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Report

Third Indus Basin Knowledge Forum (IBKF)

'Managing Systems Under Stress: Science for Solutions in the Indus Basin

Laxenburg, Austria, 31th May – 2nd June 2018

J Cherfas, S Langan, C Leb, J Newton, A Nicol, A Shrestha

5th October 2018

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ZVR 524808900

This event was funded by IIASA and its National Member Organizations in Africa, the Americas, Asia, and Europe, the World Bank, ICIMOD, UNIDO (Project ID: 140312) and GEF (Contract Agreement: 6993).

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Acknowledgments

The organisers would like to thank all the participants for their attendance and enthusiastic input which turned this into a very dynamic and exciting development that we hope will be taken forward in the coming years.

The organisers are grateful for the time and effort from the 'behind the scenes' team, particularly Samantha Byers, Barbara Willaarts, Paula Abarca del Rio, Kara Pasmore, Alejandra Virgen Urcelay and Martina Weiss from IIASA, Mia Signs and Indika Arulingam of IWMI, Ashmita Shakya of ICIMOD and all other staff who contributed to making this a successful event.

The organisers would also like to that David Grey for his significant contribution to the meeting.

The organisers would like to acknowledge receiving funding and support from UNIDO (Project ID: 140312) and GEF (Contract Agreement: 6993), IIASA, IWMI (DFID-funded Project Informing Change in the Indus Basin), ICIMOD and the World Bank to hold this event.

Photography was done by Heidi Knights Photography and Videography was done by FFAB Productions

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Summary

This meeting report covers the third IBKF held in Laxenburg, Austria, 31st May to June 2nd, 2018 and builds on the outcomes of the second IBKF that was held in Colombo, Sri Lanka in July of 2017.

The meeting was co-convened by the International Centre for Integrated Mountain Development (ICIMOD), the International Institute for Applied Systems Analysis (IIASA), the International Water Management Institute (IWMI), and the World Bank.

The Indus Basin Knowledge Forum (IBKF) brings together researchers and policy makers from the four basin countries and beyond to share knowledge and advance collaborative efforts for sustainable resource management. For this the third IBKF we had well over 100 participants.

The IBKF aims to further strengthen the connections amongst those working in policy making, research and knowledge generation in the Indus Basin

Figure 1: Group Photo - Participants of the 3rd IBKF, Laxenburg, Austria

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What is the IBKF?

The series of IBKF meetings is intended as a platform for all who work on water-related issues in the Indus basin to share their knowledge and experience and come together to improve global understanding of the many forces that shape phenomena in the basin. A wide spectrum of stakeholders takes part, with the idea of strengthening connections among and between policy and science and knowledge, the ultimate objective of which is to identify ways of meeting the challenges that human development faces throughout the basin.

Overview of the 3rd IBKF, Laxenburg, Austria

The 3rd Indus Basin Knowledge Forum (IBKF) was held from 31 May to 2 June 2018. The meeting was explicitly intended to move forward from two previous meetings in Colombo, Sri Lanka (2017) and Kathmandu, Nepal (2016).

It was hosted by the International Institute of Applied Systems Analysis (IIASA) in Laxenburg, Austria, and jointly convened and organised by IIASA, ICIMOD, IWMI and the World Bank.

About 100 people from all four riparian countries and beyond took part in the meeting, drawn from academia, civil society, donors, foundations, government and research.

Details of presentations, sessions and associated resources (including videos and streaming from the event are provided in the Annex.

Activities at the 3rd IBKF

At the 2nd IBKF, participants developed an outline action plan consisting of 10 activities that would help to meet three linked goals: to strengthen knowledge of the Indus basin; to identify and build on opportunities to work together on knowledge sharing and co-development; and to share existing knowledge more effectively and more easily. The 3rd IBKF set out to take these and other ideas forward with four focussed activities:

- Share different viewpoints of the issues for different countries, different sectors and different perspectives
- Develop outline concept notes for research, based on refining and extending the 10-point action plan of the 2nd IBKF
- Facilitate interaction and potential collaboration among researchers and funders with an interest in water-related topics in the Indus basin
- Review the outcome of the scenario workshop for the Indus basin held prior to the IBKF.

Participants said: "What was most impressive was the sincere desire among Basin countries to work together and understand better the challenges it faces and work towards finding solutions.

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… I am sure most of us are inspired to carry forward a message of hope for the Basin and commit to work towards it."

Participants in this 3rd IBKF also worked towards a set of five draft concept notes to underpin a joint research agenda. Including a Centre of Excellence (possibly growing out of the IBKF) could provide the expertise and act as an honest broker to bring scientists and policy makers from all four basin countries together.

- Centre of Excellence
- Indus Basin Development Goals
- Scaling Out Best Practices
- Data Without Borders, Data Without Restrictions
- The book: The Indus Basin: Science and Society

Learning from other shared catchments

Meeting held in the vicinity of Vienna, Austria, through which the Danube runs, the IBKF also learned that when the need is pressing and the will is there, a complicated agreement can be rapidly reached and effectively implemented.

The Danube River Protection Convention has united the scientists and governments of the 19 countries through which the river flows. Countries that were previously on opposite sides of the Iron Curtain now cooperate to ensure that surface waters and groundwater are managed and used sustainably and equitably, including to reduce pollution and prevent and control floods and ice hazards. The keynote provided by Ivan Zavadsky, Executive Secretary of the ICPDR, shared its history and current activities and provoked much interest in the IBKF participants.

IBKF participants also learned about other examples of cross-boundary participation. In the Niger, the Nile, the Mekong and the Zambezi, for example, countries previously at loggerheads have reached agreement to manage their joint resources for the benefit of all.

These examples were shared by David Grey, currently at Oxford University, who began by quoting a familiar refrain, put into words by Kofi Annan in March 2001.

Fierce competition for fresh water may well become a source of conflict and wars in the future.

That remains a common point of view among some pessimistic observers. However, after outlining some of the transboundary water agreements of the past few decades and how successful they have been in fostering sustainable development, Grey ended with Annan's revised opinion, uttered less than a year later.

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But the water problems of our world need not be only a cause of tension; they can also be a catalyst for cooperation. If we work together, a secure and sustainable water future can be ours.

Learning from the ISWEL Project

Participants also learned about the ISWEL project (Integrated Solutions for Water Energy and Land, led by IIASA in collaboration with UNIDO and GEF).

Specifically participants learnt about the stakeholder engagement work being carried out as part of the project, and in particular about the outcomes of the Indus Scenario Workshop, which was ran by the ISWEL project, immediately prior to the IBKF.

The ISWEL workshop brought together sectoral experts from the four countries that share the Indus basin to meet two goals:

- To co-develop informed basin scenarios for water, energy and land based on different possible pathways for economic development, hydrology and climate
- To develop technical capacity among the participants for nexus modelling and scenario development.

The scenario workshop and its reporting back to the IBKF follows up from the expressed desire at the second IBKF to further the work on water, energy and land with a forward looking scenario activity.

Next steps

An important goal to guide next steps in the conversation could include an agreed vision for the development of the Indus basin and mechanisms for getting there.

Participants said: "The 3rd IBKF provided excellent opportunity to continue discussions and information exchange regarding the Indus Basin."

Need for the IBKF

The Indus basin covers more than a million square kilometres of four countries: Afghanistan, China, India and Pakistan. It is vital to the interests of all four countries, and about 270 million people who live in the basin. The Indus feeds the largest irrigated agricultural area in the world, and is thus vital for food production. Its flow generates energy that powers industrialisation and economic development. Urbanisation and population growth in the region mean that the rivers also must supply increasing numbers of people with clean water for drinking and other household needs.

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Against this background, the Indus is faced with the challenges of climate change. Glaciers that nourish the Himalayan headwaters are shrinking much more rapidly than elsewhere in the world, changing patterns of flow in the short term and ultimately reducing flows. As a result, the recharging of groundwater from rivers is declining in many areas. The drop in groundwater is further exacerbated by unsustainable extraction of water, mining rather than harvesting. Lower flows threaten food security, human livelihoods and industrial development. Precipitation patterns are forecast to change, with wilder extremes, predicting larger floods, longer droughts and higher temperatures.

