



REPUBLIC OF TÜRKİYE  
MINISTRY OF INDUSTRY  
AND TECHNOLOGY

# NATIONAL  
TECHNOLOGY  
INITIATIVE

# TURKISH POLAR SCIENCE STRATEGY

2023  
2035





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MINISTRY OF INDUSTRY  
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The polar regions, while hosting the unique beauty of nature and unique ecosystems, also have a significant impact on global climate systems. The melting of glaciers in the Arctic and Antarctica directly affects the global climate system, the balance of natural life, energy supplies, the use of underground resources, urbanization, sea level changes and more; while indirectly affecting many topics such as economy, migration and education.

As Türkiye, we aim to contribute to the protection of these strategic geographies, conducting of scientific studies in a sustainable manner, to better understanding of climate change, and to support natural life by increasing our interest in the polar regions day by day. We want to cooperation in scientific research, environmental protection, maritime management, and logistics in these regions.

Through the national scientific expeditions to the polar regions since 2017, Turkish scientists have discovered new species and contributed to ecosystem and climate research in these critically important areas for studying the effects of climate change. These efforts strengthen our country's international scientific position and provide significant contributions for the future of the polar regions.

With the 2023 - 2035 Turkish Polar Science Strategy, we emphasise the importance of the polar regions for the world and Türkiye's approach to these strategic regions. This strategy is important in terms of showing Türkiye's scientific goals in the polar regions and the road map to be followed to achieve these goals. Türkiye's science vision for polar research is defined as "to be among the leading countries in polar research with its unique scientific studies that draw its strength from its well-equipped infrastructure, expert workforce, and cooperation network." A strategy in this direction will not only strengthen the scientific infrastructure of our country, but will also contribute to the solution of environmental problems around the world.

I would like to thank to everyone who contributed to the work carried out under the auspices of the Presidency of the Republic of Türkiye, under the responsibility of our Ministry and under the coordination of TÜBİTAK MAM Polar Research Institute, and I wish that our new scientific roadmap will be beneficial for our country.

**Mehmet Fatih KACIR**  
**Minister of Industry and Technology**

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Despite being located at opposite ends of the Earth, polar regions are in close interaction with other regions. Events occurring in the Arctic and Antarctica could have impacts on different geographies around the world; similarly, the effects of an event occurring somewhere on the Earth can be observed in the polar regions. Protecting the polar regions, which have invaluable roles for the world ecosystem and natural cycles, and hosting meticulous scientific studies are among the topics that should be on the agenda of all countries in order to understand the past and to shape the future together.

When the missions and main objectives of the Antarctic Treaty System and the Arctic Council are evaluated, the emphasis on conducting scientific studies in a peaceful environment draws attention. Such a perspective is in line with the principle of 'Peace at Home, Peace in the World' that Türkiye has adopted in both domestic and foreign policy. All relevant institutions, organizations, and scientists of Türkiye aim to contribute to world peace and a sustainable ecosystem through scientific studies in the Arctic and Antarctica.

Until the preparation period of this strategy document, Turkish polar research has progressed with an emphasis on the Antarctic continent as location and earth and life sciences as prevalent fields of research. Shortly after the entry into force of this strategy document, as the second roadmap of Turkish polar research, scientific research projects of Turkish scientists will diversify with different topics, including the Arctic region. Since the beginning of the Turkish polar science expeditions in 2017, Turkish researchers have been making significant contributions to the international polar science literature by adapting their competencies in a wide range of scientific fields to polar regions. These contributions include bringing original outputs to the literature in different scientific disciplines, from discoveries of new species to seafloor mapping studies.





Ensuring the sustainability and further strengthening of Turkish polar research is directly related to the road map to be developed. "The 2023-2035 Turkish Polar Science Strategy", that has been prepared in this direction, is built upon the data obtained from both national and international research efforts. In this context;

- In order to understand the current situation in polar research, as well as to get an idea about future trends, the studies carried out by countries within their own programs and in cooperation were examined. In the scope of this study, more than 20 institutions/organizations were examined within the framework of polar research plans and programs.

- A total of 61 one-on-one interviews were conducted. Of these interviews, 46 were with domestic stakeholders and 15 were with international stakeholders.

- Two different workshops were organized with participation from different disciplines.

- A focus group study was conducted.

The first draft of this strategy document was prepared by compiling the data obtained from the researchers. The draft version was opened to the evaluation of stakeholders with a presentation made on November 30, 2022 at the 6th Turkish Polar Science Symposium, where more than 1,000 participants from the polar research ecosystem were hosted. The document was then developed in the light of the feedback received during the presentation. For the final form of the strategy, it was deemed appropriate to conduct another stakeholder evaluation, and the document was shared with relevant institutions and organizations. As a result of the evaluations obtained from the feedback of the relevant institutions and organizations, the strategy document has taken its current final form.

From 2023 onwards, the Turkish Polar Science Strategy has the aims of guiding the activities of relevant stakeholders, particularly the Scientific and Technological Research Council of Türkiye (TÜBİTAK) Marmara Research Center (MAM) Polar Research Institute (TÜBİTAK MAM PRI), drawing attention to the main priorities for issues awaiting resolutions and challenges in national and international polar research studies, as well as informing all national and international stakeholders.

Türkiye's interest in the polar regions dates back to the beginning of the 20th century. Subsequently, Türkiye, which participated in the International Polar Year activities at the national level and became a party to the Antarctic Treaty, institutionalized its studies in polar research first through the establishment of the Polar Research Center of Istanbul Technical University (İTÜ PolReC) and then through the TÜBİTAK MAM PRI. National polar scientific expeditions have been regularly organized since the first Turkish polar expedition took place in 2017.

The momentum gained from national expeditions has significantly increased polar research studies in Türkiye, enhancing the country's experience in globally urgent issues, especially climate change. The steps taken in this way contribute to a more sustainable Türkiye and the world environment, thus becoming an element of looking to the future with confidence and increasing the public interest.

