UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

REPORT ON

Sharing and Use of Environmental Data and Indicators for Environment and Health Assessments

WITHIN THE PROJECT

Improved environmental monitoring and assessment in support of the 2030 Sustainable Development Agenda in South-Eastern Europe, Central Asia and the Caucasus

UNECE

UN environment programme

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Background and scope

The UNDA project in the context of the target countries

The project "Improved environmental monitoring and assessment in support of the 2030 Sustainable Development Agenda in South-Eastern Europe, Central Asia and the Caucasus" implemented by the United Nations Economic Commission for Europe (UNECE) in partnership with the United Nations Environment Programme (UNEP) aims to strengthen the national capacities in environmental monitoring and assessment for the 2030 Agenda of seven target countries: Armenia, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, North Macedonia and Tajikistan.

The project, funded by United Nations Development Accounts (UNDA) and implemented during the period 2018-2021, assists countries in establishing a Shared Environmental Information System (SEIS) and developing a regular reporting process within the SEIS framework. The project is aimed to strengthen environmental authorities' and statistical agencies' capacities to collect and produce data following the SEIS principles. In addition, it enhances their capacities to use regularly updated and high-quality environmental indicators for multiple policy purposes, including reporting under multilateral environmental agreements, and more importantly, for monitoring progress towards the 2030 Agenda for Sustainable Development.

Thus, the project supports the target countries in their national activities and processes towards the application of the UNECE core set of environmental indicators in line with international statistical standards and the SEIS principles. Furthermore, the target countries undergo a "nationalization of the Sustainable Development Goals (SDGs), setting targets and producing indicators to monitor their progress towards achieving the SDGs following internationally and regionally agreed methodologies. The UN Statistical Division (UNSD) has established an SDGs Data Lab – an online platform to support the Member States and the National Statistical Offices in implementing the SDG indicators.

During the first phase of the UNDA project, seven (one per target country) gap analyses were developed on SEIS establishment, environmental data, and information to cover the production of regional and international environmental indicators. Based on the gap analysis, the draft roadmaps were developed for each country, providing recommendations on how to enhance SEIS establishment. The project's first phase revealed a need to revise and update the UNECE environmental indicators to make them more policy-relevant in the longer term. The project was amended in response to the COVID-19 pandemic. Therefore, five capacity-building webinars were conducted on the environment and health-related issues:

1. Health-relevant data on air quality to inform policy and the public (SDG 3 and 11);
2. Towards clean, renewable and efficient energy use (SDG 7);
3. Sustainable consumption and production patterns (SDG 12) and municipal waste (SDG 11);
4. Availability and sustainable management of water and sanitation for all (SDG 6);
5. Informing biodiversity restoration policies (SDG 15).

The report was prepared by Dafina Dalbokova.

Objectives of the report

The overall objective of the work reported herein is to review the use and sharing of environmental data and indicators for environment and health assessments in the seven target countries. It was proposed to select two or three environmental issues of health relevance. The report will include the following:

(i) Assessment of the situation and trends of the selected issues in the seven countries using quantitative data and policy-relevant indicators and considering primarily the UNECE set of environmental indicators and the SDG ones.
(ii) Review of the current practices in the target countries concerning the sharing and use of environmental data in environment and health assessments to inform policy and regulatory actions and inform the public.

The two selected environmental issues of health relevance are:

- Air quality comprising ambient air and household air – an aspect of indoor air;
- Climate change, in particular, extreme weather, with the focus on extreme heat and floods.

The first issue is well-established with solid evidence and knowledge base and a range of policy and regulatory measures to counteract air pollution and its adverse health effects. The second one is more in the stage of development especially concerning statistics and indicators.

The two issues were selected based on the relevance for the countries, the SDG and UNECE indicators, and available global and regional statistics and country data. The Driving forces-Pressures-State-of-the-environment-Impact-Response (DPSIR) conceptual framework depicts the indicators for different issues or topic areas. The impact of a degraded environment on the population's health has two sub-elements: an environment-side one, i.e. population exposure to pollution, and the health effects one in terms of mortality and morbidity, of which only one fraction is due to the population exposure.

Within the indicators' domain, the focus was set on exposure-type indicators because the main stakeholders of the UNDA project in the target countries are the environmental authorities and the statistical agencies.

Methods and process

The first part of the report addresses the indicators and assessments focusing on the two selected issues. The indicators on the state of the environment, population exposures, and in some cases, health-related impacts and the underlying statistics were reviewed on the websites of the different United Nations organizations at the global and regional level and those with a mandate to produce and report on the state of the environment. The main criteria were the provision of scientifically sound information on population exposures and the policy relevance.

The publicly available statistical data on population exposure to ambient and household air pollution with greater temporal coverage in recent years were used to assess situation and trends.

With respect to climate change issues, the UNECE Conference of European Statisticians has recently put forward a set of core climate change-related indicators to monitor the situation for the most important environment and health issues related to climate change. The World Health Organization (WHO)/Europe, in the framework of its activities with the support of the European Commission,[1] developed and tested a set of Climate Change-Environment and Health indicators based on a

[1] See https://www.euro.who.int/en/health-topics/environment-and-health/Climate-change/archive/integrating-health-in-policies-for-mitigation-of-and-adaptation-to-climate-change/projects-on-health-in-mitigation-and-adaptation/climate,-environment-and-health-action-plan-and-information-system-cehapis; and D. Dalbokova , M. Krzyzanowski, A. Egorov, and C. Gapp, editors. *CEHAPIS Work Package 5: Policy Monitoring and Assessment.* Copenhagen: WHO Regional Office for Europe, 2011 (Technical report to EC available on request to euroclimate@who.int).

systematic review of the health effects of climate change in the WHO European Region.[2] Based on the experience gained through the WHO indicator activities, the health impact indicators of the UNECE core set were reviewed. Some additions to the methodological specifications were proposed. In addition, considerations related to the temporal resolution of the data and time series were pointed out.

With respect to the assessment of the situation in the target countries using the extreme weather events indicators, the only publicly available data were found for health-related effects from flooding. Therefore, data on deaths and affected people related to flooding during an 11-year time period were extracted, and an assessment was prepared for the seven countries.

Four out of the seven target countries used the SDG Data Lab online platform[3] to gather national data and meta-data for the global SDG indicators and determine data and information needed to establish national indicators. In addition, countries' experiences in applying the SDG indicators at the national level were reviewed with the national SDG data platform and other information.

The second part of the report reviews the target countries' practices from a SEIS perspective and its key principles.[4] The following aspects are addressed: sharing environmental data and indicators for environment and health assessments; and the use of data to inform relevant regulatory and policy actions and the public. The focus is on the two abovementioned selected issues.

The information was collected from the official websites of the national statistical offices, national environmental authorities and agencies involved in environmental and air quality monitoring. Countries' experiences presented during a series of UNDA capacity-building webinars and the 18th session of the Joint Task Force on Environmental Statistics and Indicators (18-19 October 2021) were also analysed. The list of references per country is given in the Annex.

The review of the status of the national environmental monitoring and information system in the framework of the UNECE Environmental Performance Reviews were used for Bosnia and Herzegovina (2018), Kazakhstan (2019), North Macedonia (2018) and Tajikistan (2017).

Each part is supplemented with recommendations on how to strengthen the production and use of environmental indicators in the environment and health assessments to inform policymaking and the public in the target countries.