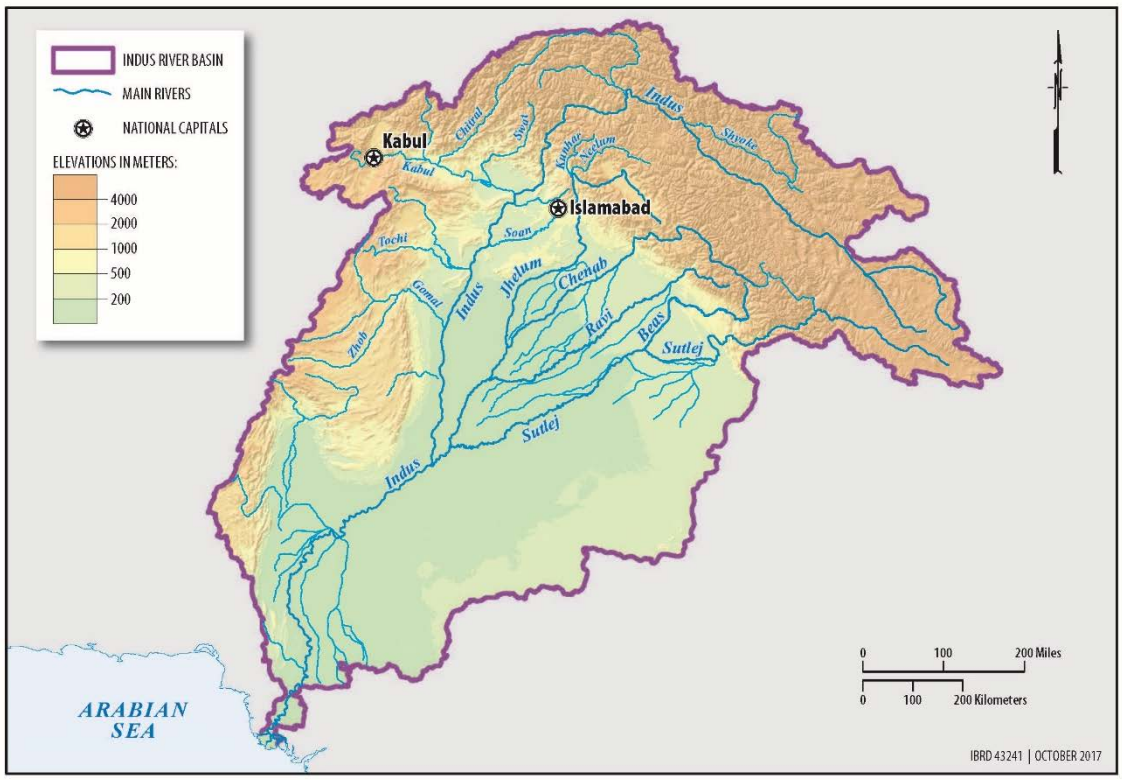

Figure 2: Map of the Indus Basin

Managing the Indus has always been difficult and complex; flows are highly seasonal and can be erratic, sediment loads are large and variable and much of the water that flows through Pakistan, and on which the country depends, arrives through India and, to a lesser extent, Afghanistan and China. Now, climate change challenges all four countries of the Indus basin, making management both more urgent and in some respects even more difficult. Along with population growth, climate change means that there is less water per person to be shared, while the quantity and quality of water throughout the basin is affected by activities elsewhere in the basin.

The Indus basin thus faces two great challenges. First, the effects of predicted changes on flows, their seasonal distribution, issues of water quality and other effects remain poorly understood. There is a need for scientific research and, precisely because the waters of the Indus flow through four countries, that research

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needs to be coordinated and collaborative. The entire system is under stress, affecting all who live in the basin. Scientists want to be able to work together and to share data in order to make sense of the natural and socioeconomic phenomena. Indeed, many were inspired by the example of the Danube, which organises joint scientific expeditions along the river to make collaborative measurements as the basis for cooperative research. Beyond greater understanding, however, scientific research must address the need to manage the waters of the Indus sustainably and equitably.

This is the second great challenge: to use scientific understanding and cooperation to build support for agreement on the future of the Indus basin. As noted above, the entire basin is under threat from climate change, population and economic growth; all four countries of the basin would benefit from more astute management of the waters of the Indus and its tributaries.

The Indus Basin Knowledge Forum (IBKF) is one of several activities that aims to provide a platform where all stakeholders can meet and learn about one another's points of view. Two strong themes emerged from this 3rd IBKF.

Scientific collaboration is taking place and is adding to our understanding of the Indus basin. Sometimes that collaboration is informal, individuals making contact with colleagues to pursue matters of mutual interest. Sometimes it involves sharing non-sensitive data. In general, closer collaboration and increased data sharing will benefit further research and hence fill some of the gaps in knowledge of the Indus. More to the point, however, trust among scientists, policy-makers and advisers could help to spur trust among governments. Crucially, however, the results of scientific research can only inform government and policy if decision makers are aware of and understand the research. This calls for an emphasis on knowledge products that translate complex research findings into clear advice that can guide policy. Equally, though, research needs to be driven by demand, to address the questions that policy needs answering.

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3rd IBKF, Laxenburg, Austria: Session Summaries

Opening session

The co-organisers of the meeting began by sharing both their history with the Indus and the IBKF and some of their expectations for this meeting.

For IIASA, Simon Langan expressed his hope that before the meeting ended it would indeed develop draft research concept notes. He reminded participants that to share ideas and knowledge requires a respect for others, not merely within the meeting but also in the world outside. This third IBKF provided further opportunities to network and share, and the challenge of learning and meeting someone new was an important facet of the IBKF. He also noted that he had picked up one of the ten action points from the previous IBKF—to discuss and develop potential future scenarios and solutions—and that the resulting scenario workshop's outputs contributed to this action point.

David Molden, Director General of ICIMOD, highlighted the importance of mountains in river basins and stressed that the Indus is one of ten river basins that originate in the Hindu Kush Himalayas. All are heavily dependent on meltwater and in total some 1.9 billion people depend on those waters. Mountains, he said, tend to bring people together, and there is a pressing need to work together to meet the challenges of climate change. ICIMOD considers regional cooperation crucial and is committed to work together in mountains.

Alan Nicol, Strategic Program Leader at IWMI, described IWMI's long history of work in the Indus basin, including the development of the Indus Basin Knowledge Platform in partnership with the UK's Department for International Development (DFID) under its South Asia Water Governance Programme (SAWGP). The entire basin, he said, represents a single system under stress. Upstream were the uncertainties of climate change, while downstream those uncertainties impacted the lives of the people dependent on the Indus. Exports of food from the basin are hugely important to national and regional economies and to human well-being. Along with other complexities, this means that in the physical world the impact of activities in the basin extends well beyond the boundaries of the watershed as shown on maps.

Michael Haney, Manager of Water Global Practice for South Asia at the World Bank, explained that the Bank's Water Global Practice has significant lending programmes on the national level in India, Pakistan and Afghanistan. These programmes are part of the Bank's core business. Typically, regional cooperation does not result in lending programmes, but the World Bank feels strongly that regional cooperation is important to economic development and to promoting prosperity and from this perspective supports various efforts aimed at increasing regional cooperation, including the IBKF.

Participants said: "This helps us to keep in mind thinking in a broader scale in transboundary context to encourage collaborations, knowledge sharing and joint activities."

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Learning from the Danube

The Danube runs from the Black Forest in Germany for 2,900 kilometres through 19 countries before it disgorges from Romania into the Black Sea. It is managed by the International Commission for the Protection of the Danube River (ICPDR), a transnational body established to implement the Danube River Protection Convention (DRPC). The Convention was agreed very rapidly after the dissolution of the Communist bloc and aims to ensure that surface waters and groundwater within the Danube River Basin are managed and used sustainably and equitably. As such, the DRPC and ICPDR offer a potentially useful model of the protection and sustainable management of a transnational river basin.

