IAEA Technical Cooperation Programme

Understanding the effects of climate change on soil and water resources in mountainous regions

Scientists examining organic matter in soil as part of an IAEA project to assess the impact of climate change and its effects on soil and water resources. (Photo: G. Dercon/IAEA)

Supporting global efforts to address climate change

Nine of the 10 warmest years on record have occurred since 2005, according to the United States National Oceanic and Atmospheric Administration, who have been measuring the world's climate for almost 140 years. The last five years (2014–2018) rank as the five hottest. These startling findings underline the need for urgent action to reduce our carbon footprints.

In support of global efforts to address the challenges related to climate change, the IAEA has been building Member States' capacities to study and understand the effects of climate change on their soil and water resources. Isotopic techniques have the comparative advantage of detecting and measuring subtle environmental changes that affect the benefits provided by key ecosystem 'services', such as water and soil. Scientists have used these techniques for a long time to study previous changes in the Earth's climatic and environmental systems. The measurements can now support government policy and decisions for managing natural resources and for conservation of ecosystems.

In view of the important role mountains play in providing freshwater and for growing food, regulating and supporting elements such as the climate, water flow and water quality, and with their ecosystems being among the most sensitive to rapid global warming, a new IAEA technical cooperation project was approved in November 2019. Its overall goal is to contribute to the conservation of ecosystem services, as well as to the resilience of local mountain communities in the Andes and the Himalayas, with the purpose of improving their ability to adapt to climatic changes and better manage land and water resources at high altitudes.

In 2015, an IAEA team conducted field training in Svalbard, Norway, with 20 fellows, to ensure that researchers at benchmark sites could use validated sampling procedures. (Photo: L.Potterton/IAEA)

IAEA's work to measure and understand climate change

In 2014, the IAEA began a five-year global initiative using nuclear techniques to build capacity in Member States to study and understand the impact of climate change on soil and water resources in some polar and mountainous regions of the world. The project facilitated data collection, sharing, cross-referencing and quality assurance among eleven specially selected sites.

With over 50 international experts from 12 countries, the initiative:

- Improved the skills of 75 scientists through fellowships and training courses in using nuclear techniques to assess greenhouse gas emissions and sediment redistribution, study changes in soil and water resources, and in the use of remote sensing tools to monitor dynamics in the cryosphere (frozen water parts of the Earth).
- Facilitated seven expert missions to polar and high-altitude sites to conduct field campaigns and collect data on soil and water resources.
- Collected over 2700 soil, sediment and water samples, and measured 70 biogeochemical parameters for dating sediment and tracing their origin, and assessing greenhouse gas emissions.
- Yielded three peer-reviewed scientific papers, including a review paper identifying knowledge gaps in climate change impacts on land-water-ecosystem quality in polar and mountainous regions, and 32 conference presentations with a dedicated session at the 2018 General Assembly of the European Geosciences Union.
- Formulated a broad set of recommendations for glaciers and water resources to inform policy decisions.

The next steps for 2020 and beyond

The new follow-up project will take advantage of the technical capabilities built and the collaborative network developed during the 2014-2019 project to focus efforts on high-altitude mountain regions, namely the Andes and the Himalayas. These regions provide invaluable goods and services not only to local communities and ecosystems, but also to populations and industries in lowland areas.

The project's focus will be on three areas where the IAEA can make a unique contribution:

- The comparative advantages of nuclear science and technology over conventional approaches in terms of measurability, accuracy and traceability of isotopes in water, soil, sediments, vegetation and greenhouse gases.
- The capacity to forge strong and adaptable collaborations through the existing nucleus of national and international experts and research institutions, additional stakeholders identified during the previous initiative, and other technical cooperation projects. This will be reinforced with more key international partners such as the Food and Agriculture Organization of the United Nations, UN Environment and United Nations Educational, Scientific and Cultural Organization.
- Assisting Member States to build and strengthen their national capacities for the effective use of nuclear and nuclear-related techniques and other approaches to tackle challenges related to climate change and natural resource management.

A training course was conducted in 2018, dividing participants' time between the Seibersdorf laboratories and the Austrian Alps, to show how nuclear and related conventional techniques are used to assess the impact of climate change on soil and water resources in polar and mountainous regions. (Photo: G. Dercon/IAEA)

Hands-on training in sampling and measurement protocols to evaluate the impacts of climate change on land-water-ecosystem quality in mountainous and polar regions.(Photo: G. Dercon/IAEA)

NEW CLIMATE CHANGE PROJECT AT A GLANCE

- Further strengthen, or build where applicable, capacities in participating Member States from the Andes and Himalayas for the use of nuclear and isotopic techniques to measure and study the impact of climate change on soil and water resources.
- Conduct intensive field campaigns in pilot high-altitude mountain sites for data collection on water, soil and sediments, as well as other relevant ecosystem services, designed to support the analysis of a wide range of biogeochemical parameters. These are important for measuring and understanding the changes affecting soil and water resources in the context of a changing climate.
- Measure and study water supply variability on specific wetland sites in an effort to understand their hydrological behaviour under changing environmental and climatic conditions.
- Undertake integrated watershed assessment studies, focusing on integrated water resource management and soil/ecosystem conservation practices, including all water uses (eg irrigation, drinking, industry, energy, fishing and ecosystems) and involving all relevant stakeholders (eg farmers, businesses, cities, civil society and policymakers).
- Devise adaptation strategies with supporting policy recommendations for the better management of high-mountain ecosystem services and their conservation as an important basis of mountain livelihoods, for the benefit of local and lowland communities and ecosystems.

For more information:
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www.iaea.org/topics/climatechange

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