PART I: Review of global and regional statistics and indicators and assessment of situation and trends for the target countries

Ambient and household air quality

WHO established the Global Health Observatory to monitor population health status, determinants, and trends for every country globally. The Global Health Observatory provides indicators and data on population exposures to ambient air pollution, household air pollution and associated burden of disease within the environment and health topic area.[5]

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[2] Wolf, T., Lyne, K., Martinez, G.S., and Kendrovski V. (2015). The health effects of climate change in the WHO European Region. *Climate*, 3(4), 901-936; https://www.mdpi.com/2225-1154/3/4/901.

[3] UNECE/CES "UNSD DataLab - France pilot transmission results and considerations", in the *Workshop on Statistics for SDGs,* 2020, April, [Online]. Available: https://unece.org/statistics/events/workshop-statistics-sdgs

[4] Shared Environmental Information System (SEIS): principles and process. Available at https://unece.org/shared-environmental-information-system.

[5] WHO Global Health Observatory (GHO) Air Pollution Data Portal. Available at https://www.who.int/data/gho/data/themes/air-pollution.

Indicators on ambient air pollution: population exposures and related health impacts

The indicator on population exposure to ambient air pollution centres on fine particulate matter with particles measuring less than 2.5 micrometres in aerodynamic diameter – PM2.5. Although exposure to smaller and larger airborne particles can also be harmful, studies have shown that exposure to high average concentrations of PM2.5 over several years has been the most consistent and robust predictor of mortality from cardiovascular, respiratory and other types of diseases.

The national PM2.5 indicator represents annual averaged concentrations across the entire country and, therefore, it inherently includes considerably high daily PM2.5 levels, which could be observed in certain seasons, especially around cities or major pollution sources. Although short-term exposure spikes can affect health, long-term exposures contribute most to the burden of disease and mortality from air pollution.

The exposure indicator is defined as the mean annual concentration of PM2.5 population-weighted for the urban population in a country. Population-weighted annual average concentrations provide better estimates of population exposures because they give proportionately greater weight to the air pollution experienced where most people live. This is the SDG indicator 11.6.2, within target 11.6 to reduce the cities' adverse environmental impact per capita, including paying particular attention to air quality by 2030.

Data for the exposure indicator in a country are available on the WHO Global Health Observatory website.[6] The annual urban mean concentration of PM2.5 is estimated with advanced modelling and use of data integration from satellite remote sensing, population estimates, topography and ground measurements. Data are available for the period 2010-2016 with an urban/rural breakdown. WHO is the custodian agency for the SDG indicator 11.6.2, hosting the city-level air quality PM10 and PM2.5 monitoring database.[7]

Within the UNECE process towards applying environmental indicators in the European Region, one of the indicators on the state of the environment is defined as the number of days with exceeded daily limit value for PM10 and PM2.5 (indicator A-2). Although the original definition included the annual average concentration of data flow, feasibility issues have possibly determined the decision to select the daily exceedances in the definition of the priority indicator. As already mentioned, the daily exceedance is data-driven mainly by the legal reporting obligations on compliance with respect to national air quality standards. It has limitations for population exposure monitoring and assessment. Important information to complement daily exceedance data is a legally defined limit for the number of exceedance days and the actions to follow in case of non-compliance. An assessment of the air quality policy measures from public health perspective[8] shows predominant use of penalties for infringement and suspension of activities in case of non-compliance in the countries of Eastern Europe, the Caucasus and Central Asia. The European Union countries are required to set in place targeted air quality plans and action programmes with effective control in non-compliance zones and agglomerations.

The European Environment Agency (EEA) defines a population exposure indicator for key pollutants (PM10, PM2.5, O3 and NO2) as the percentage of urban population exposed to air pollutant

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[6] WHO Global Health Observatory [web site] https://www.who.int/data/gho/data/indicators/indicator-details/GHO/concentrations-of-fine-particulate-matter-(pm2-5).

[7] Global Air Quality Database: Exploring air quality data in countries. *WHO Global Air Quality Database (update 2018) edition. Version 1.0.* Geneva: World Health Organization, 2018. Available at https://whoairquality.shinyapps.io/AmbientAirQualityDatabase/.

[8] Health and environment in Europe: progress assessment. Copenhagen: WHO Regional Office for Europe, 2010 (https://www.euro.who.int/__data/assets/pdf_file/0010/96463/E93556.pdf).

concentrations that exceed selected European Union (EU) air quality standards.[9] The air quality standards are the ones set in the EU Directive 2008/50/EC.[10] In addition, an option of the urban population exposure indicator is available, with the exceedance of the key pollutants' concentrations being defined vs. the corresponding WHO air quality guideline values.

Within the European Health Information Gateway, the Environment and Health Information System (ENHIS) database[11] provides health and environment indicators on several topics in the WHO European Region. For example, there are data on the population-weighted annual mean PM10 and PM2.5 in cities from urban and suburban background monitoring stations, for which PM measurements are available for at least 75% of days in the year. [12] The data provide a reliable measure of population exposure to PM in many countries but only in North Macedonia out of the seven target countries.

The distribution of the population over categories of PM10 or PM2.5 (e.g., for PM10 <15, <20, <30, <40, < 50, <60 ug/m3) throughout the years in a country can guide air quality management policy measures towards the achievement of maximum reduction of health risks from PM.

Assessment of the situation and trends: ambient air pollution exposure

The time coverage of the WHO Global Health Observatory data on PM2.5 exposure is from 2010-2016. For more recent data, the Health Effects Institute (HEI)[13] provides yearly updated reliable data on population exposure to ambient PM2.5 and ozone, and household air pollution from solid fuels for every country globally.[14] The population exposure is defined as the average annual population-weighted concentration of PM2.5. Together with the Institute for Health Metrics and Evaluation, the HEI initiative provides estimates of PM2.5 concentrations by using sophisticated techniques to combine available ground measurements of particulate matter with observations from satellites and predictions from global chemical transport models. Furthermore, the PM2.5 exposure for people living in a specific area is estimated by combining the number of people living within that area and the PM2.5 concentrations. Using a systematic, internally consistent approach to estimate air pollution exposure enables temporal evaluations over the long period that benefit from the most recent data and advanced modelling and analysis methods. Estimates are thus available from 1990 onwards. The PM2.5 exposure data were selected to assess the situation and trends in the seven target countries (see figure 1).