Ivan Zavadsky, Executive Secretary of the ICPDR, shared its history and current activities, stressing the role of expert groups, who do the work and who as individuals are mostly responsible for implementation at the national level. This dual role results in short and effective communication chains between the ICPDR and member countries. Joint programmes of standardised measurement and monitoring take place, with a transnational network of connected monitoring sites. In addition, the ICPDR organises regular investigative monitoring programmes during which scientists travel down the river together to gather data on specific topics. All data are freely available to all. The Commission produces two long-term plans, one for basin management and the other to manage flood risks. A key role for the ICPDR is to provide a platform where economic, environmental and socio-cultural needs can be balanced and trade-offs agreed. The Commission also encourages participation by stakeholder organisations as observers and catalyses public awareness and active engagement.

In discussion, it became clear that the operation of the ICPDR intrigued people at the IBKF. Expert groups, for example, play an important and sometimes invisible role in knowledge exchange and capacity development. Sharing sensitive data, such as on transboundary groundwater, is sometimes a concern, but cooperation builds the trust to overcome these barriers. The DRPC currently contains no provisions for national allocations of water, although this may become more important in future; the first recorded drought in the Czech Republic in 2015 prompted calls for greater international cooperation and, possibly, a new programme of work at the ICPDR.

Some discussion focussed on governance and implementation. Agreement in the ICPDR feeds back to the national level for implementation, but implementation is based on cooperation. No international basin management agreement can enforce standards if compliance is not forthcoming, and while there may be mechanisms for arbitration, including ultimately the International Court of Justice, these have not yet been necessary for the Danube. The EU's Water Directive has resulted in some progress among countries on issues like water quality, although its provisions are not in fact sufficient to achieve its stated aims.
In essence, the ICPDR's approach is to work from the bottom up by facilitating cooperation and collaboration on scientific issues. Based on that, countries can learn the value of cooperation. In general, however, the ICPDR tries to keep the political level away from its operation. Once every six years, during the finalisation of

its action plans, the Commission puts key issues into a declaration that politicians adopt, in order to create a political mandate for the work the ICPDR wishes to undertake.
This approach—of scientists working together and cooperating as a precursor to political and policy cooperation among the countries of the Indus basin—was widely appreciated by the IBKF.

Participants said: "I look forward to continue working with this group to promote better coordination and knowledge sharing among the IBKF stakeholders. I have no doubt whatsoever that these steps would yield good results for the Basin people."

National perspectives

As at previous meetings of the IBKF, individuals from the four riparian countries presented their perspectives on the needs and challenges of the Indus basin.

Figure 3: Panel - Nisar Memon, Pakistan; Renoj Thayyen, India; Jian Tong, China; Sediqa Hassani, Afghanistan provide perspectives from the Indus riparian countries. Alan Nicol (center) chairs the discussion

Pakistan

The Indus is vital, covering 65 percent of the country and supporting more than 90 percent of the population. Supply is stressed, with a forecast drop in availability per person of 20 percent and a storage capacity of only about 30 days. Climate change represents the biggest challenge (as it does for all four countries) with changes in precipitation patterns, vulnerability to catastrophic events in the upper Indus basin and increased variability. Water quality is decreasing. Among the reasons for hope, an extended growing season offers the

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promise of two agricultural harvests a year in some places, while a combination of solar and hydro-energy could improve human health as they replace wood burning. Joint projects, including Indus regional projects and a Kabul River Basin dialogue, could foster benefit sharing.

Some of the research being undertaken in Pakistan is intended to develop high-resolution climate models for the upper Indus basin, in order to be able to predict changes in hydrological patterns and especially the impact of extreme events on vulnerable populations. Efforts to understand the Karakoram Anomaly in greater depth are also under way, to appreciate how it might impact people and resources in the future. There is a suggestion that inflows to the upper Indus will drop, threatening availability of water for agriculture in the lower Indus during the growing season.

Transnational cooperation offers the best hope for workable solutions, both by contributing to the growth of scientific knowledge through collaboration and sharing of non-sensitive data and by paving the way for evidence-based policy internally; Pakistan adopted a National Water Policy in 2018. Greater collaboration among politicians across boundaries will, it is hoped, follow institutional collaboration among researchers.

India

The Himalayan ice and snow that feed the Indus are an important resource for India (and the rest of the Indus basin). Understanding the science of the Indian Himalayan Region is the focus of two initiatives, the National Mission for Sustaining the Himalayan Ecosystem, under the Department of Science and Technology, and the National Mission on Himalayan Studies under the Ministry of Environment, Forest and Climate Change.

As for the other riparian countries, climate change poses the greatest challenges and is a focus of research. In the Jhelum basin, stream flows are declining, perhaps as a result of lower snowfall in winter, because glacier coverage in the basin is low. In Ladakh, which is cold and arid, small glaciers are shrinking and flows have become more variable from year to year. Researchers are looking at the different hydrological regimes that follow from the monsoon-driven pattern of the Jhelum basin, in contrast to the glacial sublimation and melt of Ladakh, but gaps in knowledge remain, such as the effect of thawing permafrost.

India too calls for more research, especially long-term sustained research on climate and the hydrology of the upper Indus basin. Informal research collaborations in climate modelling, glacier-driven flows and the links between hydrology in mountain regions and groundwater are needed, and the IBKF and international agencies could help to facilitate such collaboration.

China

Although the Chinese component is a relatively small area of the Indus basin, it is important to the people who live there and to the wider understanding of the impact of climate change on river basins more generally. It is crucial to study not only the effects of climate change, but also how those intersect with socio-economic changes, because losses caused by disasters have a relatively greater impact on the economies of less developed countries.

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By incorporating predicted demographic changes in models of climate change, for example, research has shown how the number of people exposed to drought will both increase dramatically and shift in location under various scenarios. Afghanistan will be most strongly affected. Research on the Tarim river basin in China predicts that summer flows will decline sharply in coming decades as a result of shrinking glaciers. This information can help policy-makers to adjust the seasonal allocation of water. While the specific details for the Indus differ from those for the Tarim, both support a large population, and so the general approach might be suitable to apply.

Sharing data and methodologies can thus be of mutual benefit. The proposed China-Pakistan corridor, part of the One Belt One Road strategy, will have the Indus as a core concern that will call for data sharing. Mutual benefits will also ensue if data sharing can reduce the risks associated with extreme events such as flash floods, landslides and mudflows. Some research results will be immediately useful, for example by prompting people to move to safer places. Others will need to be made useful if they are to influence decision makers.

The benefits of early warning systems are particularly great, although such systems require close cooperation among local, national and transnational services. It is vital to promote cooperation among scientists and dialogue between scientists and decision makers.

Figure 4: Jiang Tong presents China's national perspective

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Afghanistan

The country is drained by five basins but only one, the Kabul River, contributes to the upper Indus basin. Nevertheless, the Kabul basin is the most populous in the country, with just over 30 percent of the people living within its watershed. Climate change is a challenge, with flows through the Kabul basin down 11 percent over recent years. Forecasts predict that the city of Kabul will have no groundwater by 2030. Reduced flow, despite its impact on agriculture, is not the only challenge; water quality has degraded as a result of urbanisation and changes in land use and overexploitation of water.

Economic development is clearly required—30 percent of the people are without electricity—and there is a hope that collaborative development in the Kabul basin will reduce downstream impact. The Kunar River Cascade hydroelectric project will, if agreed, help to deliver energy and offers opportunities for informal collaboration on research. The Afghan government is open and in favour of collaboration, with the help of the international community and donors.

Discussion noted favourably the willingness of each country to promote informal collaboration among researchers. Some ideas were exchanged, for example relaying readings from remote-sensing equipment by making use of geological surveys, because they often have more robust data transmission mechanisms. Much of the discussion focussed on how to improve scientific collaboration and, even more pressing, how to advance cooperation among countries. It was generally agreed that better collaboration and data-sharing among researchers would demonstrate benefits that would in turn help to convince political entities of the benefits of cooperation.

Participants said: "I found the meeting to be very informative and the overview I gained of work in the Indus Basin and wider South Asian region will help me. … I just need to find time to follow-up with all the connections I made."

Advancing on all fronts

The 2nd IBKF had produced a list of 10 action points that would advance the prospects for deepening scientific understanding and promoting international collaboration for the Indus basin. At this 3rd meeting, a primary goal was to have participants put flesh on the bones of those action points.

