
بسم الله الرحمن الرحيم

SOIL SURVEY IN PAKISTAN, HISTORY, ACHIEVEMENT AND IMPACT ON AGRICULTURE

BY

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SOIL SURVEY OF PUNJAB, PAKISTAN

Pakistan is located between 24 and 37^{o} N and 61 and 75^{o} E. The climate is arid with low rainfall and humidity and high solar radiation over most parts of the country. Most areas receive less than 200 mm annual rainfall, except for the high altitude northern mountains, which receive more than 500 mm annually. The rainfall distribution varies widely: 60% of rainfall in Sind and Punjab Provinces occurs during the monsoon season i.e. from July to early September. Baluchistan and the northern mountains receive maximum rainfall during October to March (FAO, 1987).

The total land area of Pakistan, including Azad Kashmir, is 88 M ha

Geographically Pakistan has a highly diversified Landscape and environment. Lofty snow covered mountains, Vast Sandy deserts, and extensive river and piedmont plains have contributed to give rise to a country reflecting remarkable variations in soil characteristics.

Six major landscapes namely, mountains, Rock plains, Aeolian plains (Loess plains and Sandy deserts), Piedmont plains, River plains and Indus Delta are known to occur in the country.

THE SOIL SURVEY OF PAKISTAN:

The Soil Survey of Pakistan (SSP) came into being in 1962 as a project titled “Soil Survey Project of Pakistan” under the Ministry of Food and Agriculture, Govt. of Pakistan. The project was assisted by the United Nations Special Fund (UNDP) with Food and Agriculture Organization (FAO) of the United Nations as its executing agency.

The project was regularized as a department in July, 1973. Main objective of the project were:

Main objectives:

To prepare an inventory of Pakistan's soil resources through standard reconnaissance soil surveys, in the form of reports and maps, which would assist the government in planning of projects aiming at new land development, irrigation extension, drainage improvement, land reclamation, soil conservation, forestry development, watershed management and range improvement, etc., and an overall economic development of the country.

Through the "Soil Survey Project of Pakistan", in total 27 reconnaissance Soil Survey reports and analog maps were prepared and covered 38% of the area. The report completed up to 1973 are listed below:

SR. NO.	TITLE OF REPORT	SR. NO.	TITLE OF REPORT
1	Sheikhupura Area 1968	11	Dera Ismail Khan 1969
2	Lahore District 1968	12	Jacobabad 1970
3	Jhang Area 1968	13	Badin 1970
4	Sahiwal District 1968	14	Ghotki 1971
5	Thal North 1968	15	Muzaffargarh 1971
6	Thal South 1968	16	Hderabad 1971
7	Thatta East 1969	17	Khairpur 1971
8	Sargodha 1966, 2nd Edition 1969	18	Campbellpur 1971
9	Multan South 1969	19	Bahawalnagar Area 1971
10	Multan North 1969	20	Bahawalpur Area 1971

SR. NO.	TITLE OF REPORT	SR. NO.	TITLE OF REPORT
21	Sanghar Area 1971	25	Jacobabad-Usta Muhammad 1972
22	Nawabshah 1971	26	Dadu District 1973
23	Larkana 1971	27	Peshawar Vale (Peshawar and Mardan District) 1967 2nd Edition 1973
24	Rahim Yar Khan 1972		

After regularization (1973) of Department , Soil Survey of Pakistan, completed 43 reports and covered 96% of the country's area. The reports completed are:

28	Cholistan 1974	32	Karachi District 1976
29	Buner Valley 1975	33	Gujranwala Area (Gujranwala and Sialkot Districts) 1968 Reprint 1977
30	Dera Ghazi Khan 1976	34	Lyallpur Area (Sandal Bar and Kamalia Plain), 1967, Reprint 1978
31	Lasbela District 1976	35	Rawalpindi Area 1967, Reprint 1978

SR. NO.	TITLE OF REPORT	SR. NO.	TITLE OF REPORT
36	Gujrat District 1967, Reprint 1978	45	Swat Catchment 1981
37	Quetta and Pishin Districts 1978	46	Swat Catchment 1981
38	Salt Range 1978	47	Loralai 1981
39	Haro Basin 1978	48	Zhob Area 1982
40	Dir 1979	49	Upper Thal 1984
41	Kohat 1979	50	Kachhi 1984
42	Tarbela Watershed 1979	51	Kohistan Mahal 1984
43	Murree-Kahuta 1979	52	Kohlu 1986
44	Kalat 1979	53	Sibi 1988
45	Thatta West 1981	54	Kachhi (Evaluation & Utilization) 1990

SR. NO.	TITLE OF REPORT	SR. NO.	TITLE OF REPORT
56	Khuzdar 1990	64	Kasur 2004
57	FATA North 1991	65	Thar (South) 2004
58	Gujranwala (Updated) 1991	66	Narowal 2005
59	Chitral 1992	67	Turbat 2005
60	Kaghan 1993	68	Azad Jamu Kashmir 2006
61	Chilas 1993	69	Panjgur 2010
62	Chagai and Kharan Districts 1993	70	Baltistan (in press)
63	Gwardar Area 1994		

Semi Detailed and Detailed survey

Sr. No.	Title of Report	Area covered
1	semi detailed area	900,000 hectares
2	Detailed area of projects (Deer (UNDP), Hilkot (ICIMOD); Minapin-Pishen; Chishtian,	390,000hectares
3	Punjab Forest area	Tahsil wise 110 reports.

