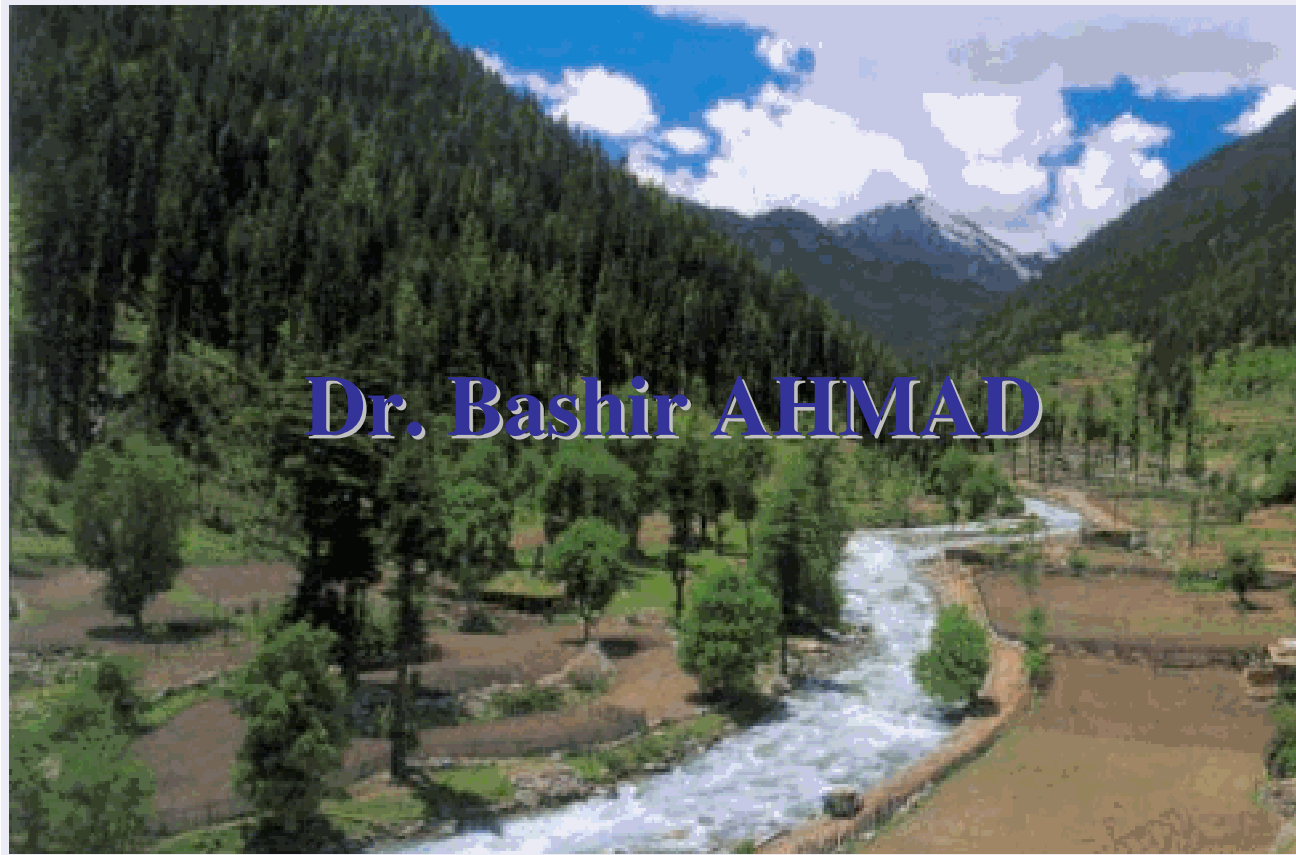