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Action Points, brought forward from Colombo:

1. Centre of Excellence
2. Indus Basin Knowledge Forum/Platform
3. Connecting science with policy/practice
4. Extreme event/floods/disaster risk management
5. Kabul River Integrated Water Resources Management (IWRM) dialogue process
6. Capacity building (youth and policy focus)
7. Data sharing, including hydrometeorological data, data portals and knowledge networks
8. Joint research program (requesting external support agency/donor engagement)
9. Scenarios/trends/futures (systems)
10. Central Asian Water (CAWa), South Asian water networks (SAWI, South Asia Consortium for Interdisciplinary Water Resources Studies)/Indus Basin interaction

About 40 percent of the participants at the 3rd IBKF had also been at the 2nd meeting, and so to brief everyone Alan Nicol (IWMI) revisited some of the highlights of the 2nd IBKF. Among the salient points:

- Lack of trust for sharing knowledge and lack of policy-making relationships were the two major challenges
- Knowledge gaps must be filled to promote sustainable development in the basin
- Different countries have different priorities; hence a need for demand-driven research.

Breakout sessions

Joshua Newton and Christina Leb (World Bank) and Simon Langan (IIASA) introduced breakout sessions in which participants were to consider three questions. Participants divided into 10 groups to consider each question.

How can the different action points come together to optimise knowledge and resources?

The 10 action points of the 2nd IBKF constituted first tentative steps towards a more coordinated programme and have already produced results. This 3rd IBKF is a result of Point 8, while Point 9 was taken up by IIASA in its ISWEL project. In discussion, three general thoughts emerged.

The 10 action points were generally grouped under three broadly understood headings: ***enhanced research and knowledge***, through better ***capacity development***, which together would lead to ***improved scientific and political cooperation***.

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Figure 5: Participants discuss the 10 action points in a breakout session

Most groups supported the idea of a Centre of Excellence (CoE) as a means of promoting and coordinating other action points. Some felt the CoE should have a physical presence, while others preferred a virtual organisation. There was support for the transformation of the IBKF into a CoE by the addition of a small secretariat and ongoing funding. One role for the CoE would be to coordinate existing research in the four riparian countries, helping to foster collaboration among institutions and ensuring that data are of a high standard and relevant to the needs of policy makers. More frequent meetings, perhaps in the basin, would speed the process of scientific and political acceptance.

Lack of trust was a focus for most groups, and many saw data-sharing as a way to build trust. To this end, many groups suggested that data could be categorised along a spectrum from publicly-available, non-sensitive to highly sensitive. Groups generally agreed that non-sensitive data should be routinely shared and made publicly accessible, and as the benefits of this became apparent, in the form of more detailed knowledge and better outcomes, it would create a desire to share additional data in future. Valuable results from sharing non-sensitive data would desensitise the fear of sharing more data.

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How can the IBKF activities be linked to and support the Sustainable Development Goals (SDGs) and other global processes?

The SDGs offer a clear entry point for action in the Indus basin. In contrast to the Millennium Development Goals, all countries of the world are involved and each country will report on its own progress.

The discussion groups all agreed that the targets established within the SDGs offer clear national and regional development goals. SDG 6 targets water specifically, although many groups pointed out that water obviously plays an important role in some of the other goals, among them hunger, health and energy. Within SDG 6, targets 6a and 6b (cooperation and participation) offer a firm foundation for the kind of transnational efforts the IBKF foresees.

Other targets within SDG 6 could also be addressed by existing work in the Indus basin and some of the proposed action points. In this connection, the proposed CoE would be relevant to many of the SDG 6 targets. As a result, it would be important to explicitly link proposed outcomes to specific SDG targets when developing research programmes. The IBKF could act as a contact point for anyone planning to work on any SDG within the Indus basin. In this way, the IBKF could build bridges between the apparent silos of the SDGs and could play an important part in liaising with all relevant government agencies designated to report on implementation of SDGs.

Given the generality of the SDG targets, many groups coalesced around the need to calibrate the SDGs specifically for the Indus basin, although as the SDGs are national in scope they would need to be downscaled appropriately. There was also general support for the desire to produce an agreed set of “Indus Development Goals” even though these would not be directly applicable to the SDGs.

Beyond the SDGs, groups identified other global agreements and frameworks relevant to the work of the IBKF. These included Priority Areas 1 and 2 of the Sendai Framework for Disaster Risk Reduction and the Paris climate agreement.

Where should our efforts be maximised? And how?

In a world of limited resources, it is important to agree on priorities and on phasing; some activities are more important than others, and some need to be carried out earlier in order to allow others to follow naturally.

The working groups used the two preceding discussions to consider and prioritise the 10 action points. Much of the discussion centred on the role that the IBKF could play in seeking demand-driven research relevant to policy makers and then making the results of that research available and useful.

All groups considered the overarching requirement to be inclusive and evidence-based policies for development; there was some disagreement on how best to achieve this. Some saw a clear need for capacity development among researchers so that they would be able to translate their research results into advice that policy makers could use. Others promoted the idea of working more closely with communications

professionals to develop knowledge products that could be easily consumed by policymakers and the public at large. Both will be necessary. There was agreement, however, that it was of the utmost importance to refashion peer-reviewed scientific literature into policy briefs, infographics, simulation models and other forms of evidence that could be useful to decision makers.

Groups considered it important to foster greater awareness and understanding not only among policy-makers but also media representatives and coming generations. School and university curricula could be targeted. More generally, the IBKF and others could aim to be a politically neutral source of information about water issues in the Indus basin. In furtherance of this idea, it could compile and disseminate best practices, possibly through the Indus Basin Knowledge Platform, derived from the Indus and other basins where transnational issues matter.

Some of the groups said that the IBKF should become more deliberately gender sensitive, working to ensure that South Asian women take part in science and policy. Other ideas included a focus on water quality and waste treatment before used water enters the basin, on creating informal ambassadors in each country who would take key messages to SDG focal points and other authorities, on conditional funding to promote data sharing and on a preference for shared problems, common to more than one country, again to promote cooperation.

Figure 6: Hina Lotia of LEAD Pakistan shares thoughts with group

Marketplace

The marketplace was an innovation at the 3rd IBKF, to expose funding agencies and researchers to one another's priorities and programmes and to promote progress on selected action points.

Funders

The session began with presentations from seven funding and donor agencies: Australia's Department of Foreign Affairs and Trade (Brian Dawson); the Global Environment Facility (Astrid Hillers); the United States Agency for International Development (Andrei Barranik); the United Kingdom Natural Environment Research

Council (Ruth Kelman); the World Bank (Muthukumar Mani); the British Council (Fatemah Ahmadi); and Canada's International Development Research Centre (Kallur Subrammanyam Murali[1]).

Figure 7: Josh Newton (standing) chairs the funder's panel discussion

Each speaker focused on their own organisation's place along the continuum from pure research through to implementation. Some are driven purely by curiosity, directed at questions that someone wants to answer. Others are focussed on development, supporting activities led by the country and, when they do fund research, insisting that it feed forward into policy advice that will have an impact on extreme poverty. Yet others lie between these extremes, combining curiosity or demand-driven research with efforts to raise awareness among policy makers and to influence their decisions with evidence. Thus some funders are helping to understand natural and anthropogenic phenomena within the Indus basin and their social and economic impacts while others are inserting scientific knowledge into projects and policies related to water to improve the effectiveness of development.

On the matter of evidence, all the organisations agreed that the Indus basin needed both greater investment in scientific research and a more effective interchange between science and policy. Some are working specifically on these goals, for example co-designing research projects with end users, who might be policy makers. Many spoke of the need for, and their support of, capacity development, with funds directed at enhancing the abilities of national researchers to do effective work. Most donors agreed that their role went beyond financial support and included technical guidance, knowledge exchange and training, even when not

[1] The UK's Department for International Development was present and contribute to discussions but did not make a presentation

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formally designated as capacity development. Some agencies have dedicated resources to fund knowledge exchange. Agencies with several projects in the Indus basin, or with projects in other river basins, were in a good position to support exchange among scientists and others to promote good practices.

