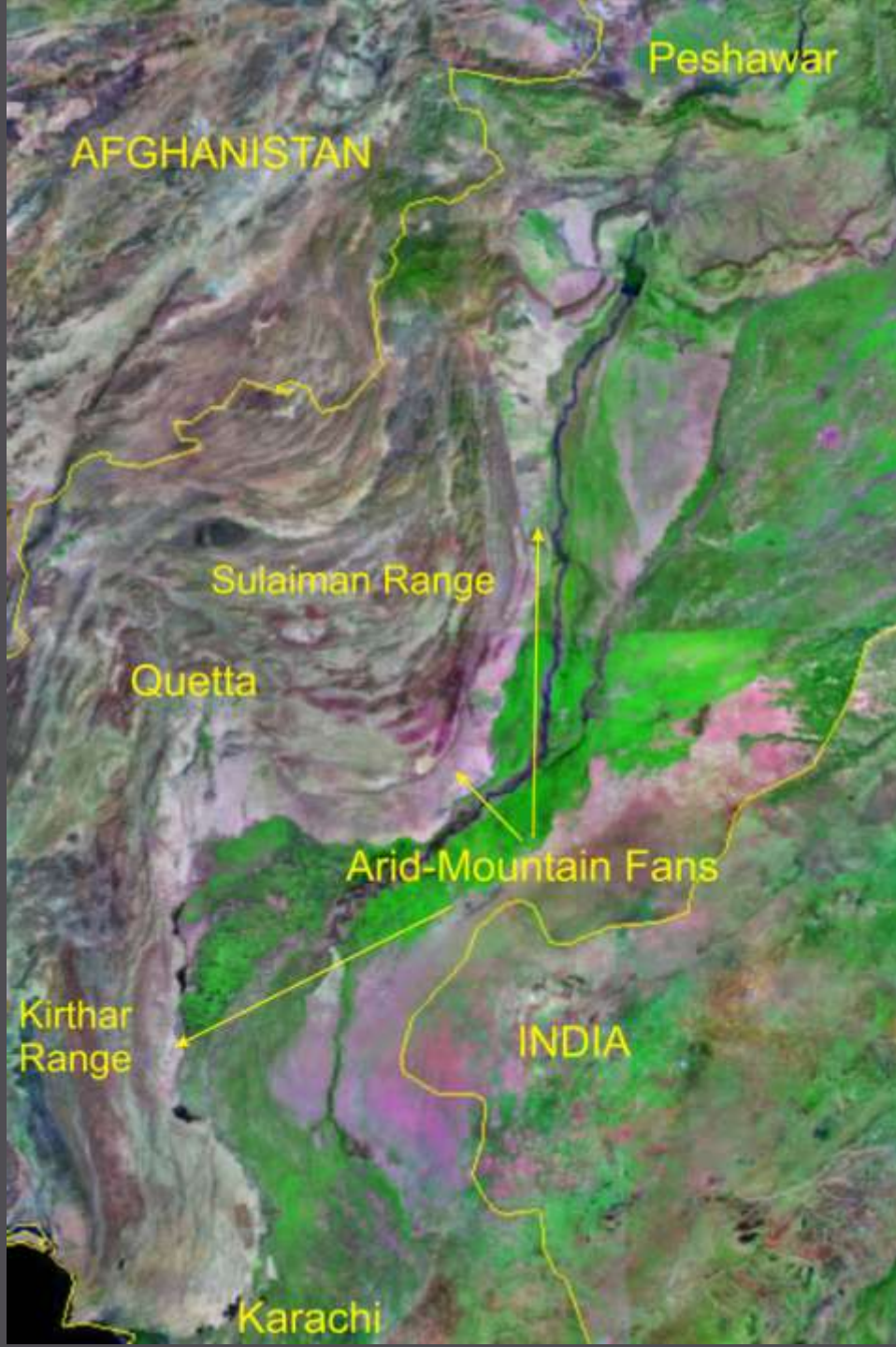


ARID REGIONS, NW FRONTIER REGION WATERSHED MANAGEMENT AND LAND REHABILITATION



M. Asif Khan,
National Centre of Excellence in Geology
University of Peshawar

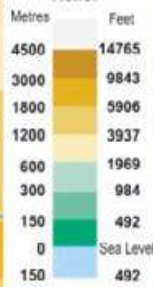


PAKISTAN

Physical