Data for the attributed burden of disease in terms of mortality, i.e. age-standardized death rates per 100,000 population – the indicator 3.9.1 for the SDG target 3.9, which calls for a substantial reduction of the number of deaths and illnesses from environment-related health hazards for every country globally from 1990 onwards, is available from the HEI State of Global Air data.[15]

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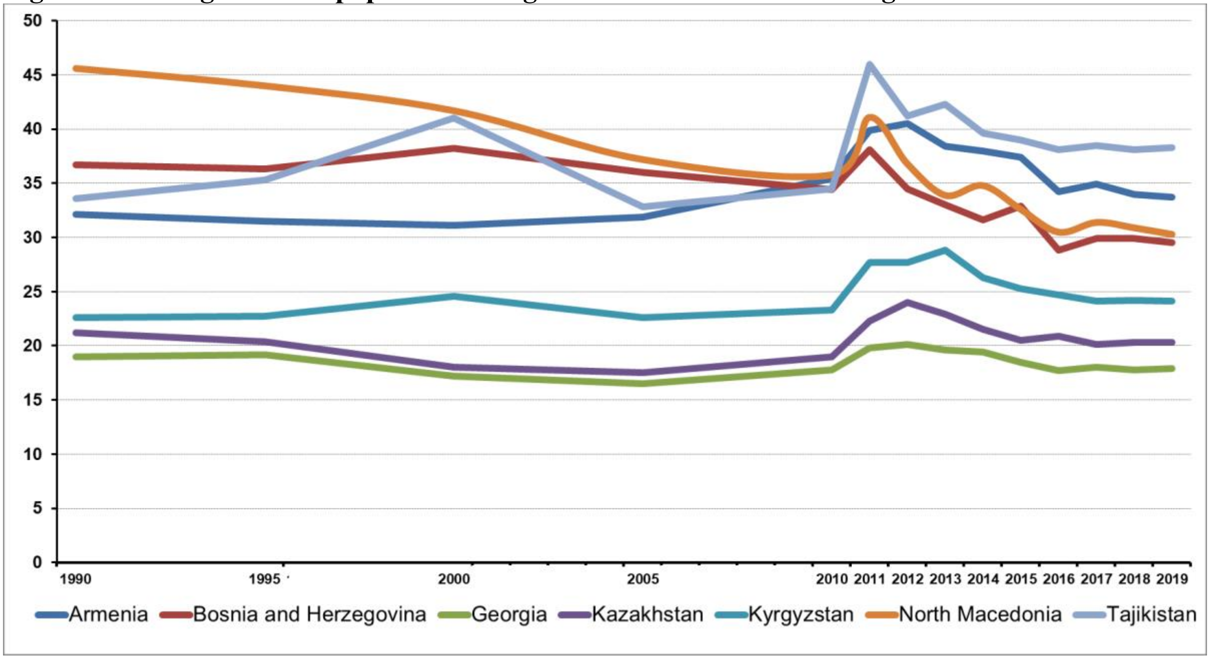
[9] Exceedance of air quality standards in Europe [web site]. Copenhagen: European Environment Agency, 2021. Available at: https://www.eea.europa.eu/ims/exceedance-of-air-quality-standards.
[10] European Union (EU), 2008, *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0050-20150918.
[11] European Health Information Gateway ENHIS Database [web site]. Copenhagen: WHO Regional Office for Europe, 2019. Available at https://gateway.euro.who.int/en/datasets/enhis/.
[12] ENHIS Database [web site] . Population exposure to PM2.5 indicator. Available at https://gateway.euro.who.int/en/indicators/enhis_26-population-weighted-annual-mean-pm25-in-cities/.
[13] (2021) Health Effects Institute https://www.healtheffects.org/.
[14] Health Effects Institute. 2020. State of Global Air 2020. *Data source: Global Burden of Disease Study 2019. IHME, 2020.* Available at https://www.stateofglobalair.org/data/#/air/plot.
[15] Health Effects Institute. 2020. State of Global Air 2020. *Data source: Global Burden of Disease Study 2019. IHME, 2020.* Available at https://www.stateofglobalair.org/data/#/health/plot

Figure 1. Average Annual population-weighted PM2.5 in the seven target countries



Source: The Health Effects Institute State of Global Air data. Available at: https://www.stateofglobalair.org/data/#/air/plot

Air quality has improved in all seven countries in the last five years. Nevertheless, in 2019 population in all seven countries continued to experience very high ambient PM2.5 levels, which is three and more times higher than the air quality guideline value of 10 ug/m^{3}for annual average PM2.5 as set in WHO 2005 Global Update.[16] This shows that more efforts are required to reduce long-term population exposure and its adverse impacts on health. It could be done by implementing policy measures to tackle air pollution and scale-up regulations on PM10 and PM2.5 monitoring and reporting. Information about the national air quality standards for key pollutants, including PM10 and PM2.5 for 24-hour and 1-year averaging periods in many countries worldwide, is available on the WHO website. [17] However, only Armenia and Kazakhstan have introduced air quality standards for daily measurements indicating the early stages of PM 2.5 monitoring. The PM10 is already in place except for Kyrgyzstan and Tajikistan, yet only Bosnia and Herzegovina and North Macedonia have set national standards for the yearly levels. As already noted, long-term exposures contribute most to the burden of disease and mortality from air pollution.

A comprehensive assessment of the sector and fuel-specific contributions to PM2.5, mortality rates by region and country[18] show the dominant role of combustion and the considerable health benefits from replacing traditional energy sources.

In 2021, WHO has released the first global update of its Air Quality Guidelines since 2005 for key ambient air pollutants with stringent guideline values. It reflects the accumulated evidence for the

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[16] Air quality guidelines, global update 2005. Copenhagen:WHO Regional Office for Europe, 2006. Available at https://www.euro.who.int/__data/assets/pdf_file/0005/78638/E90038.pdf

[17] National Air Quality Standards: Exploring and visualizing the air quality standards of different air pollutants, by country. *Data from Kutlar et al*., 2017. Version 1.0. Geneva: World Health Organization, 2019 Available at: https://whoairquality.shinyapps.io/AirQualityStandards/

[18] McDuffie, E.E., Martin, R.V., Spadaro, J.V. et al. Source sector and fuel contributions to ambient PM2.5 and attributable mortality across multiple spatial scales. *Nature Communications*, 12, 3594 (2021). Available at https://doi.org/10.1038/s41467-021-23853-y.

significantly higher impact of even lower air pollution concentrations on human health and wellbeing.[19]

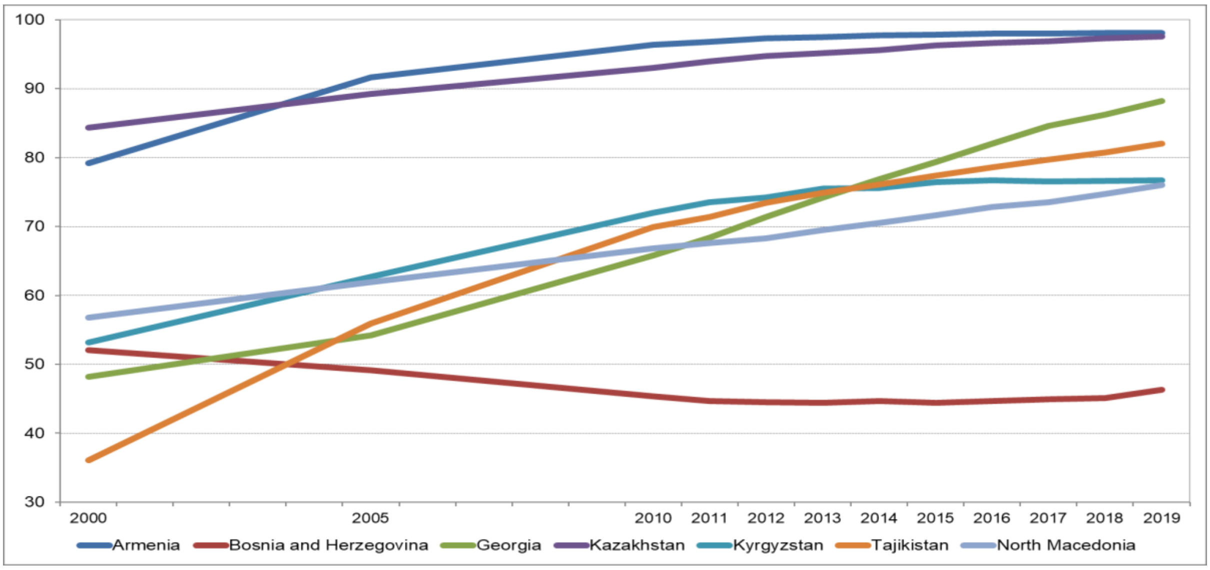
Indicators on household air pollution: population exposures and related health impacts

