

CAPACITY OF CHANNEL RUNOFF IN THE AGRICULTURE CENTRAL LESSER HIMALAYAN WATERSHEDS

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ABSTRACT : The present experimental study, a contribution to agricultural hydrology, concentrates on the annual channel runoff cycle to the agricultural watersheds of the Central Lesser Himalayas. Two micro watersheds (0.30 and 0.45 km²) in the Daulaghat (Almora) area were employed as natural laboratories since February 1986 for this experimental study. The study reveals that on an average the agricultural land of the Central Lesser Himalaya has a capacity to generate water at the rate of 940 m³/km²/day. This water generating capacity approaches upto 4660 m³/km²/day in the month of July (i.e., the highest rainfall months) and drops to 164 m³/km²/day in the month of April (dry month). During the drought of 1987-88 channel runoff capacity of the agricultural land in Central Lesser Himalaya was reduced to approximately 63 percent.

INTRODUCTION :

The waterflow generating capacity of land to channel has been used here as capacity of channel runoff. The Himalaya with a fragile and very sensitive environment is unexplored in terms of this water generating capacity of land to channels. The present investigation is an attempt to quantify the water generating capacity of Himalayan agricultural land to channels.

METHODOLOGY AND EXPERIMENTAL WATERSHEDS :

Two micro watersheds with an area of 0.30 and 0.45 km² in the Nana Kosi drainage basin, Central Lesser Himalaya were employed as natural laboratories for the present investigation. Table 1 contains the characteristics of these watersheds. To monitor the channel runoff capacity a Pigmy Current Meter was used. Water discharge was monitored in each month at the mouth of the experimental watersheds from February 1986 to January 1988. The rainfall data were obtained from the Daulaghat meteorological station which is operated under the DST project (Rawat and Bisht, 1986-1987).

RESULTS :

The hydrological data monitored in the field and analysed in the laboratory are presented in table 2 to 6. Table 2 contains

the raw data of channel runoff collected from two experimental catchments. This table reveals the concentration per day and per annum. Table 3 reveals the waterflow capacity of different months in respect to the total annual flow. Table 4 is the summary of Table 3 which describes the waterflow capacity in different seasons of the two study years and table 5 is the average of Table 4. Table 6 contains the data showing average waterflow capacity of the agricultural land of the Central Lesser Himalayan terrain.

INTERPRETATION

The following facts may be deduced with the help of above experimental study :

- (1) On an average the agricultural land of the Central Lesser Himalaya has a capacity to generate water at the rate of 940 m³/km²/day or 343107 m³/km²/annually.
- (2) The total water discharge in 1986-87 was 557939 m³/km² while it was drastically reduced upto 128,275 m³/km² in the subsequent drought year i.e. 1987-88. This significant difference between the water generating capacity of the channels of these two hydrological years is due to an about 45.8% decrease in rainfall input in 1987-88.

**Table 1 : Characteristics of the experimental watersheds,
The Nana Kosi Basin, Kumaun Lesser Himalaya.**

Parameters	Watershed 1	Watershed 2
* Absolute relief	1420 m	1800 m
* Relative relief	160 m	80 m
Vegetation cover	Nil	Nil
Agricultural land	100%	100%
* Total Length of streams	0.80 km	1.25 km
* Area	0.30 km ²	0.45 km ²
* Number of streams	4	5
* Basin perimeter	2.00 km	2.90 km
* Drainage density	2.66 km/km ²	2.78 km/km ²
* Basin length	1.00 km	0.75 km
* Stream frequency	13.30 No/km ²	8.89 No/km ²
Climatic region		Warm Temperate
** Annual rainfall		797.81 mm
Geographical region		Lesser Himalaya
Tectonic Unit		Crystalline Unit
*** Rock type		Mica-schists interbedded with Quartzites at places

* Based on Survey of India, topographical sheet No. 53 'O'/10.

** Rawat and Bisht (1986, 1987).

*** Valdiya (1980).

Table 2 : Channel runoff data of two micro agricultural watersheds, Kumaun Lesser Himalaya.

