

## CHAPTER 8 IRRIGATION

Definition of irrigation adopted for the census refers to purposively providing land with water, other than rain for crop production. With increase in number of holdings having irrigation, area under irrigation has increased over the years. In 1981/82, 845.8 thousand holdings reported having irrigation covering a total area of 583.9 thousand hectares. This increased to 1997.6 thousand holdings with area coverage of 1168.3 thousand hectares in 2001/02. Almost 60 percent of land holding reported having some form of irrigation in 2001/02.

Land area under irrigation had increased from 23.7 percent in 1981/81 to 44.0 percent in 2001/02.

In 1981/82, 19.8 thousand hectares (3.3%) in mountain, 119.2 thousand hectares (20%) in hill and 444.9 thousand hectares (76%) in tarai were irrigated land. Likewise in 1991/92, 41.8 thousand hectares (5%) in mountain, 245.5 thousand hectares (28%) in hill and 595.1 thousand hectares (67%) in tarai were irrigated land.

In the same way in 2001/02, the irrigated land of mountain, hills and tarai were 62.1 thousand hectares (5%), 304.9 thousand hectares (26%) and 801.3 thousand hectares (69%) respectively.

The trend shows that irrigated land of tarai in 2001/02 increased by 34 percent compared to 1991/92 and increased by 80 percent compared to 1981/82.

**Table 8.0 Summary Statistics**

Description	Census year		
	1981/82	1991/92	2001/02
Number of Holdings with Irrigation ('000)	845.8	1,377.5	1,997.6
Percent of Land Holdings	38.7	50.9	59.9
Area of Irrigated ('000 ha)	583.9	882.4	1,168.3
- Mountain ('000 ha)	19.8	41.8	62.1
- Hill ('000 ha)	119.2	245.5	304.9
- Tarai ('000 ha)	444.9	595.1	801.3
Percent of Holding Area	23.7	34.0	44.0

## 8.1 Concept of Irrigation

For the purpose of the 2001/02 Agriculture census, irrigation refers to purposely providing land with water through artificial means for crop production or improving pastures. Natural flooding of land by rainfall or overflow of rivers is not considered as irrigation. However, when rainwater and uncontrolled overflow of water from rivers and streams are collected, stored and later on used on the land for crop and pasture production, this is considered as irrigation.

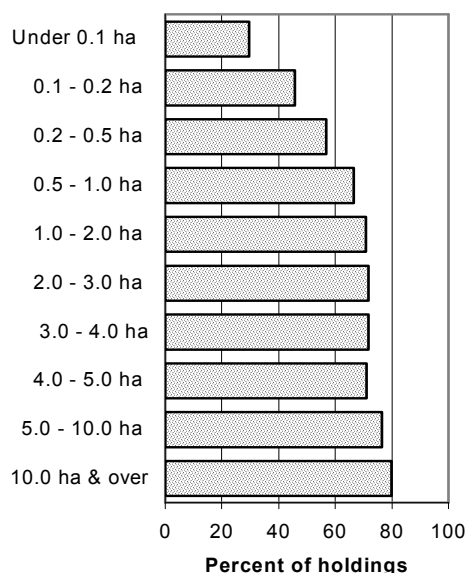
## 8.2 Land holdings with access to irrigation

The number of land holdings that have access to irrigation facilities in Nepal has been increasing through the years. In 1981/82 a total of 845,800 holdings reported of having irrigation in their farming operations. This number represented 38.7% of the total holdings in the country during that period. The number of holdings with irrigation had increased to 1.4 million in 1991/92, which was 50.9% of the total holdings existing at the time, an increase of 62.9%. In 2001/02, almost 2 million holdings availed of irrigation facilities, which is 59.9% of the total holdings, an increase of 45% over the number in 1991/92.

Tarai belt registered the highest proportion of holdings with irrigation relative to the total holdings within the belt in 2001/02 at 63.3% compared with Mountain belt of 58.2% and Hill belt with 57% of the total holdings with irrigation facilities. In 1991/92, the number of holdings with irrigation in Tarai was 545,300 holdings. This represented 49.9% of the total holdings in Tarai. In 2001/02, the number of holdings with irrigation shut up to 922,700 holdings, an increase of 377,400 holdings more with irrigation facilities which is about 69% over the number in

1991/92. The increase in the number of holdings with irrigation in Hill belt was also significant from 681,800 holdings to 902,100 holdings, an addition of 220,300 holdings that translated to an increase of 32.3%. It is in the Mountain belt where the increase is not dramatic, from 150,500 holdings with irrigation to 172,900 irrigated holdings, an increase of only about 15%.

