# Indus Water Treaty: Challenges for Future

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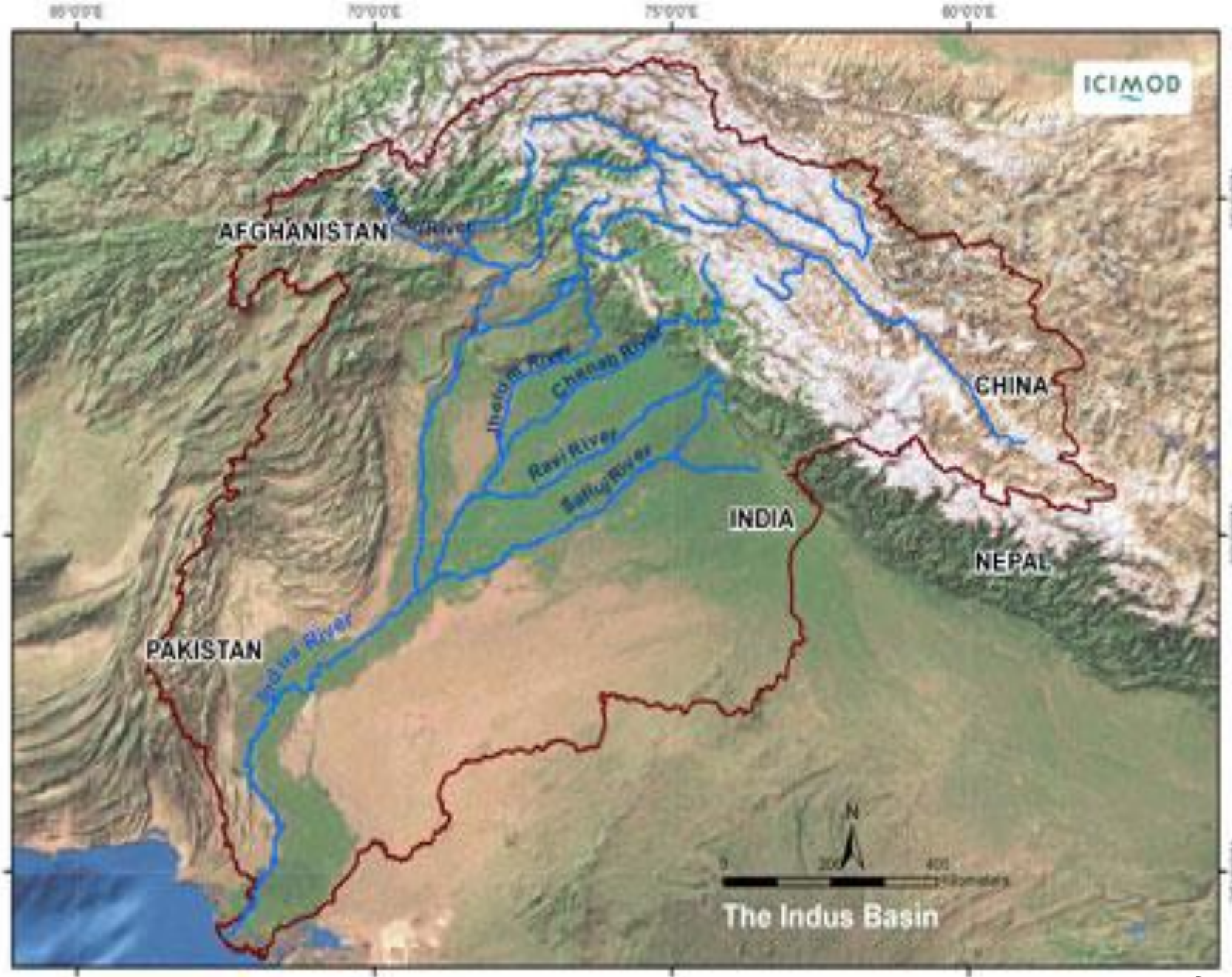
- **IWT signed in 1960 to govern Indus basin is coming under stress** due to **rapidly rising population**; **increasing agricultural, industrial & domestics uses**, **environmental degradation** and **climatic threats-** i.e., glacier melt, **rising temperatures,** fluctuation in precipitation & erratic monsoon pattern.
- **The challenges emerging from climate change, environmental degradation and changing demographics call for closer cooperation** b/w India & Pakistan for strengthening IWT so as to preserve the hydrology and ecology of Indus basin.