In the framework of the WHO Global Health Observatory, the indicator on population exposure to household air pollution focuses on the population's use of clean fuels and technologies for cooking. It is defined as the proportion of the population relying primarily on clean fuels and technologies, with an urban/rural breakdown.[20] Based on *the WHO Guidelines for indoor air quality: household fuel combustion*, the fuels and technologies that are considered clean include electricity, natural gas, liquified petroleum gas, biogas, ethanol, and solar. Data sources for the indicator production are surveys (national, population census and household). This indicator measures the progress towards SDG target 7.1 on universal access to affordable, reliable and modern energy services by 2030.

Assessment of the situation and trends: household air pollution

The time coverage of the WHO Global Health Observatory data (and the UNSDG Global Database) is from 2000 onwards, with annual estimates (see figure 2).

Figure 2. Proportion of population relying primarily on clean fuels and technologies, per cent (2000-2019)



Source: WHO Global Health Observatory data. Available at: https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-phe-primary-reliance-on-clean-fuels-and-technologies-proportion

The figure shows the good progress made in all seven target countries in the uptake of clean fuels and technologies for cooking, with over 70 % of the population using them. The exception is the case of Bosnia and Herzegovina, with a much lower population rate and mixed trend, which might also be related to the country's complex administrative-territorial structure with data reported only from one entity being considered as representative for the entire country.

[19] World Health Organization (2021). WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide: executive summary. Available https://apps.who.int/iris/handle/10665/345334.
[20] WHO Global Health Observatory [web site] https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-phe-primary-reliance-on-clean-fuels-and-technologies-proportion

With the pace of development over time, the indicator in its present formulation may become less relevant for the region. Also, it does not capture other polluting forms of energy used by households for heating.

Climate change: extreme weather events

Review of climate change-related global and regional indicators and data

UNECE has recently put forward a set of key climate change-related indicators based on the System of Environmental-Economic Accounting (SEEA) with a focus on hydro-meteorological hazards (and their impacts).[21] The hydro-meteorological hazards include tropical cyclones (also known as typhoons and hurricanes), floods including flash floods, drought, heatwaves and cold spells, and coastal storm surges. Hydro-meteorological conditions may also be a causal factor for other hazards such as landslides, wildland fires, locust plagues, epidemics, the transport and dispersal of toxic substances, and volcanic eruption material. However, floods and heatwaves and the resulting droughts were considered the most relevant hazards for the region. Overall, 44 climate change-related indicators were proposed with implementation guidelines to encompass drivers, emissions, impacts on human and natural systems, adaptation and mitigation. The following indicators are of particular relevance for the population's health:

- 22 - Number of deaths and missing persons attributed to hydro-meteorological disasters, per 100,000 population;
- 25 - Number of people whose destroyed dwellings were attributed to hydro-meteorological disasters;
- 26 - Incidence of climate-related vector-borne diseases;
- 27 - Excess mortality related to heat.

As already mentioned, WHO/Europe has reviewed the scientific evidence of observed health effects and projections of future health risks from climate variability and climate change with a specific focus on the Region's countries.[22] Priority climate change-related environment and health issues were selected based on the review and methodological guidelines for a set of policy-relevant indicators to monitor and assess associated health impacts. The indicators are summarized in Table 1.

As it can be noted from Table 1, the WHO set includes a number of population exposure indicators both to the direct effects of climate change and also on climate-sensitive airborne exposures such as ground-level ozone and allergenic pollens. The indicators require advanced monitoring, including aeroallergen monitoring and forecasting, which may not be in place in the countries. Concerning climate-sensitive infections, the WHO indicator set includes food- and water-borne diseases besides the vector-borne disease group (UNECE/CES indicator 26). As for the vector-borne disease group, Lyme disease was chosen as a model indicator from the vector-borne disease group due to the public health significance and sensitivity to climate change.

The indicators on environment and health impacts of climate change require data with a high temporal resolution, for example, daily mortality and weekly infectious disease rates. The quality of data on infectious diseases may vary considerably among the countries due to differences in public health surveillance systems. The latter in most countries is based on general practices' notifications and uses different laboratory diagnoses and references microbiology. In many countries of the region,

[21] UNECE/CES (2021) Set of core climate change-related indicators using the system of environmental-economic accounts. Available at: https://unece.org/statistics/ces-set-core-climate-change-related-indicators-and-statistics-using-seea.
[22] Wolf et al, op. cit.

infectious disease surveillance is not adequately equipped to detect pathogens throughout the country. Infectious disease cases reported by countries can thus be subject to ascertainment bias.

The indicators of heatwave impacts on population health defined as excess mortality due to heat (both WHO and UNECE/CES indicator 27) can be applied to support the monitoring and evaluation of climate adaptation policies. The daily mortality data for the big cities, where the effect of "heat island" can be observed, should be available along with data for maximum daily temperature for an extended reference period of time of at least ten consecutive years.

The indicator on health effects related to flooding in terms of deaths and missing persons is similar to the UNECE/CES indicator 22 with the exception that the former uses the cumulative number of deaths in a given period of time referenced by population, and the latter – the rate per 100,000 population. The Emergency Events Database (EM-DAT)[23] of the Centre for Research on Epidemiology of Disasters (CRED)[24] is an international database on the country's occurrence and impact of disasters for 180 countries worldwide. The database uses the following key descriptors: disaster type and sub-type; geographical and temporal information; status; physical characteristics; source; human impact; economic impact; infrastructure impact; and sectors affected. The EM-DAT inclusion criterion for a disaster is one of the following: deaths of ten or more persons; hundred or more people affected; declaration by the country of a state of emergency, and/ or appeal for international assistance. Data are compiled from different sources according to a priority list, and the database – validated and updated daily.

Two main groups of disasters are distinguished: natural disasters and technological disasters. The former is further categorized into six sub-groups: biological, geophysical, climatological, hydrological, meteorological and extra-terrestrial disasters based on the Peril Classification and Hazard Glossary developed by the Integrated Research on Disaster Risk (IRDR).[25] The hydrological sub-group comprises the flood type of disaster and the riverine, coastal, flash and ice jam flood sub-types. The data on human impact is available in the form of the total number of deaths (number of deaths and missing persons) and the total number of affected (number of injured and affected and homeless).[26] EM-DAT is the only publicly available database containing data on flood disasters and related health effects for the seven countries.