PROVINCE WISE GEOGRAPHICAL AREA AND COVERAGE OF RECONNAISSANCE SOIL SURVEY OF PAKISTAN

RECONNAISSANCE SOIL SURVEYS: PROVINCE-WISE COVERAGE				
Province	**Geographical Area**	**Area Surveyed**		**Un-surveyed Area**
	('000 square kilometers)	**('000 square kilometers)**	**(% of total)**	**('000 square kilometers)**
Punjab	**206***	**206**	**100**	**-**
Sindh	**141**	**120**	**85**	**21 (Thar North)**
Khyber Pakhtunkhwa (KPK) & FATA	**102**	**91**	**89**	**6.6 (South Wazristan) 3.7 (Gaps)**
Balochistan	**347**	**347**	**100**	**-**
Gilgit-Baltistan (GB)	**73**	**73****	**100**	
Azad Kashmir (AJK)	**13**	**13**	**100**	
Total	**882**	**850**	**96**	
Source: Soil Survey of Pakistan, Lahore. 2010				

Land use Categories of Pakistan (000’ ha) Except Gilgit Baltistan

LAND USE TYPE	AREA	%AGE
1. Agriculture	21,733	27.3
2. Rangelands	25,475	32.0
3. Coniferous Forests	1,353	1.7
4. Irrigated Plantations	80	0.1
5. Scrub Forests	796	1.0
6. Riverain Forests	239	0.3
7. Wastelands including areas under Ice and Snow	28,501	35.8
8. Water Bodies (rivers only)	1,274	1.6
9. Others	159	0.2
TOTAL:	79,610	100.0

LAND CAPABILITY CLASSIFICATION

(Thousands hectares)

Class/ Sub-class	province						Pakistan	%
	Punjab	Sindh	KPK + FATA	Baloch-istan	GB	AJK		
I	3486.4	1105.3	187.3	598.9	2.4	-	5380.3	6.10
II	3679.2	2336.2	524.4	481	145.3	14	7180.1	8.14
III	2395.1	1498.8	665.8	315.4	77.2	200.9	5153.2	5.84
IV	1439.9	838.5	581.6	929.2	105.5	225.8	4120.5	4.67
V	-	-	70.1	-	101.1	-	171.2	0.19
VI	261.8	8.3	827	84.6	114.6	306.6	1602.9	1.82
VII	4,610.6	2,454.2	2,603.8	9,294.7	869.4	20.9	19853.6	22.51
VIII	4159.7	3372.3	2974	22699.5	4364.1	510.4	38080	43.17
Total Classified	20032.7	11613.6	8434	34403.3	5779.6	1278.6	81541.9	92.45

The Soils of Pakistan identified and classified as :

Orders : 06 (Alfisol, Aridisol, Entisol, Inceptisol, Molisol, vertisol)

Suborder **:** 21.

great group **:** 38.

Sub group **:** 112.

Families **:** 353.

Soil Series : 894.

Area affected by Erosion
Water erosion:

Degree of erosion	Province (area in "000" hectares					Pakistan
	Punjab	Sindh	KPK+ FATA	Baluchistan	G.B	
Slight, (Sheet and Rill)	61.2	---	156.3	---	180.5	398.0
Moderate Sheet and Rill)	896.8	---	853.8	1805.0	25.8	3581.4
Severe (Rill, Gully & or steam bank)	588.1	58.9	1765.1	829.6	504.2	3745.9
Very sever (gully, pipe & pinnacle)	357.9	---	1517.0	---	1571.6	3446.5
Total	1904.0	58.9	4292.2	2634.6	2282.1	11171.8

Wind Erosion

DEGREE OF EROSION	PROVINCE (AREA IN "000" HECTARES					PAKISTAN
	PUNJAB	SINDH	KPK+ FATA	BALUCHISTAN	G.B	
Slight,	2251.4	295.0	13.1	36.0	----	2595.5
Moderate	279.1	70.2	3.8	143.6	---	496.7
Severe to very severe	1274.0	273.8	19.6	100.9	---	1668.3
Total	3804.5	639.0	36.5	280.5	---	4760.5

Soils affected by salinity and sodicity

DEGREE OF EROSION	PROVINCE (AREA IN "000" HECTARES					PAKISTAN
	PUNJAB	SINDH	KPK+ FATA	BALUCHISTAN	G.B	
Surface patchy						
Irrigated	472.4	118.1	5.20	3.0	---	598.7
Un irrigated	---	---	---	----	---	---
Gypsiferous Saline sodic						
Irrigated	152.1	743.4	---	76.6	---	972.1
Un irrigated	124.5	428.8	---	160.1	---	713.4
Porous saline sodic						
Irrigated	790.8	257.0	25.7	29.4	---	1102.9
Un irrigated	501.0	150.1	7.8	73.5	---	732.4
Dense saline sodic						
Irrigated	96.7	32.5	0.9	---	---	130.1
Un irrigated	530.0	379.7	8.9	159.5	---	1078.1
Total	2667.5	2109.6	48.5	502.1	---	5327.7

TRANSFER OF TECHNOLOGY:

