LAND USE /LAND COVER MAPPING BY INTEGRATING REMOTE SENSING AND GEOGRAPHICAL INFORMATION TECHNIQUES

MAJID GHIASSI FAR

Senior expert on remote sensing

Abstract

Land is a primary natural resource which is required for various purposes like Agriculture ,Forestry ,Range land, Water resources ,Urbanization and many other development activities to satisfy human needs. Since human needs always show and up-ward trend because of increase in improvement in living standards ,so remote sensing data as a tool for planing activities can play an important rule due to rapid in time availability high resolution and low cost product. Remote sensing data in the form of satellite images can be used to study land use/ land cover, to wards preparation of thematic maps depicting various land resources and these maps as an reliable input can be put to a G.I.S. (geographical information system) is describe natural resources both renewable and non-renewable as well as cultural and human resource , the spatial distribution of such phenomena is shown graphically on maps ,chart or image alternatively the data may be in the form of list of variable that are grouped by location related places shown on maps the data typically appear as maps and images to describe such things as topography ,soil, vegetation, water boundaries etc.

This paper reports as practical application , digital analysis of land sat (TM) and IRS satellite data for extraction of land use/land cover maps of an area 11343 km2 including 4 quadrants of land sat images, the resolution of IRS imagery is about 23.4 meters with 3 bands , the different steps involved in this work could be explained as below.

1- Defining a comprehensive legend according to the scale of TM,IRS images.

2- Field checking and necessary modification of the primary maps applying the auxiliary data and extant maps to promote the formation depicted on the land use /cover maps.

3- Measurement of land unit surface by applying geographical information system (GIS) facilities to accomplish the work .the total of 4 TM images have been interpreted is 11 sheet with the size of 50 by 70 cm and geographic coordinate of 30 by 30 minutes were produced. Figure 1,

INTERODUCTION

Indian remote sensing satellite I R S_1C has been lunch in 1996, and has provided excellent imageries in different parts of the world, the IRS-1C in characterized by three sensors which have enhanced the service capabilities from IRS satellite to a large extent. It has one panchromatic (PAN) sensor at resolution 5.8 m the linear imaging self scanner (LISS-III) provides management application in the green ,red and near infrared bands, resolution 23.4 m this data has been used for forest mapping crop estimation, land use/land cover mapping, the IRS data Provide the vantage point and coverage necessary to studying our planed as an integrated interactive physical and biological system IRS data is of vast use in many areas of natural resources management such as mapping and management of both renewable and non-renewable resources environmental change detection and monitoring ,G.I.S application on the other hand TM data from land sat satellite has been utilized in this project to recognized and defined land use in various way QOM province Figure 2.

AREA:

With an area of about 11343 km2 lies between 50,30 and 51,30 and 34,15 and 35,15 and in north part of Iran. it include 4city Ashtai. ,Qom, jafarabad ,kahak

METHODOLOGY:

Considering the scale of the IRS .satellite data 23.4 m in of jun,1998 and thematic mapped (TM) at 1994, 1993 at the average of 1:100,000 scale were applied . the total image was 4 quadrants which covers the QOM province for visual interpretation analysis as reflected through the image characteristics, during the month of July when the data were scanned most of the agriculture area were harvested or some part were not devoid of agriculture, consequently the radiant energy which produced the spectral signature mostly for the harvested surface ,with communicated a better and use-full-idea to the interpreted that the various image characteristics recorded on the imagery were mainly due to the variation of agriculture area and soil color and moisture with the color of exposed stone, and rocks bare surface in the visual interpretation of satellite images, salty land were differentiated as a main land use class and subdivide into subclasses corresponding to different densities and utilized land sat image TM, to compared to each others, all these interpretation units were correlated and joint with available digital data in the QOM province. The land use/land cover collection of ground truth for compassed interpretation unite of digital .IRS data for land use/land cover the repeated ground controls were again carried out where necessary, and after the completion of the interpretation of each quadrant of the images and the appropriate correction were again made, in some areas the Global positioning system (GPS) were used to correctly locate area ground samples also apply of G I S facilities system for completion of the in ARC/INFO system Figure. 3,7

GEOGRAPHICL INFORMATION SYSTEM (G.I .S)_

A geographic information system is a tool used to analyze the spatial properties and potential relationships of tools for mapping and analyzing thing that occur in space and time.
The analysis of G .I .S is not a new concept ,individuals with extensive training in mathematics geography , cartography and other related disciplines have been creating maps and analyzing spatial relationships for centuries ,such analyses can be considered a form of analog G. I .S since manual methods were employed using hardcopy maps and transparencies as overlays , analysis storage and retrieval with the geography analysis and visualization capabilities of maps this unique type of information systems is a valuable tool for explaining events predicting out comes, and planning strategies Geographic information systems have been used in fields as diverse as environmental management, urban and regional planing , retail -site selection agriculture ,forest which have been used in QOM province area .Figure 4.5.6

MATERIAL:

This project was performed utilized in the preparation of land use/land cover maps of Qom province area.