ICIMOD
AFGHANISTAN
CHINA
INDIA
NEPAL
PAKISTAN
Jhelum River
Chenab River
Ravi River
Satluj River
Indus River
N
The Indus Basin

# The Indus Basin : Key Features

- The IB has a total area of about 1.12 million sq. kms; four co-riparian:
  - **Pakistan 47 %; India 39 %: China 8 %** and **Afghanistan 6%.**
  - Major tributaries are **Sutlej, Ravi, Beas, Indus, Jehlum, Chenab** & **Kabul river**.
- **Pakistan is one of the world's driest countries** with a an average annual rainfall of about 240 mm. **It is a 'single basin' country; its dependence on external water resources is 76%.**

- The population and economy are heavily dependent on an annual influx into the Indus river system.
- **The basin accounts for**
  - **19.5 % of GDP,**
  - **42.3 % employment, and**
  - **more than 60 % of its exports.**

# The Indus Waters Treaty: Key Features

- In 1947 Partition of the subcontinent divided the Indus system, leading to the disruption of well-established irrigation systems.
- The disruption of flows to Pakistan in April 1948 exposed Pak's vulnerability to the Indian control over the headwaters of the Indus system.
- In 1960 with World Bank mediation both signed IWT that governs their transboundary water rights & obligations.

- IWT comprises a preamble and 12 articles of the treaty and eight (A-H) Annexures.
- **It divided Indus river system giving three E. Rivers- Sutlej, Beas & Ravi to India with 33 MAF** of mean flow and **three W. Rivers- Indus, Jhelum & Chenab, to Pak with 136 MAF of mean flow.**
- Article I : All the waters of the three eastern rivers– the Sutlej, Beas and Ravi–shall be available to India.

- Article III stated:
  - Pakistan shall receive "**unrestricted use of all waters of Western Rivers**" Article III (1)
  - India shall be under **obligation to let flow all waters of W. Rivers & shall not permit any interference with these waters,** except for restricted uses provided in Annex C & D. Article III (2)
- **Article 4 of the Treaty and Annexures C, D, and E list the conditions under which India was allowed limited uses-** i.e., agriculture, drinking water, non-consumptive uses and hydro-electric power generation,.

- **India is entitled to use 1.3 MAF for irrigation purposes & 3.6 MAF for conservation, flood moderation & hydro power generation. Spelled out as** general storage, power storage & flood storage.
- India is **allowed to construct run-of-river hydroelectric plants** on the W. Rivers & all the technical parameters for each river are **specified in Annexure D. Annexure E stipulates the limits of various storages of water** by India on the western rivers.

- **It is interpretation of the permissive & restrictive provisions on the western rivers** that are at the heart of the current water tensions b/w India and Pakistan.

# India's Entitlement of Storage on the Western Rivers (MAF)

| River system | General Storage | Power Storage | Flood Storage | |
|---|---|---|---|---|
| Indus | 0.25 | 0.15 | Nil | 0.40 |
| Jhelum (Excluding Jhelum Main ) | 0.50 | 0.25 | 0.75 | 1.50 |
| Jhelum Main | Nil | Nil | As in paragraph 9, Annex. E | |
| Chenab (Excluding Chenab Main ) | 0.50 | 0.60 | Nil | 1.10 |
| Chenab Main | Nil | 0.60 | Nil | 0.60 |
| Total | 1.25 | 1.60 | 0.75 | 3.6 |

# Permanent Indus Commission

- **Article VIII established a Permanent Indus Commission (PIC),** comprising 'a Commissioner for Indus Waters appointed by each country.
- **The Commission is to serve 'as the regular channel of communication on all matters** pertaining to the implementation of the Treaty', and 'promote co-operation between the Parties in the development of the waters of the Rivers…'
- The main task of the Commission is
  - to maintain a **co-operative arrangement** for the implementation of the Treaty;

- **promote co-operation b/w the parties in the development of the waters of the rivers;**
- meet regularly to **review implementation of the Treaty**;
- make every effort to settle promptly any **question** arising b/w the parties;
- and undertake **tours of inspection** of the rivers to ascertain facts.

- The Commission shall try to settle promptly to resolve any question relating to the implementation of the Treaty.

# Dispute Resolution Mechanism

- **Questions raised by either Party are to be resolved by the Commission.**
- **If the 'questions' turn into 'differences' essentially of a technical nature, they can be referred to a Neutral Expert,** whose **findings are final and binding on both Parties.**
- **The second kind of arbitration is a Court of Arbitration for resolving disputes.** The procedure for the establishment of the court of arbitration is given in the annexes of the IWT.

