26.07.10

Chair's Report from the Workshop on the legacy of the International Polar Year

Including prioritized follow-up actions

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Summary

The question pertaining to the legacy of the IPY has been a topic in both the Arctic Council and the Antarctic Treaty Consultative Meetings. In both fora the importance of continued focus on the legacy of the IPY has been stressed, and there has been agreement to bringing the discussion forward through a dedicated workshop.

On this basis the Norwegian Polar Institute invited to a workshop on the legacy of the International Polar Year in conjunction with the IPY Oslo Science Conference in Lillestrøm, Norway on 9 June 2010. The aim of the workshop was to gather scientists and policy shapers who have the relevant background and interest in moving the results of the IPY science into the framework of society and policy development and together look at ways in which the legacy of the IPY could be maximized. The workshop examined:

- the ways in which the communication and outreach of the science results from IPY projects to policy makers, stakeholders and the interested public could best be continued;
- the need for and manners in which to maintain a continued focus on IPY activities that have proven to be of particular societal and policy importance, and in this context consider the continued focus on recruitment of young polar scientists and international capacity building; and
- the ways in which the Arctic and Antarctic communities could further strengthen collaboration in the future.

The workshop was attended by around 60 representatives from a number of countries and relevant organizations. The discussions that took place during the Workshop proved beyond doubt that the legacy of the IPY is monumental and important, and that continued efforts are needed to ensure the best possible management of this legacy. It is necessary to maintain the momentum of the IPY legacy process, and organizations such as IASC, SCAR, UArctic, IAI, APECS, ICSU/CODATA that have the capacity and mandate to further develop the IPY legacy need consequently to be provided with the necessary means and resources to do so.

This report summarizes the IPY legacy issues considered most pertinent to pursue within the framework of the Arctic Council and Antarctic Treaty Consultative Meetings, including issues for which declared support from these two polar policy bodies could contribute in facilitating implementation in relevant organizations, in particular IASC and SCAR.

The workshop identified fourteen recommended follow-up action areas within six overarching themes:

Data access and management

- National authorities and funding agencies should be encouraged to develop and use procedures which require data management and sharing.
- The development, support and use of the Polar Information Commons (PIC) should be encouraged to be used as the mechanism for sharing of data and information from the IPY and spin-off activities.

Access to study areas and research infrastructure

- Efforts to enhance international access and coordination of states' and institutions' infrastructural and research facilities, which is especially relevant for the Arctic, should be encouraged.
- The Forum of Arctic Research Operators (FARO) should be strengthened and it should be encouraged to develop information sharing mechanisms based on the experiences and systems

developed by COMNAP and national initiatives such as the Canadian Polar Commission's map based information on northern research facilities.

- Arctic collaboration on logistics, science and monitoring should be strengthened, aiming for developing the Arctic Ocean an "Ocean of Science and the Arctic area as a whole as an "Area of cooperation".

Education and recruitment

- Educational and recruitment efforts such as the UArctic, IAI and APECS should be supported, strengthened and developed.
- Closer cooperation between the UArctic and IAI should be encouraged, considering also the potential advantages of developing/merging this into an UPolar encompassing both polar hemispheres.

Science communication and outreach

- The development of a document of emerging key research findings should be encouraged in order to convey information to decision makers and the general public about the science results from the IPY that are of most direct relevance for management and governance in the polar regions, as well as results that are of importance to management and governance in the global context.
- IASC and SCAR are encouraged to take the lead in such a process, e.g. building on the recommendations from the SCAR/IASC Bipolar Action Group (BipAG).
- Such a document of emerging key research findings could be presented at the IPY conference in Canada in 2012.

Scientific directions

- The focus of further scientific research should be harmonized between various relevant overarching organizations/bodies. The workshop identified the following areas of particular interest:
  a. Further efforts in bipolar studies;
  b. Studies relating to teleconnections, ie. the coupling between events in the polar regions and the rest of the world;
  c. Studies relating to emerging themes in Earth System Science, including the five areas identified by the ICSU Grand Challenges document;
  d. Encourage continuous studies focused on polar communities and social processes, particularly on the coupling of the societal and environmental change; and
  e. Studies that will enable filling gaps in knowledge revealed through the IPY and where filling of these knowledge gaps have been identified as urgent.

An International Polar Decade

- Continued focus on polar sciences in the coming decades should be supported and the initiative of the WMO Executive Council of an International Polar Decade should be further explored and supported as appropriate.
- WMO should consult with other international bodies, such as ICSU, IASC, SCAR, UNEP and UNESCO with its IOC, to jointly explore scientific decadal needs.

- Considerations should be given to find mechanisms for work together with the Arctic Council and the Antarctic Treaty Consultative Meeting in the process of developing a strategy to sustain polar research, including the concept of an International Polar Decade. National funding agencies should be encouraged to commit to such efforts.

Report from the workshop on the legacy of the International Polar Year

1. Background

The Arctic Council and ATCM supported workshop on the legacy of the International Polar Year was attended by around 60 representatives from a number of countries and relevant organizations. The workshop took place in Lillestrøm, Norway on 9 June 2010, as a side event to Oslo Science Conference (OSC). The workshop program is found at Annex 1 and the list of participants in Annex 2.

The question pertaining to the legacy of the IPY has been a topic in both the Arctic Council and the Antarctic Treaty Consultative Meetings. In both fora the importance of continued focus on the legacy of the IPY has been stressed, and there has been agreement to bringing the discussion forward through a dedicated workshop (Annex 3).