km 100 50 0 100 200 300 km

Relief



**Peshawar Basin Hill
Torrents/
Piedmont
Plains**

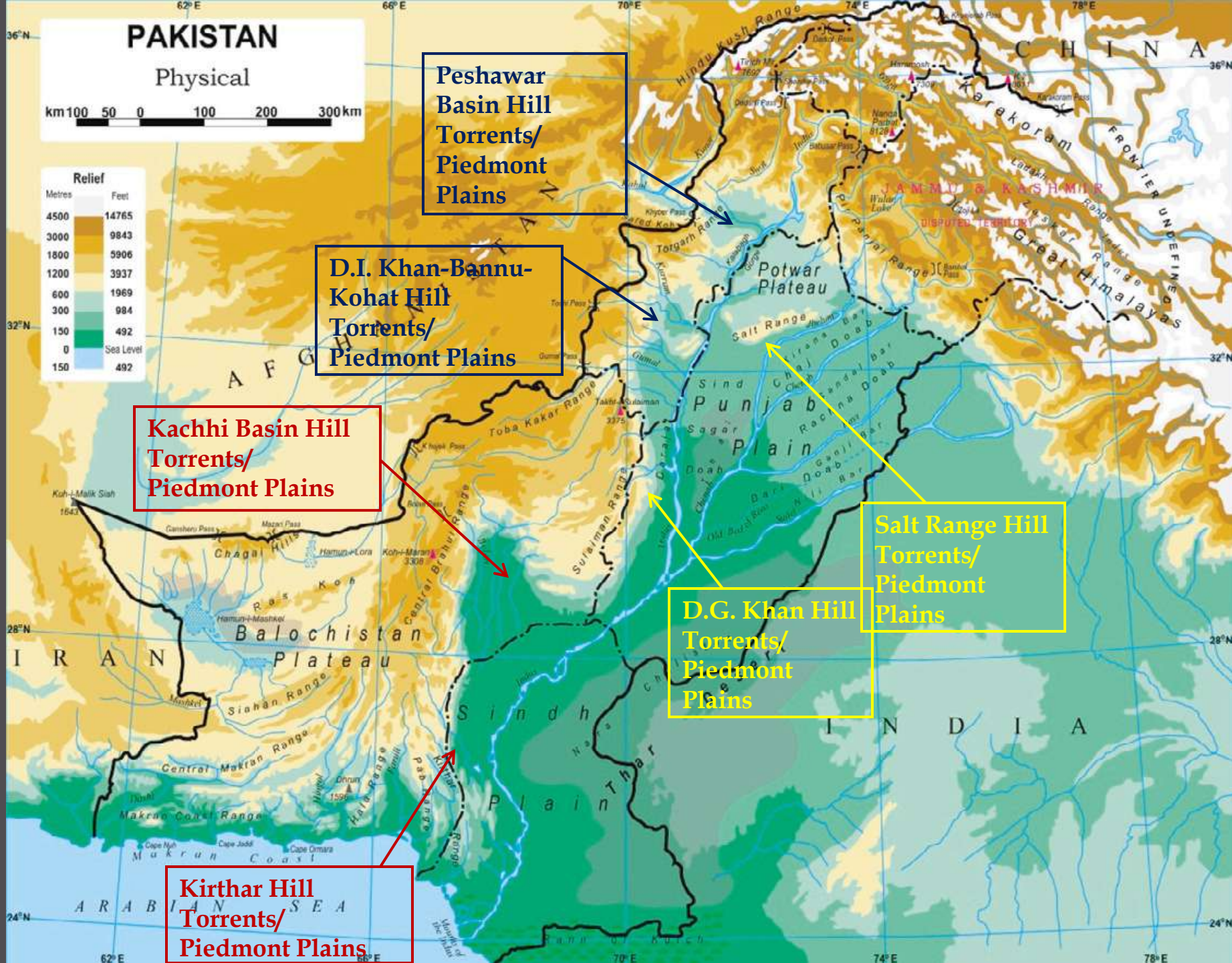
**D.I. Khan-Bannu-
Kohat Hill
Torrents/
Piedmont Plains**

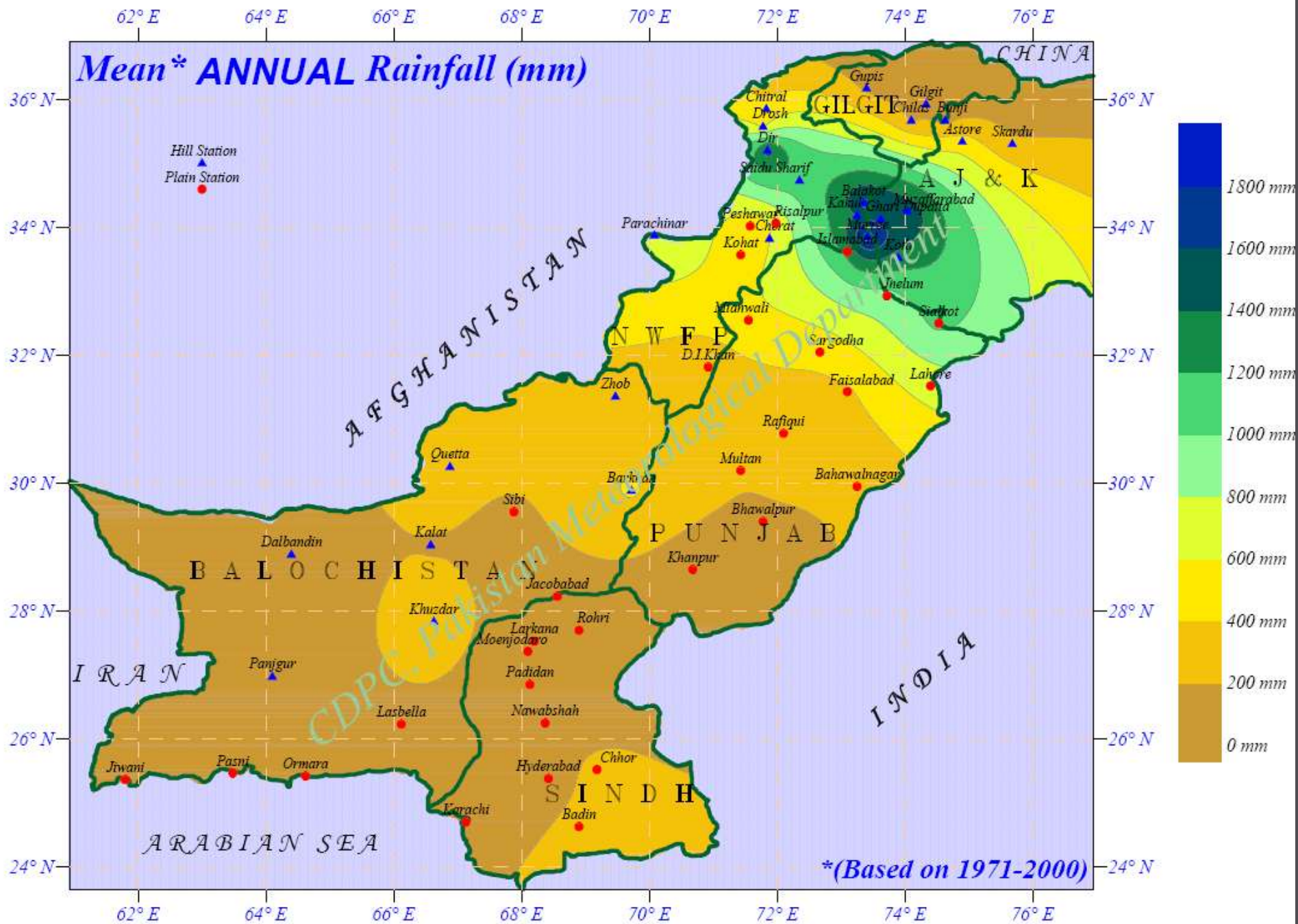
**Kachhi Basin Hill
Torrents/
Piedmont Plains**