# Article VII on 'Future Cooperation':

**Article VII:**

- **The two parties "recognize that they have a common interest in the optimum development of the rivers" and**
- **"they declare their intention "to cooperate by mutual agreement, to the fullest possible extent."**

- Article XII of the IWT is treaty provides that its provision may be modified by a duly ratified treaty by the two govts.

# Key Challenges to IWT

- Drivers of stress in IB- rising population, rapid urbanization, industrialization & Climatic threats –rising temperature, receding glaciers, erratic rainfall patterns.
  - **Climate Change**
  - **Degradation of the Indus Watershed**
  - **Population Growth**
  - **Hydropower Development on western rivers**
  - **Institutional Weakness: PWIC**
  - **Exchange of Data related issues**

# Impact of Climate Change on IB

- IB is highly dependent on water derived from the melting of snow and glacier in the upper part of the basin.
- The contribution of melt water to the flow of Indus River is est. to be from 50 to 70% of the total flow & remaining comes from rains during monsoon season from July to Sept.
- **Snow melt account for more than 65 % of the Indus river ; 50 % of Jehlum & 49 % of Chenab river.**
- **Variability: The quantum of water flowing in the Indus & its tributaries varies widely from year to year,** depending on snowfall in the Himalayan & Karakoram ranges and rainfall in the catchment areas.

# Snow/Glacier/Monsoon Melt in IB

Snow/Glacier/ Monsoon melt in the Indus Basin System

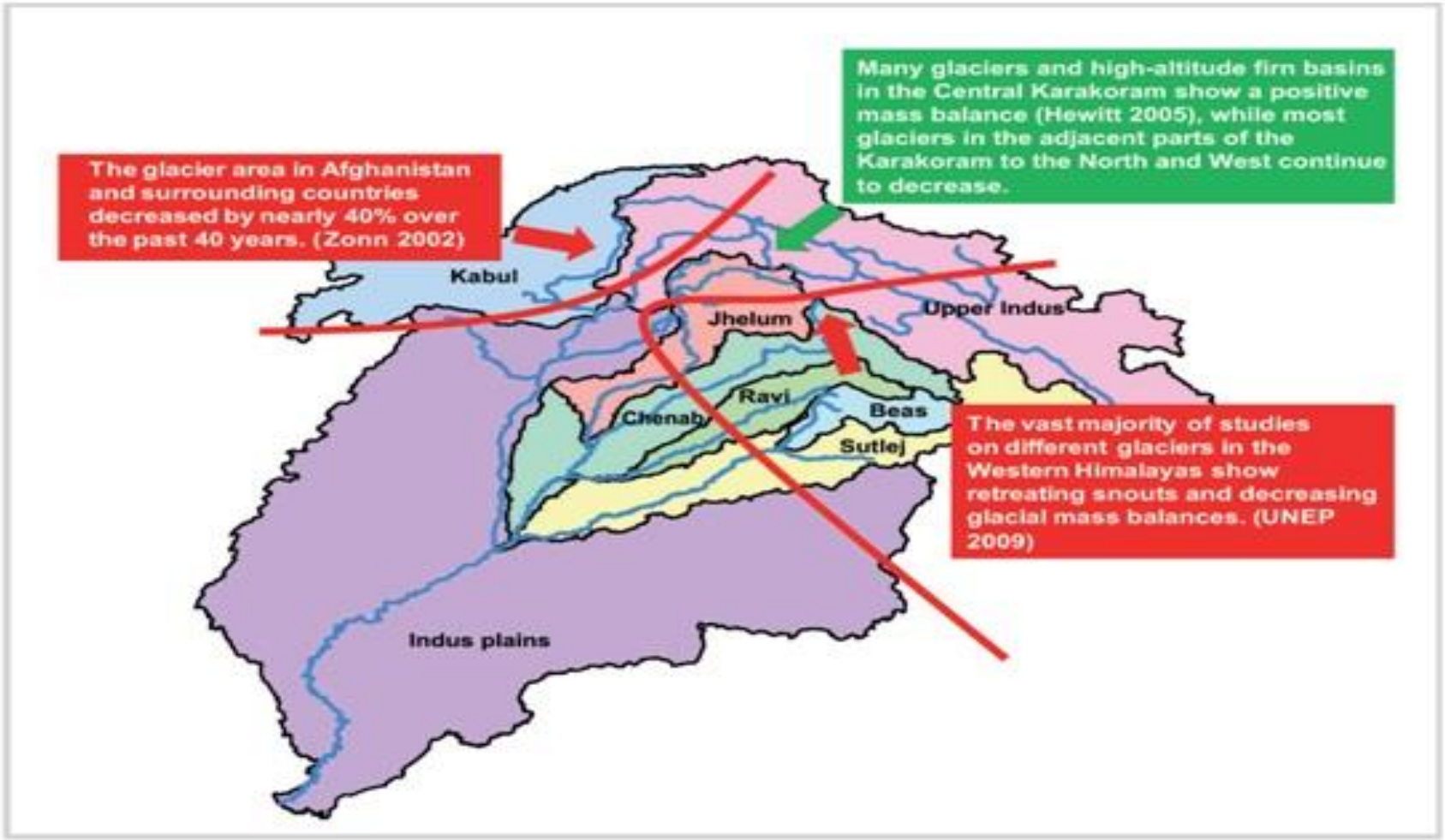
| | % of IRS inflows | % Seasonal distribution | | Dominant Source of flow |
|---|---|---|---|---|
| | | Summer (AMJJAS)a | Winter (ONDJFM)b | |
| **Indus** | 44 | 86 | 14 | Snow /glacial melt |
| **Chenab** | 19 | 83 | 17 | Snow /glacial melt+ Monsoon |
| **Jehlum** | 16 | 78 | 22 | Mainly Snow melt+ Monsoon |
| **Kabul** | 16 | 82 | 18 | Snow/glacial melt |
| **Others** | 5 | | | |

