

# A Map Based Inventory of Lakes in Nepal

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## Abstract

An inventory of lakes in Nepal based on desktop study of topographic maps published between 1992 and 2001 was produced, as a part of the National Lake Strategic Plan for Nepal. As all earlier studies reported only partially the number of lakes in the Terai and the high mountains, the scope of this study was to produce a complete list of lakes useful in planning for lakes conservation and management. Closed water bodies indicated in the topographical sheets were considered as lakes. The inventory included name, location, altitude, grids X and Y, and sheet number. An alpha-numerical code was generated to identify lakes by districts. The study also included surveillance with 121 researchers in the team representing Nepal Academy of Science and Technology, National Trust for Nature Conservation and Tribhuvan University – Central Department of Environmental Science. They gathered photographic evidences and some geographical information of 229 lakes in 49 districts from August through October 2009. They also consulted with over 1,700 stakeholders through focus group discussions and consultation meetings in the districts for the strategic plan. A list of 5,358 lakes has been prepared. Of the 75 districts, 74 contain lakes. There are 21 districts containing less than nine lakes in each, and 16 districts containing over 100 lakes in each. Among the rest of the districts, 16 contain 10 to 29 lakes, and 22 contain 30 to 99 lakes. The eight districts containing high number of lakes are Humla (381), Taplejung (380), Kapilbastu (351), Solukhumbu (339), Rupandehi (289), Banke (243), Dhanusa (230), and Dolpa (210). Altitudewise, 2,712 lakes (51%) are distributed below 500m, and 2,227 (42%) above 3,000m. Only 419 lakes (<8%) are in the mid hills of altitudinal range between 500m and 2,999m. Names are available only for 472 lakes in the topographical sheets. The lists of lakes are maintained at the National Lake Conservation Development Committee and its key partner institutions. The significant lakes included the largest Rara lake (800ha), and the longest Phoksundo lake (5.15km), and the highest placed Dhau Dhundhun Tal (5,905m).

**Key words:** lake, inventory, topographical sheet

## Introduction

The National Lake Strategic Plan for Nepal was felt essential to materialize the vision, goal and objectives of the National Lake Conservation Development Committee (NLCDC) that was established under the aegis of the Ministry of Tourism and Civil Aviation by using the provisions made in the 1957 Development Committee Act on March 23, 2007.

The primary objective of NLCDC was to conserve and develop the lakes of the country, and its scope included policy advice to the government on lakes conservation and development, program planning and implementation in coordination with the sectoral ministries, develop lakes as tourism destinations, public awareness on the cultural and religious

significances of lakes, protect the lakes from pollution, encroachment and other detrimental activities, etc.

At the time when the strategic plan was conceptualized in 2009, it was realized that the initial task should be to prepare an inventory of the lakes. Although there were three notable works on lakes inventory undertaken earlier, they need to be updated in terms of recent information and geographical coverage. According to the DOAD (1993) reports, there are around 5,000 lakes, 1,380 reservoirs, and 5,183 village ponds in the country. According to IUCN inventory (1996), there are 163 wetlands in Terai, and 79 in the hills and mountains. Similarly, 3,252 glaciers and 2,323 glacial lakes have been identified in the high mountain

region (Mool *et al.* 2001). The inventory of glacial lakes was conducted from the perspectives of the potential Glacial Lakes Outburst Floods (GLOF).

Considering the urgency of the strategic plan, and also realizing the long duration of time for undertaking field inventory of lakes, it was decided to go for an alternative ways of lakes inventory. Upon exploration of possible alternatives, the strategic plan team decided to undertake a map based inventory. There are two major types of maps being used for planning purposes. They are district maps and topographical sheets.

Initially the district maps (scale of 1:125,000) were considered to be useful to identify major lakes. However, it was found that the district maps published between

1993 and 2007 were not completely reliable since numerous lakes were not shown in those maps. For example, the district maps of 21 districts did not even mention any lake, whereas the topographical sheets of the same districts revealed as many as 1,400 lakes (Table 1).

The entire area of the country is covered with 706 topographical sheets that were produced using the latest technology and information. Published between 1992 and 2001, the topographic sheets are the most frequently used base maps for the country. The Terai and mid-mountain regions are covered with 590 sheets of 1:25,000 scale, and the High Mountain and Himalayan regions with 116 sheets of 1:50,000 scale. Each sheet is identified using an index map (Fig. 1).