**Salt Range Hill
Torrents/
Piedmont
Plains**

**D.G. Khan Hill
Torrents/
Piedmont
Plains**

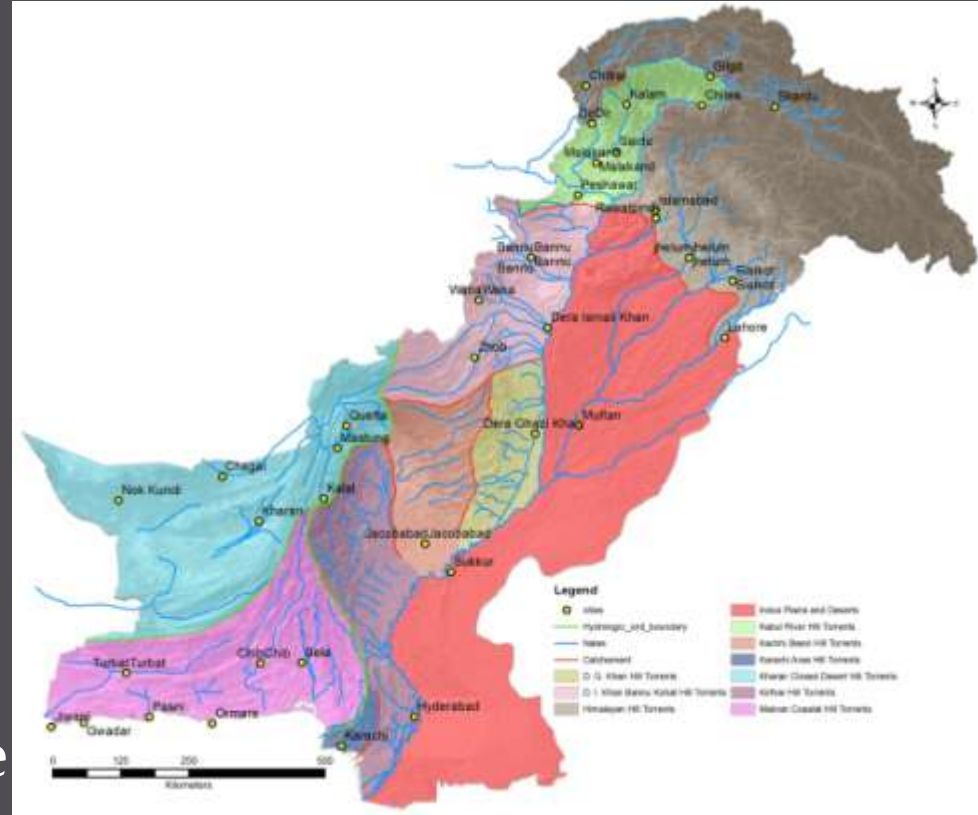
**Kirthar Hill
Torrents/
Piedmont Plains**