AREA:

1:50000 and 1:250000 scale topographic maps
1:250000 scale land capability maps produced by the water and soil research institute.
1:250000 scale range land maps produced by plan and budget organization.

SENSOR	DATE	PIXEL	SCALE
Land sat TM image	JUNE 1990,1991 1994,1993	30X30	100,000
IRS	1998	23.4 m	100,000

IRS WAVELENGHT		DESIGNATION
C.C.T MULTISPECTRAL	JUNE 1	0.52-0.59
	2	0.62-0.68
	3	0.77-0.86
PAN	1	0. 5 -0.75

SPECTRAL BANDS OF THE SENSOR

IMAGE PROCESSING AND CLASSIFICATION:

Digital image processing is the numerical manipulation enhancement and classification ,preprocessing refers to the initial processing of the raw data to calibrate the image radiometry ,correct ,geometric

distortion and remove noise the nature of the particular preprocessing required obviously depends strongly on the sensor characteristics ,because the preprocessing is designed to remove any undesirable Image characteristics produced by the sensor, the corrected image are then submitted to enhancement or classification processing , image enhancement produces a new enhanced image that is display on a(CRT) for classification, this enhance image may be easier to classify than the original image in different way.

SUPERVISED CLASSIFICATION:

Supervised classification is much more accurate for mapping classes, but depends heavily on the recognition and skills of the image specialist. There is a simple ,specialist must recognize conventional classes, real and familiar, or meaningful ,but some what artificial classes, in a scene from prior knowledge , such as personal experience with the region, by experience with thematic maps or IRS or by on-site visits . This familiarity allow the specialist to choose and set up discrete classes (thus supervising the selection) and the assign them category names the specialists also locate training site on the image to identify the classes. Training sites are area representing each known land cover category that appear correctly homogeneous on the image as determined by similarity in tone or color within shapes delineating the category .specialists locate and tracing them with polygonal boundaries drawn using the computer mouse on the image display ,for each class thus outline ,mean values and variances of the for each band used to classify them are calculated from all the pixels enclosed in the site , more than one polygon can be established for any class, the result is a spectral signature or spectral response curve for that class, in reality the spectral signature is for all of the materials within the site that interact with the incoming radiation ,classification now proceeds by statistical processing in which every pixel is compared with the various signatures and assigned to the class whose signature comes closest ,a few pixels in a scene do not match and remain unclassified, because these may belong to a class not recognized or defined.

Table.1 AREA ASSEMENT OF LANDUSE AND LANDCOVER CLASSIFICATION LANDSAT DATA

Numbers	Names of areas	Cod	Measuromen of areas in ha	Percentage of areas
1	Agriculture area Without limitation With limitation	I1+I2	106125	9.32
2	Dry farming	DF	6057	0.53
3	Range land	B+R1+R2+R3	626734	55.24
4	Mix agric area and orchard and agric and orchard	OI+IO	5957	0 .52
5	Orchards	O	10415	0.91
6	Water bodies	L1+L2	67425	5.94
7	Salty areas	SL 1+SL2	203547	17.94
8	Outcrop	OC	52836	4.65
9	Urban area	U+U2	3158	0 .27
10	Constraction area	U1	4079	0.35
11	Mix range land and dry farming	RD	13383	1.17
12	Reed bad	RB	3874	3.41
	Total areas		1134395.352	100/.

CONCLUSION

The satellite remote sensing data process the advantage of high speed and low cost in the Macroscopic inventory and monitoring of agriculture, forest and other renewable natural resources on large area its accuracy could also satisfy the requirement of production and thus they have a great application potential .

The integration and cooperation of inventory of various natural resources may helps to improve

mapping quality and to raise mapping precision and thus the inventory cost could be reduced in a wide margin, this is the development direction of resources inventory.
The interpretation of remote sensing image processing system GI.S and resources analysis and prediction system would benefit the realization of automation of resources management and monitoring and it is the direction of remote sensing development for mapping.