The aim of the workshop was to gather scientists and policy shapers who have the relevant background and interest in moving the results of the IPY science into the framework of society and policy development and together look at ways in which the legacy of the IPY could be maximized. The workshop examined:

- the ways in which the communication and outreach of the science results from IPY projects to policy makers, stakeholders and the interested public could best be continued;
- the need for and manners in which to maintain a continued focus on IPY activities that have proven to be of particular societal and policy importance, and in this context consider the continued focus on recruitment of young polar scientists and international capacity building; and
- the ways in which the Arctic and Antarctic communities could further strengthen collaboration in the future.

The workshop was attended by around 60 representatives from a number of countries and relevant organizations. The discussions that took place during the Workshop proved beyond doubt that the legacy of the IPY is monumental and important, and that continued efforts are needed to ensure the best possible management of this legacy. It is necessary to maintain the momentum of the IPY legacy process, and organizations such as IASC, SCAR, UArctic, IAI, APECS, ICSU/CODATA that have the capacity and mandate to further develop the IPY legacy should consequently be provided with the necessary means and resources to do so.

This report builds on the scoping paper circulated in advance of the meeting. Section 1 provides the background, Section 2 gives an introduction to the IPY, Section 3 provides the rationale for ensuring a legacy from the IPY and Section 4 draws out the key issues that were discussed at the IPY Legacy Workshop, and provides conclusions as to a selected number of concrete key IPY legacy actions to follow up.

The workshop report and the recommended key actions will provide the basis for a presentation to the Arctic Council and the Antarctic Treaty Consultative Meeting, providing advice and basis for their further deliberations on the legacy of the IPY.

2. The International Polar Year (IPY)

2.1 Idea and history

The unique properties of the polar regions and their significance to the rest of the planet have for a long time attracted science to the polar areas. The International Polar Year 2007–2008 (IPY) was an intensive, internationally coordinated scientific research campaign in the Arctic and the Antarctic sponsored by the International Council for Science (ICSU) and the World Meteorological Organization (WMO) aimed to exploit the intellectual resources and science assets of nations worldwide to make major advances in polar knowledge and understanding. Previous polar years (1882-1883, 1932-1933, 1957-1958) had already demonstrated the value of international scientific collaboration in the polar areas. Due to climatic conditions, distances, remoteness and the scale of scientific challenges, cooperation during these events had made it possible to execute projects that any single country could not do.

IPY 2007-2008 emerged as the largest internationally coordinated planetary research effort in the past 50 years. It engaged the intellectual resources of thousands of scientists – many more than expected and several countries with limited experience from polar regions – representing an unprecedented breadth of specialties, from geophysical to biological to social sciences. IPY was a truly international, interdisciplinary endeavor with over 160 endorsed science projects assembled from the ideas of researchers in more than 60 countries. Substantial new funding – more than USD 400 million – was pledged for IPY, which coordinated with and supplemented ongoing polar research and monitoring programs. In addition, novel system-level approaches, and observational and analysis technologies, including in-situ and remote sensing, were fundamental features of IPY science.

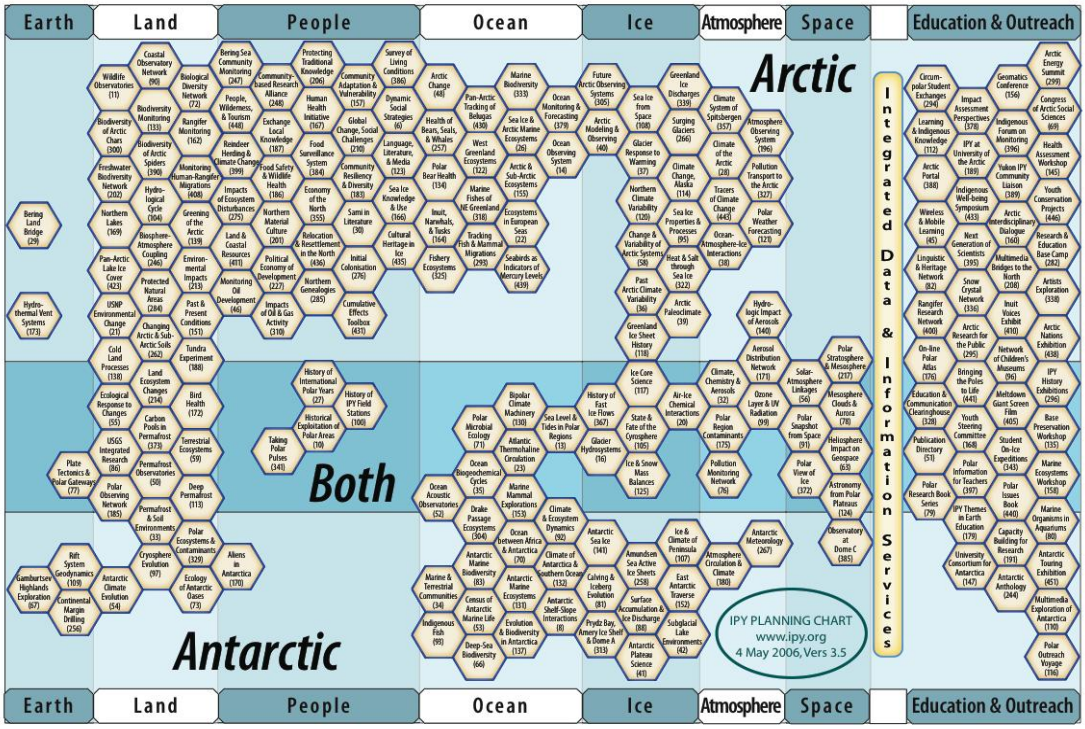
The 2007-2008 IPY recognized the importance of the human side of Arctic research and the inclusion of Indigenous perspectives in research. The IPY marks a beginning of an era where the people of the north are taking active part in the research process, both in defining the issues; do the research and monitoring; and communication of the results.