Assessment of the situation: floods and health

Flooding is the most common type of extreme weather events in the Region. A recent brief of the Centre for Research on Epidemiology of Disasters (CRED)[27] shows that floods have the most considerable impact of all weather-related disasters, with more than half of the total number of affected people. Flooding poses multiple risks to people's health: direct deaths are from drowning, heart attacks, hypothermia, trauma and vehicle-related accidents in the immediate term. Medium-term effects are the potential increase of waterborne (i.e. cholera, hepatitis A), vector-borne (i.e. malaria, Dengue fever) and rodent-borne transmission of diseases, also with significant effects on mental health (common mental disorders and post-traumatic stress disorders). In the long-term, chemical

[23] EM-DAT, the International Disaster Database [online database], https://public.emdat.be/data
[24] Centre for Research on Epidemiology of Disasters CRED https://www.cred.be/.
[25] Integrated Research on Disaster Risk. (2014). Peril Classification and Hazard Glossary (IRDR DATA Publication No. 1). Beijing: *Integrated Research on Disaster Risk, 2014*. Available at https://www.irdrinternational.org/uploads/files/2020/08/sxztCDwe0VzI4m6Ug3VLjkXSnh9vUAngozmPYAkp/IRDR_DATA-Project-Report-No.-1.pdf
[26] R. Below (CRED), "EM-DAT: 30 years of experience in disaster data collection", in the *Seventh EU Loss Data Workshop*, Joint Research Centre, Ispra, Italy, March, 2016. Available: https://drmkc.jrc.ec.europa.eu/partnership/science-policy-interface/disaster-loss-and-damage-working-group/seventh-eu-loss-data-workshop#documents/512/list
[27] Extreme weather events in Europe. *CRED Crunch Issue* No. 64, September 2021. Available at https://www.cred.be/publications.

contamination of food and water stocks, damage to water and sanitation infrastructure and damp housing can further reinforce the adverse health effects of flooding.

The scale and frequency of floods are likely to increase due to climate change (which will cause a higher frequency of extreme rainfalls) and inappropriate river management and construction in flood plains, reducing their capacity to absorb floodwaters. Also, the continued growth of the number of people and economic assets in flood risk zones contributes to the increase in the likelihood and adverse impacts of flood events.

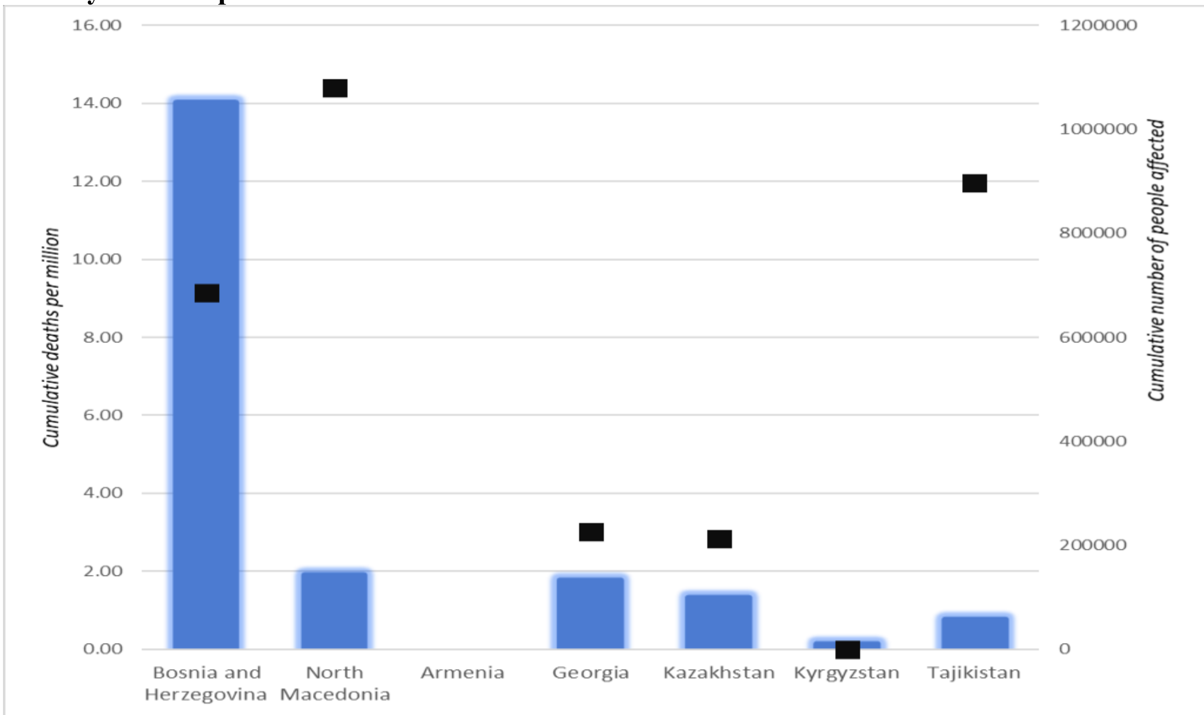
Given the relative importance of the floods, their effects on health, as well as the availability of data and indicators, assessment of the situation on climate change, environment and health for the seven target countries focused on floods.

Table 1: List of the Climate change, Environment and Health indicators vis-à-vis the identified health effects and projected health risks

	Issue	Sub-issue	Indicator	Definition	Underlying definitions	Notes
Direct effects	Extreme heat	Heatwaves	Excess mortality due to heatwaves	Difference between observed and expected	Heatwave: at least three consecutive days with maximum daily temperature for above threshold: the 95th percentile of the temperature reference period. Temperature reference period: summer periods of preceding 10 years Maximum daily temperature for the summer (extended) in the reference period	Requires daily mortality for the hot/ summer (extended) for a given area/ city for a reference period (5 years) Usually, the big cities/ "Heat islands"
			Population exposure to heat waves	The proportion of person-days spent in heatwaves		
	Hydrological	Flooding	People at risk to floods; Vulnerability			Only for local application
			Deaths related to flooding	Cumulative overtime period		Requires a long period of time e.g. 10 years
Climate sensitive infectious diseases	Food-borne	Salmonellosis	Incidence of laboratory-confirmed cases	Weekly incidence & seasonal peak		Weekly data
	Water-borne	Cryptosporidiosis	Incidence of laboratory-confirmed cases	Weekly incidence & seasonal peak		Weekly data
	Vector-borne	Lyme borreliosis	Incidence	Seasonal, annual		
Climate-sensitive airborne exposures	Ambient air	Ozone	Population exposure	The population-weighted average seasonal 8-hour daily maximum concentration		
	Airborne pollens/ allergens	Flowering	Start of flowering time		State of the environment indicator	
		Selected pollens: alder, birch and grasses	Population exposure for each pollen	Population-weighted		
		Ragweed pollen	Population exposure	Four sub-indicators/ measures defined		

Data for the total deaths and the affected people from floods during the period 2010-2021 were extracted from the EM-DAT database. The cumulative number of deaths and affected people over the period for each of the seven target countries was calculated. The cumulative number of deaths was referenced to country population and expressed as the rate per million. Deaths (per million population) and affected people from flood events in the target countries over the period 2010-2021 are presented in Figure 3.

Figure 3. People affected (bar chart)[1] and deaths per million (thick dashes)[2] from floods by country over the period 2010-2021



Notes

[1] Cumulative number of total affected people from floods over the period 2010-2021

[2] Cumulative number of total deaths from floods over the period 2010-2021: rate per million population

Source: EM-DAT, the International Disaster Database, https://public.emdat.be/

The high number of deaths and a very high number of affected people during the observation period in Bosnia and Herzegovina resulted from the catastrophic flood of May 2014. Tajikistan and North Macedonia show a disproportionally high number of deaths for affected people in floods, indicating that considerable efforts are necessary to advance country policies on prevention, preparedness and response to hydrological disasters.

