

HYDROLOGICAL STUDIES IN A HIMALAYAN CATCHMENT

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Hydrological studies are carried out in representative basins for the intensive investigation of specific problems. The National Institute of Hydrology (NIH) has been carrying out hydrological studies in selected representative basins in different parts of India. One of the representative basins is located in the Western Himalayas. It is the sub-basin of Baira *nallah* upto Tissa in Himachal Pradesh.

The Baira *nallah* (rivulet) is a small tributary of River Siul which is a tributary of the River Ravi, one of the five rivers of the Indus system. The sub-basin is located about 150kms to the north of the town of Chamba in Himachal Pradesh (Fig.1). The sub-basin is located in the Pir Panjal range of the middle Himalayas and the elevation ranges from 2,450 to 4,500m. The sub-basin has an area of 585km² upto Tissa. The average annual precipitation of the sub-basin is 1,150mm. The sub-basin is partly covered by snow in winter (December-March). The natural vegetation is of forest type and the species are a form of pine (locally known as *Deodar*) and fir. Agriculture and horticulture are the main forms of land use.

To date, the following studies and investigations were carried out in the sub-basin.

- (i) Collection of hydrometeorological data, including snow water equivalent and snow depth
- (ii) Geomorphology of the sub-basin
- (iii) Determination of infiltration rates of different soils in the sub-basin
- (iv) Land cover and land-use classification
- (v) Mapping of seasonal snow cover
- (vi) Simulation of snowmelt

Geomorphological parameters were determined using a toposheet on a scale of 1:50,000. Some of the important linear, areal, and relief parameters are given in Table 1.

Table 1. Geomorphological Parameters

Length of main channel	33.5km	Drainage area	585km ²
Bifurcation ratio	4.51	Drainage density	2.91km/km ²
Sub-basin eccentricity	0.83	Elongation ratio	1.81
Basin perimeter	113km	Basin relief	3.92km

Data of precipitation and stream flow were not observed in the past. The Institute (NIH) established a hydrometeorological observatory at Tissa (elevation 2,450m) in the year 1992. Besides parameters like rainfall, temperature, humidity, evaporation and windspeed, snow water equivalent and snow depth are also monitored daily. In May 1995, an Automated Weather Station was installed at Tissa for recording the parameters at short intervals.

Point infiltration tests were conducted at 30 selected locations in the catchment using a double-ring infiltrometer. The tests were conducted under five different land-cover conditions. The results are presented in Table 2.

Table 2. Infiltration Rates under different Land-Cover Conditions

Land Cover	Final Infiltration Rate cm/hr
Barren	1.2 to 2.4
Grass	0.6 to 2.4
Agriculture	1.2 to 3.6
Forest	12.0 to 14.0
Mixed Forest	8.4 to 12.5

Mapping of the snow-covered area was done for five seasons, in 1984, 1985, 1989, 1990, and 1992. The satellite data of Landsat MSS and the Indian Remote Sensing satellite IRS 1A LISS 1 were used. The snow-covered area delineated by the analysis is presented in Table 3. Studies on simulation of snowmelt have been initiated and are in the preliminary stages.

Table 3. Snow Covered Area

Month/Year	Snow Covered Area (SCA) km ²	SCA as Percentage of Sub-basin Area
Feb 1984	410.7	70.2
Feb 1985	395.8	67.6
Feb 1989	329.4	56.3
Mar 1990	304.4	52.0
Mar 1992	350.0	59.8

The main Hydrology and Regulation of Water Resources Programme includes the following:

Establishment of hydrological history data of the Koshi