**Table 1.** Number of lakes in the selected districts

Districts*	Number of lakes**	Districts*	Number of lakes**
1. Baitadi	1	2. Lalitpur	3
3. Banke	243	4. Mahottari	186
5. Bara	93	6. Myagdi	33
7. Bhaktpur	2	8. Nawalparasi	163
9. Chitawan	40	10. Parsa	71
11. Dailekh	7	12. Saptari	46
13. Darchula	19	14. Sarlahi	74
15. Dhanusa	230	16. Sindhuli	9
17. Jajarkot	16	18. Siraha	140
19. Kalikot	1	20. Surkhet	22
21. Kavrepalanchok	1	<b>Total</b>	<b>1400</b>

\*No lake was mentioned in the district maps \*\* As shown in the topographical sheets

These are accurate maps which are also available in digital forms. They contain eight basic layers that are essential for field level planning. The layers are: Administrative boundaries (Village Development Committee, Municipalities, District Development Committee), Building (settlements etc), Contours (20 m intervals), Designated area (national park etc), Hydrographic (lake, river, canal, glacier, etc), Land cover (rocks, cultivation, forest types, orchard, swamp etc), Transportation (roads etc), Utility (school, hospital, bus terminal, monument, etc).

## Methodology

### Defining lakes

For the purpose of this inventory, water bodies indicated in the topographical sheets were considered as lakes although they were less than one hectare in area. There are several definitions of lakes, and they vary according

to their purposes and scopes of studies. Lakes greatly vary in size. Of an estimated 304 million standing water bodies worldwide, 91% are one hectare or less in area (Downing *et al.* 2006). One definition of “lake” it is that is a body of water of two hectares (five acres) or more in area, however, others have defined lakes as water bodies of five hectares (12 acres) and above, or eight hectares (20 acres) and above. Charles Elton, one of the founders of ecology, regarded lakes as water bodies of 40 hectares (99 acres) or more (Answers Corporation 2009). Another criterion that was referred to was the shape of a water body. The water bodies having natural shapes were considered as lakes. The artificial fishery ponds and the water bodies having rectangular shapes were considered man-made and hence not included in the list of lakes (Fig.1).