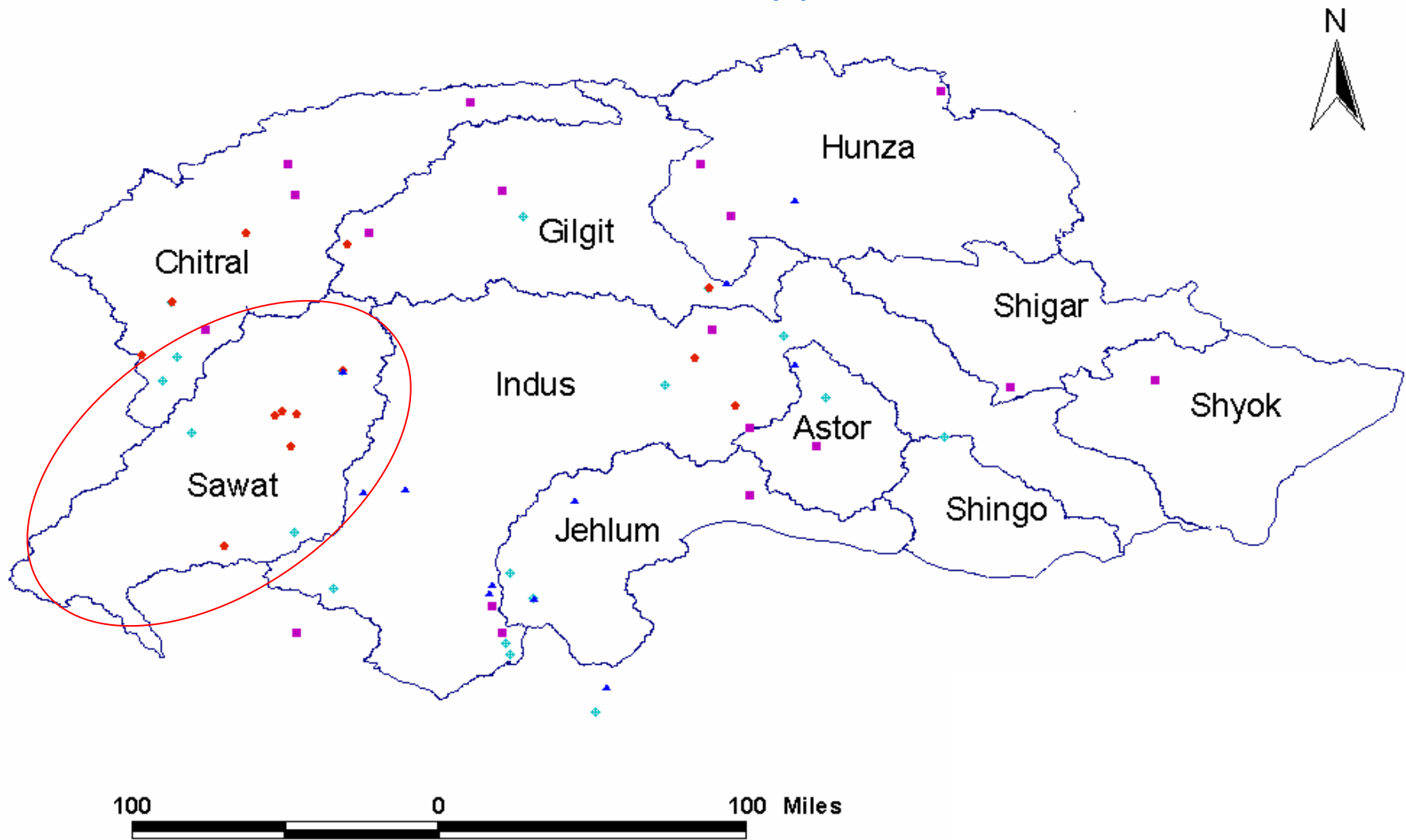