**FIGURE 8.1: HOLDINGS WITH IRRIGATION BY SIZE OF HOLDING, NEPAL, 2001/02**



It is significant to observe that the size of the holding is positively correlated with the incidence of holdings with irrigation facilities. That is, as the size of the holdings becomes bigger, the proportion of land holdings with access to irrigation increases. The above chart illustrates the positive relationship. If we look at TABLE 8.8, the access to irrigation facilities has greatly improved among the small holdings, especially those below 0.1 hectare where the increase in the number of holdings with irrigation registered at 91.5% between 1991/92 and 2001/02. It is noted that as the size of the holding becomes bigger, the increment in the use

of irrigation declined up to the point where the number of holdings availing of irrigation facilities actually decreased in number. This phenomenon was observed to occur among the large holdings starting with size 3 hectares onwards, see TABLE 8.8.

### 8.3 Land under irrigation

The total land area under irrigation has steadily increased proportionally and physically since 1981/82.

In 1981/82, the total land area irrigated registered at 583,900 hectares. This was 23.7% of the total land area of the holdings. The area under irrigation increased to 882,400 hectares in 1991/92, an increase of 51.1% over the area in 1981/82. There was also a corresponding increase in the proportion of this irrigated area to the total land area of the holdings during the period, to 34%.

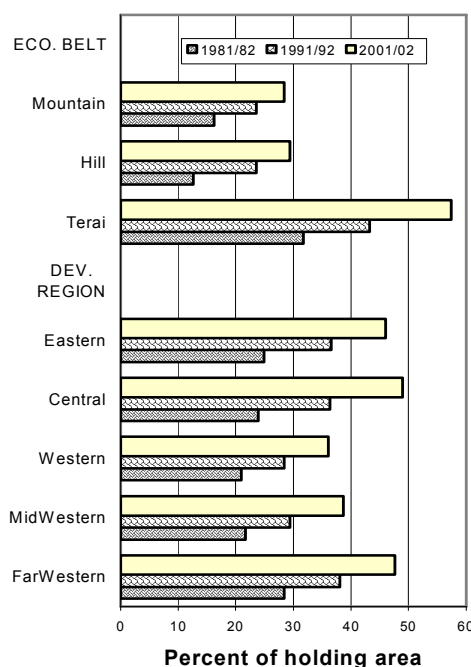
In 2001/02, the area under irrigation had increased to 1,168,300 hectares, an increase of 32.4% over the area under irrigation in 1991/92. Take note, however, that the increase has started to slow down when compared with the level of increase between 1981/82 and 1991/92.

By ecological belt, it is observed that there was a sizeable increase in the area irrigated between 1991/92 and 2001/02 in Tarai belt from 595,100 hectares to 801,300 hectares, an increase of about 35%; 41,800 hectares to 62,100 hectares in Mountain belt, an increase of about 49%; and 245,500 hectares to 304,900 hectares in Hill belt, an increase of approximately 24%.

The proportion of the irrigated area relative to the total area of the holdings was observed to be rather high in Tarai at 57.4% compared with only 29.4% and 28.4% in Hill belt and Mountain belt, respectively.

Like the ecological belts, all the development regions exhibited increases in

**FIGURE 8.2: AREA OF LAND IRRIGATED, 1981/82, 1991/92 AND 2001/02**



the area under irrigation since 1981/82 up to 2001/02. However, it was observed that the increases had slowed down except in Central development region where the increase between 1991/92 and 2001/02 was higher than the increase between 1981/82 and 1991/92, see TABLE 8.2.

The average area under irrigation has been going down from 0.6904 hectare in 1981/82 to 0.6406 hectare in 1991/92 and 0.5849 hectare in 2001/02. However, if we examine the averages by ecological belt, there seemed to be an increasing average in Mountain belt that runs counter to the trend in Hill and Tarai belts, both of which were on the downtrend.

Except for Mid-Western region where the average irrigated area was increasing, all the other regions exhibited a decreasing average size of irrigated area per holding.

## 8.4 Source of irrigation

About 57% of the total holdings with irrigation reported “canal (seasonal)” as the source of irrigation water to irrigate their holdings in 1991/92. The percentage of holdings availing of this source declined a little bit in 2001/02 to 54.7% but the area irrigated had increased comparatively. It may be noted, however, that there are holdings that availed of several sources of irrigation water both in 1991/92 and 2001/02.

The second most common source of irrigation both in 1991/92 and 2001/02 is the canal (permanent) where 37.4% of the total holdings reported in 2001/02 as the

source of irrigation. Tubewell/bore was availed of only by about 8.7% of the holding in 1991/92 and 15.2% in 2001/02.