It has throughout been an aim for the IPY to leave a legacy of new or enhanced observational systems, facilities and infrastructure, as well as a new generation of polar scientists and engineers and an increased level of interest and awareness from polar residents, schoolchildren, the general public, and decision-makers, worldwide. Consideration of potential legacy outcomes of IPY was part of the original planning framework for IPY, and legacy activities were identified by IPY project teams and the WMO/ICSU Joint Committee during the project review process.

2.2 Projects

In the 2007-2008 IPY six research themes were defined, which were addressed by six interdisciplinary observational strategies. The IPY consisted of altogether 228 projects that were endorsed by the IPY Joint Committee (JC), addressing these six major themes. More than 160 of these projects were funded or partly funded and implemented. The figure below shows the extensiveness and complexity of the IPY project portfolio.

Education, outreach and communication with the media were integral components of each major IPY activity and were required parts of IPY projects.



Source: IPY International Office

2.3 Achievements

The 2007-2008 IPY achievements can be summarized as follows:

- IPY highlighted the global importance of polar processes and the urgent need to understand and track the extremely rapid changes occurring at high latitudes;
- IPY generated an unprecedented set of environmental and socio-economic data, which provide a comprehensive snapshot of both polar regions. This dataset will lay a foundation for major scientific advances in knowledge and understanding of the polar regions and their role in the functioning of our planet;
- IPY increased international research coordination and collaboration and created stronger links between researchers across different disciplinary fields;
- IPY developed a new generation of enthused polar researchers; and
- IPY engaged and increased the understanding of the public (in particular the residents of the region itself) and decision-makers worldwide in the purpose and value of polar research.

2.4 The Arctic Council IPY legacy initiative

At the Senior Arctic Officials (SAO) meeting in Svolvær, April 2008, the SAOs discussed the idea of an IPY legacy initiative. The rationale for the engagement of the Arctic Council in this regard was the importance that science plays in the Arctic region in general, and the role of science in decision-making on almost all issues before the Arctic Council (AC) and its members.

At the SAO Meeting in Kautokeino on 19-20 November 2008, the SAOs endorsed the IPY legacy initiative and expressed strong support for the importance to incorporate results of relevant IPY projects into all work of AC and for the AC to take an active role in fostering sustained IPY legacy. In particular, the SAOs emphasized that the legacy of IPY should reach beyond the pure scientific achievements to enable scientists, policy-makers, and Arctic residents to continue to work together to understand and to address the major scientific outcomes of IPY. The Sustaining Arctic Observing Networks (SAON) initiative[1], led by AC, IASC and WMO in cooperation with other Arctic research programs, is a good example of how the IPY legacy of Arctic observations can be supported.

Four IPY legacy themes were identified as central to the work of AC programs and its overall goals:

1. Observations, data access and management
2. Access to study areas and research infrastructure
3. Education, recruitment and coordinated funding
4. Outreach, communication and assessment for societal benefit

On the basis of the discussions in Kautokeino a scoping study was initiated to consider how the legacy of the IPY could be maximized in the Arctic context. A scoping study document was drawn up through electronic communication and a dedicated workshop in Bergen during the Arctic Science Summit Week in 2009. The scoping study was submitted to the Arctic Council's 2009 fall meeting in Copenhagen, where a substantial discussion on the matter took place. The meeting concluded that the Arctic Council would continue to contribute to the legacy of IPY by asking its working groups to make use of the most up-to-date research results in ongoing assessment processes, as well as through contributions to, inter alia, SAON. SAOs also agreed to support a joint Arctic Council/ATCM workshop in June 2010 in conjunction with the Oslo IPY Science Conference to further discuss IPY legacy issues.

2.5 The Antarctic Treaty Consultative Meeting IPY legacy initiative

At the Antarctic Treaty Consultative Meeting in Baltimore, April 2009, the Antarctic Treaty Parties discussed the idea of an IPY legacy initiative along the same lines as presented for the Arctic Council (Kautokeino, 2008). As for the Arctic, the rationale for the engagement of the Treaty Parties in this regard is the importance that science plays in the Antarctic in general, and the role of science in decision-making in the Antarctic context.

The ATCM welcomed the proposal to consider IPY legacy issues more closely and agreed that a dedicated joint Arctic-Antarctic meeting to this end would be of great value in this regard2.

The meeting also adopted a Resolution3 on the legacy of the IPY, which recommended that Parties to the Antarctic Treaty:

1. continue to focus attention on Antarctic research at the highest levels of national and international science organisations;

[1] Sustaining Arctic Observing Networks (SAON) is a process to support and strengthen the development of multinational engagement for sustained and coordinated pan-Arctic observing and data sharing systems that serve societal needs, particularly related to environmental, social, economic and cultural issues (see http://www.arcticobserving.org)

[2] Cf. para 154-157 in the final report from ATCM XXXII (http://www.ats.aq/documents/ATCM32/fr/ATCM32_fr001_e.pdf)

[3] ATCM XXXII Resolution 6 (2009): *Ensuring the legacy of the IPY*

2. work with SCAR and COMNAP to implement Resolution 3 (2007)[4] and maintain, extend and develop long-term scientific monitoring and scientific observations in Antarctica and the surrounding Southern Ocean;
3. develop integrated climate-ecosystem prediction capabilities for Antarctica and regional prediction capabilities for specific areas of the Antarctic;
4. identify stable long-term locations for the many networks and programmes established and strengthened during IPY;
5. provide attention and assistance to the recruitment and retention of young polar scientists within national Antarctic research programmes;
6. provide IPY data and outcomes from Antarctica as contributions to integrated climate change and environmental reviews and assessments; and
7. preserve, store and exchange reliable, accessible, long-term IPY data.