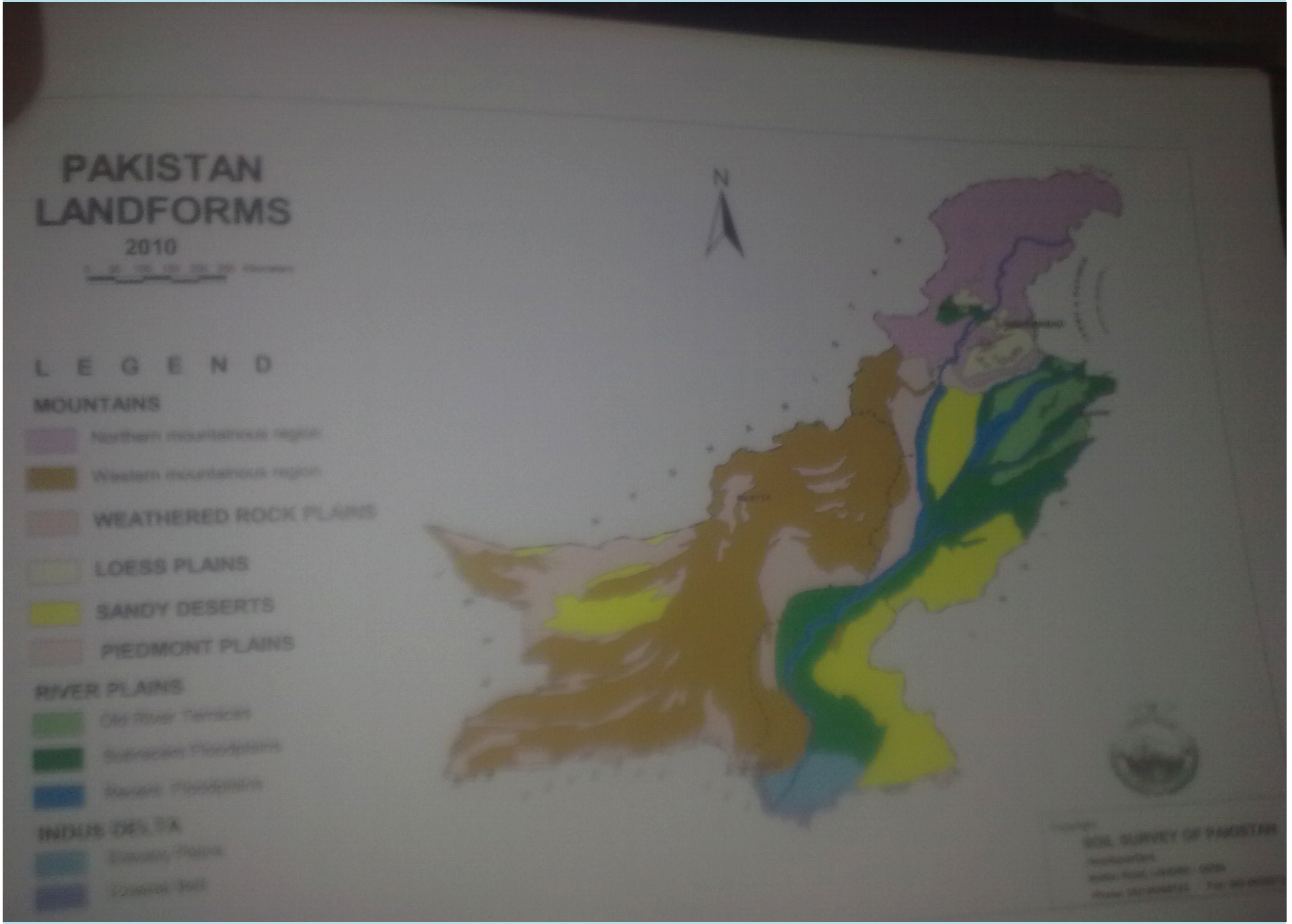
Through Trainings of 1000s of Extension Workers, Forest officers/ officials, Students, regarding, management of Soils, Selection of soil for specific crop, keeping in view the Soil Type, Climate, Limitation Factors, depth of Soil, Relief, Erosion, drainage / infiltration, aeration / pore spaces, water logging, Salinity / sodicity management, etc

UP DATION OF THE DATA AND DIGITIZATION: THE WORK WAS STARTED FROM 2003. THE WORK IS IN PROGRESS, THE DETAIL OF COMPLETED WORK IS GIVEN AS UNDER :

Updation of Land resource Inventory / Land Evaluation through field surveys. Of 126 Districts of Pakistan and prepare updated reports digitized, Land Form and soil map , present land Use, Land suitability, Land Capability, maps at District, Provincial and country level.