Figure 8: Participants in action

Actual funding mechanisms and parameters vary too. The World Bank offers loans and grants and undertakes its own in-house research. It is also a trustee for several different funds supplied by donors and to which countries can apply for support. Some funding agencies support research programmes devised and carried out by international teams of researchers. Others provide funds to partner organisations or to countries directly, who then organise and implement projects themselves. Funding may be relatively long-term and open-ended, for example on a four-year cycle, or it may be limited to a particular project.

In discussion, participants raised the issue of donor coordination. Strategically, most of the funding organisations coalesced around research on the effects of climate change and policy support, but there is no centralised coordination of funding across the basin. Greater coordination might be beneficial for research activities to meet country needs and for transnational cooperation. Several speakers said that their organisations do coordinate informally. For example, they look closely at each other's programmes and also at the make-up of consortia they are funding. It was also suggested that there might be too many existing

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forums to be able to coordinate effectively and that a mechanism to implement the kinds of coordination being discussed would be extremely difficult to develop.

One reason participants strongly support an enhanced role for the IBKF is that it would be aware of knowledge gaps and would gain the trust of researchers and policy makers, and so could convene and support coordination. It could also fulfil the need for an institutional memory for the Indus basin, which has seen many research efforts that go back decades. Knowledge exists, but it is scattered and often hard to access.

Participants said: "I learnt a lot by being part of the discussions and managed to make contact with many water scientists in South Asia."

Researchers

A second element of the marketplace allowed people researching aspects of the Indus basin to share some of their findings with funders and other participants.

Figure 9: Arun Shrestha chairs the researcher's panel discussion

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Walter Immerzeel of the University of Utrecht spoke about recent advances in climatic, hydrological and cryospheric research in the Indus basin.

In addition to showing how Asia's glaciers will respond to even a 1.5°C average global warming and surfacing ways in which science can help policy makers and water managers, he offered a potential explanation for the Karakoram Anomaly.

The thesis is that increased irrigation in the basin results in increased evapotranspiration and more cloud cover. Solar radiation is reduced and more snow falls, so the glaciers grow. The data show clear summer cooling in the basin as a result of irrigation and evaporative cooling, with a smaller effect in the high mountains. Summer snowfall is higher too, by an average of 5 percent in Kunlun Shan and Pamir, and the snow in Kunlun Shan can be traced directly to irrigation in the Tarim basin. Elsewhere there is a decrease in summer snowfall. The overall conclusion is that irrigation can increase glacial mass, but because part of the water for irrigation in the Tarim and Upper Indus basins is coming from groundwater, any decision to increase levels of irrigation partly in order to feed glaciers is not likely to be a sustainable policy.

Hina Lotia of LEAD Pakistan focussed on the idea of research as a process rather than a product and showed how LEAD works to bring researchers and policy makers together as part of the process. As a result, policy makers get an opportunity to say what kinds of research they need to be done. LEAD is then able to help scientists deliver the research results and to convert scientific knowledge into policy briefs that decision makers can rely on and use. These policy briefs join other products that communicate complex information simply and accurately to improve overall levels of awareness and engagement.
One of the benefits of this approach is that policy makers who have been involved in co-designing research cannot easily disown the results at the end of the process. A drawback is that donors sometimes fail to take the long view that is needed because engagement along the chain from science to implementation often takes longer than curiosity-driven research.
The overall process was exemplified in brief for four LEAD projects: a transboundary Kabul river partnership; the Himalayan Adaptation, Water & Resilience (HI-AWARE) project; a project for heatwave management in Karachi; and a project to review Pakistan's spending and research on climate change.

Mobin Ahmad of CSIRO discussed a large project funded by Australian Aid and Pakistan's Ministry of Water Resources to develop a planning tool to explore the water-energy-food nexus in the Indus basin of Pakistan. He explained how a 2012 report had called for an evidence base that could be used in the face of climate change to guide development decisions that would allocate around USD26 billions of infrastructure investment and respect the Water Apportionment Accord for Pakistan's provinces. The project agreements were signed only after several highly engaged meetings with national and provincial administrations in Pakistan and the partner organisations. Capacity development was a crucial element in the project, to enable the transfer of skills in data management and modelling and other capacities essential to effective water management from Australia to Pakistan. The Indus model, based on Australian experience, highlighted the importance of accurate data and data sharing to improve its performance for all.

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The model proved able to simulate historical data accurately, which convinced the Ministry of Water Resources to use it in assessing options for storage and hydro-electric generation. The model is also being used to quantify agricultural yield gaps and to examine alternative approaches that would boost the efficiency of water use in irrigation. An emphasis there is on the work of women in the rice-wheat zone of Punjab, aiming to reduce their workload and make them more productive. Efforts are taking place to involve more female graduates in future studies of the impact of agricultural policies. Water quality is also an issue, with the model helping to inform decisions about collaborative efforts to improve water quality in the Ravi and Sutlej tributaries of the Indus.

Nusrat Nasab of the Aga Khan Agency for Habitat talked about the Agency's work to ensure that people are protected from and resilient to the effects of natural disasters while at the same time being able to take advantage of opportunities for improved economic performance. This strategic framework is carried out through projects on risk management, emergency preparedness, water and sanitation and improvements in housing.

The presentation focussed on risk management and resilience, where both too much water and too little pose problems. Clearing debris from the path of flash floods, for example, reduced damage to dwellings in towns in the Kabul basin. Early warning systems can also reduce the risk of disasters. Networked rain gauges can not only inform scientific research into precipitation patterns but also give valuable time to prepare for floods downstream—if data are shared with central response units. Combined with hazard and risk maps, an early warning system can predict how many people might be affected, rather than only the likelihood of a flood, which helps to ensure that the correct level of emergency supplies is mobilised.
The Agency is concerned to put research knowledge to use by ensuring that evidence results in policies and actions that reach the most vulnerable people in the community.

Abijit Mukherjee of the Indian Institute of Technology in Kharagpur introduced research into India's policies for groundwater rejuvenation by reminding people of the long history of groundwater use and management in the region. As elsewhere in the basin, floods and droughts are a constant challenge, as are water quality and pollution, all affected by climate change.

A NASA mission, launched in 2002 with a predicted duration of five years but still going strong, has revealed long-term changes in groundwater. Over the course of a decade, the north and east have lost groundwater, while the south and west have gained. (Over the entire region, there has been a slight loss.) India has several policies that might be expected to influence groundwater recharge directly or indirectly; can the rejuvenation seen in the south and the west be attributed to any of these? One policy restricted the availability of electricity for pumping to extract groundwater. A close look at groundwater in Gujarat showed no impact of this policy. By contrast, in Andhra Pradesh a policy-driven increase in surface ponds did enhance recharge. Evidence such as this could inform future policies on water-use and aquifer recharge.

Anamika Barua of the Indian Institute of Technology in Guwahati took people out of their basin comfort zone by talking about science, policy and practice in the Brahmaputra basin. Like the Indus, the Brahmaputra flows through four countries and brings opportunities and risks. The four countries—Bangladesh, Bhutan, China and India—are unequal in size and power. Each treats water as a "security" issue and there is no basin wide agreement. Communities have little access to information and communication among stakeholders is poor, especially between proponents and opponents of development. The lack of information, knowledge and communication makes cooperation among the basin countries more difficult.

Under the South Asia Water Initiative, a Brahmaputra dialogue began in 2013. The end goal is some sort of basin-level agreement, which will take time; in the meantime, collaborative projects at the basin level are building knowledge and trust. One study is looking at water resources and vulnerability across the Januma basin, bringing science to bear on the question of "water security". Another is about the potential impact of climate change on hydro-electricity. Gender plays a prominent role, with studies looking at differences between how women and men act in and suffer from floods and their aftermath. An overall goal is to improve the influence of science in policy and practice.

Crucially, generating more knowledge, even collaboratively across countries, is not enough. All parties, including policy makers, need to accept that the process of generating the information is trustworthy. The information has to be communicated in a way that can inform policy decisions, and to that end should not be used only to justify decisions that have already been taken. Rather, scientific knowledge should be used as one input during decision making. A crucial element is what Dr Barua described as "science diplomacy within the ministries".