On the occasion of the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change, the European Commission, in partnership with the European Environment Agency and several other organizations launched the European Climate and Health Observatory ('Observatory') and published a set of climate change and health indicators focusing on health effects and combining information from different providers.[28]

Review of countries' experiences in the application of the global SDG indicators

[28] European Climate and Health Observatory [web site]. Available at https://climate-adapt.eea.europa.eu/observatory

Overall, the countries show diverse experiences and approaches towards applying the global SDG indicators in a national context. Four countries – Armenia, Bosnia and Herzegovina, Kazakhstan and Kyrgyzstan – use the UN SDG Data Platform and collect national data for the global indicators. Most probably, the responsibility on the SDG indicators is primarily with the National Statistical Offices. Nevertheless, national indicators for some targets have been put forward to better reflect national situations, especially after an intensive nationalization of the global SDGs and targets. For example, for SDG target 7.1 ("Affordable and clean energy for all"), the national indicator for Kazakhstan is the level of population gasification.[29] Kyrgyzstan's indicator 7.2.1 points out the considerable inequalities by income quintile but only for the year 2018. Georgia has also introduced a new indicator to monitor population access to reliable and modern energy services (electricity and natural gas).

Reporting on the disease burden of air pollution (SDG indicator 3.9.1) is challenging for some countries. For example, Kazakhstan, Kyrgyzstan, and Georgia are exploring data. Indicators on disease burden require multidisciplinary expertise, advanced health impact assessment capacity, and good cooperation between the environment and health sectors.

Armenia has reported mortality statistics by a number of respiratory and cardiovascular diseases causes, for which air pollution is one of the contributing risk factors. However, the policy-relevant indicator in the context of sustainable development needs to address specifically the fraction of all causes of mortality attributed to air pollution. In the framework of a project implemented by the Statistical Committee in twinning partnership with other organizations and supported by the World Bank, nineteen indicators have been identified as measures of quality of life and the environment linkages.[30] The indicators represent a mixture of the SDG indicators (health impacts of environmental pollution, access to services, environmental quality) and subjective measures on population satisfaction with the services and amenities. Methodologies were developed, and statistics are available in the national statistical database for national and sub-national ("marzes" and the city of Yerevan) levels.[31] The composite indicator of the quality of life related to the environment, which combines objective and subjective data, is of particular interest and is available in the national statistical database, however, no methodology is provided. The country is currently exploring data on population exposure to fine particles (SDG indicator 11.6.2). It is equally relevant for Kyrgyzstan. Kazakhstan reports annual average PM10 and PM2.5 for several regions and cities with extensive air quality monitoring.[32] Georgia reports population exposure to PM10 and PM2.5 for four cities and has set targets on the exceedance of annual average PM levels by 2030.[33]

North Macedonia reports a national air quality indicator (MK – NI 004) on the exceedance of limit values in urban areas, focusing on PM10. Two measures of urban population exposure to PM10 corresponding to the two legally binding limit values (annual mean PM10 limit; and the 24-hour PM10 limit not to be exceeded more than 35 times throughout the year) are reported together with an assessment of the situation and trends since 2004.[34] The indicator features limitations related to the lack of urban background monitoring stations and the number of valid daily measurements in order to qualify for a representative measure of population exposure.

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[29] National SDG indicator 7.1.2 of Kazakhstan 2021. Available at https://kazstat.github.io/sdg-site-kazstat/ru/7-1-2/.
[30] UNECE/CES "National developments in the implementation and sharing of environmental indicators and statistics, Armenia" in *18th Session of the Joint Task Force on Environmental Statistics and Indicators*, 2021, October [Online]. Available https://unece.org/info/Statistics/events/357762
[31] Indicators on quality of life and environment. Statistical database of Armenia [online database] https://armstatbank.am/pxweb/en/ArmStatBank/?rxid=93ef0e74-b011-48dc-9104-4e6442c4ef74.
[32] National SDG indicator 11.6.2. of Kazakhstan 2021. Available at https://kazstat.github.io/sdg-site-kazstat/ru/11-6-2/.
[33] National SDG indicators and targets Georgia 2021. Available at https://sdg.gov.ge/goals-details-inner/11/1.
[34] Exceedance of air quality limit values in urban areas – PM10. National environmental indicator-based assessment, North Macedonia 2021. Available at https://www.moepp.gov.mk/?page_id=4819&lang=en

Concerning climate change, North Macedonia has developed and applied a heatwave indicator for the capital and three other cities.[35] A heatwave is defined as a period of at least six consecutive days with a maximum temperature higher than the ninetieth percentile for each corresponding day (T_{max}> 90th percentile), with the reference period from 1981-2010. The average number of heatwaves and the total number of days are calculated for 1990, 1995 and 2000-2020. The assessment shows an increasing trend during this period in all locations, including the increase in the number of heatwaves, the total number of days with Tmax> 90th percentile and the average number of days after years with heatwaves.

Bosnia and Herzegovina is currently identifying data and information needs vis-à-vis the estimates for the global SDG indicators.[36]

Concerning Tajikistan, the database "socio-demography" of the Agency on Statistics under the President of the Republic of Tajikistan contains basic demographic and social statistics, morbidity data (from 1991 to 2019) and emissions of air pollutants from stationary sources (1998-2019) in the form of Excel files. However, it is difficult to access them.[37]

Conclusions and recommendations

Air pollution is a significant health threat in the target countries. Yet, applying the global SDG indicators to monitor the effects of the relevant policy actions in a national context remains a challenge. It shows the need to scale up airborne fine particles monitoring, introduce health-relevant standards (long-term PM10 and PM2.5 concentrations) and strengthen countries' capacities to assess urban air quality and associated health impacts focusing on population exposures.

The target countries with advanced air quality monitoring networks should be supported so that long-term PM10 and PM2.5 concentrations become "core" data-flows within the national environmental information system. In addition, capacities should be strengthened for periodic indicator-based assessments of population exposures, including aggregation across scales to inform decision-making at the local and national levels. For this purpose, mechanisms for technical cooperation which enable the countries to benefit from the expertise and practical experience of more advanced countries should be sought. At the level of the UNECE Joint Task Force on Environmental Statistics and Indicators members, thematic-specific cooperation on issues related to assessment of air quality and its determinants should be pursued with the members of the EEA bodies such as the European environment information network (Eionet), the European Topic Centres, the members of the UNECE Working Group on Effects under the Convention on Long-Range Transboundary Air Pollution etc. Implementation of specific projects in twinning partnership with a country well advanced in air quality data and indicators, thematic and integrated assessments would ensure effective transfer of knowledge and expertise in strategic monitoring and evaluation to the target countries.

The household air pollution measurement in terms of the population relying primarily on clean fuels and technologies for cooking shows that some of the global SDG indicators, especially those on access to services, should periodically be re-visited and complemented with new relevant measures at the European regional level.

There are promising examples of producing early signals of heatwaves and their adverse health impacts with respect to climate change. However, it would require higher temporal resolution data

[35] National indicator on heat waves North Macedonia (MK-NI 005) 2021. Available at https://www.moepp.gov.mk/?page_id=24941.
[36] National SDG platform Bosnia and Herzegovina [web site] https://sdg.bhas.gov.ba/.
[37] Statistical database of the National Statistical Agency, Tajikistan, 2021. Available at https://www.stat.tj/ru/database-socio-demographic-sector.