Source: Climate Change: A threat to Water Security of Pakistan

# Melting Glaciers

- There are 18,495 glaciers in the IB; of which 13215 glaciers are in the UIB; 5218 are in Indus Pak & 7,997 in Indus India mainly in IHK & HP which support the IB rivers system.
- **There is a high uncertainty in the behaviour of glaciers in the UIB, esp. the cryosphere**.
- Various studies incl. those conducted by Int,. Centre for Integrated Mountain Development (ICIMOD) indicate that **glaciers in western Himalaya are retreating** while glaciers in central part of the UIB in the Karakorum range are advancing described as Karakoram anomaly.

# Spatial behaviour of glacial dynamics in the Indus Basin



- ICIMOD observes:
  - **receding & eventually disappearing high altitude reservoirs of snow & ice will over time reduce downstream runoff, and increase its variability.**
  - In June 2010 Walter W. Immerzeel report, ***Climate Change will Affect Asian Water Towers*** observed that **by 2050 IB would lose 8.4 % of its upstream flow due to climate change.**
- Space Application Centre **(SAC), India observed: 359 glaciers in the Chenab basin that stretched over 1,414 sq. kms (Km2) in 1962, were reduced to 1,110 km2 by 2004 - a reduction of 21 % in the snow cover area.**

- **The Kolahoi, biggest glacier in IHK, main source of Jehlum river** is melting faster than other Himalayan glaciers, from 11 km2 to 8.4 km2 over the past three decades.
- **The 78-km long Siachen glacier - the site of an Indian-Pakistani military standoff** has shrunk to half its size.
- **The glacier is the source of the Nubra River** that falls into the Shyok River in Laddakh which then empties into the Indus.
- The **cloudburst & flash floods in Leh district** in August 2010 were described as a **definitive sign of the impact climate change** having on Indian side of Himalayas.

# Trends in Flows

- Reports suggest that water flows in the western rivers have decreased from 119 MAF in 1960 to 113 MAF in 1997 and further fell to 102 MAF by 2011
- **In Chenab, the average annual flow has declined by 12 % b/w 1960 and 2011**, while **in the river Jhelum it has declined by 17 %.**
- The decline in rivers' flows could quite possibly be due to the lower precipitation in IHK and Himachal Pradesh, which constitute the watershed region of these two rivers or construction of upstream dams by India.

# Impact of climate change

- **Climate Change is likely to increase the variability of monsoon rains & enhance the frequency & severity of extreme events such as floods & droughts.** Any reductions in flow in the Indus caused by climate change would further intensify this scarcity.
- **Effects of Glacial Retreat on run off:** best estimates are that there will be 50 years of glacial retreat, during which time river flows will increase.