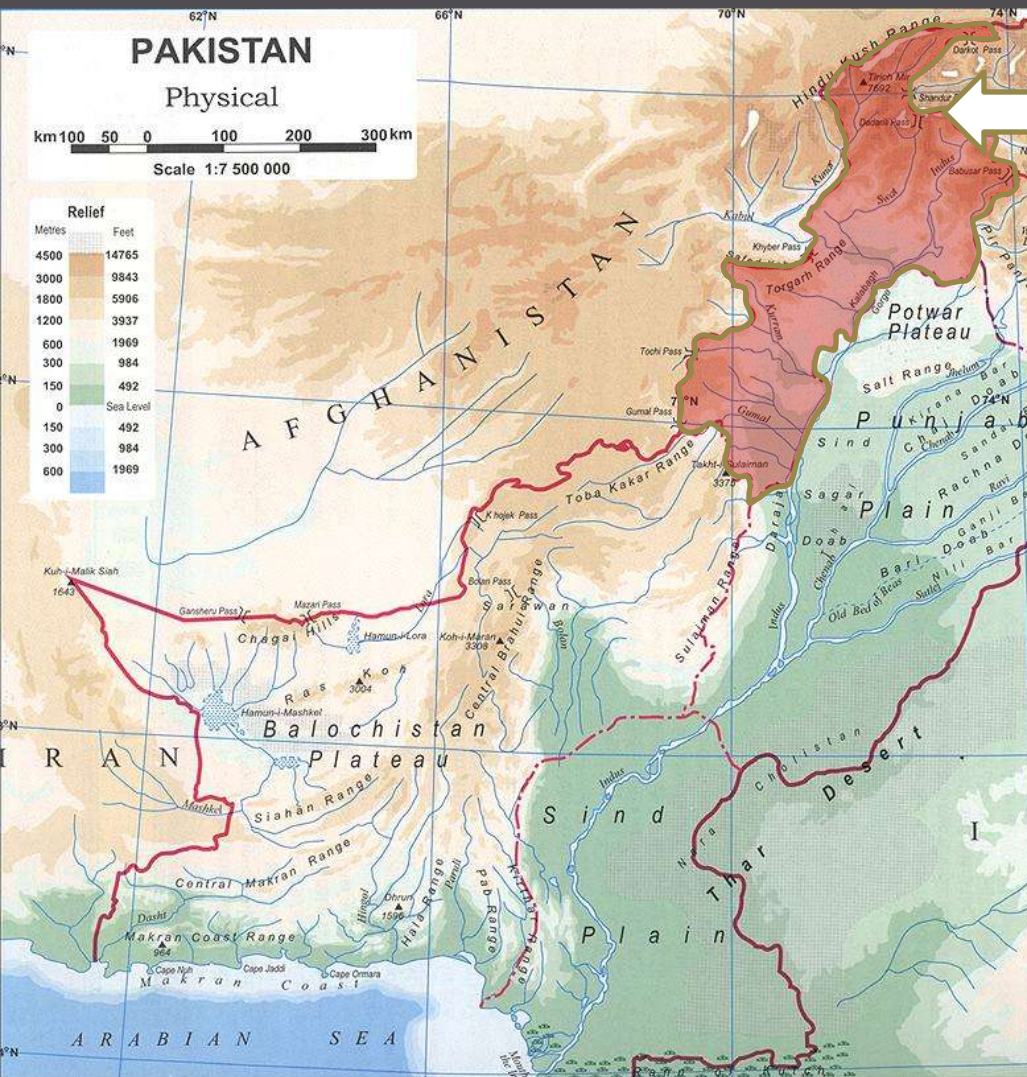


Background

- Mountain Front Alluvial Plains constitute $\sim 1/6^{\text{th}}$ of Pakistan area (i.e., 200,000 Km²).
- All the four provinces partially constituted by these alluvial plains.
- Being topographically higher than the Indus River, only partially irrigated by canals from the trunk river.
- Irrigation dependent on hill torrents from Sulaiman-Kirthar Ranges, with some input from ground water