Demonstration Basin Activities in Pakistan



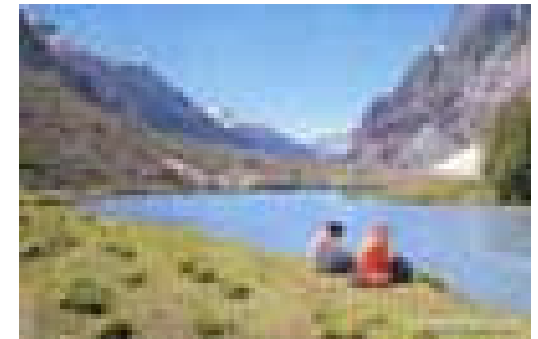
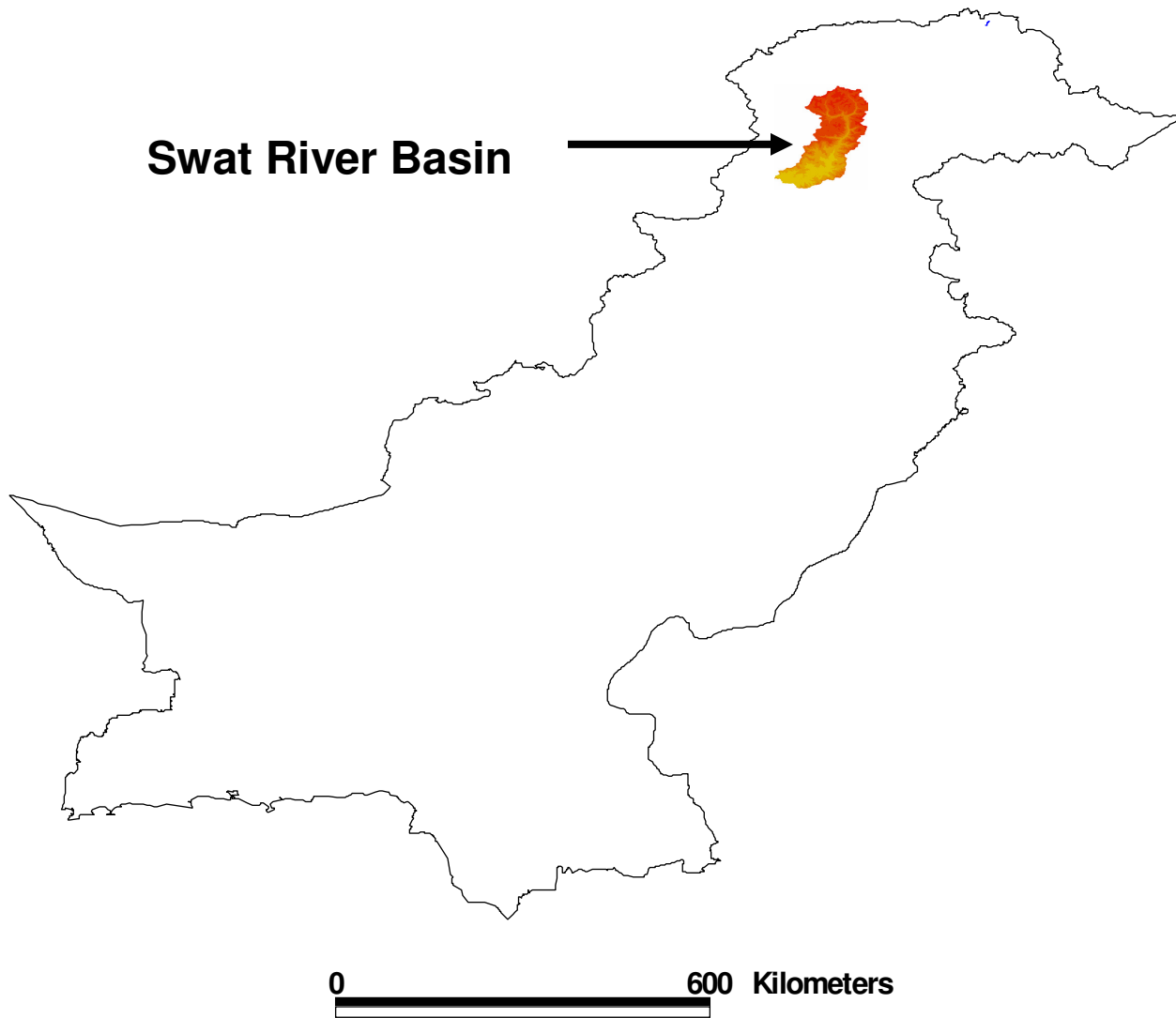
Asian Water Cycle Initiative

Sub-basins in Upper Indus



Demonstration Basin in Pakistan

Swat River Basins



Background

- Increasing water scarcity and pollution, environmental degradation including desertification are increasing seriously in the Upper Indus Basin
- Present and future water scarcity in the country has overwhelming economical and political implications
- Possible impacts of the global climate change on fresh water resources of glaciers and snow cover
- Integrated temporal and spatial water resources modeling is required for decision making and long-term planning