Participants said: "Of all such events that I have attended, I found this the most productive with much that I brought back to work with colleagues and partners here."

Figure 10: Senator Nisar Memon asks a question to the panel

After a general fact-finding discussion aimed at clarifying aspects of the researchers' presentations, the panel of presenters was asked to say a few words about the key entry point that would link science to policy and end users. Answers ranged widely.

- Research alone is not sufficient; it requires communication to make results available and useful to all stakeholders
- A new type of professional who can act as a bridge between scientists and policy-makers, speaking both languages
- By contrast, capacity development for modellers and other scientists to strengthen their ability to talk to politicians
- Government commitment to ensure that grassroots institutes can benefit from research
- Stakeholders at all levels, not only in government, should demand the kind of research they need, and agree to respect the results
- Create a new vision that includes participatory research and joint involvement in project planning.

Marketplace roundtables

The exchange of ideas continued with participants dividing into small groups to develop some of the 10 action points agreed at the 2nd meeting of the IBKF. Groups were tasked to move towards a draft concept note for a project that would involve and benefit more than one of the riparian countries, address the demand for knowledge and offer potential solutions. Each group pitched its ideas to a panel of experts in a format modelled on the Dragons' Den reality TV show, in which entrepreneurs pitch their ideas to experienced investors and receive criticism, feedback and sometimes funding.

The potential could be seen as a session intended as a marketplace of ideas that would inform concept notes for action. As people of diverse backgrounds and disciplines formed small groups to work on concept notes for selected projects, the room increasingly came to resemble a real marketplace. Open outcry bids called for a data specialist here, a country representative there. Self-appointed group spokespeople hawked the value of joining their group. Scribes scribbled. Hands waved. Fingers pointed. Slowly, people stopped hopping from table to table, settled with their preferred choice, and the noise level subsided from utterly chaotic to the quiet hubbub of busy people sharing ideas, agreeing and disagreeing, cajoling one another to their point of view, thoughts gathering like a fan of separate tributaries into a single stream of consciousness

The concept notes from the individual groups are summarised below:

Centre of Excellence on Capacity Building

The centre would be created in Xingjiang Province in China and would focus on improved adaptation to climate change in the basin. The primary participants would be Masters and PhD students as well as a network of trainers. The centre would provide a stakeholder platform and initiate dialogues for and with policy makers through a series of seminars, workshops and conferences. The outcomes would be bridges built between researchers and policy makers, between investors and profits and between stakeholders inside and outside the basin.

The aim is to build bridges between policy makers and research.

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Indus Basin Knowledge Centre

Speaking to a wide target audience of researchers, government and policy makers, development partners, the private sector and philanthropy, the proposed centre would undertake action-oriented research focused on the Indus basin. It would act as a node to support existing institutions and offer a platform for networking and interdisciplinary research. The goal would be to increase the supply of knowledge products relevant and useful for stakeholders, founded on a shared facility that provides leadership and acts as a trusted convenor for stakeholders in all four countries of the basin.

We are inspired by the history of IIASA. The knowledge that we will produce will have more credibility and trust when we take it from the centre to governments.

Government Dialogue and Collaboration

The objectives of the concept note are to ensure that demand-driven research is conducted and to bridge the gap between science and policy. It would draw from a wide range of contributors such as national research institutes and universities, planning ministries, parliamentarians and policy makers, media and others. Together they would map government objectives and work to establish scientific priorities and identify the research landscape. A platform would be established to promote regional dialogue. In the end, this concept note would ensure that governments fund a priority-based research agenda and that policies are based on robust science. All stakeholders would benefit, from basin governments to the women and men in water-dependent communities.

The problem is that the research that is done does not address the real problems the country is facing. That's why we bring science and policy together, so we know we are researching what government wants to know.

Data without Borders, Data without Restrictions

The concept note recognises that despite the sensitive nature of some types of data, there exists also a wide range of non-sensitive data that are available publicly or on request. These data could improve transboundary research and knowledge creation, paving the way to greater cooperation, but the amount of data and diversity of sources make it difficult to take advantage of such non-sensitive data. The project proposes an online portal that unifies the data, eases access, provides information on quality and potential uses and is continuously maintained and updated. It would collate analytical tools and ways to use them. The primary beneficiaries would be scientists and policy makers, with all society ultimately benefitting from improved knowledge and practice. This concept note could draw from and build on the 10-year effort currently manifested in the Indus Basin Knowledge Platform.

Each country categorises data sensitivity in its own way; the platform will maybe offer different levels [of access] to different categories [of researchers].

Indus Basin Development Goals I

The group proposed setting goals under four headings: governance, productivity, cooperation and environmental sustainability. The project would bring together development partners, research agencies, governments and NGOs from all four countries to set targets for the four goals and plan interventions that would move towards improved governance, productivity, water security and environmental sustainability. The project outcomes include a shared vision for the Indus basin, agreed targets and greater connectivity among partners.

The project will contribute to SDG 6 and to others such as nutrition. It provides common ground for the countries to achieve these targets.

Indus Basin Development Goals II

The concept note seeks to drive inclusive development in the Indus basin, with a final goal of a cooperative and conflict-free region. It aims to cycle around the three realms of knowledge, policy and investment to secure first economic development and then social and environmental development. Beneficiaries are the communities and habitats of the basin. The project is built on four sets of activities: interdisciplinary collaborative research; capacity development focused on the wider, basin perspective; active identification of investment opportunities; and an emphasis on social factors such as gender inclusivity and indigenous people.

There has to be investment through government to get involvement at the highest levels.

Best Management Practices

There are many sectors in which countries inside the Indus basin and those outside are at different levels of resource management. By identifying scalable and successful good practices, after agreeing a framework, the project would be able to improve areas such as water productivity, data management and sharing, integrated modelling and others. The project would encourage younger people to champion solutions and would use modern technology for greater outreach. Outcomes would include improved water and food security, contribution to the SDGs, as well as the co-creation of diverse knowledge products, all helping to improve regional cooperation.

Pilot projects never fail and never scale, but there are many examples [of good practices] in the region. The project will promote technologies such as indigenous methods for irrigation and water conservation, practiced for centuries but ignored recently.

The Indus Basin: Science and Society

The concept note is for a multi-authored, multidisciplinary volume that would offer the broadest, deepest and most visionary book on the entire Indus basin. Chapters by expert authors would be peer reviewed and would synthesise current best knowledge on the Indus. The content would be agreed through a series of planning meetings and workshops. At present, three overarching sections are envisaged: reimagining the Indus; analytical and regional; and visionary perspectives. The goal is to produce, by 2020, a definitive, open access

reference that would be used throughout the basin and beyond from classrooms to policy advisers, a source of knowledge for generations to come.

Decision makers do not read books. We want to build the knowledge so that others can make use of it to influence decision makers. The book is a first necessary step; it is not sufficient.

Figure 11: Participants engage in the marketplace roundtables

The Dragons Deliberate

A member of each group pitched their draft concept note to the Dragons, chaired by David Grey (Oxford University). The dragons were forthright in their comments and questions as they sought to understand each concept note; doubtless the ideas will be improved as they are developed with that feedback in mind.
All the Dragons wanted to ensure that there was no duplication of efforts and that the expertise within groups be used to full advantage. After hearing the pitches, they recommended amalgamating some concept notes; the two concept notes for a Centre of Excellence and Knowledge Centre should join the concept note on Government Dialogue and Collaboration; the two concept notes to establish Indus Basin Development Goals should join forces. That creates five draft concepts to go forward:

- Centre of Excellence
- Indus Basin Development Goals
- Scaling Out Best Practices
- Data Without Borders, Data Without Restrictions
- The book: The Indus Basin: Science and Society

Figure 12: Dragons deliberating

Next Steps

Simon Langan (IIASA), on behalf of the co-organisers, thanked all the groups and the Dragons for their participation in the playful spirit of exploration and experiment that had been intended. Each of the five groups should now be prepared to work together on a more complete formulation that could form the nucleus of a set of draft concept notes. He further volunteered IIASA to host a writeshop for these concept notes either in Vienna or in the Indus basin, later in 2018 or early in 2019.