IRRIGATION POTENTIAL

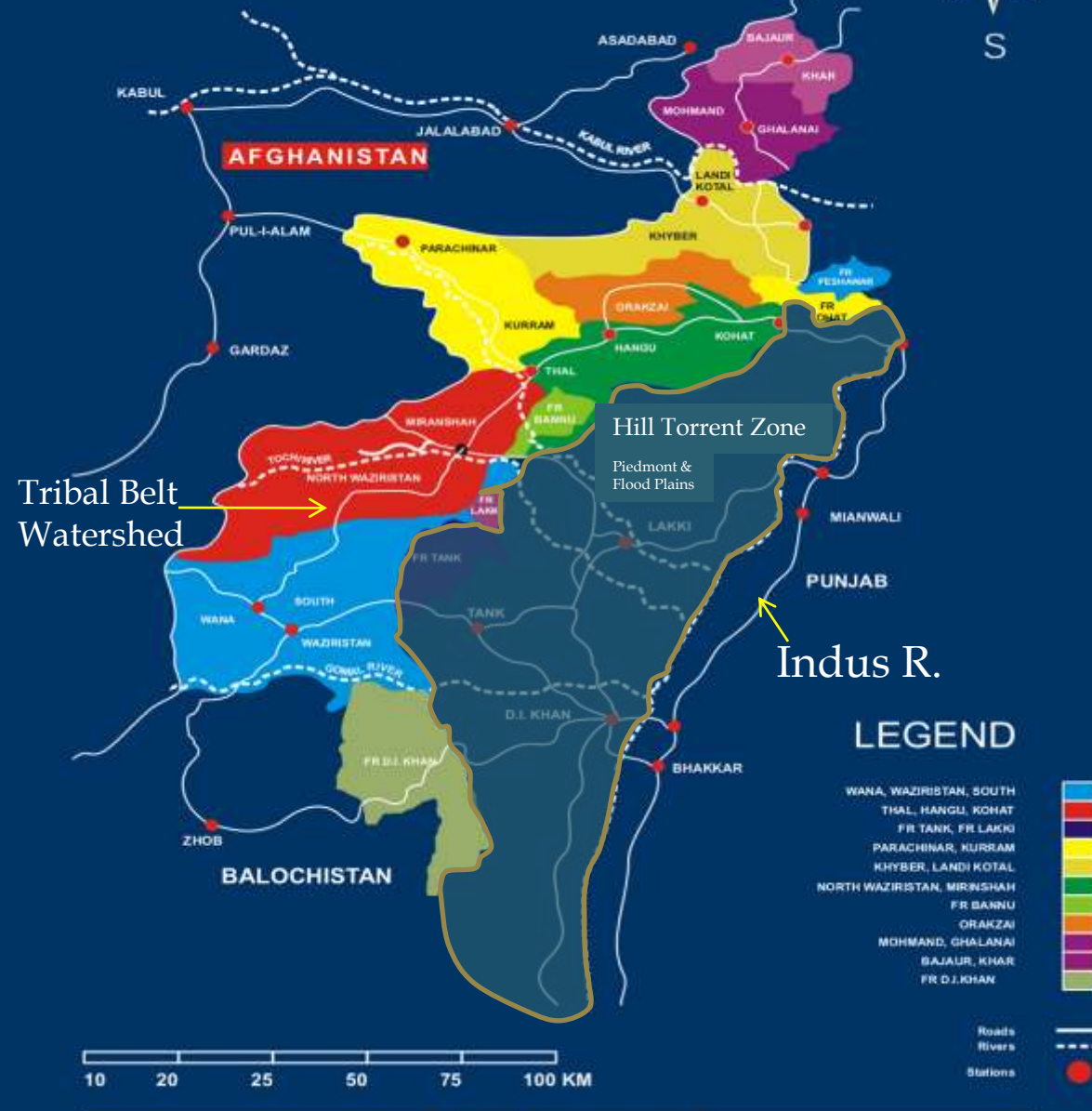


Khyber-Paktunkhwa (NWFP)	(Million Acres)
Total Area (NWFP+FATA)	25.4
Cultivable Area	6.72
Irrigated Area	
Govt. Canals	1.2467
Civil Canals	0.82
Lift Irrigation Schemes	0.1095
Tube Wells/Dug Wells	<u>0.1008</u>
Total	2.277
Potential Area for Irrigation	4.443
Lakki Marwat	0.588
D.I. Khan	1.472
Tank	1.472
Total	2.496
Rest of Province	1.947

After: Naseem Golra, KP Irrigation Department



WATERSHED & HILL TORRENT ZONE, KP (NWFP) & FATA



- Southern KP (NWFP) lies between Indus (East) and Sulaiman Range Mountain Front (West)
- Comprises Arid Piedmont Plains (West) and Flood Plains (East)
- Tribal Belt (FATA) marks the watershed for Hill Torrent Zone of Southern NWFP.
- Watershed Environment of FATA is key to Hill Torrent Flood Mitigation and Rud Kohi Irrigation in Piedmont and Flood Plain of the Southern KP.

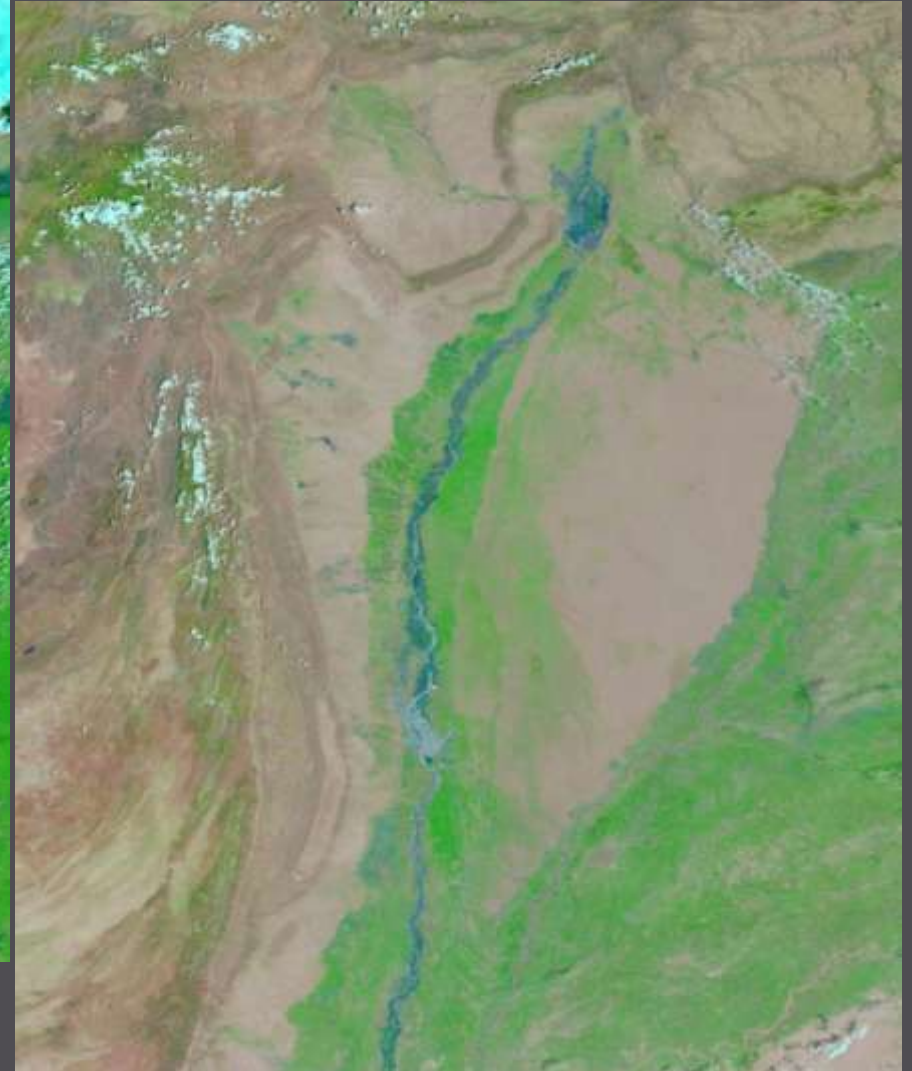
Hill Torrent Floods D.I.Khan Region, 2010