Objectives

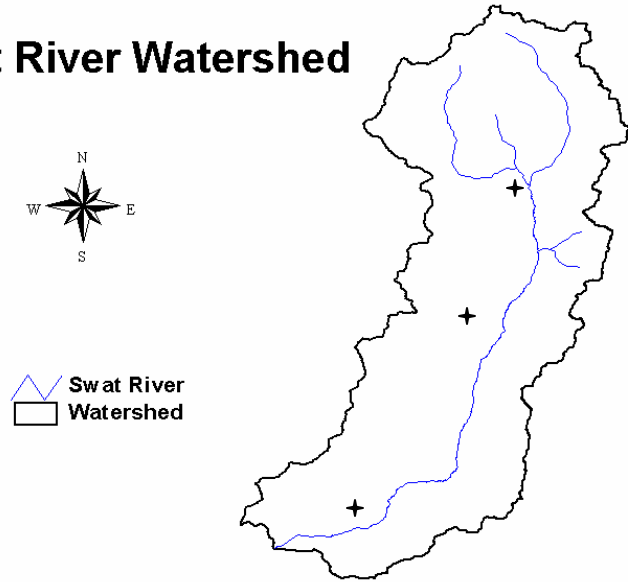
- 1. Water resources assessment using in-situ and Remote Sensing data**
- 2. Integrated water resources management**
- 3. Water resources forecast using RCM output**
- 4. Impact of climate change on snow cover and glacier resources**
- 5. Impact of landuse system changes on agriculture in response to climate change**
- 6. Strengthen the observation network especially at high altitudes**

Available Data Set

- **Meteorological stations = 3**
- **Precipitation, temperature, evaporation, wind, snow depth,**
- **Stream flow**
- **Radar**
- **Radiation and profiler data would be available soon**
- **land use, soil, vegetation**

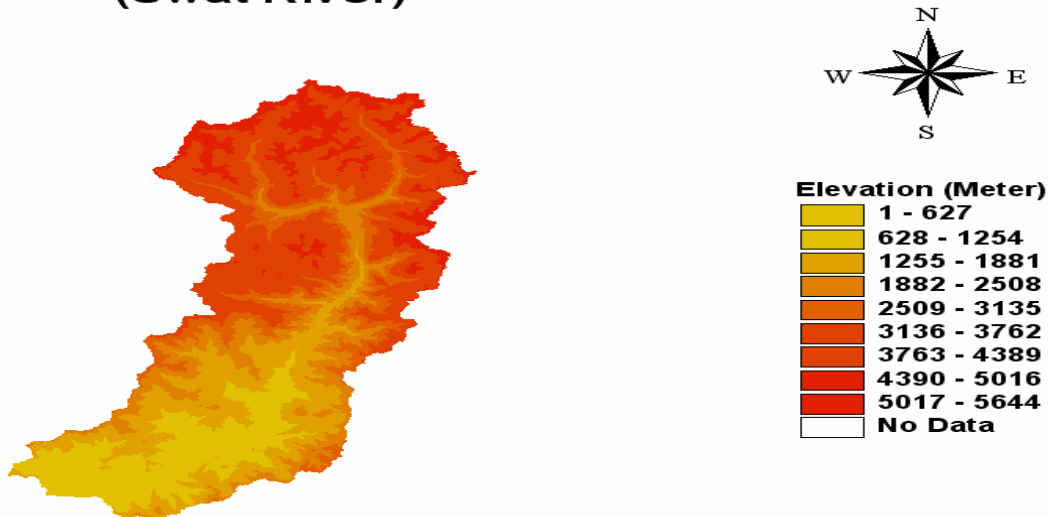
Swat River Basin

Swat River Watershed



- Area (sq. km) **5894**
- Maximum elevation (m) **5644**
- Upper part mostly covered by snow in winter
- Few Glaciers
- Meteorological stations = 3

Digital Elevation Model
(Swat River)