The mission and vision of the strategy prepared for the polar research to be carried out between 2023-2035 have been determined as follows;

**Mission:** To consistently develop scientific research and science diplomacy activities with a governance-based approach in order to strengthen a sustainable world, which is the common vision of humanity, through polar research.

**Vision:** To be among the leading countries in polar research with its unique scientific studies that draw its strength from its well-equipped infrastructure, expert manpower, and cooperation network.

The values that will differentiate Turkish polar research and gain competitiveness have been identified as being Responsive, Original, and Collaborative. The primary scientific themes that shape the direction of the studies are determined below;

- **Global Climate Change**
- **Ecosystems Under Threat**
- **Anthropogenic Impacts and Social Systems**
- **Understanding the Past, Predicting the Future**
- **A Look into Space**

Three strategic aims have been defined in the period up to 2035;

- **To achieve scientific excellence** in this field by increasing the quantity and quality of national polar science outputs, thereby strengthening Türkiye's position in scientific international organizations and networks.

- To increase awareness, understanding, and knowledge on polar regions and global climate change by increasing the **interaction** of polar research and society.

- To ensure the **sustainability** of national polar research.

At the same time, performance indicators have been identified to annually track the effectiveness of national polar research during the specified period.

# The History of Turkish Polar Research



Turkish polar research traces their origins to the mapping studies conducted by High Admiral Piri Reis. In 1513, at the outset of the 16th century, Piri Reis featured Tierra del Fuego, the closest land to Antarctica, on his map. Fifteen years later, in 1528, he crafted a second map illustrating Greenland. The strength of polar research finds its roots in the map studies pioneered by Piri Reis in the 16th century. This legacy has continued to thrive, gaining momentum on a national scale with individual initiatives in the 20th century and institutional initiatives in the 21st century.

Turkish scientists started their research in Antarctica in the mid-1960s within the framework of international cooperation. In honor of their notable contributions, three geographic features in Antarctica have been named after Turkish scientists: Karaali Rocks (Atok Karaali), Inan Hill (Umran Inan), and Tilav Cirque (Serap Tilav).

Türkiye became a party to the Antarctic Treaty in 1995, aligning itself with the principles dedicated to peace and science on the white continent. In the period until 2015, Turkish researchers participated in science expeditions of various countries to conduct scientific studies and had the opportunity to work at research stations.

The first institutional initiative on polar research at the national level was made by Istanbul Technical University (ITU) in 2014. This led to the establishment of the Istanbul Technical University Polar Research Center (PolReC) in 2015. In 2016, a team of 13 Turkish scientists participated in a joint expedition organized by Ukraine & Türkiye conducted the first interdisciplinary Antarctic scientific expedition (Turkish Antarctic Research Expedition 2016). In the same year, Türkiye became an associate member of the Scientific Committee on Antarctic Research (SCAR) as a result of the application made by TÜBİTAK.

In 2017, within the scope of the sustainability goal, Türkiye's polar research activities were taken under the auspices of the Presidency of the Republic of Türkiye and the first Turkish Antarctic Expedition (TAE-I) was organized. After the expedition, with the support of 44 institutions and more than 100 scientists, a five-year Turkish National Polar Science Program (2018-2022) was established to define Türkiye's mission, vision, goals, and future research priorities in polar research. Also in 2017, Türkiye became a party to the Protocol on Environmental Protection of the Antarctic Treaty and ratified all its annexes. In 2018, Türkiye's application for observer membership was accepted at the 10th Council of Managers of National Antarctic Programs (COMNAP) meeting. The expeditions organized in 2018 (TAE-II) and 2019 (TAE-III) were carried out under the coordination of PolReC. In TAE-III, where many researchers from different countries took part, a temporary scientific research camp of Türkiye was established on Horseshoe Island in Marguerite Bay. In 2019, the first Turkish Arctic Scientific Expedition (TASE-I) was organized under the coordination of PolReC to the Arctic, one of the regions in the world most affected by climate change.

The Polar Research Institute (TÜBİTAK MAM PRI) was established in December 2019 under Marmara Research Center (MAM) of the Scientific and Technological Research Council of Türkiye (TÜBİTAK). In 2020, the fourth Turkish Antarctic Expedition (TAE-IV) was organized under the coordination of the TÜBİTAK MAM PRI.

In the 11th Development Plan (2019-2023) of Türkiye, it was stated that “the international position of our country in polar research will be strengthened and the institutional capacity for polar research will be improved and preparatory work for the establishment of a research station in Antarctica will be completed in this period”.

“High Technology and Innovation” is among the components of Türkiye's “2023 Industrial and Technology Strategy”, which was published as part of the “National Technology Initiative”. This component, aiming to strengthen Türkiye's technological competencies through innovation, emphasizes the preparation of roadmaps with an ecosystem approach. In this context, there is a goal of developing national and original products and services to meet the needs of sectors that have significant intersections with polar science studies, such as space and energy technologies. There are situations where Antarctica's natural laboratory facilities and harsh natural conditions can be utilized for technologies developed in related sectors. In the Strategy Document prepared by the Republic of Türkiye Ministry of Industry and Technology, polar science activities are emphasized within the scope of the “High Technology and Innovation” component, as in the 11th Development Plan.

In 2021, amid the global pandemic, Türkiye became a full member of both SCAR and COMNAP through its applications. Furthermore, Türkiye is a member of the European Polar Board (EPB) and follows the Asian Forum for Polar Sciences (AFoPS) as an observer.

The draft of the environmental impact assessment report for the proposed research station in Antarctica was submitted to the Antarctic Treaty parties and received positive opinions, leading to its approval. In the same year, despite pandemic-related restrictions, the 5th Turkish Antarctic Expedition (TAE-V) was successfully organized.