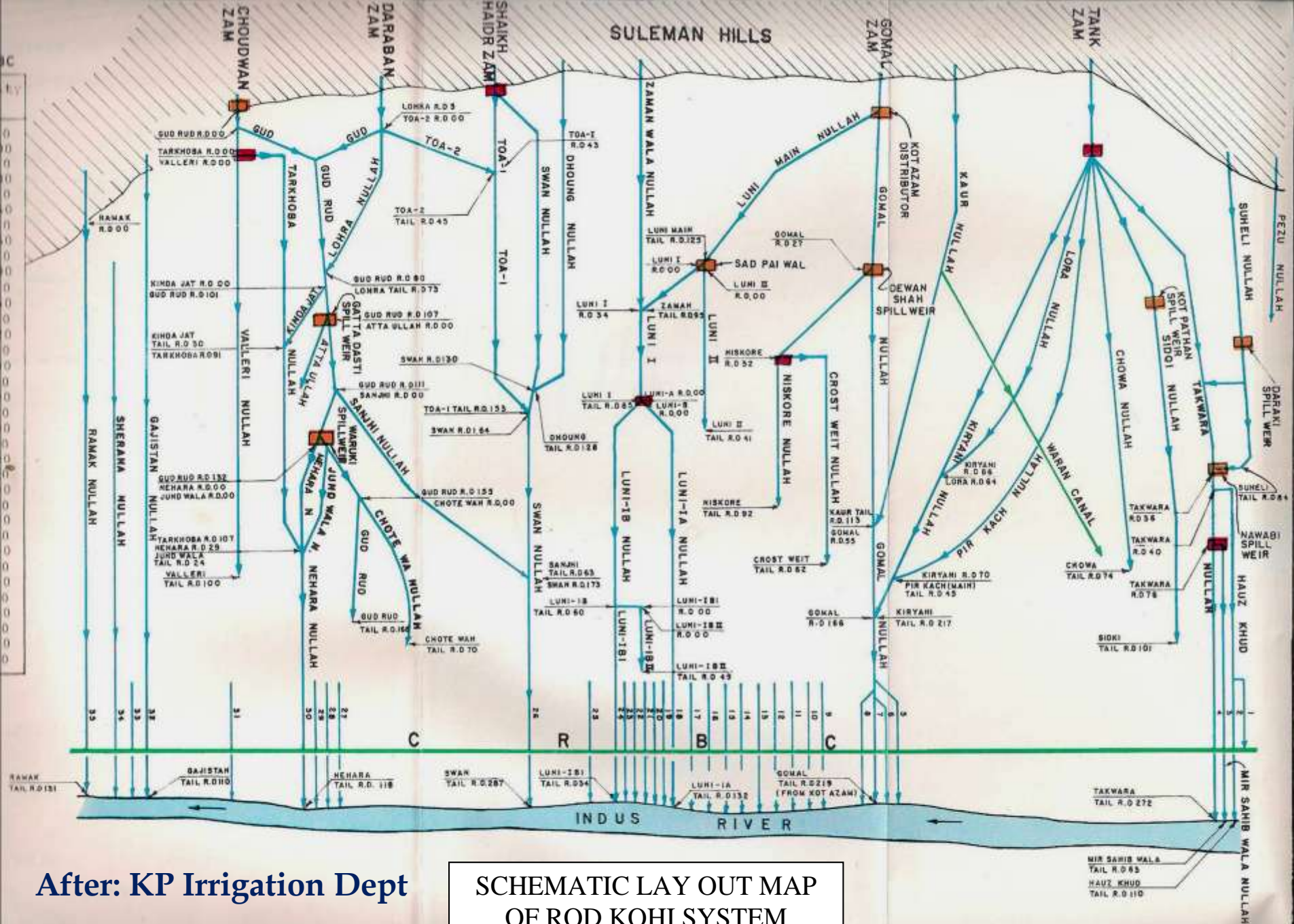


acquired July 10, 2010



acquired August 11, 2010





After: KP Irrigation Dept

SCHEMATIC LAY OUT MAP OF ROD KOHI SYSTEM

Status of Arid-Alluvial Plains

Potentials

- ▣ Vast plain area (e.g., DIK-Tank Area over 90,000 Km²)
- ▣ Rich alluvial soils transported by hill torrents
- ▣ Efficient recharge of the groundwater
- ▣ Irrigation potential through hill torrents

Impediments

- ▣ Arid climate, < 200 mm annual rainfall.
- ▣ Monsoon precipitation highly variable (droughts and floods)
- ▣ Sustainability of Flood irrigation (Rod Kohi) difficult.
- ▣ Soil erosion extensive.
- ▣ Low agriculture/horticulture yield
- ▣ Poor socioeconomic conditions.



Objectives

- ▣ Reduction of flood damages on piedmont plains (inundation, soil erosion) and on infrastructures (villages, canals, roads, railways, bridges) and thereby reducing the maintenance costs.
- ▣ Increased and sustained biomass production for sustainable livelihood through watershed management practices including development of irrigation methodologies (flood and groundwater based irrigation), rangeland and livestock development, and forestry.
- ▣ Watershed protection and ecological rehabilitation through soil and water conservation, revegetation.

Possible Remedies

Piedmont Plains (Southern KP-NWFP)

- ❑ Flood management in piedmont plains by structural measures such as distribution and diversion structures
- ❑ Permanent diversion structures to withstand heavy floods, to ensure reliable resources for irrigation, agriculture development and sustainable livelihood.

Watershed/Catchment area (Tribal Belt-FATA)

- ❑ Watershed needs structural and ecological rehabilitation to ensure increased and sustained biomass production for the inhabitants.
- ❑ Flood management in the catchment area through structural (sediment traps, rain harvesting ponds, slope stabilization) and non-structural measures (grazing management, grass seeding, afforestation, bioengineering).



Planning Concepts

- ▣ Integrated Watershed Management
 - System (holistic) Approach. Rather than addressing the issue in parts, need to think in terms of “System”.
 - Process Oriented. Each component needs to be dealt with in terms of process (e.g., erosion control, sediment trapping, rangeland development, water harvesting, storage-diversion structures)
 - Community oriented. Beneficiaries to be actively involved in the detailed planning and implementation of the proposed measures.
 - Short-term, medium-term and long-term measures to constitute the plan.