ISSUES

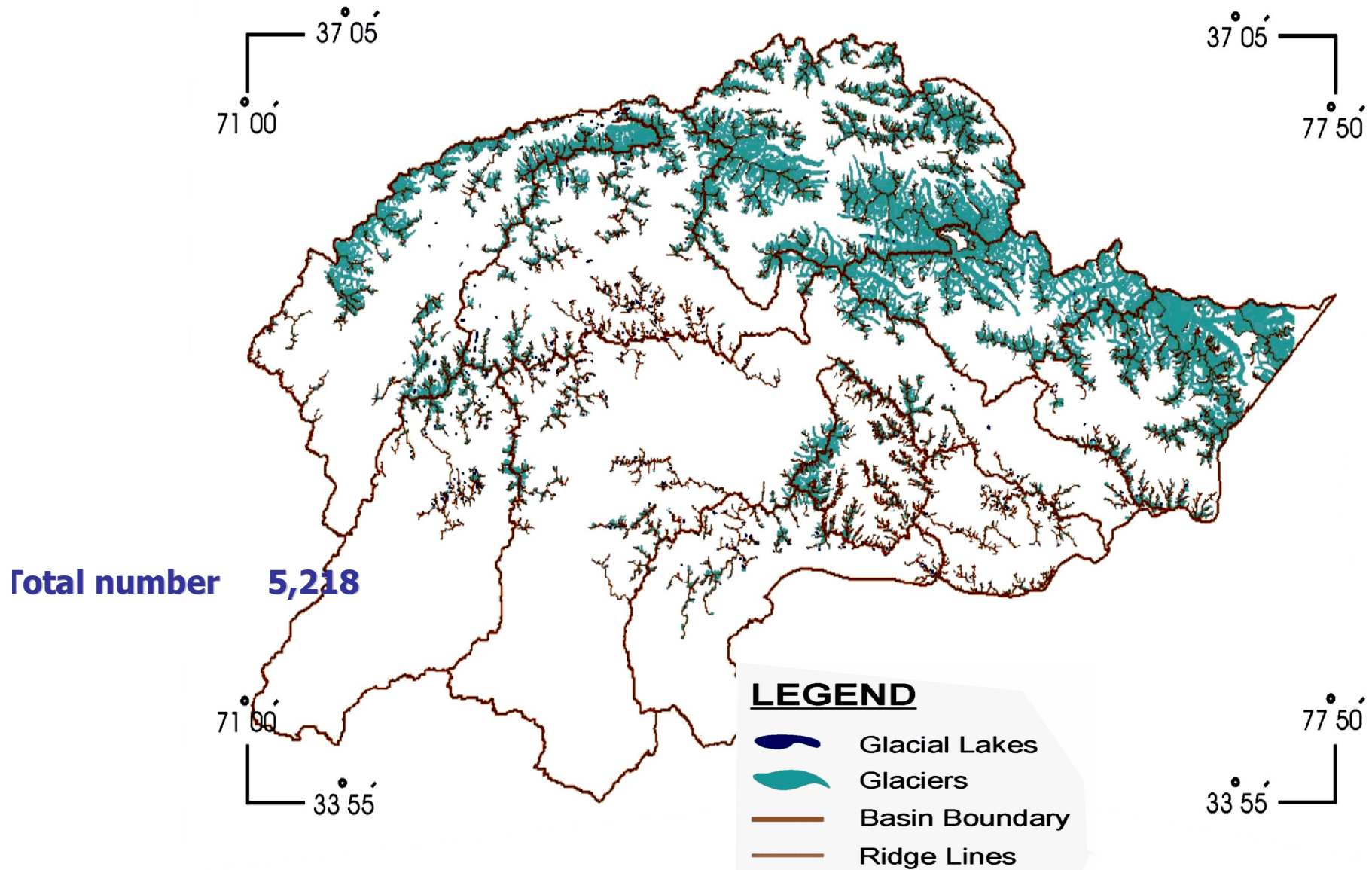
- Water resources assessment
- Snowmelt Floods
- Water Scarcity
- Land sliding
- Sediment
- Water quality
- Monitoring at high altitude

Swat River Basin

Swat River with many other major tributaries like Panjkora River joins Kabul River which is the western tributary of Indus River. The northern and north eastern part of basin has the glaciated area. The Basin is located in the northern areas with the latitude and longitude range of $34^{\circ} 06'$ to $35^{\circ} 53'$ and 71° to $72^{\circ} 48'$ respectively. This basin is bounded in southwest by Afghanistan, northwest by Chitral River basin, north by Gilgit River basins and east and southeast by Indus River basin. In the south of the basin, Peshawar Valley is located.