- In the beginning there will be 20 to 40% increase in Indus flows and after 50 years, there will be glacial retreat and flows will drop down to 30 to 40%- in 100 years time.
- Severe water stressed & heat stressed conditions in arid and semi arid regions leading to **reduced agriculture productivity & power generation.**
- Increased upstream **intrusion of saline water in the Indus delta,** adversely affecting coastal areas. Threat to coastal areas due to sea level rise and increased cyclonic activity due to higher sea surface temperature.

# Degradation of the Indus Watershed

- **Indus watershed is highly vulnerable to environmental change due to deforestation, and pollution.**
- The environmental degradation in the upper reaches of IB is going to have adverse impact on the down stream flows of the western rivers.
- **Forest cover in the Indus basin is extremely low at 0.4%** as more than 90% of the original cover has been lost mainly in the upper parts of the basin.
- The forest cover of IHK is 10.14%. (Forestry Survey of India, 2008). IMD observes, **deforestation has caused 35% decrease in monsoon & 10 % in snow annually in the region.**

- The forests in the mountainous areas of Pak. are degrading fast with a high rate of deforestation of 0.2 - 0.4% per annum.
- **The deforestation has adversely affected the ecosystem and the watershed of the UIB.**
- **Upstream construction of dams is also having local as well as transboundary environment. effects as came out in case of Kishenganga Project-** on Gurez Valley and Neelum Valley.

- **The UIB is prone to natural disasters like earthquakes, floods, landslides, avalanches**, high velocity winds, snow storms that will be aggravated by Climate change.
- **The degradation of water bodies in the UIB is affecting both the quality and quantity of the water in the catchments area.**
- The three major lakes in IHK- Wular lake, Dal lake and Mansbal lake are facing environmental degradation due to pollution.

# Population Growth

- With the basin's population of 215.8 million, the annual per capita water availability of 1,329 m3, is much below the threshold of 1,700 m3 and is lowest when compared to GBM (3473) and Helmand (2589) basins in the region.
- Population increase, rapid urbanization and industrialization, are resulting in higher water demands for domestic and industrial purposes, food production and energy.
- Pakistan's per capita water availability has dwindled from 5,600 cubic meters at the time of independence to 1,066 cubic metres in 2010.
- The National Academy of Science, in its report (NAS 2013) on hydrology in the Himalayan region estimated that **by 2050 Pak. will move to 700 cubic meter per person.**

# Future Water Scenario for Pakistan

| Year | Population (Million) | Water availabil per capita ($m^3$) |
|---|---|---|
| 1951 | 34 | 5300 |
| 1961 | 46 | 3950 |
| 1971 | 65 | 2700 |
| 1981 | 84 | 2100 |
| 1991 | 115 | 1600 |
| 2000 | 148 | 1200 |
| 2010 | 168 | 1066 |
| 2020 | 196 | 915 |
| 2025 | 209 | 850 |