Principal Components

- ▣ Water Conservation:
 - Storage of surface water
 - Optimal diversion to storage structures and fields
 - On-Farm best management practices.
 - Recharging of groundwater.
 - Seepage control
 - Evaporation reduction through aspect considerations, choice of plant species, on-farm water management.
- ▣ Regenerating the Natural Vegetation
 - Community managed temporary closures from grazing activity.
- ▣ Rotational grazing.
 - Renewed grass, shrub, tree seeding for fodder development. native vegetation regeneration
- ▣ Soil Retention
 - Earthen and stone bunding
 - Vegetation

Principal Components

Piedmont Plains

- Flood Mitigation Plans
- Rod Kohi Development Plans
- Groundwater Management Plan
- Soil Conservation/Development Plan
- Agriculture/Horticulture Development Plan

Watershed/Catchment

- Rangeland Management Plan

Flood Mitigation/Irrigation Program

- ▣ Existing diversion structures
(Modification/Repairing/Rehabilitation)
- ▣ New flood diversion structures
- ▣ Water storage ponds/Rain Harvesting
- ▣ Bund stabilization through:
 - Structural measures (e.g., stone pitching)
 - Bioengineering (e.g., trees, shrubs, grass)

Groundwater Management Program

- ▣ Groundwater monitoring for water levels, water quality, and abstraction from existing wells
- ▣ Monitoring of recharge conditions
- ▣ Rain harvesting structures for increased recharge
- ▣ Water Conservation (improved irrigation techniques, on farm water management)

Rangeland Management Program

Objectives:

- ▣ Reduced rainwater run off.
- ▣ Increase soil moisture through water retention.
- ▣ Greater groundwater recharge
- ▣ Reduce erosion and adverse siltation in water courses

Possible Measures

- ▣ Regenerating vegetation (grass, shrubs, trees).
- ▣ Erosion control through structural measures for slope stability
- ▣ Erosion Control with bioengineering
- ▣ Temporarily closing/fencing of grazing ground
- ▣ Rotational grazing
- ▣ Multi-purpose grass/tree species (erosion control, water/moisture retention, fodder and fuelwood)

Expected Benefits:

- ▣ Increased livestock products/higher income.
- ▣ Increased charcol production
- ▣ Greater retention of run off water reduced flood damage
- ▣ Groundwater recharge through higher infiltration rates
- ▣ Reduced erosion and adverse siltation in downstream



Pre-Requisite Studies

- ▣ Inception Stage:
 - Homework started since March 2010.
 - Organizing an international workshop as part of the Inception Stage to formulate planning and strategies and identification of expert human resources
 - Identification of representative watersheds for pilot projects.
 - Preparation of Project Proposal (December 2010-January, 2011)

Stage II: Planning/Designing

Terrain Mapping

- Physiography (Topography, Geology, Geomorphology, Landforms, Soil (NCEG; Soil Survey of Pakistan)
- Landuse/Vegetation (NCEG, PFI)
- Drainage Pattern (WRII_NARC, UET_Pesh, KPAU_Pesh)

Surveys & Inventories

- Agro-Economy Survey (KPAU)
- Inventory of Flood Irrigation System (WRII_NARC, KP Irrigation Dept)
- Inventory of Existing Soil Conservation Measures (NCEG, WRII_NARC, KP Irrigation Dept)
- Inventory of Existing Water Conservation Measures (NCEG, WRII_NARC, KP Irrigation Dept)
- Assessment/Mapping of Soil Erosion (KPAU_Pesh, NCEG, SSP)
- Socioeconomic Survey (UoP)
- Rangeland Survey for grass, shrub varieties (PFI_Peshawar)
- Water Resources Survey (Rainfall data, Stream Flow-Gauge Data) NCEG, WRII_NARC, KP Irrigation Dept
- Sediment Load Survey (NCEG, WRII_NARC, KP Irrigation Dept)
- Ground Water Inventory (Existing well data, Water Table depth, Aquifers, Quality, Recharge) (NCEG, WAPDA)

Plans/Designs to be Developed

Rangeland

Non-Structural

- Afforestation (Plant, Grass Seed Nursery, Supply and Pasture Development)
- Grazing Management (control/development measures)
- Livestock Development

Structural

- Rangeland Erosion Control
- Catchment Sediment Traps
- Rainwater Harvesting Structures
- Water Storage Structures (Ponds, small dams, Large Dams)
- Flood Control Structures
- Rain Harvesting Structures

Piedmont

Non-Structural

- Soil retention/stabilization/redevelopment plans
- Soil fertility plans
- Agriculture/horticulture development (crops, fruits)
- Bund stabilization bioengineering designs
- Flood water management (control/distribution, on-farm management)

Structural

- Diversion Channel Structures (Earthen, Stone-Pitched, Concrete Bunds)
- Rainwater Harvesting Structures
- Water Storage Structures (Ponds, small dams, Large Dams)
- Flood Control Structures
- Soil Erosion Control and New Soil Development Structures

Stage III: Implementation

- Pilot/Demonstration Project Approach
- Funding to be arranged Government/International Donors
- Consortium Approach
 - Expertise from academia, governmental institutions, private sector to be synchronized as a consortium with proper incentives.
- Project Directorate
 - A dedicated Project Directorate to implement the Demonstration Project.
- Relevant Government Departments to be involved with appropriate incentives.
- Maximum emphasis on community participation with appropriate incentives.

International Planning Workshop Watershed Management & Land Rehabilitation, NW Frontier Region, Pakistan

- December 6-8, 2010
- Auditorium, Pakistan Academy of Sciences, Islamabad
- Sponsored by:
 - U.S. Department of Agriculture
 - Higher Education Commission, Pakistan
 - 12 Foreign Participants from USA, Netherlands, Nepal, Egypt and Canada.
- Overall 80 participants.
- To be inaugurated by Federal Minister of Food & Agriculture.
- Final Plenary Session Wednesday, December 8, 2010, which will be chaired by the Honourable Governor Khyber-Pakhtunkhwa Province.