In 2022, the 6th Turkish Antarctic Science Expedition (TAE-VI) and the 2nd Turkish Arctic Science Expedition (TASE-II) were organized. The Turkish Polar Science Symposium, initially organized in 2017, convened for the sixth time in 2022. These symposiums serve as an annual platform that brings scientists, students, and stakeholders together from the public and private sectors engaged in polar research.

- 1513** • High Admiral Piri Reis draws the map showing the lands closest to the Antarctic Continent
- 1528** • High Admiral Piri Reis draws the second world map and Greenland lands were included in this map
- 1912** • Celal Nuri İleri, a member of the Ottoman Chamber of Deputies, visits the Arctic region
- 1913** • The publication of Celal Nuri İleri's works on "Polar Accounts and Polar Travelogues"
- 1932** • Participation in the 2nd International Polar Year at the national level
- 1933**
- 1967** • Atok Karaali - The First Turkish scientist to go to Antarctica for scientific research purposes
- 1995** • Türkiye becoming a party to the Antarctic Treaty
- 2015** • Establishment of the Polar Research Center (PolReC) at Istanbul Technical University (ITU).
- 2016** • First joint Ukrainian-Turkish Antarctic Expedition  
• Associate member of the Scientific Committee on Antarctic Research (SCAR)
- 2017** • National polar research activities under the auspices of the Presidency of the Republic of Türkiye  
• First Turkish Antarctic Expedition (TAE-I)  
• Signing of the Antarctic Treaty Protocol on Environmental Protection  
• First Turkish Polar Science Workshop  
• Publication of the National Polar Science Program 2018-2022
- 2018** • 2nd National Antarctic Science Expedition (TAE-II)  
• The Council of Managers of National Antarctic Programs (COMNAP) observer  
• 2nd Turkish Polar Science Workshop/Symposium
- 2019** • Establishment of the TÜBİTAK MAM PRI  
• 3rd Turkish Antarctic Expedition (TAE-III)  
• First Turkish Arctic Scientific Expedition (TASE-I)  
• 3rd Turkish Polar Science Workshop/Symposium
- 2020** • 4th Turkish Antarctic Expedition (TAE-IV)  
• Membership of the European Polar Board (EPB)  
• 4th Turkish Polar Science Workshop/Symposium
- 2021** • 5th Turkish Antarctic Expedition (TAE-V)  
• Full membership of the Scientific Committee on Antarctic Research (SCAR)  
• Member of The Council of Managers of National Antarctic Programs (COMNAP)  
• 5th Turkish Polar Science Workshop/Symposium
- 2022** • 6th Turkish Antarctic Expedition (TAE-VI)  
• 2nd Turkish Arctic Science Expedition (TASE-II)  
• 6th Turkish Polar Science Workshop/Symposium



The entire world is presently facing the threat of climate change, necessitating the implementation of radical measures to mitigate its far-reaching impacts. Climate change poses a significant risk to the sustainability of life, emphasizing the urgent need to restrain global warming within defined limits. Accurate and comprehensive scientific research is imperative for the formulation of effective measures and the establishment of new targets.

The polar regions stand out as the best research points on Earth to conduct scientific research in many subjects such as lithosphere, atmosphere, ecosystems, and especially climate change to gain insights into the past, current, and future conditions of our planet. The research conducted identifies numerous risks that may arise not only in the polar regions but also across the globe.

With the advancing capabilities, the polar regions have become more accessible, emerging as focal points of interest for countries, international research institutions, non-governmental organizations, the media, and the public. Turkish scientists have been conducting research in the polar regions, where the impacts of climate change are most intensely felt, featuring as a natural laboratory. This research aim to enhance global knowledge about the Earth's past & future, and any contribution in this context is embraced as a duty for the well-being of future generations.

Türkiye is located in a geography that has been hosting the turning points in the history of science since the dawn of human civilization. With its qualified human resources, modern infrastructure investments, young and dynamic population, as well as having a unique moral strength coming from both the past and the 100th anniversary of the Republic, Türkiye holds a significant scientific potential in the world. For all these reasons, it is the national and international responsibility of Türkiye to conduct scientific studies in the polar regions where critical knowledge is produced for the sustainable future of the world.

The degree to which Türkiye is or will be affected by climate change and the solutions developed against this impact depend, to a significant extent, on the results of scientific research conducted in the polar regions, which creates a vital public interest. Accordingly, national polar research is geographically divided into two main branches;

- Seeking answers to unresolved research questions in the extreme environmental conditions of Antarctica.
- Contributing to international scientific synergy in the unique environment of the Arctic.

Türkiye, historically assuming the role of a bridge between continents and cultures, aspires to be among the leading nations in polar research globally.



## National Polar Research Ecosystem

Unlike other fields of science, polar research, which is carried out under inherently challenging conditions, also requires interdisciplinary knowledge and has a high potential for international impact. In polar research, the efforts of national decision-makers, researchers, and society should be integrated at the same direction, and this effort should be continued in coordination and in cooperation with international stakeholders. A similar situation exists for Türkiye, which accelerates its scientific activities in the Arctic and Antarctica to be among the leading countries in polar sciences and related international organizations.