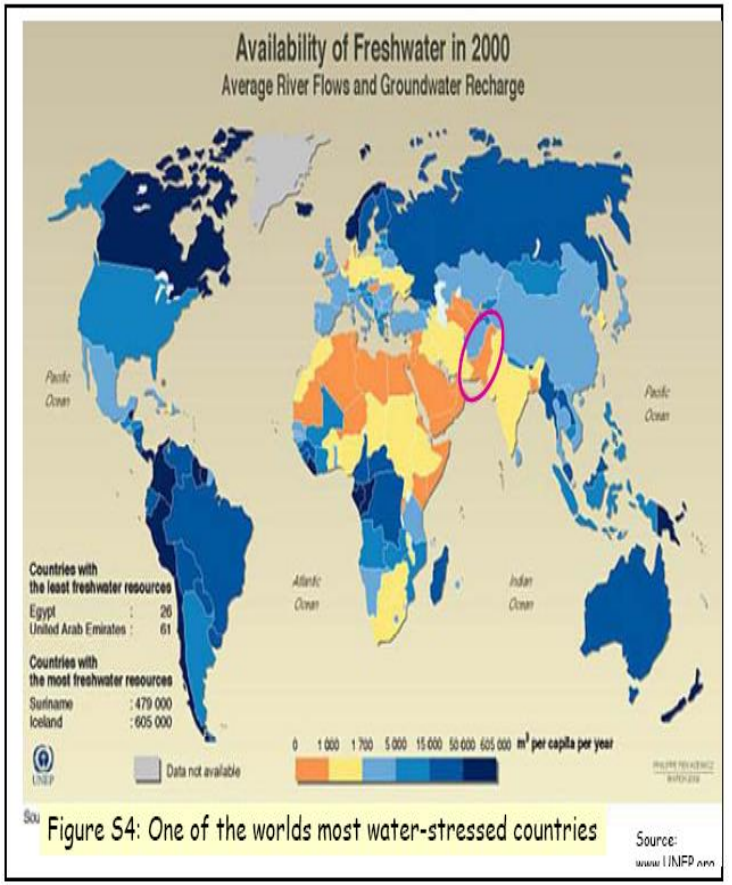


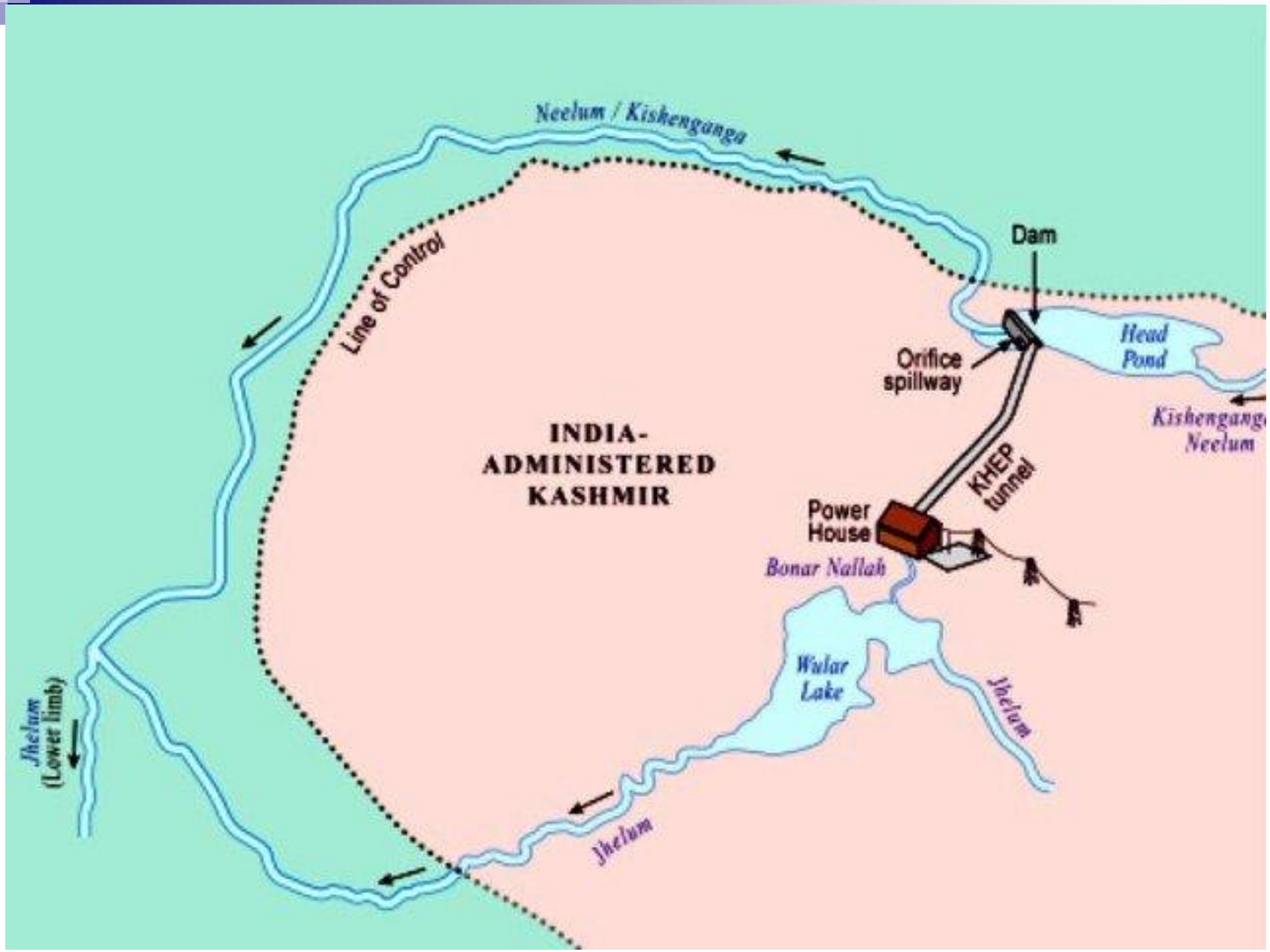
Figure S4: One of the worlds most water-stressed countries