3. The need for an IPY legacy

3.1 Joint Arctic Council-Antarctic Treaty Consultative Meeting cooperation

On the occasion of the 50th anniversary of the Antarctic Treaty and the conclusion of the fourth International Polar Year (IPY), ministers and other officials of the Member States of the Arctic Council and the Consultative Parties to the Antarctic Treaty met in conjunction and had discussions relating to the International Polar Year and Polar Science. The joint meeting adopted a declaration[5] underlined the need for building a lasting legacy on basis of the 2007-2008 IPY. The declaration:

- Urges states, national and international scientific bodies, and other interested parties to cooperate to deliver a lasting legacy from the IPY, and to support appropriate infrastructures to achieve this;
- Calls upon IPY participants to continue to make data collected under IPY 2007- 2008 and its legacy programmes available in an open and timely manner, recall the obligations related to exchange of scientific information to this effect in the Antarctic Treaty, and encourage the same spirit of scientific openness among Arctic researchers;
- Commit themselves to reviewing key issues related to scientific cooperation and recent scientific findings at the biennial Ministerial Meetings of the Arctic Council and annual Antarctic Treaty Consultative Meetings, and further commit to using science to help inform the cooperative development of measures to address the threats to the polar regions;
- Endorses the goal of strengthening international cooperation at all levels in polar regions among States, scientists, Arctic residents, including indigenous peoples, and their institutions in areas such as educational outreach, human and ecosystem health, environmental protection, and scholarships for young scientists;
- Encourages the development of coordinated research and scientific observations at both poles to compare the current dynamics of polar areas and their contributions to the Earth's processes and changes;
- Recommends that governments continue their support for efforts initiated during IPY to create and link observational systems in order to improve the modeling and prediction of climate change on both regional and temporal scales;
- Encourages states and international bodies to use the scientific understandings derived from IPY research to support the development of concrete steps to protect the environment in the polar regions;
- Supports the analysis and use of scientific data and information collected from the polar regions as a result of IPY to contribute to future assessments by the Intergovernmental Panel on Climate Change, as well as other efforts to address climate change, and future Arctic Council assessments;
- Calls upon states, organizations, scientists, and other stakeholders to continue to engage with young people to cultivate the next generation of polar scientists, and to communicate with the general public to develop an awareness of the importance of polar research for life in all regions of the world; and

[4] See Appendix 1 for the text of ATCM Resolution 3 (2007)

[5] Antarctic Treaty – Arctic Council Joint Meeting: *Washington Ministerial Declaration on the International Polar Year and Polar Science*.

- Affirms the value of collaboration and coordination between states and Arctic residents, including indigenous peoples, for the benefit of polar research.

The declaration, and any action taken upon the basis of this declaration, will facilitate the creation of a long-lasting cooperation between the Arctic Council and the Antarctic Treaty Consultative Meetings, especially with respect to climate change issues.

3.2 Optimizing the scientific outcome

The 2007-2008 IPY was an intensive scientific research campaign which already has shown an impressive scientific outcome and will likely continue to spawn important outcomes in many years to come.

It seems evident that there should be an effort to ensure that the outcomes of the scientific efforts that took place during the IPY are optimized in a best possible manner in order to get as much results as possible out of the data and information from the IPY, inter alia through:

- managing the data collected through this vast international effort in such a manner that also future research can build upon and benefit from the data gathered in the context of the IPY;
- continue to focus on science communication and outreach, through this aiming to ensure that relevant findings and results from the IPY are disseminated, made well-known and are fed into decision making processes relevant for the management of the polar areas;
- ensuring that those (young) scientists who were recruited into polar science during the IPY stay in polar science and thereby contribute to further increases our understanding of the polar systems, and provide the means for new polar scientists to be recruited; and
- continue research initiatives of particular scientific importance.

3.3 Ensure societal benefits from scientific advances

The science communication and outreach aspects of the IPY have been and are naturally to a large degree centered on the scientific aspects of the work that has been conducted during the event.

Society and government has however contributed greatly both through financing and other support to make the IPY become a reality, and it is therefore fundamental and necessary to reflect upon how to ensure that the scientific advances and key findings can visibly benefit society by placing scientific results in the context of management and governance, converting scientific knowledge into policy and action.

3.4 Convert data into predictive models

IPY observations have improved our understanding of the many processes that take place in the region, and it is now imperative that this understanding and the data collected are utilized in a best possible manner to feed into and develop further the existing meteorological and community resilience (response) climate models. This will be an important manner in which to exploit IPY science for the benefit of Arctic residents and global citizens.

The IPY geophysical observations will be instrumental in verifying and calibrating the corresponding part of the climate model output. However, existing predictive techniques do not include ecological and social domains. They will have to be developed and tested against more complete data sets, which can help facilitate comparisons across disciplines, including the dataset generated during the IPY.