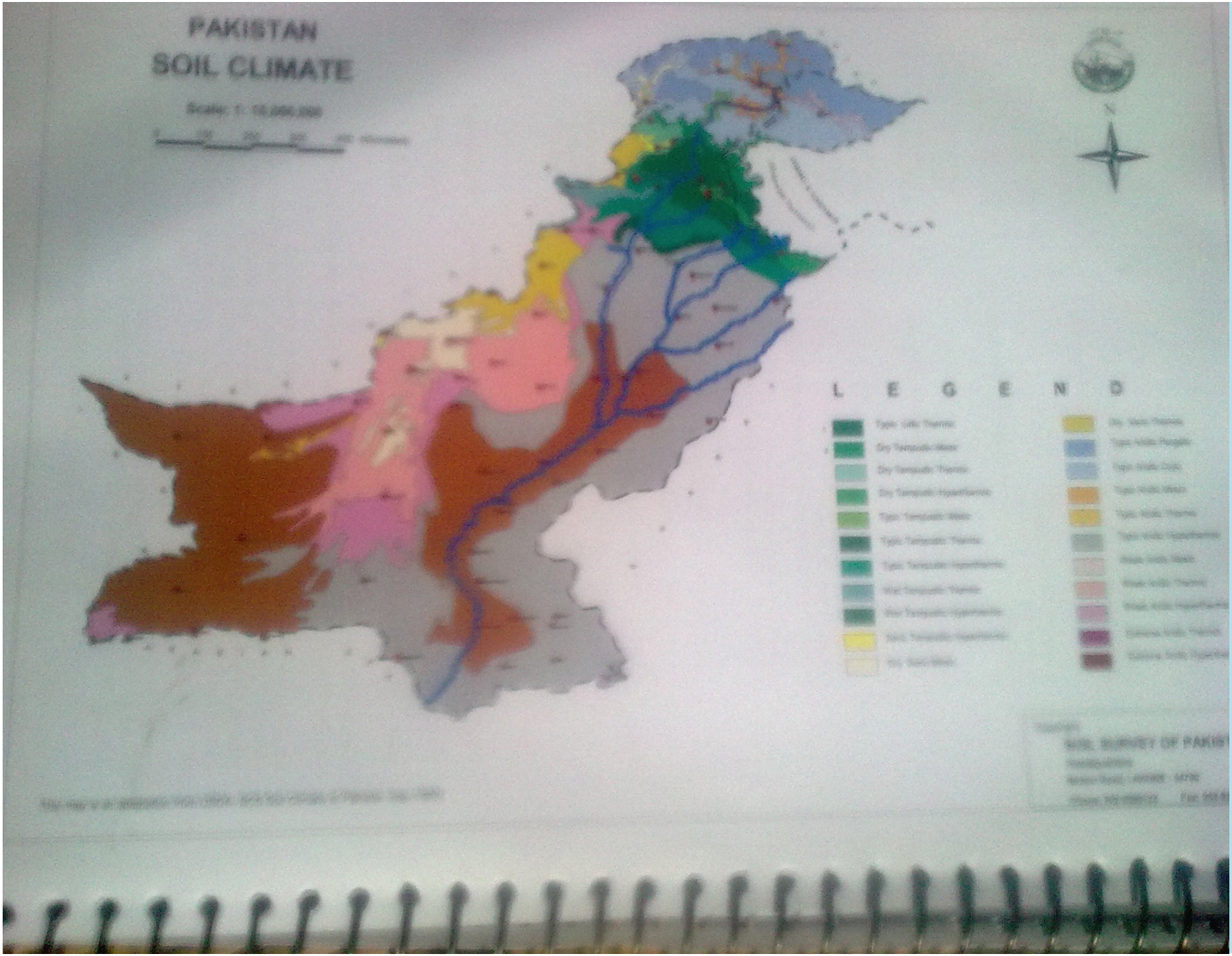
The six land forms are:

1. Mountains ; Northern and Western
2. Weathered rock plains.
3. Loess plains.
4. Sandy Deserts.
5. Piedmont plains.
6. River plains: Old river terraces, Sub-recent flood plains, and Recent flood plains.
7. Indus Delta