# Indian Hydropower Development on W. Rivers

- IWT allows India to build run of the river projects on the Western rivers, but has stipulated certain restrictions and conditions that safeguard Pakistan's interests. **But number of dams Indian can build is not specified.**
- In the past two decades or so, many controversies have arisen due to **lack of timely data sharing in compliance with the provisions of the Treaty.**
- This has widened distrust b/t the co-riparian. **Pakistan took Baglihar to NE & Kishenganga project to Int. Court of Arbitration.**

- As per the assessment made by Central Electricity Authority (CEA) of India there is around 16475 MW of power potential in IHK- out of which **11,283 MW of hydro power can be produced on river Chenab**, followed **by 3,084 MW on river Jehlum** and **1,608 MW on Indus river.**
- Presently, IHK is the only state where development of hydropower is a priority. Elsewhere in India, the focus is on solar power.
- **Blood & water cannot flow simultaneously, Modi, said referring to Uri attack by the militants.**

- Pakistan warned **revocation of IWT could be taken as an act of war or hostility against Pakistan.**
- India is stepping up efforts to fast track hydrpower development on western rivers with a capacity of over 6,000 MW. These projects are:
- Sawalkote (1,856 MW), Kirthai I (390 MW), Kirthai II (930 MW), Pakal Dul (1,000 MW), Kwar (540 MW), Kiru (624 MW), Bursar (800 MW) in the Chenab basin.


Neelum / Kishenganga
Line of Control
Dam
Head Pond
Orifice spillway
INDIA-ADMINISTERED KASHMIR
KHEP tunnel
Power House
Bonar Nallah
Wular Lake
Jhelum
Jhelum (Lower limb)
Jhelum
Kishenganga Neelum

- A total of 3,263.46 MW has been harnessed on three western rivers (17 % of identified potential). **State Sector generates 761.96** MW while Central Sector 2009.00 MW. Private sector produces 42.50 MW. Demand is 2,768 MW.
- Currently controversy is going on Kishenganga, Ratale, Swalkot, Pakdul.
- Environmentalists have expressed concerns about Sawalkote and Bursar projects. These are around **local environment and ecology, environmental flows, seismic concerns**. **Around 1.5 million trees will be cut for the construction of the Bursar storage project.**

# Framework for Sustainable Management of Indus Basin

- **Expanding Cooperation through Article VII on "Future Cooperation:**
- CC challenges were not factored in when the Treaty was signed in 1960. The demographic challenges are further aggravating the water quantity as well quality in the IB.
- There is need to use Article VII on "future Cooperation" for sustainable management on IB in optimal manner.
- A cooperative framework for sustainable management of IB should include.
  - **Joint Monitoring of impact of CC on the IB river system.**

- Joint Study on the behaviour of Himalayan glaciers
- Joint study on the effects of Glacial Retreat on run off
- Transboundary Coordination in watershed management
- Coordinating CC adaptation strategies
- Strengthening PIWC & Trust building mechanisms in IWT

# Joint Monitoring of impact of CC on the IB river system

- **There is a need to monitor behavior of the glaciers and glacial lakes,** and compile their inventories on regular basis to ensure effective water resources management in future.
- **Transboundary scientific coordination** is essential in order **to obtain a holistic perspective of the existing & anticipated changes in the natural system of IB.**
- **The monitoring of glaciers & lakes can be facilitated by using high resolution remote sensing data** coupled with frequent field observations.

# Joint Study on the Behaviour of Himalayan Glaciers

- The study of the behaviour of Himalayan glaciers is very important to assess the **actual impact of climate change on the Himalayan glaciers.**
- Glacial fluctuations and changes in precipitation patterns are expected to alter the hydrology of IB.
- **The largest challenge stems from inadequate information & monitoring, and limited scientific understanding of these high elevation glaciers.**
- Both sides need to form a group of experts to jointly study the behavior of glaciers whether decreasing or advancing.