Polar research was taken under the auspices of *the Presidency of the Republic of Türkiye* in 2017, and since then, Turkish polar science expeditions have been consistently organized every year. The determination, execution, and support for national policies and industry collaborations are carried out under the responsibility of *the Ministry of Industry and Technology*. Since 2019, the visible face of national polar research has been the TÜBİTAK MAM PRI, carrying out various activities with two main organizational units: "Logistics, International Relations, Law, Environment" and "Polar Sciences, Education and Outreach". Numerous public institutions and organizations actively support the TÜBİTAK MAM PRI in completing various tasks, including national polar science expeditions, planning, organization, and execution of scientific studies, education and outreach activities, preparation of a national polar science strategy, development and operation of infrastructure in polar regions, and representation in the international arena. Various activities are carried out with *the Ministry of Environment, Urbanization and Climate Change*, such as environmental protection and implementation of environmental legislation the polar regions; environmental impact assessment studies and related reporting within the scope of the "Regulation on the Implementation of Protocol on Environmental Protection to the Antarctic Treaty". Research and studies related to marine living resources and fisheries are conducted in collaboration with *the Ministry of Agriculture and Forestry*, while education and capacity building activities are carried out in cooperation with *the Ministry of National Education*. Many collaborative activities, especially research efforts, are conducted in partnership with *the Ministry of National Defense*. Representation in international research and meetings, international collaborations, and joint efforts in foreign policies are carried out in cooperation with the *Ministry of Foreign Affairs*. The significant potential stakeholders include the *Ministry of Culture and Tourism* for tourism and commercial activities related to the polar regions, *the Ministry of Transport and Infrastructure* for associated research activities, and *the Council of Higher Education* for education and capacity-building activities.



During the effectiveness period of the previous roadmap, the Turkish Polar Science Program (2018-2022), more than 400 education and outreach activities were organized, and hundreds of research proposals were submitted by many universities and various institutions. During the same period, numerous abstracts were accepted for the annual Turkish Polar Science Symposiums. The number of researchers interested in polar regions is increasing day by day, and the national polar science ecosystem is developing. Annually organized "National Polar Science Symposiums," held since 2017, play a significant role in this developments. Researchers from various disciplines and stakeholders interested in polar research come together at these symposiums.

International cooperation in polar research holds importance for all countries. Countries need to maintain constant communication within the scope of international cooperation for scientific activities such as the operation of stations/bases and sample collection; logistical activities such as the safe transportation of researchers and research equipment to the polar regions; and security activities such as receiving/transporting support in emergencies. Türkiye is taking steps to expand its collaboration network in polar research through signing bilateral agreements and becoming a member of international organizations.

National polar research will achieve the 2035 goals and objectives through the continuous communication and effective collaboration of all stakeholders within the ecosystem, especially with the TÜBİTAK MAM PRI, and Türkiye will become a leading country in the international arena.

**507****Abstracts**  
(Turkish Polar Science Symposiums)**455****Activities**  
(Education & Outreach)**194****Scientific  
Publications****27****Thesis  
Studies****26****International  
Collaborations**

## Vision

To be among the leading countries in polar sciences with its unique scientific studies that draw strength from its well-equipped infrastructure, expert workforce, and cooperation network.

## Mission

To consistently develop scientific research and science diplomacy activities with a governance-based approach in order to strengthen a sustainable world, which is the common vision of humanity, through polar research.

## Core Values

National polar research is conducted with respect for the existence of all living beings and all their rights. In this era, where knowledge gains value as it is shared, the importance of *internationally adopted ethical principles and open science approach* in polar sciences, as in all branches of science, is indisputable. Article 3 of the Antarctic Treaty, which protects Antarctica as the largest center of polar research in this way, refers to the importance of open science. In this framework, national polar research is encouraged to be conducted in adherence to FAIR (Findable, Accessible, Interoperable, Reusable) principles. Together with these basic principles, the values guiding national polar science studies are **Responsive**, **Original**, and **Collaborative**.

### Antarctic Treaty: Article III

In order to promote international cooperation in scientific investigation in Antarctica, as provided for in Article II of the present Treaty, the Contracting Parties agree that, to the greatest extent feasible and practicable:

- (a) Information regarding plans for scientific programs in Antarctica shall be exchanged to permit maximum economy and efficiency of operations;
- (b) Scientific personnel shall be exchanged in Antarctica between expeditions and stations;
- (c) Scientific observations and results from Antarctica shall be exchanged and made freely available.



## Responsive

Respecting each component of ecological and social systems and prioritizes sustainability

Promoting and supporting equal opportunities for all researchers who want to contribute to polar sciences



## Original

Continuously assessing the opportunities and challenges of the future in order to transform them into a scientific contribution

Adopting new techniques as a leader and exploring new subjects with courage



## Collaborative

Supporting a governance-based ecosystem as a foundation for leading the polar research

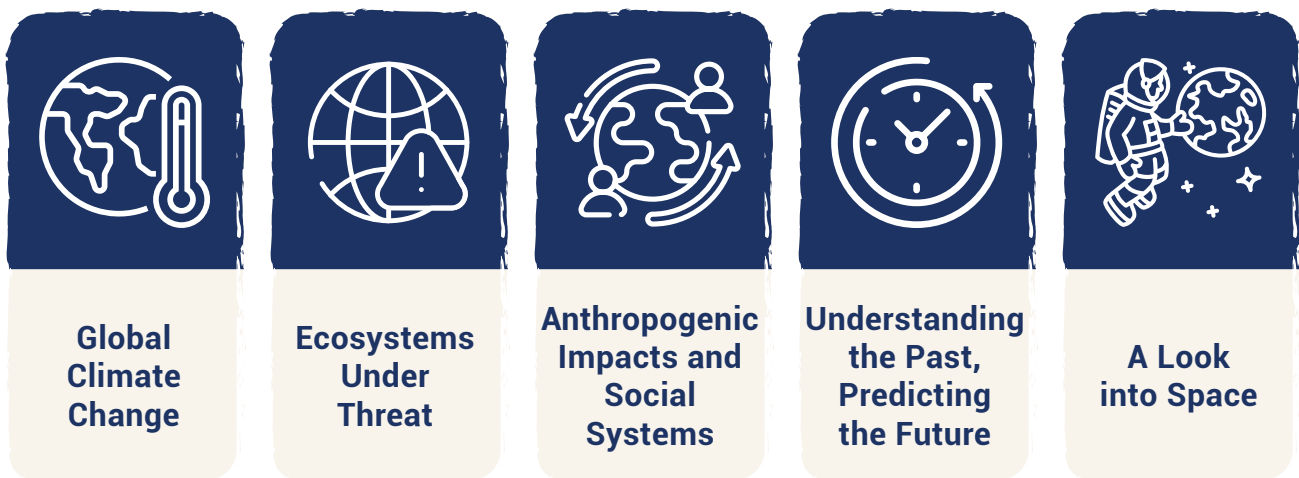
Encouraging the exchange of knowledge and experience with national and international stakeholders