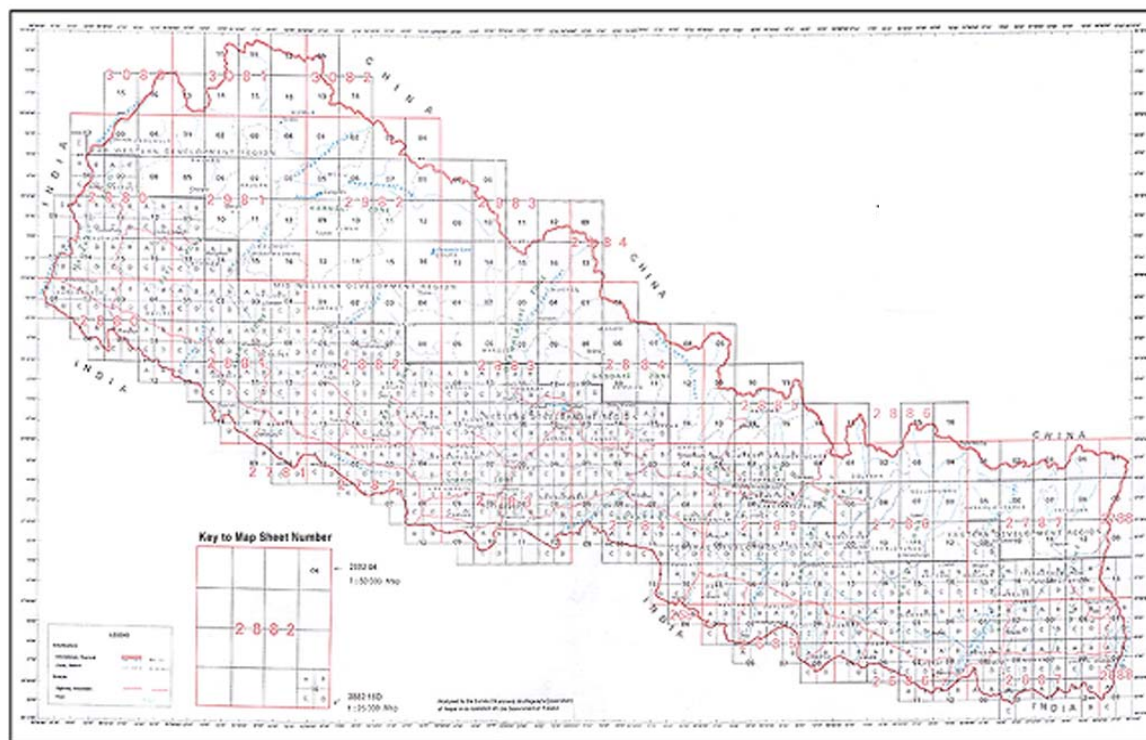


Fig. 1. Topographic Base map of Nepal

### Basic Information of Lakes

The following basic information derived from the topographical sheets included: name of the lake (where available), district of location, altitude (on the basis of the contour lines), grids X and Y (instead of latitude and longitude), topographical sheet number.

An alpha-numerical code was generated to identify lakes by districts. The first two alphabets indicate the name of a district, and the subsequent numbers indicate the serial number within the district. Thus, the code numbers indicate both the number of lakes and name of a district in which they contain.

Upon knowing the location of the lakes, additional information could be collected from the topographical sheets. As mentioned earlier, the eight layers of the sheets include administrative boundaries, transportation, settlements, land cover, other hydrographic data, altitude, utility, and designated areas.

### Field Validation

The districtwise information of the lakes was also verified during field observations and consultations

in 49 districts during August through October 2009. The field observations were parts of the strategic planning process. The two main aspects that were considered for field observations were:

1. Photographic evidences of landscapes, tangible and intangible heritage, rituals, socio-economic aspects, usage of lake resources, ecological and environmental components of lakes and so on.
2. Textual documentation and mapping of lakes including vegetation types, floral and faunal distribution, geographical locations for references research and monitoring, water quality and quantity, lake resources, etc.

The above mentioned points were presented and discussed in the pre-field one day workshops for the researchers. Among the 121 persons who conducted field works were senior researchers and field assistants representing Nepal Academy of Science and Technology (NAST) (38) and National Trust for Nature Conservation (NTNC) (29), and four faculty members and 50 master level students of environmental science representing Tribhuvan University, Central Department of Environmental Science (TU-CDES). They conducted rapid ecological surveys (CBD 2006) of 229 lakes, and

gathered information including photographic evidences in 49 districts. They also conducted 97 focus group discussions in the communities around the lakes, and 49 consultation meetings in the district headquarters where over 1,700 participants shared their views.

### Lakes Distributions

A list of 5,358 lakes has been prepared using the topographical sheets, whereas only 278 lakes were identified from the district maps (Table 1).