However, in Tarai, tubewell/bore ranked second as the source of irrigation compared with canal (permanent) for the Hill belt and Mountain belt.

In Hill and Mountain belts, almost all of the irrigated land holdings depend on canal (seasonal) as well as canal (permanent) as their source of irrigation water. In Tarai belt, there were three important sources of irrigation, as follows in the order of importance areawise: canal (seasonal), 309,700 hectares; tubewell/bore, 212,200 hectares; and canal (permanent), 207,600 hectares.

By development regions, the two most common source of irrigation are: canal (seasonal) and canal (permanent) where almost 90% of all the holdings reported as their source.

In terms of the area being served by irrigation, there were three regions where three sources were utilized. These sources are canal(seasonal), canal (permanent) and tubewell/bore and the three regions were: Eastern, Central and Far-Western. The use of tubewell/bore for irrigation in Western and Mid-Western regions covered only 11.7% and 6.6% of the total irrigated area, respectively.

**FIGURE 8.3: SOURCE OF IRRIGATION, NEPAL, 2001/02, PERCENT OF IRRIGATED LAND**

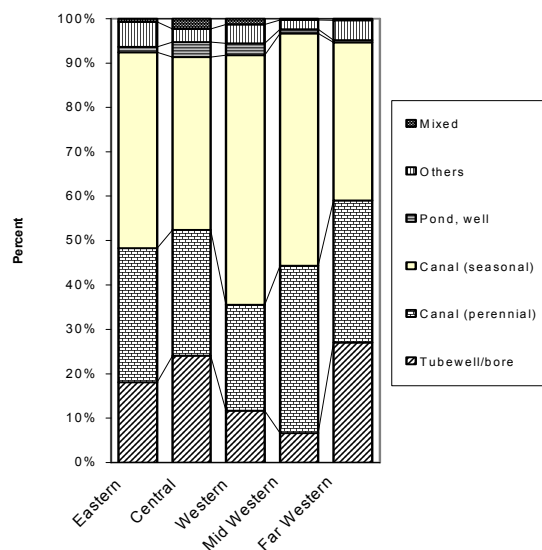


TABLE 8.1: NUMBER AND PERCENT OF LAND HOLDINGS IRRIGATING - ECOLOGICAL BELTS AND DEVELOPMENT REGIONS, 1981/82, 1991/92 AND 2001/02

Geographic area	Number irrigating (' 000)			% to total land holdings		
	1981/82	1991/92	2001/02	1981/82	1991/92	2001/02
NEPAL	845.8	1,377.5	1,997.6	38.7	50.9	59.9
ECOLOGICAL BELTS						
Mountain	103.1	150.5	172.9	52.3	57.9	58.2
Hill	413.7	681.8	902.1	39.7	50.5	57.0
Terai	329.1	545.3	922.7	34.8	49.9	63.3
DEVELOPMENT REGIONS						
Eastern	213.0	327.4	451.9	37.0	52.1	56.5
Central	263.9	421.7	652.4	37.4	50.0	63.5
Western	187.5	300.0	405.9	41.4	49.7	57.0
Mid Western	105.3	189.7	271.3	38.1	51.5	58.0
Far Western	76.0	138.8	216.1	43.6	53.4	65.1

TABLE 8.2: AREA AND PERCENT OF LAND IRRIGATED IN ECOLOGICAL BELTS AND DEVELOPMENT REGIONS, NEPAL, 1981/82, 1991/92 AND 2001/02