## Priority Scientific Themes

During the five-year period covered by the Turkish Polar Science Program (2018-2022), Turkish scientists produced projects and publications in various subjects in line with SCAR's working groups. When the accumulated knowledge from national expeditions, projects, and publications, as well as international scientific needs and trends, are evaluated together, it has become clear that certain themes should be selected for the second period of national polar research.

This section of the 2023-2035 Turkish Polar Science Strategy provides information on research themes that are of national and international significance, as well as the scientific basis for selecting these themes, targeting the national research community. The research themes are overarching for both polar regions and draw their strength from prioritized research topics. Priority research topics refer to the scientific objectives to which the scientific values generated by national projects will contribute. Each research theme is characterized by its potential to generate numerous research questions and projects while also facilitating interdisciplinary collaboration.

By identifying research priorities at the general thematic and intermediate subject levels, it is aimed to maximize the benefit of all stakeholders in the polar ecosystem and the public interest. The 2023-2035 Turkish Polar Science Strategy covers five different thematic research areas;



An aerial photograph of a parched, cracked earth. The ground is a mosaic of grey and brown polygonal shapes, indicating severe drought. Scattered across this landscape are numerous pieces of white, crumpled plastic waste, likely discarded food packaging. In the center-right, a larger, irregularly shaped piece of white plastic is prominent, with several small, dark, dried leaves or twigs resting on its surface. The overall scene conveys the impact of climate change on the environment.

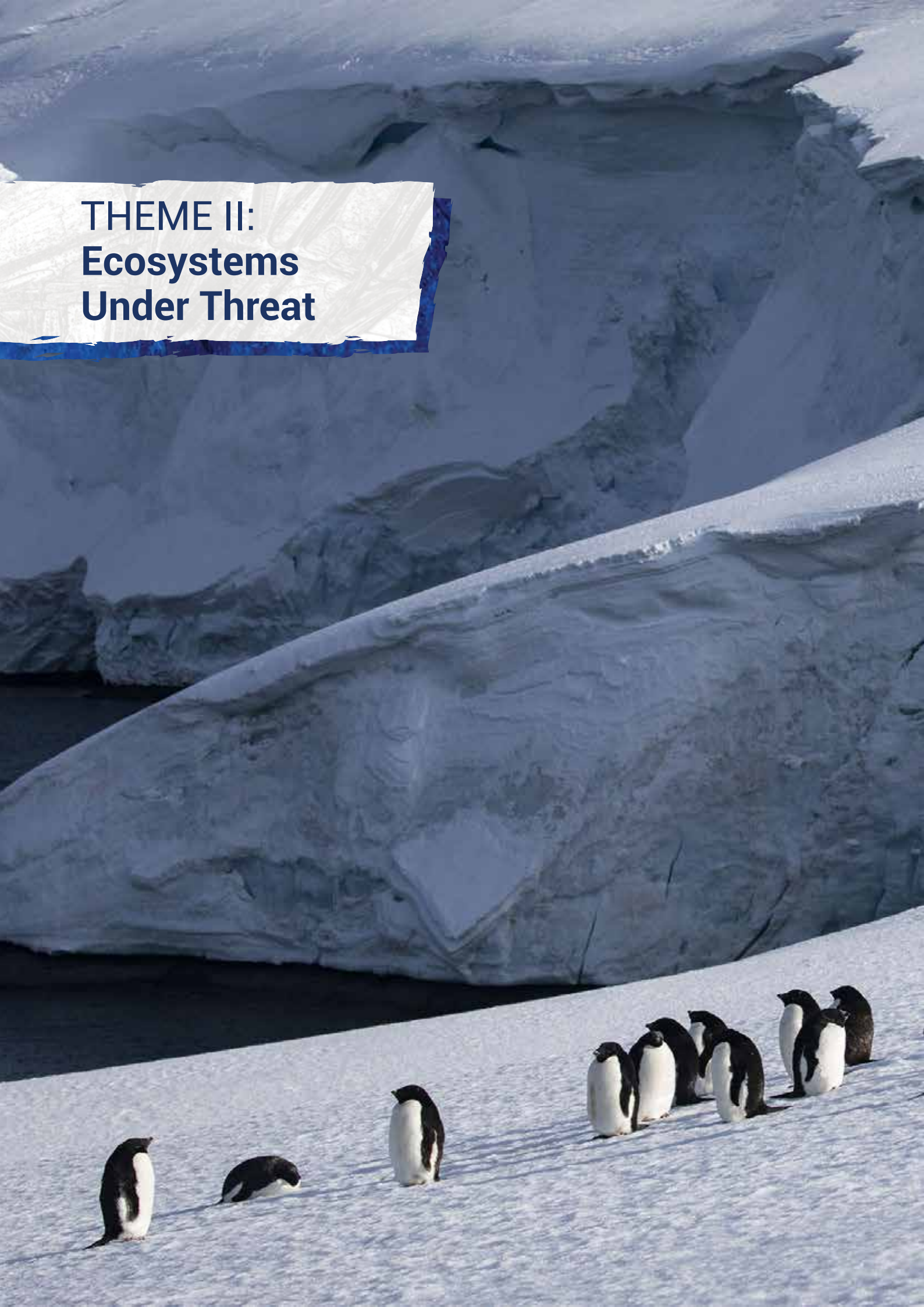
**THEME I:**  
**Global Climate Change**

Antarctica, the Southern Ocean, the Arctic, and the Arctic Ocean are important components that play a role in regulating the global climate system. Being regulators of climate through ocean currents, having high biodiversity and providing numerous scientific records of the changes the Earth has undergone are just a few of the countless vital functions of these components. However, these regions, which are vital for the future of the Earth, face the threat of climate change. For instance, in the Arctic region, global warming is occurring at a much faster rate than in the rest of the world. It is predicted that ice-free periods could occur in the Arctic Ocean in less than 20 years.