Three-day
International Planning Workshop

WATERSHED MANAGEMENT & LAND REHABILITATION, NW FRONTIER REGION, PAKISTAN

Auditorium, Pakistan Academy of Sciences
Islamabad, December 6-8, 2010

Support:
Facilitate with relevant background information, especially those with special presentation on the NW Frontier Region. In-personal contact is welcome. Information on this event is available at the website.

ORGANIZATION:
Patron: Prof. Dr. Anwar Hameed Khan, Vice-Chancellor, University of Peshawar, Peshawar
Co-patron (International): Dr. David DeGloria, U.S. Department of Agriculture, Washington, D.C., USA
Patron (Pakistan): Prof. Dr. Anwar Hameed Khan, Vice-Chancellor, University of Peshawar, Peshawar
Co-patron (Pakistan): Dr. M. Anwar Khan, Federal Secretary, National Centre of Excellence in Zoology, University of Peshawar, Peshawar
Patron (USA): Dr. David DeGloria, U.S. Department of Agriculture, Washington, D.C., USA
Patron (Netherlands): Dr. M. Anwar Khan, Federal Secretary, National Centre of Excellence in Zoology, University of Peshawar, Peshawar
Patron (Nepal): Dr. M. Anwar Khan, Federal Secretary, National Centre of Excellence in Zoology, University of Peshawar, Peshawar
Patron (Egypt): Dr. M. Anwar Khan, Federal Secretary, National Centre of Excellence in Zoology, University of Peshawar, Peshawar
Patron (Canada): Dr. M. Anwar Khan, Federal Secretary, National Centre of Excellence in Zoology, University of Peshawar, Peshawar

VENUE:
Pakistan Academy of Sciences, National Centre of Excellence in Zoology, Islamabad, Pakistan
Dr. M. ANWAR KHAN, Vice-Chancellor, University of Peshawar, Peshawar

DATES:
Wednesday 12, 2010-Registration & Inauguration
Thursday 6, 2010-Workshop
Friday 7, 2010-Workshop & Inauguration

Organized by:
National Centre of Excellence in Zoology, University of Peshawar

Sponsored by:
Higher Education Commission, Pakistan (HEC) & U.S. Department of Agriculture (USA)



Three-Day International Planning Workshop
Watershed Management & Land Rehabilitation, NW Frontier Region, Pakistan
Islamabad, December 6-8, 2010

Participants:
• U.S. Department of Agriculture (Dr. David DeGloria)
• Department of the National Centre of Excellence in Zoology, University of Peshawar (Dr. Anwar Hameed Khan)
• Higher Education Commission, Pakistan (Dr. M. Anwar Khan)
• National Centre of Excellence in Zoology, University of Peshawar (Dr. M. Anwar Khan)

Workshop Objectives:
• To discuss the current status of the NW Frontier Region and the need for watershed management and land rehabilitation.
• To identify the key issues and challenges in the NW Frontier Region and to develop strategies to address them.
• To discuss the role of the government, the private sector, and the community in watershed management and land rehabilitation.
• To discuss the role of the NW Frontier Region in the national economy and to develop strategies to improve its productivity and sustainability.

Workshop Themes:
• Watershed Management and Land Rehabilitation
• Watershed Assessment and Planning
• Watershed Rehabilitation and Land Use
• Watershed Conservation and Management
• Watershed Policy and Legislation
• Watershed Education and Training
• Watershed Research and Development
• Watershed Extension and Outreach
• Watershed Monitoring and Evaluation
• Watershed Financing and Investment
• Watershed Governance and Institutional Arrangements
• Watershed Capacity Building and Human Resource Development
• Watershed Policy and Legislation
• Watershed Education and Training
• Watershed Research and Development
• Watershed Extension and Outreach
• Watershed Monitoring and Evaluation
• Watershed Financing and Investment
• Watershed Governance and Institutional Arrangements
• Watershed Capacity Building and Human Resource Development

Workshop Format:
The workshop format is a mix of presentations, group discussions, and field visits. Presentations will be given by the keynote speakers, the workshop leaders, and the participants. Group discussions will be held on the key issues and challenges in the NW Frontier Region. Field visits will be organized to the NW Frontier Region to observe the current status of the region and to discuss the need for watershed management and land rehabilitation.

Workshop Themes:
• Watershed Management and Land Rehabilitation
• Watershed Assessment and Planning
• Watershed Rehabilitation and Land Use
• Watershed Conservation and Management
• Watershed Policy and Legislation
• Watershed Education and Training
• Watershed Research and Development
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Watershed Management & Land Rehabilitation, NW Frontier Region, Pakistan

December 6-8, 2010

Auditorium, Pakistan Academy of Sciences, Islamabad

WORKSHOP FORMAT

- 11 Sessions, 9 sessions are Technical.
- 37 Technical Papers being presented.
- Three Working Groups in 4 Technical Sessions : Way-Forward Plan

WORKSHOP THEMES

- Mountain-Front Alluvial Fans, Pakistan: Geological and geomorphological aspects.
- Hill torrents and flash floods: history, frequency, intensity, distribution, hazards and possible remedies.
- Flood irrigation practices (Rod Kohi); historical background, layouts, structures, achievements, shortcomings and way forward.
- Irrigation engineering; channelization, diversion channels, sediment traps, reservoirs (dams), irrigation canals from Indus River.
- Soil erosion, degradation, reclamation, stabilization, fertility and productivity.
- Groundwater hydrology.
- Agriculture development and afforestation