(daily temperature and mortality) and a long time series (e.g., ten years for temperature) in big cities, which requires big data management technologies.

PART II: Review of the target countries' practices from the SEIS perspective

Sharing environmental data and indicators for use in environment and health assessments

Overall, the availability of environmental data online, which can be downloaded in a ready-to-use format, has been improved in the last five years. It is particularly relevant for the upstream elements of the Driving forces-Pressures-State-Impact-Response (DPSIR) chain, for example, pollutant emissions. The latter is used to obtain population exposures estimates through modelling and require reliable emission inventories. Sharing environmental statistics implies the existence of database management systems. It applies to the indicators residing at the National Statistical Offices (e.g., in Armenia, Georgia and Kazakhstan). For example, air quality databases are established and managed by the national environmental agencies in Georgia and North Macedonia. Armenia and Bosnia and Herzegovina are developing such databases.

The national online SDG platforms facilitate data exchange among various data-holders in some countries, for example, Armenia, Kazakhstan and Kyrgyzstan.

Nevertheless, national statistical offices have reported challenges in the environmental data exchange with other sector institutions and setting formal agreements. Furthermore, in most cases, data for the air pollution topic is spread among different institutions. For example, emissions are reported by the statistical offices and concentrations by hydro-meteorological offices, which are differently administrated depending on the country. It creates constraints to easy access the information. IT platforms, which enable easy access to environmental data and indicators online, allow users to browse by topic area, pollution source or sector and at different scales (local, regional and national). The target countries lack such platforms at the moment. Another challenge concerning data sharing is related to deficiencies in the meta-data. Given limited human resources in the target countries, priority is given to activities related to the production of statistical data. The national meta-data on the SDG platforms are limited only to the data-holders and, in some cases specifying that the national indicator is the closest to the corresponding SDG one. That meta-data is absolutely insufficient, particularly for the impact indicators, which are integrated measures by nature. The impact indicators integrate data from diverse domains of environment, health, population and information on the method used has to be specified in the meta-data. Furthermore, meta-data scarcity is a serious challenge that hampers good practice in indicator development and application.

Using environmental indicators and data to inform relevant policymaking and the public

Currently, almost all environmental indicators published online are presented as tables and graphs, thus the user can make the assessment and interpretation of the statistics. Regularly published state-of-the-environment reports based on indicators increasingly include an analytical part in all the seven countries, though to a varying degree. Nevertheless, the policy relevance of the reports requires strengthening. It is often difficult in such comprehensive publications to find specific pieces of information. Indicator-based reports in the "fact sheets" format, which are meant to reach different user groups, are currently lacking in the target countries.

The experience of North Macedonia may be considered as a good practice example. Following the EEA indicator fact sheet format, the country fact sheet integrates data and assessments produced for the national core environmental indicators. The national factsheets also include policy-relevant information, are regularly updated and are available online in Macedonian, Albanian and English.[38]

Four countries (Bosnia and Herzegovina, Georgia, Kazakhstan and North Macedonia) provide information to the public through an air quality portal. Bosnia and Herzegovina, Georgia and North Macedonia use the European Air Quality Index[39] to provide online information on local air quality for five key pollutants (PM2.5/PM10, O3, NO2, and SO2) that significantly affect people's health and the environment.[40] Unfortunately, dedicated indicator-based reports targeting the general public were not identified in any of the countries.

Conclusions and recommendations

The UN SDG platform has served to a great extent as a catalyst for applying the SDG indicators at the national level. Therefore, it may be considered that well-designed web-based platforms which integrate data and indicators along with assessment and reporting tools (e.g., fact sheets) would support materializing SEIS at the national level in the target countries. The Environment for Europe policy process, countries' experience together with the expertise of EEA, UNECE, UNEP and other organizations favours such a development. In addition, distributed database architecture and a network of partner institutions with a role or a mandate to produce environmental data would facilitate the use and re-use of data and indicators in the target countries.

Concerning the deficiencies in the national meta-data, there is a need to define, as a part of the environmental indicator guidelines, essential (minimum) requirements for meta-data. The existence of a data entry form and template for those requirements would facilitate the process of national meta-data provision in the countries.

Providing information to decision-makers and using environmental indicators to monitor and evaluate the implementation of relevant policies is a complex issue. Several aspects need to be considered. For example, capacity building activities are necessary to advance the preparation of assessments in a broader context, i.e. that of environmental protection policies and regulations in place across the country. Equally important is capacity building on the preparation of assessments in a clear and understandable language, thus reaching beyond a professional expert audience. In the UNECE Environmental Monitoring and Assessment programme framework, activities should be dedicated to the development of guidance and reporting tools in the format of, for example, fact sheets and policy briefs to better structure environmental statistics and indicators to answer key policy questions. At a higher political level (through the Committee on Environmental Policy), mechanisms of voluntary national reporting should be promoted to enhance the demand for policy-oriented monitoring and evaluation in the UNECE countries using environmental data and indicators.

[38] National environmental indicators North Macedonia 2021. Available at https://www.moepp.gov.mk/?page_id=746&lang=en.
[39] The European Air Quality Index. Copenhagen: European Environment Agency [online database] https://www.eea.europa.eu/themes/air/air-quality-index/index.
[40] National Air Quality Index [online database]. The links are as follows: Bosnia and Herzegovina - https://zrakubih.ba/bs; Georgia - https://air.gov.ge/en/; North Macedonia - https://air.gov.ge/en/and also alert threshold in case of high pollution episodes. Kazakhstan uses different methodology for air quality index based on MAC (https://kazhydromet.kz/ and https://waqi.info/kk/#/c/51.112/71.552/11.2z).

ANNEX

References per country

ARMENIA

National institutions [web site]:

Ministry of Environment [http://www.mnp.am/];

Hydrometeorology and Monitoring Centre of the Ministry of Environment [http://www.armmonitoring.am/#home]

Statistical Committee [https://www.armstat.am/en/] Online databases: https://armstatbank.am/pxweb/hy/ArmStatBank/

Ambient air quality of Yerevan: http://meteomonitoring.am/posts/33

Implementation of the Shared Environment Information System in the Eastern Partnership Countries (ENI SEIS II East) project 2016-2020. Country factsheet on air quality. Copenhagen: European Environment Agency, 2020. Available at https://eni-seis.eionet.europa.eu/east/areas-of-work/data/air

G. Shahnazaryan/ Ministry of Environment, "Air Quality Monitoring and Data Management in Armenia" in *Health-relevant air quality data informing policy and the public (UNDA Webinar #1)*, 2020, December [Online]. Available https://unece.org/environmental-policy/events/health-relevant-air-quality-data-informing-policy-and-public-unda

UNECE/CES "National developments in the implementation and sharing of environmental indicators and statistics, Armenia" in *18th Session of the Joint Task Force on Environmental Statistics and Indicators*, 2021, October [Online]. Available https://unece.org/info/Statistics/events/357762

National indicators of life quality and environment [online database] https://armstatbank.am/pxweb/en/ArmStatBank/?rxid=fc6266dd-4b58-49be-9555-195a196fef62

Methodology for national indicators on life quality and environment, Statistical Committee 2020. Available https://www.armstat.am/file/ECASTAT/ECO/en/Annex%208_EN.pdf