In the southernmost and northernmost regions of the world, climate change is causing numerous problems in sea levels, sea/ocean surface temperatures, ocean acid balance, and many other components critical for life. Therefore, global climate change is a priority theme in almost all polar science programs/strategy documents.

Within the theme of **Global Climate Change** the research topics aimed at contributing through national studies in both polar regions have been identified as follows:

- To understand the impacts of global climate change on physical variables, biodiversity, biogeochemical processes, and ecosystem functioning, as well as the adaptation mechanisms within the ecosystem.
- To identify the risks (sea level rise, resurgence of pathogens, release of methane or carbon dioxide into the atmosphere, etc.) that may be encountered as a result of glacier melting, to evaluate these risks on the basis of scenarios, and to develop potential solutions.
- To investigate the changes in the spatial distribution and volume of ice sheets on long time scales, to monitor ongoing changes, to determine their impact on regional and global sea level, and to draw future projections.
- To investigate the response of environmental conditions to climate change and other human activities.
- To understand the changes in extreme weather events in the polar regions in the context of global climate change.
  - To investigate heat and energy balances in the polar oceans.
  - To understand the processes that control the shape and flow of ice sheets.
  - To study the physical and chemical processes in the atmosphere and make inferences about climate change.
- To make improvements at spatial and temporal scales in studies that will increase the predictability of the polar climate system.
- To conduct research on climate-resilient agriculture, considering the impact of climate change on agricultural activities.
- To expand the growing knowledge on Arctic amplification, taking into account past warming data.

A photograph of an Antarctic landscape featuring large, jagged icebergs in the background and a snowy slope in the foreground. A group of penguins is scattered across the slope. A white text box with a blue border is overlaid on the top left.

**THEME II:  
Ecosystems  
Under Threat**

One of the solutions to the numerous problems faced by the Earth, especially global climate change, is to carry out systematic studies on ecosystems. Many ecosystems on Earth are being deteriorated at a much faster rate than their ability to regenerate. With various initiatives led by the United Nations, the framework for the necessary actions to be taken for ecosystems is being drawn, emphasizing the importance of the period until 2030 for the whole world. Healthy ecosystems are a guarantee of a sustainable future.

Polar regions host various animal and plant species in both terrestrial and marine environments. As the polar regions are highly vulnerable to the impacts of climate change, life under the ocean and on land needs to be assessed multidimensionally. When the chain effects of climate change are analysed, it is observed that the biodiversity declines, thus the food chain becomes more fragile and non-native species become widespread. Therefore, a comprehensive understanding of the role of polar ecosystems on Earth is of utmost importance.

Within the theme of **Ecosystems Under Threat** the research topics aimed at contributing through national studies in both polar regions have been identified as follows:

- To understand the role of the polar oceans in the global climate system.
- To conduct biodiversity research in threatened polar ecosystems and to elucidate the special adaptation and development mechanisms of these organisms.
- To make an integrated ecosystem assessment in order to detect spatial and temporal changes; to examine plant and animal species and microorganisms by considering their relationship with environmental conditions.
- To predict future changes in the interaction between marine and land systems.
- To understand the sources and extent of pollution in polar ecosystems; to develop understanding of current and future impacts of pollution.
- To develop solutions to reduce and prevent environmental damage for a resilient polar biosphere.
- To study how the distribution of invasive and native species changes in marine and terrestrial ecosystems, and to investigate the effects of these changes on polar ecosystems.
- To understand and develop the importance of the cryosphere in ecological processes.
- To develop understanding of the biogeochemical processes of the polar oceans in relation to sea ice, glaciers, ice shelves, and air.
- To support studies to be carried out on the greening and browning trend in Arctic vegetation due to global warming.

**THEME III:  
Anthropogenic Impacts  
and Social Systems**



Social systems are an important part of ecosystems, and the interaction between them impacts the future of sustainability. Uncontrolled human activities can lead to devastating consequences in every region of the world. Antarctica is relatively one of the most isolated and protected regions of the Earth. However, various activities of a scientific or commercial nature in Antarctica bring about intense mobility between the southernmost tip of the Earth and other regions. It is an obligation, not a choice, that all human activities in Antarctica to be conducted with a high level of environmental protection. The potential consequences of these activities in and around Antarctica should be continuously investigated and necessary measures should be taken promptly. The availability of evidence-based scientific information is of great importance for decision-makers and policy-makers in these issues.

The Arctic is home to nearly 4 million people, approximately 10% of whom are indigenous. Unlike Antarctica, the presence of human populations in the Arctic adds various dimensions to the scientific studies to be conducted in the region. The first dimension is that people living in the Arctic are affected by changes in and outside their region. For people living in the Arctic, the direct and/or indirect effects of climate change can have negative consequences on health or culture. Therefore, there is a need to develop solutions to ensure that those living in the Arctic are less affected by the negative consequences of global climate change. Another research dimension on human presence involves issues related to traditional knowledge and cultural heritage. The cultural know-how of Arctic peoples not only becomes a subject of scientific studies but often has a facilitating effect on other scientific studies in different fields. At this point, the examination of social systems in the Arctic, including international cooperation, becomes significant.