- A Glacier Monitoring Research Centre could be set up to
  - Study the **Climate Change impacts on UIB Cryoshpere and Forecast**
  - **Long-Term water availability from Upper Indus Basin**
  - **Conduct Mass-Balance studies** for five selected glaciers in four years.
  - Carryout **Mapping and Monitoring** of more than 50 UIB **glacier snouts.**
- This can help in understanding the extent of glacier melt and **creating joint mitigation and adaptation techniques, sharing information and improving flood forecasting systems.**

# Joint Study on the effects of Glacial retreat on run off

- **Reports suggest that water flows in the western rivers have decreased. It is happening under the conditions of climate change which predict that there will be 50 years of glacial retreat, during which time river flows will increase.**
- **The additional flows in the western rivers remain undetermined. Pakistan being lower riparian has a right to its due share out of this additional water.**
- **There should be a Joint study on the effects of Glacial Retreat on run off, assessing predictable flows under climate change.**

- **Protect Himalayan Glaciers: India-Pak need to declare all glaciers protected area. Siachen must be demilitarized.**
- It has shrunk to half its size. Parties showed some interest to accept new ideas to resolve the issue, by turning it a '**mountain of peace**' or making it a **'zone of peace'.**

# Cooperation in Watershed Management

- **Coordination in watershed management is critical to maintain sustainable flow, to control soil erosion & floods.**
- **Cooperative watershed management** will help IB in sustaining flows, controlling soil erosion, sedimentation & floods, especially flash floods.
- There is need of a mechanism on water management and environment under which both sides can meet periodically, exchange data on water quality and water flows, and consult with one another on environmental problems & share best practices.
- This can be covered under Article VII of the IWT.

- Watershed management projects should factor in climate change, and **some 'dedicated climate change adaptation projects' should be designed to deal with high-risk watersheds within UIB.**
- both sides need to work together in mapping deforestation and its impact on Indus watershed in UIB and coordinate strategies for sustainable conservation, protection and development of forests in the region.
- There is need to expand the scope of Article VII of the IWT on "future Cooperation" for the sustainable management of the IB.
- Issue of pollution of the river bodies in the Indus system can be addressed through [Article IV (9)].

# CBMs on Hydro Power Development

- For over 40 years, the IWT has proved a best model of conflict resolution. A proactive hydro diplomacy can help in stabilizing IB regime created in 1960.
- Being lower riparian Pakistan is apprehensive about adverse impact of these projects on down stream flows and environment.
- **Trust building:**
  - **Real time data sharing through installation of telemetry system.**
  - **If telemetry is properly installed and operated effectively, it would restore trust and minimize uncertainty & confusion over water transactions** b/w the two countries. These may incl. weather forecasting & flood warning telemetry systems.

- **Transparency in data sharing regarding the construction of Indian projects on W. Rivers.**
- **Assessment of the cumulative impact of the Indian hydro projects on W. rivers on the down stream flows & environment.**
- Sharing of **Environment Impact Assessment** (EIA) of the Indian projects on the western rivers will build trust.

# Strengthening the functioning of the PIWC

- **There is need to expand scope and mandate of the Commission** regarding co-operation in the harnessing the Indus waters. The role of PIWC needs to be in line with the current realities or else it will loose its relevance.
- **A Indus Water Consultative Group comprising India, Pakistan and int. water experts can be formed** to provide input on supply capacity of the Indus basin taking into account the issues like climatic changes and environmental degradation.
- Expanded the scope and mandate of the PIWC would help in averting frequent recourse to the NE or Court of Arbitration.

# Integrated Water Resources Management

- Internal water resource management becomes very important given the fact that **physical separation of the Indus tributaries has hampered the possibilities of efficient integrated basin management.**
- In view of growing demographic change adding to water scarcity, it is the responsibility of both countries to ensure internal water resources management by following the principles of Integrated Water Resources Management (IWRM) & share best practices in water conservation techniques in agriculture, industrial & domestic uses.
- **Maintenance of trans-boundary aquifers; groundwater management.**

- There is need for a paradigm shift in water management **from technocratic approach that looks almost exclusively toward engineering solutions to socio-centric approach** which lays emphasis on indigenous physical & human resources management at more resource-efficient and ecologically conducive.

# Conclusion

- **Climate change & changing demographics are emerging as new challenges to the sustainable management of the IB** and **need to be addressed by India and Pakistan through a cooperative framework that ensures coordinated response to common challenges.**
- **Climate Change is emerging as a major threat to the sustainability of Indus basin. There are key gaps in knowledge about its impact which is causing anxieties in lower riparian Pak that needs to be addressed.**
- **Both sides need to cooperate in installing monitoring & forecasting capabilities for the glacial regions and catchment areas of the UIB** to meet the challenge of climate change.
- **The demographic challenge to the sustainability of IB can be met through adopting an IWRM approach** by both sides.