3.5 Multiple facets of an integrated system

IPY has emphasized the intensity and complexity of linkages among multiple facets, marine and terrestrial, physical and biological, societal and environmental, local and global, of the polar systems, as well as the rapid rates of change of many components. Although prediction for the polar system may start from weather and climate, real prediction skill for ice, ecosystems and health will require assets of and cooperation from meteorology, hydrology, oceanography, glaciology, biology, ecology, physiology, sociology, economics, and from local and community knowledge and observations. Progress on prediction skill for the integrated Arctic system, while enormously difficult, will represent an important enabling step for other regional or global systems.

3.6 Impacts from globalization and resource exploitation on local and indigenous societies

While much of the discussion focuses on environmental and social changes driven by the changing natural conditions, one must not discount the impacts of the globalized economy and the increasing use of natural resources in the Arctic. The economic, legal, social, cultural and other aspects related to these issues are of importance to Arctic residents, and in a number of cases are even more pressing than the environmental change.

Through participation in IPY research, indigenous communities, for the first time in IPY history, assumed a role of a partner rather than a subject of research. The benefits of this partnership are multifaceted: knowledge sharing, building research capacity for on-going observations in remote locations, better understanding of the research needed to address socio-economic concerns of arctic communities, and many others.

Further development of new and the continuation of current projects that build on this legacy should be a priority for future research initiatives.

4. Identified follow-up actions to maximize the legacy of the IPY

4.1 Data access and management

Access to research data is crucial for science itself and for ensuring societal benefit from multinational and multidisciplinary collaborations. The IPY set out a standard and requirement for handling and access to research data. This was a very good initiative that, for a number of reasons, was only partially successful during the observance period of IPY. Today there are a number of IPY data bases for specific projects available and IPY projects have to a large degree made their data available through a network of existing and specially funded data centers, repositories, and distribution systems including project web sites. It is important to ensure the availability of standardized metadata and the highest priority should be given to assuring that metadata records are stored for all IPY data, and done so in such a way that access to the actual data is possible.

The newly established Polar Information Commons (PIC) is an important tool in this regard[6]. PIC aims to ensure that the data generated by the IPY and follow-on activities are accessible and preserved for future generations. The Polar Information Commons (PIC) creates a fast and easy-to-use open data resource accessible through normal search and browse tools. Using PIC tools, investigators quickly expose their data to the world and share them, thereby contributing to a repository for scientific data and information about the polar regions.

However, although data repository structures do exist there nevertheless remains the challenge of having data registered into these systems, and the science organizations, national programs and institutes, and not the least funding agencies, must ensure routines that require repository of data. Dedicated data management agencies/coordinators are considered an essential investment in order to ensure a higher level of data sharing.

Consideration should furthermore be given as to how data sharing can be of credit value for the individual scientists, through citation indexes etc.

As part of the IPY legacy it is suggested that:

1. ***National authorities and funding agencies should be encouraged to develop and use procedures which require data management and sharing.***
2. ***The development, support and use of the Polar Information Commons (PIC) should be encouraged to be used as the mechanism for sharing of data and information from the IPY and spin-off activities.***

4.2 Access to study areas and research infrastructure

Achieving the goal of being able to understand and accurately predict the future trajectory of the Arctic system requires unconstrained access for research and monitoring across the Arctic. It would be desirable to obtain the perception of the Arctic Ocean as an "Ocean of Science" and the Arctic as a whole as an "Area of cooperation", emphasizing the need for extensive cooperation and dialogue within science in order to understand the processes that are shaping and changing the Arctic systems, and thereby the global systems. Such a perception, in line with Antarctica being a continent of peace and science, should not exclude other activities but rather emphasize the importance of research.

Access to areas under national sovereignty has naturally to abide national laws and regulations. However, in some cases these regulations have been unnecessary complicated and or unpredictable. An important and highly valuable legacy of IPY could be to facilitate Arctic research by the sharing of information on the processes and requirements for access and research permits within Arctic countries.

Infrastructure for polar research comprises usually terrestrial research stations, research vessels, helicopters, and/or airplanes. Many of these 'tools' are not used in a cost-efficient way. The IPY has contributed to a more international attitude and insight into joint logistical planning. This is an element that could be developed further and more extensively, in order to ensure best possible and efficient

[6] Released on 8 June (the day before the IPY Legacy Workshop). For more information see www.polarcommons.org

access for scientific initiatives that contribute to develop the overall understanding of the polar systems in a global context.

In the Antarctic context the Council for Operators and Managers of National Antarctic Programs (COMNAP)[7] is a well functioning organization that provides the necessary mechanisms for information sharing with regard to access to Antarctic infrastructure resources. In the Arctic context, however, the organization around information sharing is much weaker and requires substantial strengthening if the good efforts enabled during the IPY is to continue. The Forum of Arctic Research Operators (FARO)[8] has yet to gain the role and resources to mirror the efforts in COMNAP.

Several national initiatives have been taken (also as a result of the IPY) to develop mechanisms in order to provide coordinated information about polar research infrastructure resources. Canada, for example, has developed a map based service providing information on all its northern research facilities[9], enabling easy access to any researcher in need of information about these infrastructure resources.

The COMNAP framework, as well as well developed national initiatives such as the Canadian research facilities service, could be used to inform and shape the further development of an infrastructure information sharing mechanism (for key information to be exchanged on a regular basis and an accessible manner), including a strengthened FARO and closer collaboration between COMNAP and FARO, which likely could easily be built by using the expertise of the bipolar operators.