Months	Sample 1			Sample 2		
	m ³ /sec	m ³ /day	m ³ /km ² /day	m ³ /sec	m ³ /day	m ³ /km ² /day
Feb. 86	0.00201	173.664	578.88	0.00428	369.792	821.76
March 86	0.0004	34.56	115.20	0.00287	247.968	551.04
April 1986	0	0	0	0.0015	129.600	228.00
May 86	0.0006	51.84	172.80	0.00223	192.672	428.16
June 86	0.0028	240.019	800.064	0.0090	777.60	1728.00
July 86	0.0331	2861.57	9538.56	0.0413	3568.32	7992.60
August 86	0.0045	385.344	1284.48	0.0120	1037.318	2305.15
September 86	0.0027	230.169	767.23	0.00887	766.368	1703.04
October 86	0.0023	198.72	662.40	0.00736	635.904	1413.12
November 86	0.0021	190.08	633.60	0.00693	598.752	1330.56
December 86	0.0020	172.80	576.00	0.0064	552.96	1228.80
January 87	0.0020	172.80	576.00	0.00653	564.192	1252.76
February 87	0.00143	123.552	411.84	0.00428	369.792	821.76
March 87	0.00018	15.552	51.84	0.00212	183.168	407.04
April 87	0.00009	7.776	25.92	0.00178	153.792	341.76
May 87	0.00004	3.456	11.52	0.00065	56.16	124.80
June 87	0	0	0	0.00041	35.424	78.72
July 87	0.00210	181.44	604.80	0.00296	255.744	568.32
August 87	0.00109	94.176	313.92	0.00135	116.64	259.20
September 87	0.00189	163.296	544.32	0.00163	140.832	312.96
October 87	0.00203	175.392	584.64	0.00197	170.208	378.24
November 87	0.00195	168.48	561.60	0.00163	140.832	312.96
December 87	0.00174	150.336	501.12	0.00146	126.144	280.32
January 88	0.00186	160.704	535.68	0.00209	180.576	401.28

Table 3 : Monthly channel runoff (%) in the agricultural watersheds of Kumaun Central Himalaya

Year	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1986-87	3.80	1.68	0.69	1.57	6.70	49.22	9.63	6.54	5.48	5.10	4.77	4.82
1987-88	14.55	5.37	4.30	1.60	0.92	13.91	6.81	10.21	11.46	10.42	9.31	11.14
Average (86-88)	9.18	3.52	2.50	1.58	3.81	31.56	8.22	8.38	8.47	7.76	7.04	7.98

Table 4 : Seasonal channel runoff (%) in the agricultural watersheds of Kumanu Central Lesser Himalaya in different years

Sample	86-87			87-88		
	Summer	Rainy Season	Winter	Summer	Rainy Season	Winter
1	5.52	79.03	15.45	12.09	35.27	52.64
2	9.96	65.14	24.90	39.54	28.44	32.02
Average	7.74	72.09	20.17	25.81	31.86	42.33

Table 5 : Average Seasonal Channel Runoff (%) of the agricultural Watersheds in Kumaun Central Himalaya

Summer	Rainy season	Winter
16.77%	51.98%	31.25%

Table 6 : Average channel runoff data of two Hydrological years of the experimental agricultural watersheds, Kumaun Lesser Himalaya

Year	m ³ /day	m ³ /km ² /day	m ³ /year	m ³ /km ² /year
1986-87	589.71	1528.60	215244.15	557939.00
1987-88	132.23	351.44	48263.95	128275.6
Average	360.97	940.02	131754.05	343107.3

If we compare the water generating capacity of these two years—in the drought year (i.e. 1987-88) the water generating capacity of the agricultural land to channels decreased upto 62.62%.

(3) Table 3 suggests that out of the total budget of annual waterflow about 31% is contributed by the month of July alone. The minimum water contributing month is May which contributes only 1.5% of the total annual waterflow budget.

(4) On an average in the agricultural land of the Central Lesser Himalaya more than half (i.e., 53%) of the total annual water discharge flows in the rainy season. In the summer and winter seasons the percentage of waterflow stands at 16% and 31% respectively (Table 5).

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