National SDG indicators platform [website] https://sdg.armstat.am/

BOSNIA and HERZEGOVINA

Agency for Statistics [https://bhas.gov.ba/]

Third Environmental Performance Review of Bosnia and Herzegovina 2018. Available at https://unece.org/environment-policy/publications/3rd-environmental-performance-review-bosnia-and-herzegovina

A. Rogović-Grubić "Improved environmental monitoring and assessment in support of the 2030 Sustainable Development Agenda in South-Eastern Europe, Central Asia and the Caucasus" in *Health-relevant air quality data informing policy and the public (UNDA Webinar #1)*, 2020, December [Online]. Available https://unece.org/environmental-policy/events/health-relevant-air-quality-data-informing-policy-and-public-unda

National Air Quality Portal [online database] https://zrakubih.ba/bs and https://zrakubih.ba/bs/tekst/prosjecne-godisnje-vrijednosti/7

National SDG indicators platform [web site] https://sdg.bhas.gov.ba/

UNECE/CES "Progress in producing and using environmental statistics and indicators Bosnia and Herzegovina" in *18th Session of the Joint Task Force on Environmental Statistics and Indicators,* 2021, October [Online]. Available https://unece.org/info/Statistics/events/357762

GEORGIA

Institutions [web site]:

Ministry of Environmental Protection and Agriculture [https://mepa.gov.ge/En/]

National Environmental Agency [https://nea.gov.ge/En/]

National Statistical Office [https://www.geostat.ge/en]

Implementation of the Shared Environment Information System in the Eastern Partnership Countries (ENI SEIS II East) project 2016-2020. Country factsheet on air quality. Copenhagen: European Environment Agency, 2020. Available at https://eni-seis.eionet.europa.eu/east/areas-of-work/data/air
L. Ahalaia, M. Arabidze, "Air Quality Data Policy in Georgia" in Health-relevant air quality data informing policy and the public (UNDA Webinar #1), 2020, December [Online]. Available https://unece.org/environmental-policy/events/health-relevant-air-quality-data-informing-policy-and-public-unda
National Air Quality Portal [online database] https://air.gov.ge/en/
National SDG platform targets and indicators (website) https://sdg.gov.ge/main

KAZAKHSTAN

Institutions [websites]:

Ministry of Ecology, Geology and Natural Resources [https://www.gov.kz/memleket/entities/ecogeo?lang=ru]; subordinate institutions:
RSE Information and Analytical Centre for Environmental Protection [https://iacoos.kz/]
RSE Kazhydromet [https://kazhydromet.kz].
Bureau of National Statistics of the Agency for Strategical Planning and Reforms [https://stat.gov.kz/].

Third Environmental Performance Review of Kazakhstan. UNECE, 2019. Available at https://unece.org/environment-policy/publications/3rd-environmental-performance-review-kazakhstan
A. Kerimray, "Air Quality in the Cities of Kazakhstan. Health Effects of Air Pollution," in *Health-relevant air quality data informing policy and the public (UNDA Webinar #1)*, 2020, December [Online]. Available https://unece.org/environmental-policy/events/health-relevant-air-quality-data-informing-policy-and-public-unda
Kerimray, A., Assanov, D., Kenessov, B. and Karaca, F. (2020). Trends and health impacts of major urban air pollutants in Kazakhstan. *Journal of the Air and the Waste Management Association.* 70:11, 1148-1164, DOI: 10.1080/10962247.2020.1813837
National Air Quality Portal [web site] https://kazhydromet.kz and https://waqi.info/kk/#/c/51.112/71.552/11.2z
UNECE/CSE "Monitoring of Environmental Indicators in Kazakhstan" in *18th Session of the Joint Task Force on Environmental Statistics and Indicators*, 2021, October [Online]. Available https://unece.org/info/Statistics/events/357762
National SDG indicators platform [web site] https://kazstat.github.io/sdg-site-kazstat/ru/

KYRGYZSTAN

Institutions [web sites]:

State Committee on Ecology and Climate, established in June 2021 [https://www.osoo.kg/inn/00306202110080/]
National Statistical Committee of the Kyrgyz Republic [http://www.stat.kg/ru/]

Environmental statistics http://www.stat.kg/ru/statistics/turizm-otdyh-ohrana-okruzhayushej-sredy/
National Sustainable Development Strategy 2018-2040 http://www.stat.kg/ru/nsur/
National SDG indicators platform [web site] https://sustainabledevelopment-kyrgyzstan.github.io/

NORTH MACEDONIA

Institutions [web sites]:

Ministry of environment and physical planning [https://www.moepp.gov.mk/?lang=en];
Department Macedonian Environmental Information Centre under the Ministry [https://www.moepp.gov.mk/?page_id=1140&lang=en].
State Statistical Office [https://www.stat.gov.mk/Default_en.aspx].

Statistics environment https://www.stat.gov.mk/OblastOpsto_en.aspx?id=28

Third Environmental Performance Review of North Macedonia, UNECE, 2019. Available at https://unece.org/environment-policy/publications/3rd-environmental-performance-review-north-macedonia

N. Golubov, "Air Quality Monitoring in the Republic of North Macedonia" in *Health-relevant air quality data informing policy and the public (UNDA Webinar #1)*, 2020, December [Online]. Available https://unece.org/environmental-policy/events/health-relevant-air-quality-data-informing-policy-and-public-unda

National air quality indicator-based assessments (2021):

Exceedance of Air Quality Limit values in Urban Areas by Monitoring Station https://www.moepp.gov.mk/?page_id=5849&lang=en;

Exceedance of air quality limit values in urban areas – PM10 https://www.moepp.gov.mk/?page_id=4819&lang=en

M. Dimovska (2021) "Health impact assessment of air pollution – the case of North Macedonia" in *Health Effects Institute Webinar Series on Air Pollution and Health in South-East Europe (2021-2022)*. Available at https://www.healtheffects.org/meeting/webinar-series-air-pollution-and-health-se-europe

National Air Quality Portal [online database] https://air.moepp.gov.mk/; campaign https://www.facebook.com/dishemezaedno;

National indicator-based assessment on heat waves (2021) https://www.moepp.gov.mk/?page_id=24941

Heat-health action plan https://climate-adapt.eea.europa.eu/metadata/case-studies/implementation-of-the-heat-health-action-plan-of-the-former-yugoslav-republic-of-macedonia

National environmental indicator-based assessments https://www.moepp.gov.mk/?page_id=746

Environmental indicators report (2020) https://www.moepp.gov.mk/wp-content/uploads/2014/10/0301_Infografici_2020.pdf

UN Sustainable Development Goals Voluntary National Review Report North Macedonia (2020). Available at https://sustainabledevelopment.un.org/memberstates/macedonia

TAJIKISTAN

Institutions [web sites]:

Agency on Statistics under the President of the Republic of Tajikistan [https://www.stat.tj/ru].

Committee on environmental protection under the Government of Tajikistan [http://tajnature.tj/ru/].

Database "socio-demography" https://www.stat.tj/ru/database-socio-demographic-sector (access problematic);

Statistical Yearbook on Environmental Protection, 2019 https://stat.ww.tj/publications/October2019/tphifzi_muhiti_zist_-_2019_nav.pdf

Third Environmental Performance Review of Tajikistan. UNECE, 2017. Available at https://unece.org/environment-policy/publications/3rd-environmental-performance-review-tajikistan