The focus on access to research areas and research infrastructure as a part of the IPY legacy is in line with ICSU's recent statement on the *Universality of Science in Polar Regions*.

As part of the IPY legacy it is suggested that:

3. ***Efforts to enhance international access and coordination of states' and institutions' infrastructural and research facilities, which is especially relevant for the Arctic, should be encouraged.***
4. ***The Forum of Arctic Research Operators (FARO) should be strengthened and it should be encouraged to develop information sharing mechanisms based on the experiences and systems developed by COMNAP and national initiatives such as the Canadian Polar Commission's map based information on northern research facilities.***
5. ***Arctic collaboration on logistics, science and monitoring should be strengthened, aiming for developing the Arctic Ocean an "Ocean of Science and the Arctic area as a whole as an "Area of cooperation".***

4.3 Education and recruitment

Adequate and balanced recruitment and relevant training of young experts must be secured and existing systems for comprehensive/extensive cooperation and exchange programs for scientists and students must be considerably strengthened. This will promote a culture of mutual understanding across national

[7] See: http://www.comnap.aq

[8] See: http://faro-arctic.dmu.dk/

[9] See: http://www.polarcom.gc.ca/gdir.php?mode=ShowDirectory&directoryID=1

and discipline borders, which is an important aspect in ensuring that critical changes in the region are identified and understood and measures can be taken.

Nearly every Arctic Council member country and Antarctic Treaty Parties have experienced a surge in graduate students and Post-Docs during IPY, due partly to increased interest and publicity about polar research as an opportunity to 'make a difference', but due largely to funding increments. The international participation in future Arctic research represents a very positive development, although overall funding and particular issues related to national funding and employment opportunities present crucial and urgent issues in the long-term retention and future recruitment of Arctic scientists.

In addition to students directly related to IPY projects, the number of students seeking competence in and about the polar regions is growing strongly. The enrolments in the interdisciplinary Arctic Studies Program of the University of the Arctic (UArctic)[10] have grown substantially. There is also a noticeable growth in students with origin from southern latitudes in this program, now being delivered at about 20 member institutions of UArctic.

In the Antarctic context an International Antarctic Institute (IAI)[11] was established in 2006. The International Antarctic Institute (IAI) is a global consortium of universities and agencies that provide university-level education and conduct research in Antarctica. The IAI offers international opportunities in Antarctic undergraduate and postgraduate multi-disciplinary education by sharing teaching resources between international partner universities. IAI has not yet gained the same amount of momentum and acknowledgement as UArctic.

The Association of Polar Early Career Scientists (APECS)[12] was established during IPY. APECS is an international and interdisciplinary organization for undergraduate and graduate students, postdoctoral researchers, early faculty members, educators and others with interests in Polar Regions and the wider cryosphere. APECS' aims are to stimulate interdisciplinary and international research collaborations, and develop effective future leaders in polar research, education and outreach. During IPY, SCAR and IASC signed a Memorandum of Understanding with APECS which recognizes APECS as the preeminent organization for young researchers working in the Arctic, Antarctic and cryospheric regions striving to provide a continuum of leadership in polar research. However, APECS is still a "grassroots' organization" which lacks a long-term strategy and funding structure. As such this important initiative is fragile, and steps to ensure a sustainable business model must be taken while the organization still is healthy and active.

The AC and the ATCM should continue to support education, recruitment and retention initiatives, such as the University of the Arctic (UArctic), the International Antarctic Institute and the Association of Polar Early Career Scientists (APECS), that are essential in promoting a culture of mutual understanding across national and disciplinary borders. There would also be benefit in considering establishing tighter (and more formal) connections between these initiatives (and other relevant initiatives outside the polar context, such as EU's ERASMUS program[13]), in order to ensure a coordinated international focus on education and recruitment in the polar context. Cooperation between the university initiatives and the

[10] See: http://www.uarctic.org

[11] See: http://www.iai.utas.edu.au/.

[12] See: http://www.apecs.is .

[13] ERASMUS is the EU's flagship education and training program enabling 200 000 students to study and work abroad each year. In addition, it funds co-operation between higher education institutions across Europe.

early career organization could also facilitate a smoother transition phase for students moving into the career context, an area identified as a current point of weakness.

As part of the IPY legacy it is suggested that:

6. ***Educational and recruitment efforts such as the UArctic, IAI and APECS should be supported, strengthened and developed.***
7. ***Closer cooperation between the UArctic and IAI should be encouraged, considering also the potential advantages of developing/merging this into an UPolar encompassing both polar hemispheres.***

4.4 Science communication and outreach

Both the complexity and the volume of measurements and other results of the IPY projects and possible legacy activities require very effective "condensation" and outreach processes in order to become available to administrators, stakeholders and the interested public in an understandable and timely way. Such (a) document(s) would need to focus on conveying information about results that are of most direct relevance for management and governance in the polar regions. It would also need to focus on conveying more broadly the importance that the polar regions play in the global context. It is also noted that providing such information in a timely and directed manner could contribute to maintain the pool of interested and enthused journalists and teachers emerging from the IPY.

Taking into account the resources and engagement that governments and the general public has taken with respect to the 2007-2008 IPY, there is no doubt that there need to be a clear communication back to these entities with respect to the findings from the endeavor.

As part of the legacy of IPY it should also be an aim to expand knowledge of the polar regions to the global community through the class room and mass media. Countries and people outside the polar region have to be made aware that what is happening at the poles will have an impact on their weather and eventually well-being. Currently most of the outreach and communication is still within the traditional polar communities.