He closed by reminding people that 22 March—World Water Day—focussed on Leaving No One Behind in 2019 and Climate Change in 2020 and that both would make ideal news pegs for the continuing work of the IBKF.

Participants said: "It sure was a good opportunity to meet people and make new work friends."

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A future for the Indus basin

The complex interplay of water, food and energy complicates all efforts to manage any one area in isolation. Add transboundary issues and it might seem on the surface as if just, equitable and sustainable solutions are impossible. That, however need not be so. History shows that solutions can be found, as long as there is joint commitment to a shared vision. The final session of the meeting explored the challenges of developing such a vision.

Integrated Solutions for Water, Energy, and Land

The ISWEL project at IIASA aims to answer "what if" questions for the water, energy and land nexus. In effect it is Action Point 9 of IBKF 2, researching scenarios, trends and possible futures. Simon Langan, Program Director at IIASA, spoke about ISWEL's work to date.

While ISWEL seeks to understand water, energy and land at the global level, it has a focus on two transboundary basins, the Zambezi in sub-Saharan Africa and the Indus in Asia. Both will be affected by climate change, but societal demands differ between the two. In the Zambezi, population is increasing rapidly and greater climate variability threatens sustainable development. The Indus too faces a growing population, though less so than in Africa. Water scarcity is likely to be the biggest single challenge. Increasing urbanisation and rapid economic development will draw scarce water away from food production. However, economic development may change the patterns of trade in the water embedded in food.

Figure 13: Renoj Thayyen, sharing his perspective

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ISWEL is developing and integrating three different open-source integrated assessment models to map possible futures. These models are concerned with community water, land use and energy, and together they result in 14 indicators that reveal the vulnerability of different regions and different sectors under various changed scenarios. There are complex trade-offs to be accounted for, among them: how water demands from land and energy will change; how withdrawals of water in one place or sector will affect availability to other places and sectors; how shifts in water use from agriculture to household and industry will affect water quality. Such analyses, however, must find traction outside the study if they are to be contribute to decision-making, and so meetings with stakeholders are an important element in ISWEL, to present results for discussion and also to listen to feedback that can adjust future studies.

Participants said: "The two-day scenario building workshop was engaging, and I found it particularly stimulating to have the opportunity to discuss, reflect, and envision a future that is possible."

Plotting the road ahead

Before the IBKF, IIASA conducted a scenario workshop with many people from the basin, to share the process of developing scenarios and, more importantly, to take the first steps towards developing such scenarios for the Indus basin, which faces multiple and difficult challenges. Participants were asked to jointly discuss desirable futures for the basin with regards to water, energy, and land security and to think about the best possible pathways that might address those challenges. Participants characterised the current situation, combining and sharing their knowledge about major challenges, and then developed "business as usual" pathways as a reference for the pathways leading to desired futures. Finally, each group developed the pathways to achieve their visions, and the visions and pathways were tested against different global developments and climate scenarios to further improve the robustness of the pathways. The workshop resulted in an enhanced and shared understanding of the implications of different investments in the basin and the consequences of these investments as they cascaded through the water-energy-land nexus. Participants emphasised the importance of cooperation among the four riparian countries as a key to achieving their goals.

Participants said: "It was very useful to be able to imagine an inspired future. Doing this with people from different regions was a unique experience."

During the 3rd IBKF each of the groups presented their first drafts. Each had its strengths and weaknesses, as might be expected, and because an important element of scenario planning is a two-way flow of information between the scenario developers and the stakeholders who would make use of scenarios, discussion during the presentations will help to shape future versions.
In a panel discussion of the scenarios, there was general agreement that the exercise helps to bring the riparian countries together and to strike a balance between "what we want and what there is". Having people from each country in the development team helped to expose one another to differences and similarities of communities across borders. It also gives people a clearer vision of upstream and downstream benefits and consequences and their interplay. Contributions from people with different areas of expertise shows to each

member of a team that their own, individual vision may not be big enough and that only by working together can they develop a scenario that is robust and compelling. Perhaps the most valuable feature of the workshop was that it provided the luxury of time to sit and think deeply about difficult problems.

Participants said: "Contrary to media reports, I realized that the need of joint cooperation and shared vision is real for all riparian countries. Everyone wants to cooperate without borders. I hope this becomes a reality."

The particular part that scientists can play in promoting a shared vision also came under scrutiny. Many panel members shared personal experience of the gap between science and policy and the lack of trust shown by many politicians. Where did this data come from? How can we trust it? These are familiar questions, and while research units work hard to foster trust, when a new politician or civil servant becomes involved, the cycle of mistrust may start again. Science, one panellist said, needs to provide "simple answers to tough questions. Simple, but not simplistic." All agreed that collaborative science can promote transboundary cooperation.

The vision thing

If you don't know where you're going, any road will take you there. The vision is where you want to be.

The need to subscribe to a shared vision of the future is perhaps the most pressing need in the Indus basin. How to get there?
David Grey projected a standard textbook picture of the water cycle, familiar to all the participants, and posed the provocative question: "whose water is it?". There are no country boundaries on the diagram. "We know that the cycle is central to life on our planet," he said. "Who owns the different bits of that cycle? Can we parse it out, so that some of that belongs to this country and other bits belong to another country?" Rhetorical questions, but the current state of transboundary relationships among the countries that share the waters of the Indus requires that they be asked. Leading by example, Grey shared four cases of transboundary basin visions.

- The Nile Basin Initiative "to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources".
- The Zambezi vision, of "a future characterised by equitable and sustainable utilisation of water for social and environmental justice, regional integration and economic benefit for present and future generations".
- The Niger basin vision of "a shared region of sustainable development achieved through the comprehensive, integrated management of water resources and their associated ecosystems, to improve everyday living standards and prosperity by 2025".
- The Mekong basin vision of "an economically prosperous, socially just and environmentally sound Mekong River Basin".

Countries that had been at war many times managed to find agreement, sometimes only after extended negotiations. And although in many cases problems remain, "the most important thing is they're talking, and they have a vision."

Agreement can result in exceptional cooperation. The Manantali dam, for example, lies 300 km inside Mali, yet is owned by four countries of the Niger basin. Each borrowed individually to pay for it, and even though it is inside one country, they manage it collectively.

For the Indus basin, despite a long history of disagreement, scientific collaboration can lay the groundwork for agreement on a vision. To some extent, the science itself is important. In order to manage anything effectively, you have to be able to measure it, and some of the science is about measurement. Some of it is about prediction, so that managers have a less uncertain view of the challenges they face. In the end, though, the fruits of scientific research, and even more so of scientific collaboration and cooperation across the riparian countries, will have a bigger impact by far if they nourish the search for political agreement.

The value of an agreed vision is that in some respects the journey to reach agreement is the destination, because it sets the parameters within which future discussions among basin countries take place. "It's locked in. New ministers coming in don't open the vision box."

Science without policy is just science … But policy without science is gambling.

Closing the meeting

To close the meeting, the four co-organisers each expressed their thanks and hopes for the future.

Arun Shrestha said that ICIMOD regards three Himalayan-fed basins—the Indus, the Ganges and the Brahmaputra—as priorities. The Indus may be the most important of these, especially in socioeconomic terms. It will be a focus of activity "for a long time to come". ICIMOD has long term commitment to work in the Indus basin and will continue to facilitate interactions and collaboration through Upper Indus Basin Network with new thinking. He looked forward to the participants and other stakeholders developing the draft concept notes and hoped that participants, rather than organisers, would help to shape future meetings of the IBKF

Alan Nicol of IWMI endorsed that view, praising participants for their "brain power and commitment". He acknowledged that the IBKF had not yet met in the basin itself, agreed that it should, and would work towards that. IWMI remains committed to research and developmental outcomes in the Indus basin, he said, but "don't wait for an email from us. Come and knock on our door". He urged participants to build on the open, transparent and collegiate atmosphere that had characterised the IBKF to date.