**Table 1.** Number of lakes by districts, phytogeographical regions, and ecological zones

Phytogeographical regions	Western (< 83°00'E)			Central (83°00'E-86°30'E)			Eastern (> 86°30'E)			
	Districts	D	T	Districts	D	T	Districts	D	T	
Highlands	<b>Districts</b>	<b>D</b>	<b>T</b>	<b>Districts</b>	<b>D</b>	<b>T</b>	<b>Districts</b>	<b>D</b>	<b>T</b>	
	Jumla	11	99	Dolakha	5	42	Taplejung	12	380	
	Kalikot	-	1	Sindhupalchok	6	75	Sankhuwasabha	15	159	
	Mugu	16	125	Rasuwa	5	38	Solukhumbu	32	339	
	Humla	2	381	Manang	1	66				
	Bajura	1	57	Mustang	25	78				
	Bajhang	2	25	Dolpa	6	210				
	Darchula	-	19							
		<b>7</b>	<b>32</b>	<b>707</b>	<b>6</b>	<b>48</b>	<b>509</b>	<b>3</b>	<b>59</b>	<b>878</b>
	Mid – hills	Pyuthan	2	19	Sindhuli	-	9	Panchthar	4	17
Rolpa		1	16	Ramechhap	4	25	Ilam	5	30	
Rukum		1	70	Kavrepalanchok	-	1	Dhankuta	1	4	
Salyan		2	5	Lalitpur	-	3	Terhathum	5	4	
Surkhet		-	22	Bhaktpur	-	2	Bhojpur	5	7	
Dailekh		-	7	Kathmandu	2	1	Okhaldhunga	2	0	
Jajarkot		-	16	Nuwakot	2	3	Khotang	7	10	
Achham		6	13	Dhading	2	5	Udayapur	3	14	
Doti		1	19	Makwanpur	3	2				
Dadeldhura		2	2	Gorkha	6	36				
Baitadi		-	1	Lamjung	7	23				
				Tanahau	2	2				
				Syangja	3	4				
				Kaski	13	29				
				Myagdi	-	33				
				Parbat	2	5				
				Baglung	4	60				
				Gulmi	3	11				
				Palpa	4	12				
				Argkhanchi	1	3				
	<b>11</b>	<b>15</b>	<b>190</b>	<b>20</b>	<b>58</b>	<b>269</b>	<b>8</b>	<b>32</b>	<b>86</b>	
Terai – siwaliks	Kapilbastu	9	351	Dhanusa	-	230	Jhapa	3	136	
	Dang	1	38	Mahottari	-	186	Morang	1	184	
	Banke	-	243	Sarlahi	-	74	Sunsari	1	69	
	Bardiya	3	82	Rautahat	3	85	Saptari	-	46	
	Kailali	4	114	Bara	-	93	Siraha	-	140	
	Kanchanpur	5	85	Parsa	-	71				
				Chitawan	-	40				
				Nawalparasi	-	163				
				Rupandehi	4	289				
		<b>6</b>	<b>22</b>	<b>913</b>	<b>9</b>	<b>7</b>	<b>1231</b>	<b>5</b>	<b>5</b>	<b>575</b>
	<b>24</b>	<b>69</b>	<b>1810</b>	<b>35</b>	<b>113</b>	<b>2009</b>	<b>16</b>	<b>96</b>	<b>1539</b>	

Note: Clustering of districts in the Phytogeographical Regions and Ecological Zones are based on distribution of areas.

Sources: District Maps (D), Topographical Sheets (T)

A complete list of 5,358 lakes along with the basic information are compiled and maintained as a baseline for the lake database. The lists were distributed among the key partner institutions, namely NAST, NTNC, TU-CDES and the Central Department of Statistics of the Government of Nepal, amidst a function of the National Workshop on Lakes Conservation and Development Strategic Plan Preparation held on December 29, 2009 in Lalitpur, Nepal.

Of the 75 districts of the country, 74 contain lakes. Although the district map of Okhaldhunga indicates two lakes, there are none on the topographical sheets of the district. There are 21 districts containing less than nine lakes in each, and 16 districts containing over 100 lakes in each. Among the rest of the districts, 16 contain 10 to 29 lakes, and 22 contain 30 to 99 lakes (Fig. 3).

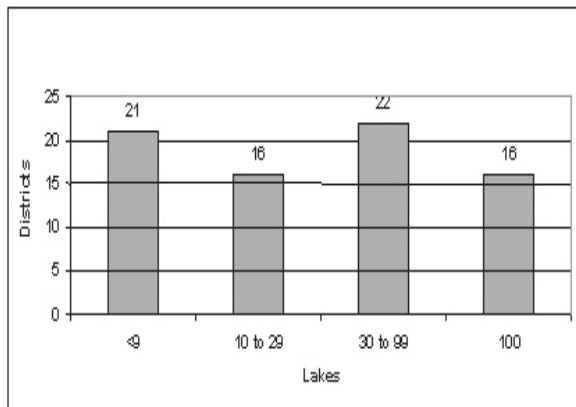


Fig. 3. Number of lakes and districts

The eight districts containing high number of lakes are Humla (381), Taplejung (380), Kapilbastu (351), Solukhumbu (339), Rupandehi (289), Banke (243), Dhanusa (230), and Dolpa (210).

Altitude wise, 2,712 lakes (51%) are distributed below 500m, and 2,227 (42%) above 3,000m. Only 419 lakes (<8%) are in the mid hills of altitudinal range between 500m and 2,999m (Table 2).

The number of lakes having their names mentioned in the topographical sheets is 472 which are 9% of the

total number of lakes. Of these named lakes, 60% lie above 4,000 m altitude, 18% below 499 m altitude.