There is little doubt that there is both a clear need and a clear obligation to communicate the key research findings of the IPY to administrators, stakeholders and the interested public. However, there are differences in opinion as to:

- The timing: Whether the results from the IPY are far enough advanced for a synthesis (or such) to be developed by the IPY conference in Canada (2012) [14] or whether a later date should be aimed for (considering also the timing of the fifth IPCC report in this regard). In this context it should also be noted that scientific results from IPY will continue to be published for many years to come, and that it on this basis may be impossible to "know it all" before a synthesis document is produced. Societal needs for continuous updated knowledge support completion of such a document within a few years.
- The style/direction: Whether it should be a synthesis of "key findings", "emerging key findings"; who the main audience would be (different products for different audiences?); etc.

[14] The International Polar Year "From Knowledge to Action" Conference will be Held in Montreal, April 22-27, 2012.

- The process: Who should select the key issues/findings to convey and how to get consensus on these; who would write; who would chair the process; etc.

As part of the IPY legacy it is suggested that:

8. ***The development of a document of emerging key research findings should be encouraged in order to convey information to decision makers and the general public about the science results from the IPY that are of most direct relevance for management and governance in the polar regions, as well as results that are of importance to management and governance in the global context.***
9. ***IASC and SCAR are encouraged to take the lead in such a process, e.g. building on the recommendations from the SCAR/IASC Bipolar Action Group (BipAG).***
10. ***Such a document of emerging key research findings could be presented at the IPY conference in Canada in 2012.***

4.5 Scientific directions

The IPY 2007-2008 has provided a wealth of new information and understanding within the realm of polar science. The legacy of the IPY will certainly rest upon all this information, but five selected directions that may be particularly gainful to build further knowledge upon as part of the legacy process were vented at the workshop. The workshop noted and recognized, however, that a number or relevant organizations are in the process of identifying and prioritizing scientific directions for the future, and that it is important to attune such initiatives and maintain a common direction. The five directions discussed by the workshop that may be brought into such a context are:

- Bipolar studies: A substantial portion of the IPY projects have undertaken comparative studies between the two hemispheres (Fig. in section 2.2). Many of these studies have given new insight in global climate interactions and linkages that are useful for understanding past and present climate. Drawing on this knowledge will further enhance our understanding of important global climate that is critical for future projections. The SCAR/IASC Bipolar Action Group has provided the SCAR and IASC Executive Committees with concrete suggestions that may, along with similar initiatives, provide a useful foundation for further strategic deliberations in this regard.
- Teleconnections: There is evidence that many climate processes are related to each other at large distances (typically thousands of kilometers), and such processes in the polar regions may have fundamental effects in other parts of the world. From a societal point of view these connections are of utmost importance, and IPY data and findings could play a crucial role as a basis for further developing our understanding of important teleconnection mechanisms.
- Connected systems: Building on the two previously identified directions (above), acknowledging the Earth as an integrated system (Earth System Approach). ICSU recently pre-published *Grand Challenges in Global Sustainability Research*[15], its new vision and strategic framework for earth system research. This strategy may, along with similar initiatives, provide a useful foundation for further strategic deliberations with respect to earth system research.

[15] See: http://www.icsu-visioning.org/

- Societal issues: The IPY 2007-2008 recognized the importance of the human side of Arctic research and the inclusion of Indigenous perspectives in research. The linking of the environmental aspects and the human aspects has proven to be of utmost significance, and deserves continued focus.
- Gaps: The findings of IPY may reveal critical knowledge gaps that may urgently need to be filled. These areas need to be considered as potential scientific focus areas as they arise.

As part of the IPY legacy it is suggested that:

11. The focus of further scientific research should be harmonized between various relevant overarching organizations/bodies. The workshop identified the following areas of particular interest:

a. Further efforts in bipolar studies;
b. Studies relating to teleconnections, ie. the coupling between events in the polar regions and the rest of the world;
c. Studies relating to emerging themes in Earth System Science, including the five areas identified by the ICSU Grand Challenges document;
d. Encourage continuous studies focused on polar communities and social processes, particularly on the coupling of the societal and environmental change; and
e. Studies that will enable filling gaps in knowledge revealed through the IPY and where filling of these knowledge gaps have been identified as urgent.

4.6 An International Polar Decade

The WMO Executive Council made the following statement at its 60th session: "The Council felt that the success of the first year of the IPY (2007-2008) implementation, great investments of the governments to this international campaign, growing requirements of scientific and local communities in a period of drastic changes in Polar Regions environment motivate the nations to continue and sustain high-quality observations and research for a more extended period of time. In view of this, Council recognized the unique opportunity for WMO in consultations with ICSU and other international organizations to consider the launch of an International Polar Decade as a long-term process of research and observations in Polar Regions to meet the requirements of climate change studies and predictions so as to benefit societal needs."

Consultations are ongoing as to which decadal needs (in addition to climate change) there are, and which require or more efficiently can be met by a circum-arctic and international cooperation, including how an International Polar Decade (IPD) could be initiated and organized. However, there are clear indications that there is a wide and strong principal support for such an initiative, noting nevertheless the financial and organizational constraints that exist after the intensive IPY effort. An IPD could also contribute to fulfilling the joint AC and ATCM Washington declaration asking for further dedicated and coordinated polar research.

The continued focus on polar science and acquiring a more in-depth understanding of the polar systems is essential and would be of great benefit to the management and governance processes in the polar

regions. IPY has been an impressive effort and an important starting point for increasing our basic understanding, but substantial further effort is needed in order to gain a full comprehensive understanding. An International Polar Decade could in all likelihood play an important role in this context.