Christina Leb at the World Bank was pleased to note that almost everyone at the IBKF had met new colleagues and had learned about new initiatives connected to the Indus basin. She recounted that one reason the Bank had supported the IBKF was that while the Bank had its own projects in the basin, it wanted more partners to come together to share information and build new initiatives. She also introduced her successor, Lucy Lytton, who would be responsible for carrying forward the World Bank's "strong commitment to ensure that there will be a next IBKF".

For IIASA, Simon Langan thanked the Austrian government for its support of IIASA and the IIASA staff who had worked tirelessly to make the meeting a success. He repeated the importance of building a library of draft concept notes and saw these as the basis of future engagement that will distil evidence into useful advice and build trust, especially by sharing non-sensitive data. Through a series of small incremental steps and the recognition of different perspectives, the Indus basin could achieve the cooperation needed to deliver sustainable development to all the people who depend on its waters.

Participants said: "I personally see a lot of potential and opportunities to concentrate our joint efforts to resolving water transboundary problems through constant and consistent integrated approaches."

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Annex - Resources

3rd IBKF, Laxenburg, Austria, May/June 2018

Presentations

DAY 1 – 31st May

Keynote address and discussion on the Science-Policy Interface

Science-policy interface: Example from the Danube River Basin, Mr. Ivan Zavadsky, Executive Secretary, International Commission for the Protection of the Danube River (ICPDR)

National perspectives on the science-policy interface in the Indus Basin

Afghanistan National Perspective, Sediqa Hassani, Afghanistan Government

China National Perspective, Jiang Tong, Chinese Academy of Sciences

India National Perspective, Renoj Thayyen, National Institute of Hydrology

Pakistan National Perspective, Nisar A Memon, South Asia Water Initiative

Working of the 2nd Indus Basin Knowledge Forum

Presentation of the 2nd Indus Basin Knowledge Forum, Alan Nicol, IWMI

Breakout groups to develop action on the 2nd Forum: A 10-Point Action Plan, Joshua Newton, World Bank

DAY 2 - 1st June

Funder presentations: What is the funding landscape for water-related research activities in the Indus basin?

The Global Environment Facility, Astrid Hillers

British Council Science for Cultural Relations, Fatemeh Ahmadi

Natural Environment Research Council, Ruth Kelman

IDRC Support Strategy, Mr. Murali Kallur

Research project presentations: What are examples of current water-related research activities conducted in the Indus Basin and how are they relevant for policy processes?

Policy Interventions and Groundwater Rejuvenations across India, Abhijit Mukherjee, Indian Institute of Technology Kharagpur (IITKGP)

Science - Policy - Practice Interface, A Critical Challenge, India, Anamika Baruwa, Indian Institute of Technology Guwahati (IITG)

Approaches to Public Policy Engagement, Pakistan, Hina Lotia, Leadership for Environment and Development (LEAD)

Indus River System Model: A planning Tool to Explore Water-Energy-Food Nexus for Pakistan, Mobin Ahmed, Commonwealth Scientific and Industrial Research Organization (CSIRO)

Research, Policy and Current Practices in The Indus Basin, Pakistan, Nusrat Nasab, Aga Khan Agency for Habitat (AKAH)

Examples of Recent Advances in Climatic, Hydrological and Cryospheric Research In the Indus Basin – Mr. Walter Immerzeel, Universiteit Utrecht (UU) and Future Water

DAY 3 – 2nd June

Water, Energy, and Land Nexus in the Indus Basin: Exploring future and desirable futures - Overview presentations:

Integrated Solutions for Water, Energy, and Land (ISWEL) project, Simon Langan, IIASA

Indus Basin Vision – Why is it needed? David Grey, Oxford University

IWMI- Activities and Challenges of water Resources River Basin - Zafar Gafurov, Oyture Anarbekov and Umida Solieva, IWMI

Summary of the scenario development workshop, Barbara Willaarts, IIASA

Modelling Activity - Overview and hands-on training on nexus tools

ISIMIP and ISIpedia, Edward Byers, IIASA

Global Hydrological Model Community Water Model (CWATM), Peter Burek, IIASA

The MESSAGEix IAM and the "ix modeling platform" for integrated and x-cutting analysis, Daniel Huppmann, IIASA

MESSAGE-basin Model applied to Indus, Adriano Vinca, IIASA

Posters

Mitigation of climate change impacts through improved reservoir operation - A J Adeloye

Characterising different hydrological regimes of Upper Indus Basin - Renoj J Thayyen

Reduction in Water Footprint of Paddy through Alteration in Crop Calendar in Indian Punjab - Balwinder Singh

Upper Indus basin research highlights - Shakil Ahmad Romshoo

Agenda

http://www.iiasa.ac.at/web/home/research/iswel/Agenda_21st_May.pdf

Concept Note

http://www.iiasa.ac.at/web/home/research/iswel/Concept_Note_only_IBKF.pdf

Videos

Livestream http://www.iiasa.ac.at/web/home/research/iswel/180529-IndusWorkshop.html

Summary Video http://www.iiasa.ac.at/web/home/research/iswel/180529-IndusWorkshop.html

Webpage

http://www.iiasa.ac.at/web/home/research/iswel/180529-IndusWorkshop.html

Photos

https://www.flickr.com/photos/iiasa/albums/72157696919597184/with/42647452784/

Websites

Event Page – IIASA website http://www.iiasa.ac.at/web/home/research/iswel/180529-IndusWorkshop.html
ISWEL Project Home Page http://www.iiasa.ac.at/web/home/research/iswel/ISWEL.html
World Bank IBKF event page - https://www.worldbank.org/en/events/2018/05/30/third-indus-basin-knowledge-forum
IWMI IBKF event page https://wle.cgiar.org/event/3rd-indus-basin-knowledge-forum
ICIMOD IBKF event page http://www.icimod.org/?q=32077
Rice and Reason blog post by Alan Nicol IWMI https://blog.iiasa.ac.at/2018/05/30/rice-and-reason-planning-for-system-complexity-in-the-indus-basin/

2nd IBKF Colombo, Sri Lanka, July 2017

Report

https://drive.google.com/file/d/1dQpxne8uqqmbvZ7gaDxaNZW-_LpiITG4/view
or
http://www.iiasa.ac.at/web/home/research/iswel/IBKF_Conference_Report_Low_resn.pdf

Presentations

Available via http://www.iwmi.cgiar.org/events/indus-basin-knowledge-forum/

Live stream

Available via http://www.iwmi.cgiar.org/events/indus-basin-knowledge-forum/

Webpage

http://www.iwmi.cgiar.org/events/indus-basin-knowledge-forum/

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ISWEL Project Stakeholder Workshop 'Developing water, energy, and land nexus scenarios for the Indus Basin' Vienna, Austria, May 2018

Event webpage

http://www.iiasa.ac.at/web/home/research/iswel/180529-IndusWorkshop.html

Event Concept Note

http://www.iiasa.ac.at/web/home/research/iswel/ISWEL-Indus_Scenario_Workshop_CN.pdf

Agenda

http://www.iiasa.ac.at/web/home/research/iswel/ISWEL_Agenda-Indus_Scenario_Workshop.pdf

Event report

http://www.iiasa.ac.at/web/home/research/iswel/ISWEL_Indus_Scenarios_Workshop_Report-draft_summary.pdf

Presentations

1. Introduction to Integrated Solutions for Water, Energy, and Land (ISWEL) project, Simon Langan, IIASA
2. Why do we need visions? David Grey, Oxford University
3. Water, Energy, and Land Challenges from country perspective, Afghanistan, Sediqa Hassani, Ministry of Energy and Water
4. Water, Energy, and Land Challenges from country perspective, China, Jiang Tong, National Climate Centre and Chinese Academy of Sciences
5. Water, Energy, and Land Challenges from country perspective, India, Shakil Ahmad Romshoo, University of Kashmir
6. Water, Energy, and Land Challenges from country perspective, Pakistan, Khalid Mohtadullah, Upper Indus Basin Network
7. Overview on the Indus Nexus Modeling tool, Simon Parkinson, IIASA
8. Introduction to the Indus Scenario Process, Piotr Magnuzewski, IIASA

Videos

Summary Video http://www.iiasa.ac.at/web/home/research/iswel/180529-IndusWorkshop.html

Photos

https://www.flickr.com/photos/iiasa/albums/72157693383248520