Table 2. Altitudinal distribution of lakes in Nepal

Altitude	Lakes		
	Number	%	
Below 100	1270	50.62	
100-499	1442		
500-999	77		
1000-1499	69		
1500-1999	125	419	782
2000-2499	114	2227	41.56
2500-2999	34		
3000-3499	56		
3500-3999	60		
4000-4499	418	764	167
4500-4999	762		
5000-5499	764		
above 5500	167		
Total	5358	5358	100.00

Among the notable lakes of the country, the Rara lake is the largest one covering an area of 800ha, and Phoksundo is the longest one with its length 5.15km. Similarly, the Dhau Dhundhun Tal is the highest placed lake in Mustang at an altitude of 5905m, and a lake near Musahamiyatol in Mukhiya Patti VDC, Dhanusha is at 59m altitude (Boxes 1-4, and Fig. 4-7).

(Note: The maps shown in the figures are images of the parts of the topographical sheets, and are not necessarily to the scale).

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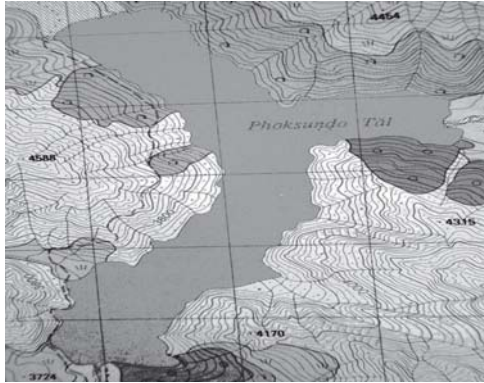


Fig. 4. Lake Phoksundo

**Box 1. Longest Lake Phoksundo**

Name of Lake:	Phoksundo Tal
Topo-sheet no:	2982-16
Code:	DP70
District:	Dolpa
VDC:	Phoksundo
Nearby City/Village:	Rigmo (0.8Km)
Area:	494ha
Length:	5.15Km
Breadth:	1.1Km
Altitude:	3620m

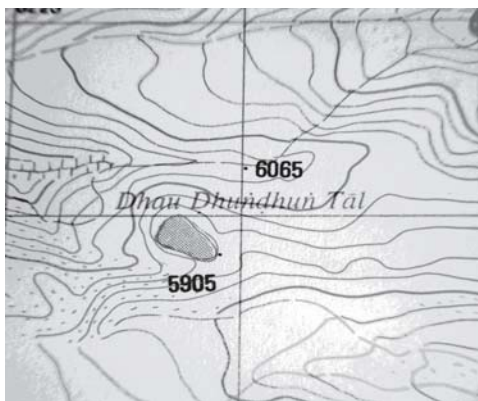


Fig. 5. Lake Dhau Dhundhun

**Box 2. High Altitude Lake**

Name of Lake:	Dhau Dhundhun Tal
Topo- Sheet no:	2983-16
Code:	MS52
District:	Mustang
VDC:	Charan
Nearby City/Village:	Saukre (20Km)
Area:	4.75ha
Length:	350m
Breadth:	150m
Perimeter:	900m
Altitude:	5905m

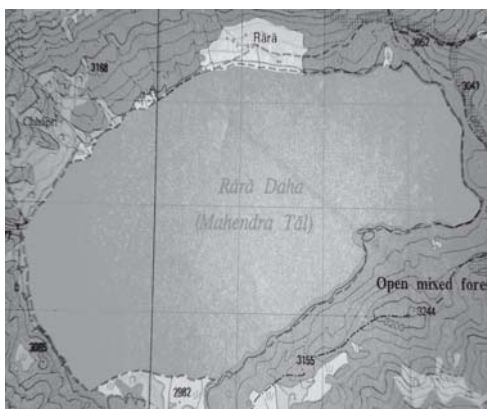


Fig. 6. Lake Rara

**Box 3. Largest Lake**

Name of Lake:	Rara
Topo-sheet no:	2982- 05
Code:	MU12
District:	Mugu
VDC:	Rara
Nearby City/Village:	Rara (0Km)
Area:	800ha
Length:	5Km
Breadth:	2Km
Perimeter:	9Km
Altitude:	3060m



Fig. 7. Lake near Musaharniyatol

Box 4. Low Altitude Lake	
Name of Lake:	X
(near Boundary Pillar 53)	
Topo- Sheet no:	2685-08C
Code:	DS65
District:	Dhanusha
VDC:	Mukhiya Patti
Nearby City/Village:	Musaharniyatol (1.5Km)
Area:	0.5ha
Length:	125m
Breadth:	50m
Perimeter:	425m
Altitude:	59m

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