As part of the IPY legacy it is suggested that:

12. ***Continued focus on polar science in the coming decades should be supported and the initiative of the WMO Executive Council of an International Polar Decade should be further explored and supported as appropriate.***
13. ***WMO should consult with other international bodies, such as ICSU, IASC, SCAR, UNEP and UNESCO with its IOC, to jointly explore scientific decadal needs.***
14. ***Considerations should be given to find mechanisms for work together with the Arctic Council and the Antarctic Treaty Consultative Meeting in the process of developing a strategy to sustain polar research, including the concept of an International Polar Decade. National funding agencies should be encouraged to commit to such efforts.***

APPENDIX 1

ATCM Resolution 3 (2007): Long-term Scientific Monitoring and Sustained Environmental Observation in Antarctica

The Representatives,

Recalling the Edinburgh Antarctic Declaration on the International Polar Year 2007-2008 (IPY) that was agreed at ATCM XXIX, which supports the objective of delivering a lasting legacy for the International Polar Year, and promotes increasing collaboration and coordination of scientific studies within Antarctica;

Recalling that the Committee for Environmental Protection has a continuing commitment to environmental monitoring related to the implementation of the Protocol on Environmental Protection to the Antarctic Treaty;

Noting that the Arctic Council Ministerial Meeting of 26 October 2005 urged all member countries of the Arctic Council to maintain and extend long-term monitoring of change in all parts of the Arctic as well as to create a coordinated Arctic observing network;

Recalling the success of the CCAMLR Ecosystem Monitoring Programme in providing over two decades of circum-Antarctic data on the Antarctic marine ecosystem and biological environment;

Welcoming and supporting the proposal by the Scientific Committee for Antarctic Research to establish a multi-disciplinary pan-Antarctic observing system, which will, in collaboration with others, coordinate long-term monitoring and sustained observation in the Antarctic;

Recommend that the Parties:

1. urge national Antarctic programmes to maintain and extend long-term scientific monitoring and sustained observations of environmental change in the physical, chemical, geological and biological components of the Antarctic environment;

2. contribute to a coordinated Antarctic observing system network initiated during the IPY in cooperation with SCAR, CCAMLR, WMO, GEO and other appropriate international bodies;

3. support long-term monitoring and sustained observations of the Antarctic environment and the associated data management as a primary legacy of the IPY, to enable the detection, and underpin the understanding and forecasting of the impacts of environmental and climate change.

Annexes

Annex 1: Program

IPY Legacy Workshop
Lillestrøm, Norway
9 June 2010

Time[16]	Description	
9:00	Opening and introduction	Jan-Gunnar Winther, Norwegian Polar Institute *Chair of the meeting*
9:15	IPY Legacy considerations by the SCAR/IASC Bipolar Action Group (BipAG)	Heinz Miller, AWI
9:30	*Topic 1: Data Access and Management*	
	Introduction based on Scoping Paper	Chair
	Round table discussion	All
	Conclusion/Recommendation	
10:10	*Topic 2: Access to study areas and research infrastructure*	
	Introduction based on Scoping Paper	Chair
	Round table discussion	All
	Conclusion/Recommendations	
10:50	Coffee break	
11.00	*Topic 3: Education and recruitment*	
	Introduction based on Scoping Paper	Chair
	Round table discussion	All
	Conclusion/Recommendations	
11:45	*Topic 4: Outreach and Communication*	
	Introduction based on Scoping Paper	Chair
	Round table discussion	All
	Conclusion/Recommendations	
12:30	Lunch	
13:30	*Topic 5: Scientific directions*	
	Introduction based on Scoping Paper	Chair
	Round table discussion	All
	Conclusion/Recommendations	
14:10	*Topic 6: International Polar Decade*	
	Introduction based on Scoping Paper	Chair and Eduard Sarukhanian (WMO)
	Round table discussion	All
	Conclusion/Recommendations	
14:50	AOT (Any Other Topics)	All
15:00	Conclusion and closing of the meeting	

[16] Tentative time schedule. Flexibility will be maintained depending on how much time is needed for the discussions on the various topics.

Annex 2: List of participants[17]

Last name	First name	Affiliation	E-mail
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[17] No roll call was made at the workshop and consequently the list may contain the names of some pre-registered participants who in the end were not present at the workshop.

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Annex 3: AC and ATCM support for workshop

Arctic Council decision (SAO meeting Novmeber 2009):

SAOs agreed that the Arctic Council would continue to contribute to the legacy of IPY by asking the working groups to make use of the most up-to-date research results in ongoing assessment processes, as well as through contributions to, *inter alia*, SAON. SAOs agreed to support a joint Arctic Council/ATCM workshop in June 2010 in conjunction with the Oslo IPY Conference to further discuss IPY legacy issues.

Antarctic Treaty Consultative Meeting recommendation (ATCM April 2009):

- The Meeting welcomed this proposal from Norway and the UK.
- It was agreed that the workshop will be hosted by Norway in June 2010, back-to-back with the IPY Oslo Science Conference. The workshop will be open for all interested Parties and organisations, such as SCAR and IPY (ICSU and WMO). The contact point will be Dr Jan-Gunnar Winther at the Norwegian Polar Institute (winther@npolar.no).
- The conclusions and recommendations of the workshop will be prepared by an open ended contact group led by Norway and will be reported to the ATCM XXXIV.