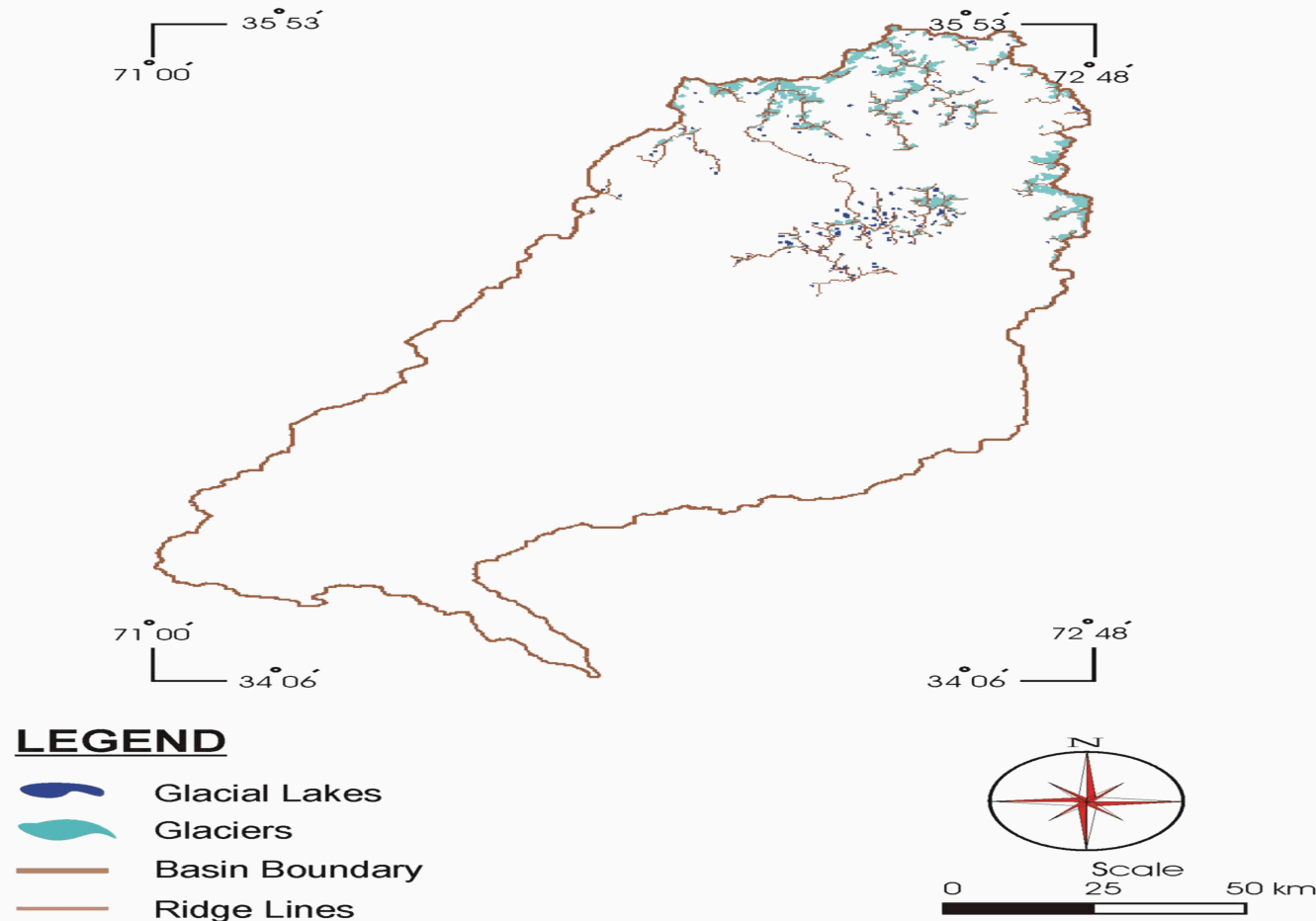
The northern part of the basin has high mountainous terrain with an elevation range of about 750 masl to more than 5,800 masl. The basin occupies glacier area is about 223.55 sq. km

Glaciers of Upper Indus Basins



Source: WRII, NARC (2005) "Inventory of glaciers"