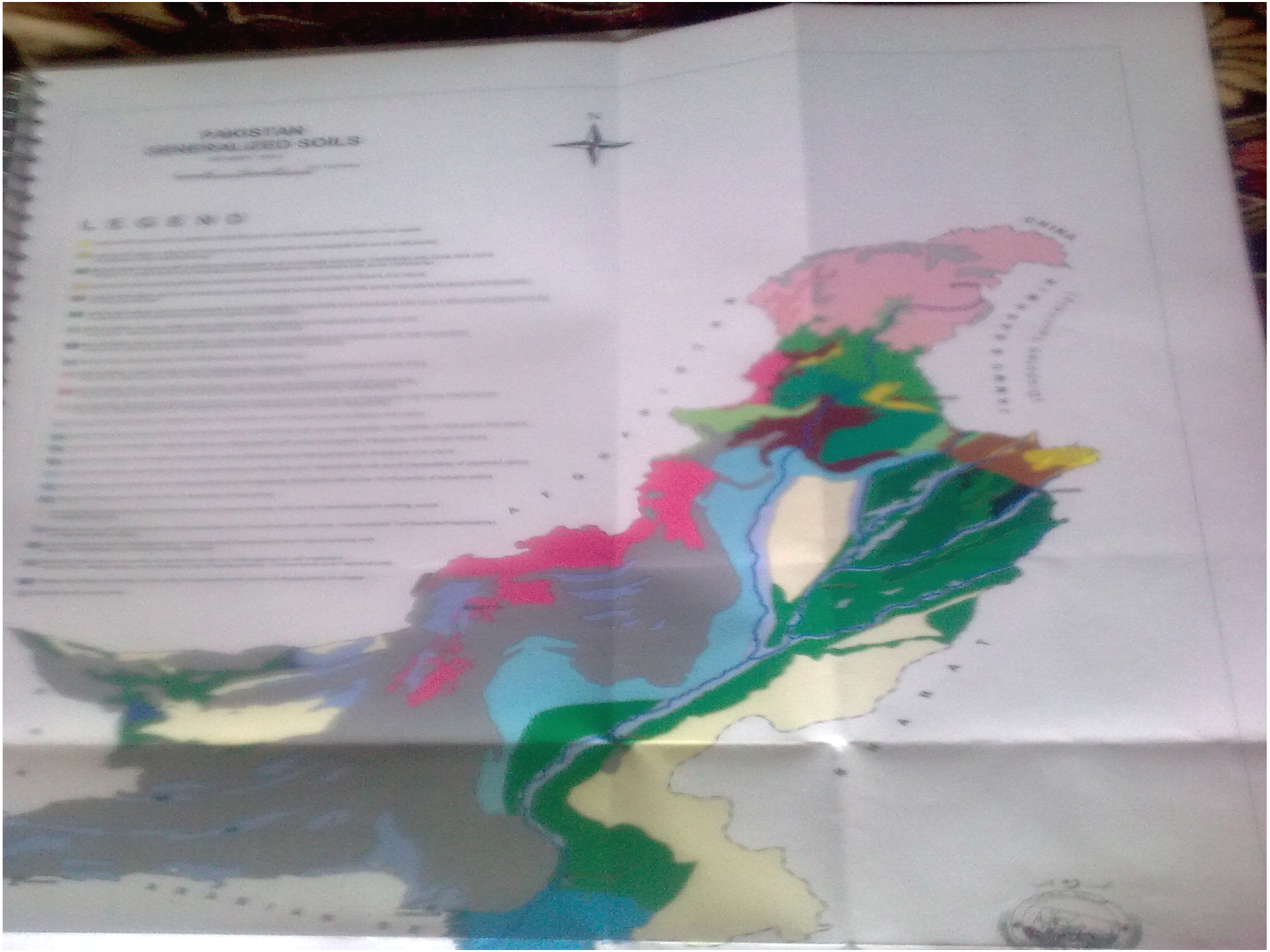

PAKISTAN
LANDFORMS
2010
N
L E G E N D
MOUNTAINS
Northern mountainous region
Western mountainous region
WEATHERED ROCK PLAINS
LOESS PLAINS
SANDY DESERTS
PIEDMONT PLAINS
RIVER PLAINS
Old River Terraces
Subrecent Floodplains
Recent Floodplains
INDUS DELTA
Estuary Plains
Coastal Belt

Soil Climate: a soil climate map of Pakistan has been produced on the basis of available meteorological data and field experience. In all 04 moisture regime and five soil temperature regimes have been recognized as defined in soil taxonomy. 22 soil climatic regimes resulting from grouping pertinent soil moisture and temperature regimes on accompanying map of Pakistan at 1:10,000,000 scale.

The geographic area delineation representing various soils climatic regimes have been based on a mathematical model (Newhall, 1972). The calculation s (Van Wambeke, 1985; SCS-USDA, 1990) are supplemented by our own field experience (Soil Survey staff-SSP, 1965 to 1994)


PAKISTAN
SOIL CLIMATE
L E G E N D

Up to date soil series identified are 894 but Generally the soils are categorized in 25 types of soils. The Generalized soil map at 1: 24,000 is given for soil complexes. The dissimilar components are not more than 25%.


PAKISTAN
GENERALIZED SOILS
LEGEND
CHINA

THE DISTRICT WISE UP-DATION AND DIGITIZATION

	To be covered	**Covered**
Total Districts	162	63
Punjab province	36	23
Other provinces	126	40

But unfortunately the organization is devolved to province of Punjab.Thus now the remaining Districts in Punjab will be covered. But this organization Will not continue work for other provinces. Still the provinces or Federal Government has not established any unit for this work.

In those District wise reports, 04 maps are prepared as,

Land forms and Soils, Present land use, Land Suitability, and Land Capability.

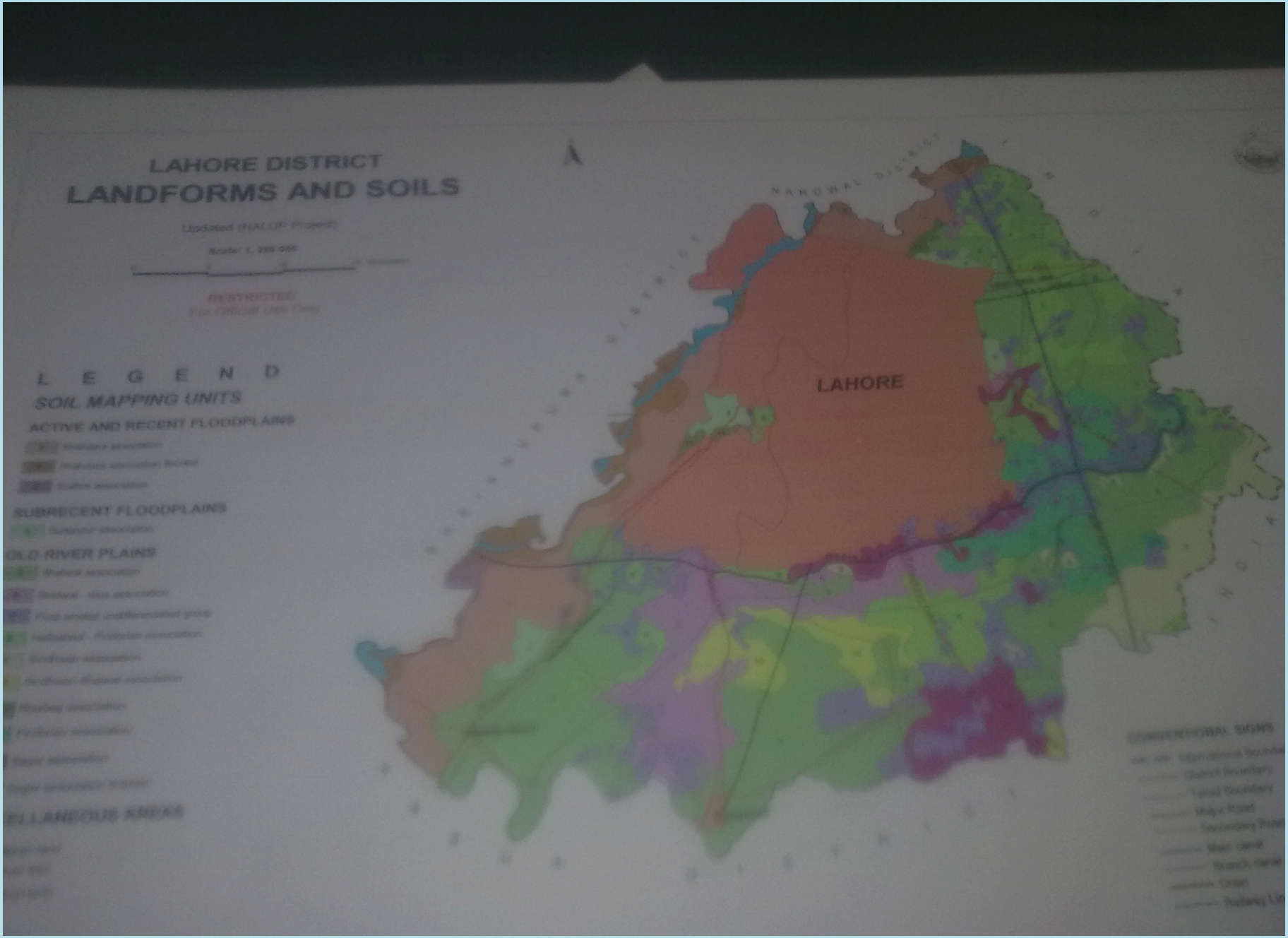
The reports covers and Describes:

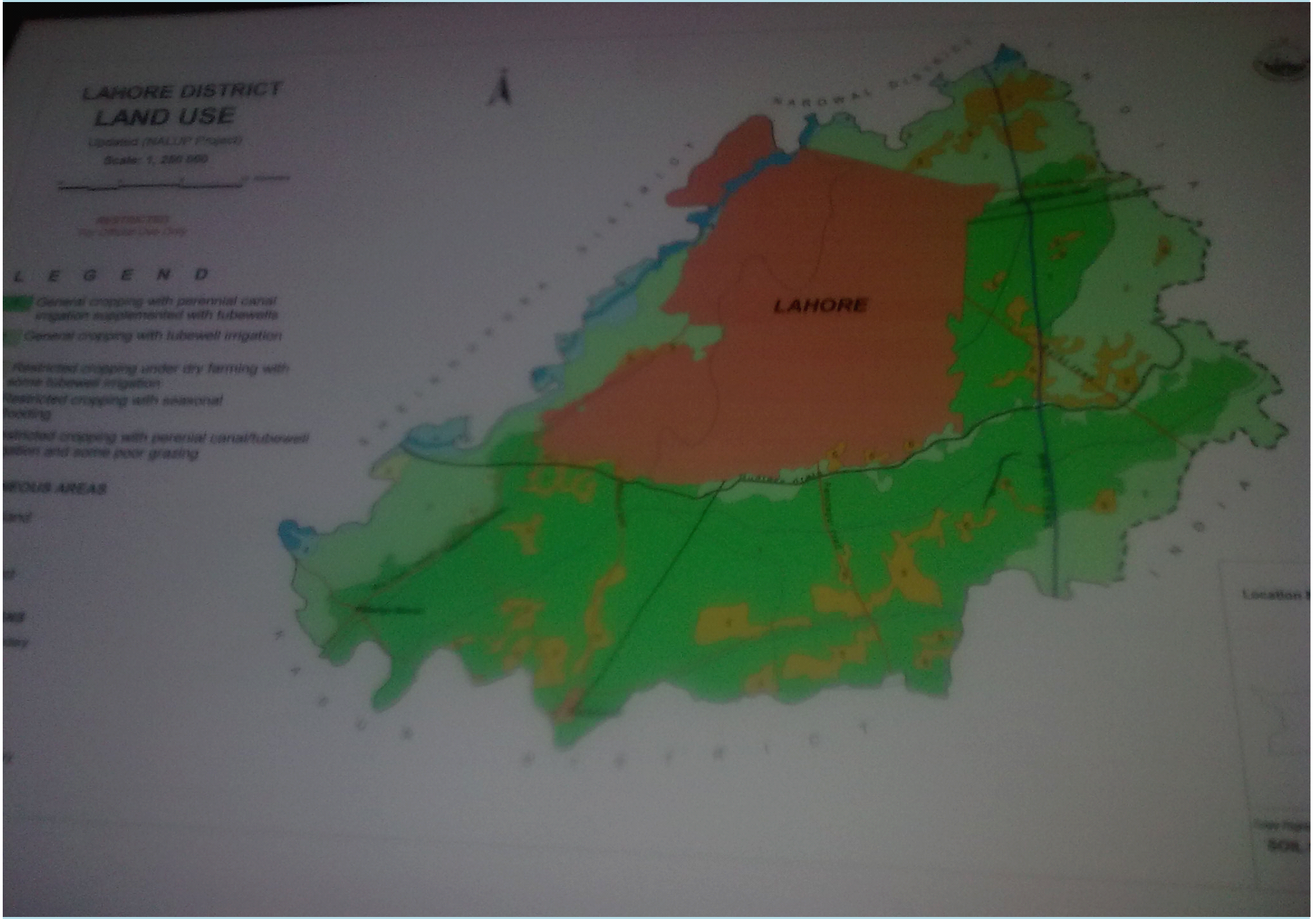
1.Introducion / general Nature of Soil.

