reservoir from lake Zaysan, with reduced regulatory capacity; deterioration in fisheries, environmental conditions in the basin and flooding flood plain; significant reduction in electricity generation at Irtysh HPP cascade; deterioration in navigation along the Irtysh River on the territories of Kazakhstan and Russia (Omsk oblast'). Major complexities in water management in the Ili basin will be related to maintenance of water level in Lake Balkhash and protection of deltaic ecosystems in the river's lower reaches.

Recommendations for the Future: Measures for Sustainable Water Security in Central Asia

The analysis of implementation of "Fundamental Provisions of Water Management Strategy in the Aral Sea Basin" of 1998 shows that by present many actions proposed in 1998 are still relevant. Those include: (1) a set of measures for the reduction of unproductive water losses, (2) regional program for water conservation, (3) development and implementation of a mechanism for economic water relations, and (4) maintenance of systematic hydro-ecological monitoring in the Aral Sea region. In this context, more concrete and effective actions are needed to achieve progress.

To ensure sustainable water security in CA and achievement of SDGs by countries, **a set of measures for water management is required at all levels of water hierarchy**. Those include: improvement of water management at all levels; improvement of water accounting and forecasts and SCADA system at hydraulic structures; water conservation – a key priority at all levels; all-round application of satellite images for better water management; revision of irrigation norms and schedules; coverage of energy deficit and address of idle discharges; coverage of irrigation water deficit through multiyear regulation; development of measures for adaptation to climate change; development of economic measures; human resources development and raising of public awareness; revival and enhancement of water research and design; and mobilization of additional water sources.

The need for the **enhancement of regional water cooperation** must be emphasized. Here, the focus should be placed on increased intersectoral coordination, improved accountability for fulfillment of decisions made, strengthening of regional organizations in key focus areas, such as water conservation, climate change, financial and economic mechanisms, as well as the establishment of an independent multidisciplinary expert platform for management decision support.

Source: OECD/SIC-ICWC, 2020. Overview of the Use and Management of Water Resources in Central Asia. A Discussion Document. Available online: https://issuu.com/oecd.publishing/docs/final_report_eng_issuu