Within the theme of **Anthropogenic Impacts and Social Systems**, the research topics aimed at contributing through national studies in both polar regions have been identified as follows:

- To predict the short-, medium- and long-term situation of human presence and activities, which are major stress factors in polar regions, and their potential environmental and social impacts, as well as to develop prevention and protection methods against these risks.
- To develop solutions to make human activities in the polar regions more sustainable.
- To study the effects of working in the harshest weather conditions and most isolated environments on human physiology and psychology.
- To develop and share scientific expertise in scientific developments related to possible crises that may occur in polar regions.
- To examine the effects of stress factors faced by Arctic people on society.
- To examine the role of the Arctic region in the global system from the perspectives of sustainability, health, geopolitics, security, international law, and international relations.
- To examine Arctic cultures in the dimension of interaction process with world history and cultures.
- To examine Arctic traditional cultural practices as a source of inspiration for improving humanity's ability to survive in challenging conditions.

**THEME IV:  
Understanding the Past,  
Predicting the Future**




The geologic records in polar regions can provide multidimensional information about the dynamics of the Earth's natural environment and processes. In particular, more detailed information is needed on the geology of Antarctica, the largest untouched region on Earth. Every geological record from polar regions is an important tool not only for our planet, but also for increasing our knowledge of the solar system in which our planet resides.

In the light of the principle "the past is the key to the future", the ability to accurately interpret the geological record is of great importance. In the geography of Türkiye, which is almost like a natural museum, a significant number of researchers working in the field of earth sciences continue their active field research on various subjects. This dynamic know-how in field research provides a differentiating feature to national studies, especially in the context of earth sciences research in Antarctica.

Within the theme of **Understanding the Past, Predicting the Future**, the research topics aimed at contributing through national studies in both polar regions have been identified as follows:

- To gain insight into the geographical and environmental changes that have occurred over different time periods during the geological evolution of Antarctica and to contribute to Earth sciences research in the region, studying the characteristics and processes of the Earth's crust beneath the glaciers.
- To study past climatic conditions in detail through paleoclimatic indicators derived from cryosphere and sediments deposited from different environments.
- To examine the changes and interactions of cryosphere, tectonism, volcanism, and biodiversity.
- To conduct studies through unmanned vehicles for areas that can be investigated but have not yet been reached.
- To investigate the lithospheric properties of the ocean and to develop seafloor mapping studies, especially in regions lacking data.

The background of the slide is a photograph of a fjord. The water is dark and calm, reflecting the purple and blue tones of the sky. In the distance, there are large, rugged mountains covered in snow. The sky is a deep, vibrant purple, suggesting a sunset or sunrise. The overall mood is serene and majestic.

## **THEME V: A Look into Space**

Scientific studies in the polar regions are not limited to research based on aquatic or terrestrial observations. The boundaries of research conducted at the Earth's extremes can be extended to space. An important part of the questions that human beings need to answer in order to realize the dream of living on more than one planet makes sense with the interpretation of the data obtained from polar regions.

The Antarctic continent offers a unique research environment for astronomical observations with a stable atmosphere, high altitude, low light pollution, low seismic activity, long periods of darkness, and access to the southern celestial hemisphere. Antarctica's cold, dry and isolated environment, geology, impact craters, ice caps, and harsh environment make it an important place to study Mars and some of the moons in our solar system and to prepare for future missions, and it offers a natural test medium for space exploration. Despite being not identical to the conditions in Antarctica, there are also conditions in the Arctic that enable research in space sciences.

In 2021, two of the targets specified in the "National Space Program" by Turkish Space Agency (TUA), were related to "Observation and Tracking of Space Objects from the Ground" and "Technological Research on Space Weather". An opportunity for Türkiye to improve its capabilities in these areas will be the research to be conducted within the scope of national polar research.

Within the theme of **A Look into Space**, the research topics aimed at contributing through national studies in both polar regions have been identified as follows:

- To conduct research on astronomy, space science, atmospheric observations, satellite, and space technologies.
- To conduct research on space weather.
- To conduct astrobiology studies based on interdisciplinary research, especially physical, chemical, and biological studies of meteorites.
- To conduct tests of technologies developed for the benefit of humanity, especially space studies, in the natural laboratory environment of Antarctica.

At the Intersection of Priority Themes:

## Supporting Competencies

The research to be conducted within the framework of the themes identified in the 2023-2035 Turkish Polar Science Strategy can be supported by various fundamental competencies. These competencies, associated with popularizing polar research and facilitating its implementation, provide opportunities for conducting more research in this field.

Educational and capacity-building activities to raise awareness and dissemination of polar research at all levels are the seeds of innovative scientific projects of the future. Therefore, it is critical to develop activities that can increase the interest of potential researchers in polar regions at all levels and fields of education.

Some studies in polar research require intensive fieldwork, while others can be conducted without the researchers' physical presence in the region. Various factors in both polar regions can make scientific studies challenging to carry out. Extreme natural conditions, compelling logistics, limited research time, and exposure to unexpected and unfavorable weather conditions during expeditions are among the difficulties frequently encountered in field studies. Indeed, the development of innovative technological solutions that facilitate overcoming these challenges will greatly contribute to achieving research objectives.

In future polar research projects, many of the competencies exemplified below can be used as research methods, and the development of these competencies can also be considered as separate project topics.

- Diversifying education and capacity building activities that will increase awareness of polar sciences and ensure their dissemination.
- Development and use of innovative technologies in polar sciences, especially to support field studies.
- Developing technological solutions by utilizing natural life principles, especially polar ecosystems.
- Creating models / digital twins in the process of better understanding the changes occurring in the polar regions.
- Obtaining, analyzing, and interpreting long-term datasets for forecasting models.