Geographic area	Area irrigated (' 000 ha)			% to total area of land holding		
	1981/82	1991/92	2001/02	1981/82	1991/92	2001/02
NEPAL	583.9	882.4	1,168.3	23.7	34.0	44.0
ECOLOGICAL BELTS						
Mountain	19.8	41.8	62.1	16.2	23.6	28.4
Hill	119.2	245.5	304.9	12.7	23.5	29.4
Terai	444.9	595.1	801.3	31.7	43.3	57.4
DEVELOPMENT REGIONS						
Eastern	192.2	287.0	365.9	24.9	36.6	46.0
Central	196.4	261.4	367.1	23.9	36.3	48.9
Western	97.2	161.0	184.6	21.0	28.4	36.0
Mid Western	56.1	95.6	143.4	21.7	29.4	38.7
Far Western	41.9	77.4	107.4	28.4	38.1	47.7
Increase/Decrease						
	1981-1991		1991-2001		1981-1991	1991-2001
NEPAL	51.1		32.4		43.5	29.5
ECOLOGICAL BELTS						
Mountain	111.1		48.5		45.7	20.3
Hill	106.0		24.2		85.0	24.9
Terai	33.8		34.7		36.6	32.5
DEVELOPMENT REGIONS						
Eastern	49.3		27.5		47.0	25.7
Central	33.1		40.4		51.9	34.8
Western	65.6		14.6		35.2	26.9
Mid Western	70.4		50.0		35.5	31.6
Far Western	84.7		38.8		34.2	25.1
Average area irrigated per reporting holding						
					Increase/Decrease	
					1981-1991	1991-2001
NEPAL	0.6904	0.6406	0.5849	-7.2	-8.7	
ECOLOGICAL BELTS						
Mountain	0.1920	0.2777	0.3592	44.6	29.3	
Hill	0.2881	0.3601	0.3380	25.0	-6.1	
Terai	1.3519	1.0913	0.8685	-19.3	-20.4	
DEVELOPMENT REGIONS						
Eastern	0.9023	0.8766	0.8096	-2.9	-7.6	
Central	0.7442	0.6199	0.5626	-16.7	-9.2	
Western	0.5184	0.5367	0.4547	3.5	-15.3	
Mid Western	0.5328	0.5040	0.5285	-5.4	4.9	
Far Western	0.5513	0.5576	0.4973	1.1	-10.8	

TABLE 8.3: NUMBER OF HOLDINGS WITH ACCESS TO IRRIGATION  
AND AREA IRRIGATED BY SOURCE OF IRRIGATION, NEPAL,  
1991/92 AND 2001/02

Source	Holdings with irrigation		Area irrigated	
	No. ('000)	% 1991/92	'000 ha	%
Canal (permanent)	119.9	8.7	99.8	11.3
Canal (seasonal)	474.3	34.4	245.8	27.9
Pond, well	787.1	57.1	436.7	49.5
Others	51.7	3.8	25.4	2.9
Mixed	129.6	9.4	74.7	8.5
Total	1,377.5	100.0	882.4	100.0
2001/02				
Tubewell/bore	303.2	15.2	214.9	18.4
Canal (permanent)	747.7	37.4	346.8	29.7
Canal (seasonal)	1,092.7	54.7	521.3	44.6
Pond, well	71.8	3.6	23.9	2.0
Others	115.7	5.8	46.9	4.0
Mixed	25.7	1.3	14.6	1.3
Total	1,997.6	100.0	1,168.3	100.0

TABLE 8.4: NUMBER AND PERCENT OF HOLDINGS WITH ACCESS TO IRRIGATION  
BY SOURCE OF IRRIGATION AND BY ECOLOGICAL BELT, NEPAL, 2001/02

Source of irrigation (a)	Ecological Belt			
	Mountain	Hill	Tarai	Nepal
Number of holdings reporting ('000)				
Tubewell/bore	1.5	12.4	289.4	303.2
Canal (permanent)	77.5	386.8	283.4	747.7
Canal (seasonal)	112.7	561.7	418.3	1,092.7
Pond, well	1.8	18.8	51.2	71.8
Others	1.9	36.7	77.0	115.7
Mixed	2.1	9.3	14.4	25.7
Total holdings with access to irrigation	172.9	902.1	922.7	1,997.6
Percent to total holdings with irrigation				
Tubewell/bore	0.9	1.4	31.4	15.2
Canal (permanent)	44.9	42.9	30.7	37.4
Canal (seasonal)	65.2	62.3	45.3	54.7
Pond, well	1.0	2.1	5.6	3.6
Others	1.1	4.1	8.3	5.8
Mixed	1.2	1.0	1.6	1.3
Total	100.0	100.0	100.0	100.0

(a) Some holdings reported more than one source of irrigation

TABLE 8.5: AREA OF LAND HOLDINGS IRRIGATED BY SOURCE OF IRRIGATION AND BY ECOLOGICAL BELT, NEPAL, 2001/02

Source of irrigation	Ecological Belt			Nepal
	Mountain	Hill	Tarai	
Area of land holdings irrigated ('000 ha)				
Tubewell/bore	0.3	2.4	212.2	214.9
Canal (permanent)	20.8	118.3	207.6	346.8
Canal (seasonal)	39.2	172.3	309.7	521.3
Pond, well	0.6	2.8	20.4	23.9
Others	0.3	7.4	39.2	46.9
Mixed	0.8	1.6	12.2	14.6
Total area irrigated	62.1	304.9	801.3	1,168.3
Percent to total area irrigated				
Tubewell/bore	0.4	0.8	26.5	18.4
Canal (permanent)	33.6	38.8	25.9	29.7
Canal (seasonal)	63.2	56.5	38.7	44.6
Pond, well	1.0	0.9	2.6	2.0
Others	0.5	2.4	4.9	4.0
Mixed	1.4	0.5	1.5	1.3
Total	100.0	100.0	100.0	100.0