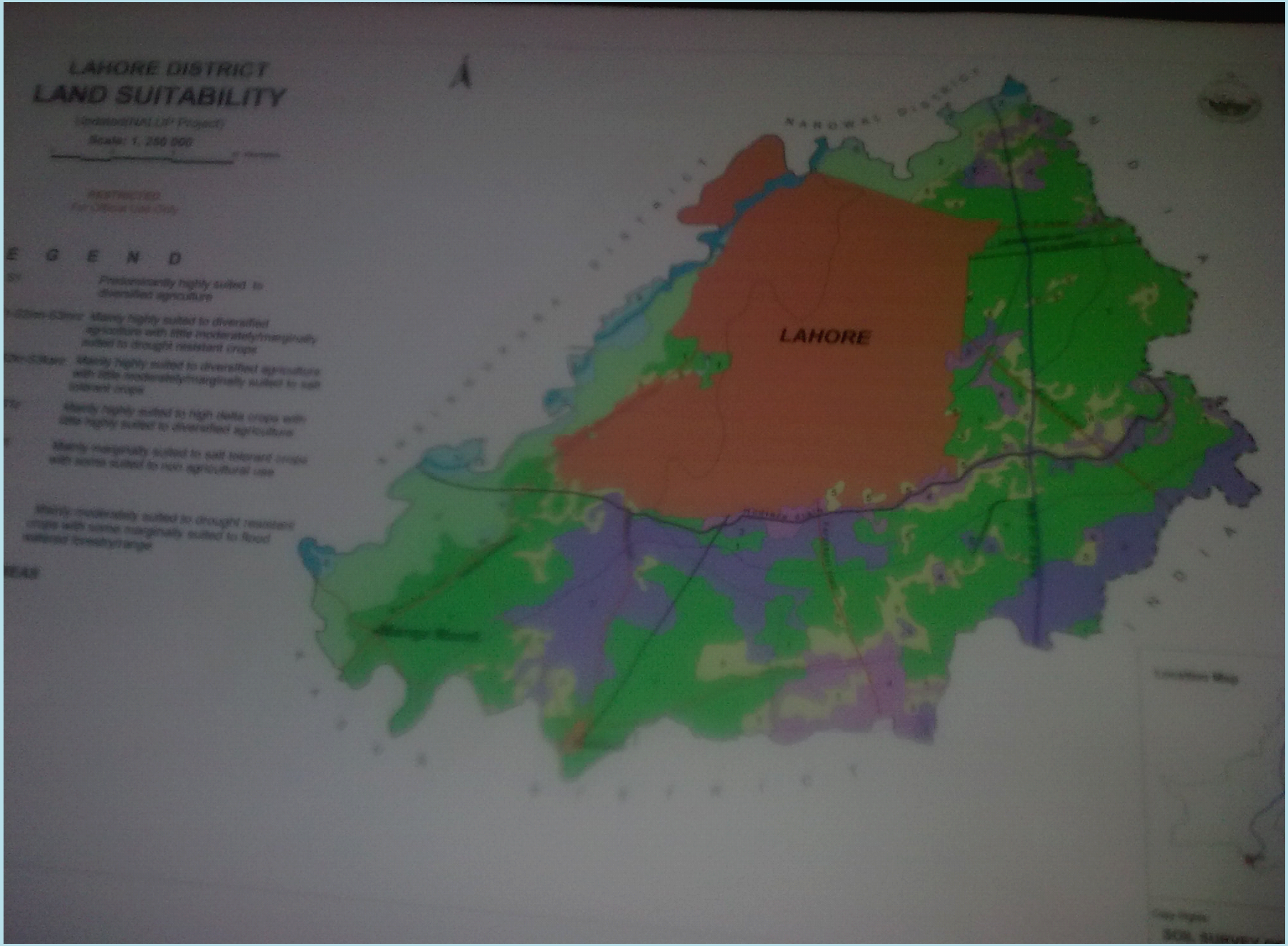
2. Present land use. 3. Land Suitability.

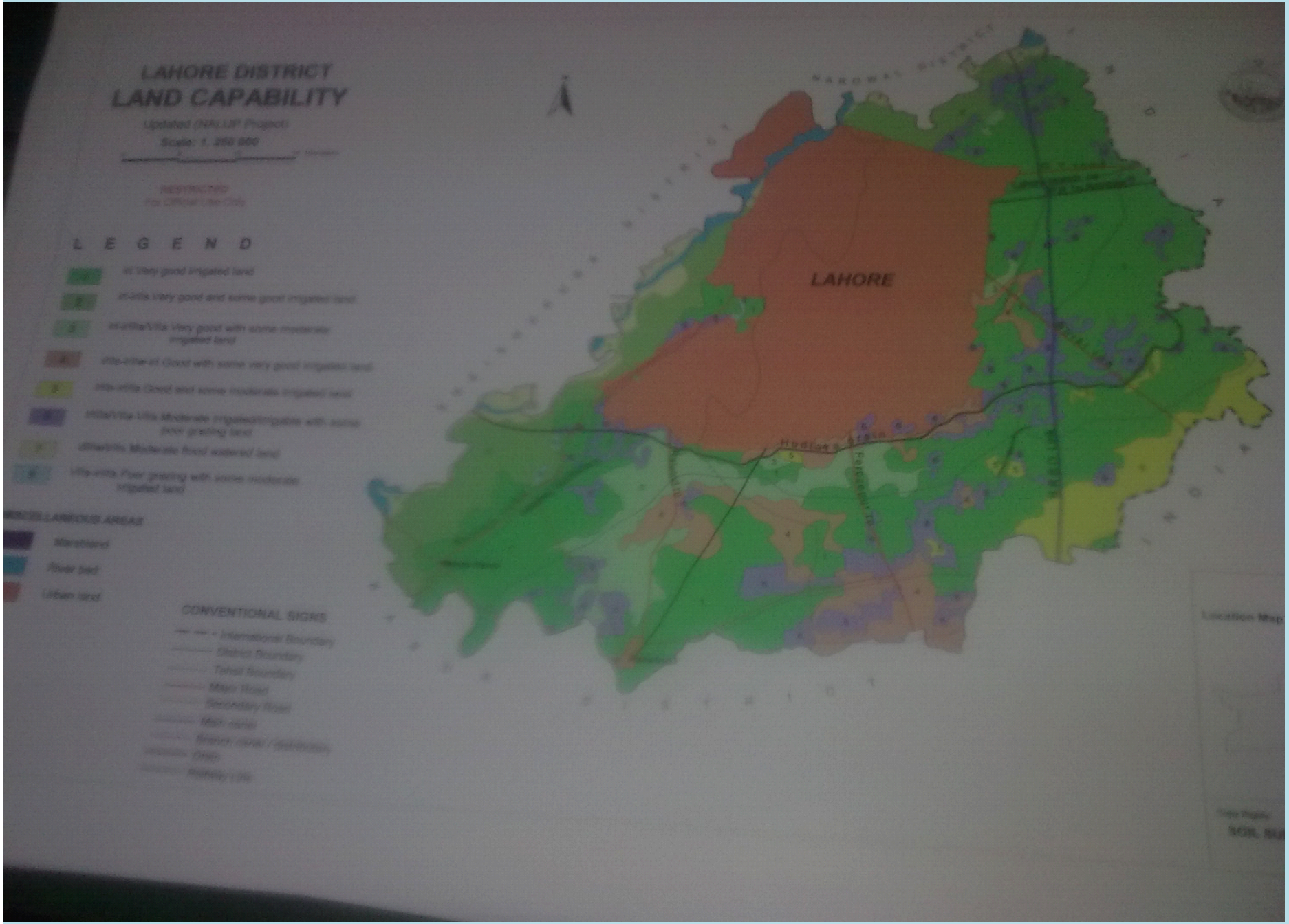
4. Land Capability. 5. Management Factors.