# Strategic Goals and Objectives





## Strategic Goal I

To achieve **scientific excellence** in polar research by increasing the quantity and quality of national polar science outputs, thus strengthening Türkiye's position in international organizations and networks with science missions;

**Strategic Objective 1:** In order to increase scientific activity in polar regions, Turkish Antarctic Expeditions (TAE) and Turkish Arctic Scientific Expeditions (TASE) will be organized annually in accordance with the relevant national and international legislations.

**Strategic Objective 2:** The existing infrastructure of the TÜBİTAK MAM PRI will be reviewed, its needs will be identified, its strategic management model will be developed, and its institutional infrastructure, including human resources, will be strengthened to serve as a center for national polar research and to ensure its sustainability.

**Strategic Objective 3:** "Polar Science Symposiums" will be organized annually.

**Strategic Objective 4:** In order to make the scientific samples obtained from the expeditions available to more scientists, a "National Polar Sample Archive" will be established within the TÜBİTAK MAM PRI.

**Strategic Objective 5:** A "National Polar Data Center" will be established within the TÜBİTAK MAM PRI, enabling open and timely use of data and information.

**Strategic Objective 6:** The necessary infrastructure work for the establishment and operation of the Turkish Antarctic Research Station will be continued in the short term and completed in the medium- to long-term.

**Strategic Objective 7:** An academic journal in the field of polar sciences will be launched in the short-term and studies will be carried out in the medium- to long-term to index the journal in internationally recognized databases.

**Strategic Objective 8:** With the accession to the Svalbard Treaty, the infrastructure work for Arctic studies will be initiated.

**Strategic Objective 9:** Efforts will be carried out to develop and diversify the opportunities and support (project funding, bilateral collaborations, etc.) for studies on polar research and researchers.



## Strategic Goal II

To enhance awareness, understanding, and knowledge of polar regions and global climate change by increasing the **interaction** of polar sciences with all segments of society;

**Strategic Objective 1:** Comprehensive and interactive information activities such as polar science festivals, workshops, symposiums, and presentations will be regularly organized each year.

**Strategic Objective 2:** Increasing academic and popular publications on polar sciences will be encouraged.

**Strategic Objective 3:** Awareness activities will be increased through cooperation with non-governmental organizations.

**Strategic Objective 4:** A polar encyclopedia will be published and made available to stakeholders online.

**Strategic Objective 5:** "Turkish Polar Research Booklet" will be prepared in Turkish and English that will be regularly updated and published online in order to increase the international recognition of national polar science studies and Turkish researchers conducting these studies.

### Strategic Goal III

To ensure the **sustainability** of national polar research;

**Strategic Objective 1:** Considering the high public interest it carries, in order to expand the national polar science studies, more use of national resources will be enabled.

**Strategic Objective 2:** A “National Polar Coordination Board” will be established for polar activities. Related public institutions and the private sector representatives will be invited to the Board. The Board will hold a situation assessment meeting once a year.

**Strategic Objective 3:** Türkiye will continue to be strongly represented in international organizations and related annual meetings, and support will be provided to increase its representation power.

**Strategic Objective 4:** The need for legal legislation regarding the scientific activities carried out in Antarctica and the Arctic, the research personnel managing the organization of these activities and the operation of the Turkish Antarctic Research Station will be determined and presented to the relevant authorities.

**Strategic Objective 5:** The number of members and activities in the working groups of Physical Sciences, Earth Sciences, Life Sciences, and Social Sciences & Humanities established under the coordination of the TÜBİTAK MAM PRI will be increased.

**Strategic Objective 6:** A mid-term assessment of the 2023-2035 Turkish Polar Science Strategy will be conducted in the first quarter of 2029. In case a need for revision emerges as a result of the assessment, ‘mid-term revision’ studies will be initiated.

**Strategic Objective 7:** The end-of-term assessment of the the 2023-2035 Turkish Polar Science Strategy will be carried out in the last quarter of 2034. Work on the preparation of a new science strategy will begin as of 2035.



## Monitoring and Assessment

In line with the vision of 2023-2035 strategy, performance indicators to be monitored in order to measure the effectiveness of national polar science studies have been identified to be among the leading countries in polar sciences. Performance indicators to be monitored annually within the scope of monitoring and assessment are as follows;

- ★ Number of scientific articles and abstracts,
  - Number of articles published in national peer-reviewed journals indexed by TÜBİTAK National Academic Network and Information Center (ULAKBİM)
  - Number of articles published in journals indexed in SSCI, SCI, SCI-E or AHCI
  - Number of abstracts submitted to Turkish Polar Science Symposiums
- ★ Number of project proposals and acceptance rate,
  - Project calls for polar research
  - 2204-C Polar Research Projects Competition for High School Students
- ★ Number of graduate theses
- ★ Number of researchers supported for conducting studies in research stations of other countries within the scope of bilateral collaborations
- ★ Number of activities conducted, number of participants in activities and their opinions
- ★ Number of researchers/experts/academic staff benefiting from scholarships, grants, and/or projects in polar science studies
- ★ Number of international meetings in which Türkiye is represented through participation
- ★ Number of meetings held by commissions and working groups



The 2023-2035 Turkish Polar Science Strategy provides a roadmap for all national stakeholders to develop concrete steps.

All areas that Türkiye aims to further strengthen in polar research, such as human resources, international cooperation, education & outreach activities, were assessed holistically. In this way;

✔ Existing ties between researchers and decision-makers, who are the main actors in the ecosystem, will be further strengthened.

✔ Türkiye will gain differentiating competitive power in the scientific field.

With the implementation of the strategic goals in the 2023-2035 Turkish Polar Science Strategy, Türkiye will approach its goal of being among the respected countries that provide high-quality contributions to polar research with its strong infrastructure. This will create a suitable ground to reach to the status of "Consultative Party" in the Antarctic Treaty System, to become an "Observer State" in the Arctic Council, and to contribute and have a say in the governance of polar regions.