TABLE 8.6: NUMBER AND PERCENT OF LAND HOLDINGS WITH ACCESS TO IRRIGATION BY SOURCE OF IRRIGATION AND BY DEVELOPMENT REGION, NEPAL, 2001/02

Source of irrigation (a)	Ecological Belt					Nepal
	Eastern	Central	Western	Mid Western	Far Western	
Number of land holdings						
Tubewell/bore	86.3	134.9	33.5	13.4	35.1	303.2
Canal (permanent)	159.3	237.1	122.5	130.3	98.5	747.7
Canal (seasonal)	232.7	334.5	273.5	149.7	102.4	1,092.7
Pond, well	14.2	32.3	15.7	4.3	5.2	71.8
Others	36.4	35.8	25.7	8.6	9.2	115.7
Mixed	4.7	12.9	5.0	1.6	1.6	25.7
Holdings with access to irrigation	451.9	652.4	405.9	271.3	216.1	1,997.6
Percent to total land holdings reporting						
Tubewell/bore	19.1	20.7	8.2	5.0	16.2	15.2
Canal (permanent)	35.3	36.3	30.2	48.0	45.6	37.4
Canal (seasonal)	51.5	51.3	67.4	55.2	47.4	54.7
Pond, well	3.2	4.9	3.9	1.6	2.4	3.6
Others	8.1	5.5	6.3	3.2	4.3	5.8
Mixed	1.0	2.0	1.2	0.6	0.7	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

(a) Some holdings reported more than one source of irrigation.



TABLE 8.7: AREA OF LAND HOLDINGS IRRIGATED BY SOURCE OF IRRIGATION AND BY DEVELOPMENT REGION, NEPAL, 2001/02

Source of irrigation	Development region					Nepal
	Eastern	Central	Western	Mid Western	Far Western	
Total area of land holding irrigated ('000 ha)						
Tubewell/bore	66.2	88.5	21.6	9.5	29.0	214.9
Canal (permanent)	110.4	104.0	44.0	54.0	34.4	346.8
Canal (seasonal)	161.4	142.7	103.9	75.1	38.2	521.3
Pond, well	4.7	12.5	4.8	1.3	0.6	23.9
Others	20.4		7.8	3.0	4.7	46.9
Mixed	2.8	8.4	2.5	0.5	0.4	14.6
Total area irrigated	365.9	367.1	184.6	143.4	107.4	1,168.3
Percent to total area irrigated						
Tubewell/bore	18.1	24.1	11.7	6.6	27.0	18.4
Canal (permanent)	30.2	28.3	23.8	37.7	32.0	29.7
Canal (seasonal)	44.1	38.9	56.3	52.4	35.6	44.6
Pond, well	1.3	3.4	2.6	0.9	0.6	2.0
Others	5.6	3.0	4.2	2.1	4.4	4.0
Mixed	0.8	2.3	1.4	0.3	0.4	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 8.8: NUMBER AND PERCENT OF LAND HOLDINGS WITH ACCESS TO IRRIGATION BY SIZE OF HOLDING, NEPAL, 1991/92 AND 2001/02

Size of Holding	1991/92			2001/02			
	Total land holdings ('000)	Holding with access to irrigation ('000)	Percent of holdings with irrigation	Total land holdings ('000)	Holding with access to irrigation ('000)	Percent of holdings with irrigation	% increase in no. of holdings with access to irrigation
Under 0.1 ha	173.0	40.2	23.2	260.5	77.0	29.5	91.5
0.1 ha and under 0.2 ha	263.8	97.1	36.8	346.1	158.7	45.8	63.4
0.2 ha and under 0.5 ha	729.3	341.8	46.9	972.3	552.6	56.8	61.7
0.5 ha and under 1 ha	711.7	392.2	55.1	915.7	609.1	66.5	55.3
1 ha and under 2 ha	529.5	317.5	60.0	588.6	416.6	70.8	31.2
2 ha and under 3 ha	168.4	103.7	61.6	157.0	112.7	71.8	8.7
3 ha and under 4 ha	59.6	38.1	64.0	51.6	37.0	71.7	-2.9
4 ha and under 5 ha	28.6	19.3	67.5	20.2	14.4	71.2	-25.4
5 ha and under 10 ha	32.0	21.7	67.8	21.6	16.5	76.6	-23.8
10 ha and over	8.2	6.0	73.1	3.8	3.0	80.0	-49.6
Total	2703.9	1,377.5	50.9	3,337.4	1,997.6	59.9	45.0

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