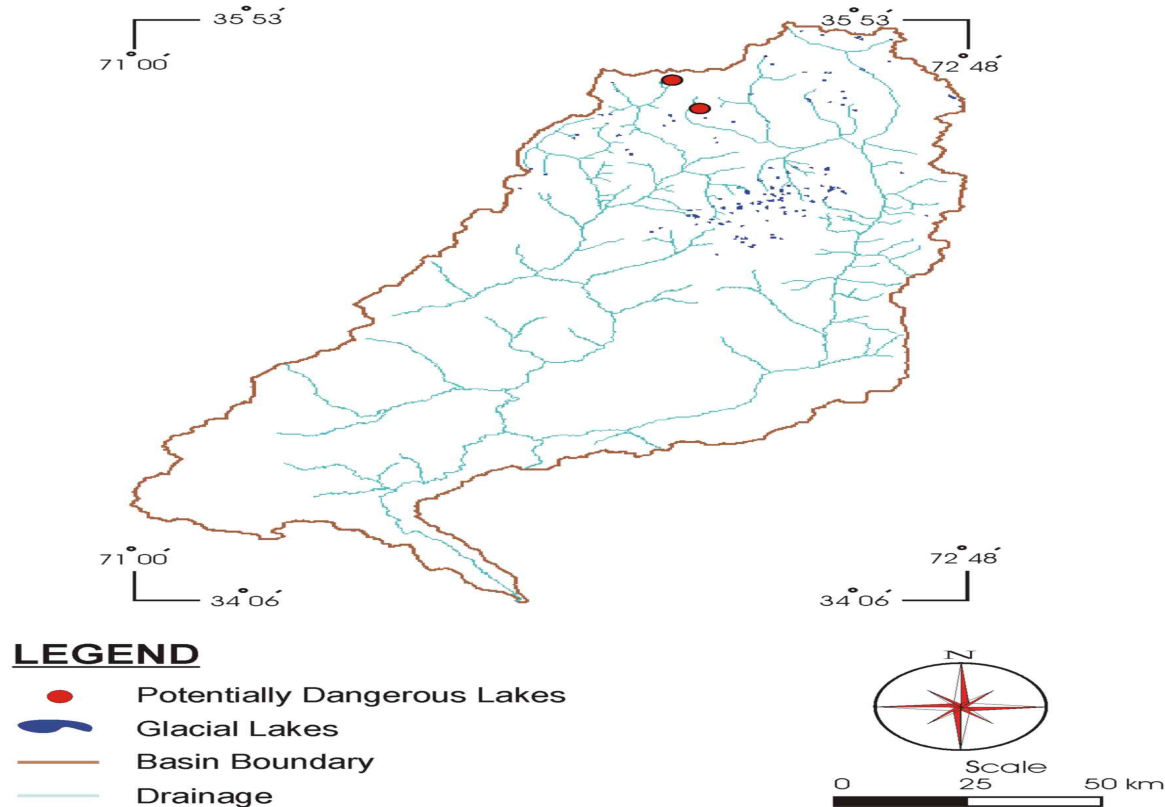
Glaciers of Swat River Basins



The upper reaches of the Kohistan-Swat ranges are mostly covered with snow and glaciers. Glacier area is about 223.55 sq. km. Less information are available about glacier mass balance and snowcover extent.

Source: WRRI, NARC (2005) "Inventory of glaciers"

Glacial and Dangerous Glacial Lakes of Swat River Basins



Glacial lakes = 255

Glacial lakes area of more than 15.86 sq. km .

Glacial lakes are distributed in the north-central parts of the basin

Two potentially dangerous lakes.

Source: WRI, NARC (2005) " Inventory of glaciers"

Schedule

2007 (*pre-phase*):

- Digital Hydrological Model Development

2008 – 2009:

- Data Acquiring
- Field Data collection
- Input Data Preparation
- Model Calibration
- Model validation
- Climate change Analysis

2010 – 2011:

- Water resources forecast using RCM output
- Shifting from research to more-operational phase

Capacity Building Requirements/Programs

- **Flood & Drought Forecasting and Warning**
- **Flood and Drought Risk Map**
- **Climate Change Scenario**
- **RS data in Water Quality**
- **RS Data Availability**
- **GCM Output Utilization for Forecasting**

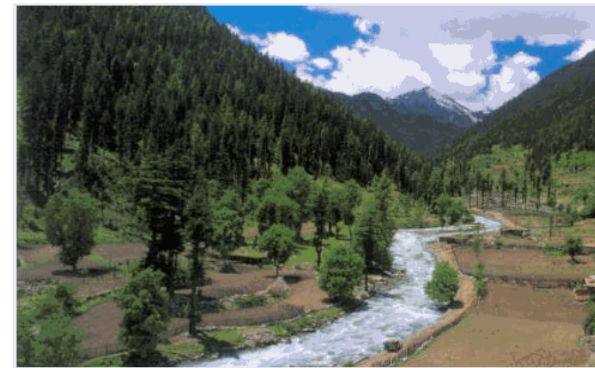
Collaborative Institutes

Pakistan Meteorological Department

Climate Change Impact Study Center



Swat River near Kalam Valley



Utrot Valley

Thank you