Maps are given for example:


LAHORE DISTRICT
LANDFORMS AND SOILS
Updated (NALUP Project)
RESTRICTED
For Official Use Only
L E G E N D
SOIL MAPPING UNITS
ACTIVE AND RECENT FLOODPLAINS
SUBRECENT FLOODPLAINS
OLD RIVER PLAINS
ELLANEOUS AREAS
LAHORE
NANKANA SAHIB
CONVENTIONAL SIGNS


LAHORE DISTRICT
LAND USE
Updated (NALUP Project)
Scale: 1, 250 000
L E G E N D
General cropping with perennial canal irrigation supplemented with tubewells
General cropping with tubewell irrigation
Restricted cropping under dry farming with some tubewell irrigation
Restricted cropping with seasonal flooding
Restricted cropping with perenial canal/tubewell irrigation and some poor grazing
LAHORE
NAROWAL DISTRICT


LAHORE DISTRICT
LAND SUITABILITY
LAHORE
NANDWAL DISTRICT


LAHORE DISTRICT
LAND CAPABILITY
LAHORE
L E G E N D
CONVENTIONAL SIGNS

Impact of Soil Survey reports, maps The scientific base for resource based land use planning to rationalize agriculture Land use and maximize agriculture production through adoption of appropriate management technology and systematic development / improvement of agriculture land resources. And optimum utilization of land use.

Impact **on some major Crops is given as under: No doubt there is contribution of other Research organizations along with soil Survey, identification of soil types and management practices suggested as per soil characteristics. The area and production is Increased. The detail of comparison is given in following Table.**

Crop	1987-88		2004-05	
	Area million ha.	Production million Tonnes	Area million ha.	Production Million Tonnes
Wheat	7.308	12.675	8.358	21.612
Cotton (Lint Prod. '000' bales* of 375 lbs each)	2.568	8.633	3.193	14.265
Sugar cane	0.842	33.029	0.966	47.244
Onion	0.055	0.633	0.128	1.765
Chillies	0.061	0.084	0.049	0.091
Pulses	1.222	0.556	1.492	0.871
Maize	0.854	1.127	0.982	2.797
Rapeseed and mustard	0.269	204.2	0.257	0.216
All Vegetables	0.192	2.518	0.239	3.048

Thanks

ORDER	NUMBERS		
	SUB ORDER	FAMILIES	SERIES
Alfisoils	2	17	43
Aridisol s	05	121	407
Entisols	04	89	181
inceptisol	03	94	195
Molisols	04	23	56
Vertisois	03	09	12
Total = 06	**21**	**353**	**894**

Land Capability Classification

Class/ Sub-class	Punjab	Sindh	KPK + FATA	Balochistan	GB	AJK	Pakistan	%
I	3486.4	1105.3	187.3	598.9	2.4	-	**5380.3**	**6.10**
II	3679.2	2336.2	524.4	481	145.3	14	**7180.1**	**8.14**
III	2395.1	1498.8	665.8	315.4	77.2	200.9	**5153.2**	**5.84**
IV	1439.9	838.5	581.6	929.2	105.5	225.8	**4120.5**	**4.67**
V	-	-	70.1	-	101.1	-	**171.2**	**0.19**
VI	261.8	8.3	827	84.6	114.6	306.6	**1602.9**	**1.82**
VII	4,610.6	2,454.2	2,603.8	9,294.7	869.4	20.9	**19853.6**	**22.51**
VIII	4159.7	3372.3	2974	22699.5	4364.1	510.4	**38080**	**43.17**
Sub-Total	**20032.7**	**11613.6**	**8434**	**34403.3**	**5779.6**	**1278.6**	**81541.9**	**92.45**
Unclassified	592.3	364.9	704.9	315.2	1517.3	51.3	**3545.9**	**4.02**
Grand Total	**20625**	**11979**	**9139**	**34719**	**7297**	**1330**	**85089**	**96.47**