Reference

Sabins,J.I.1997 remote sensing, principles and interpretation .second edition W.H. Free man and co.Newyork,USA
Mather,P.M. 1987 computer processing of remote sensing, an introduction. Willy and sons.U K
ABKAR,A.1994 Knowledge-based classification method for crop inventory using high resolution data QOMPROVINCE

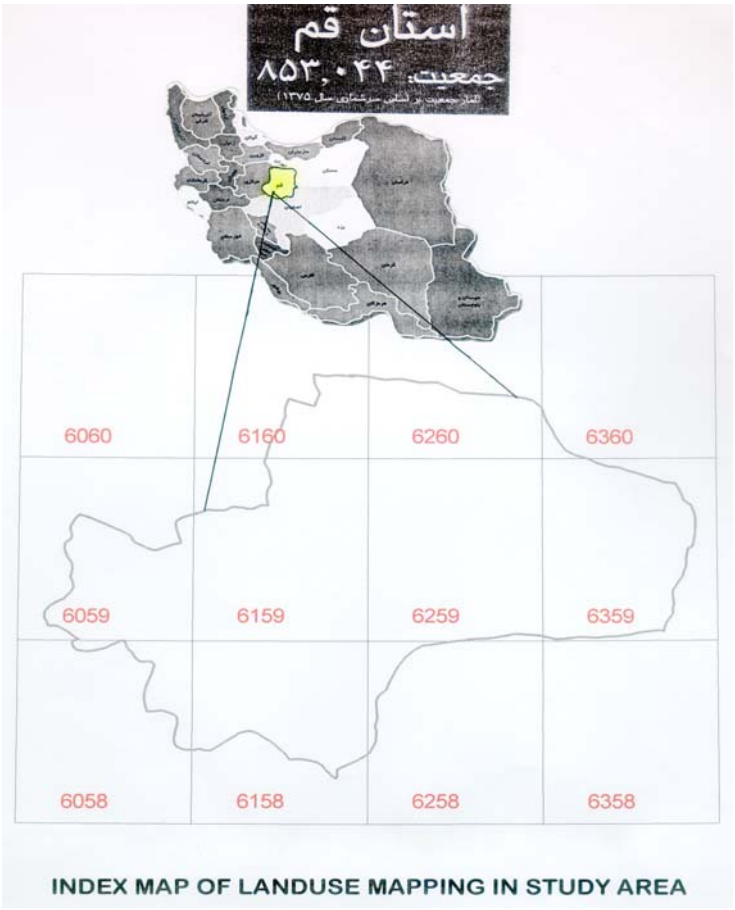
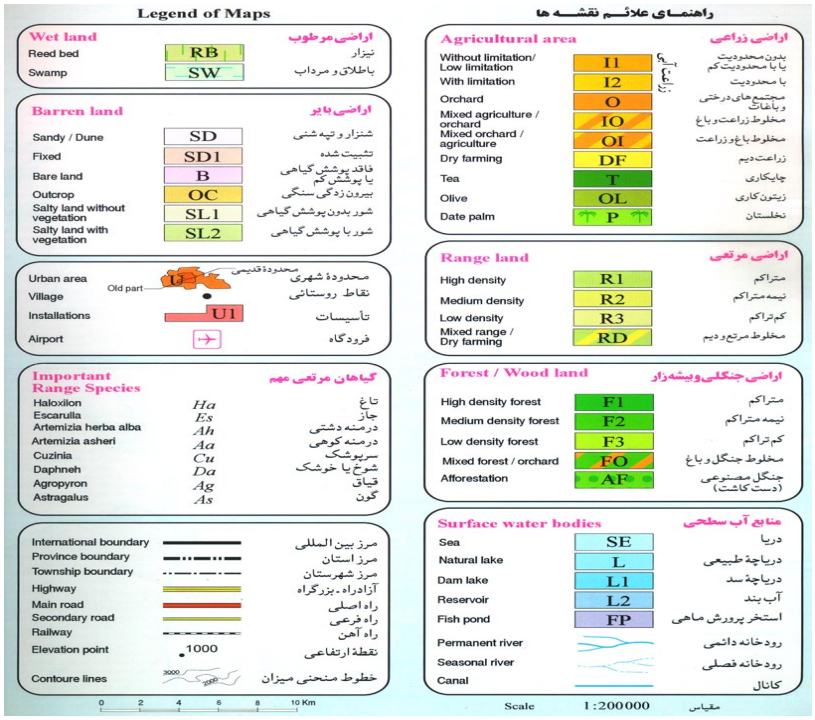


Figure 1.


Legend of Maps
راهنمای علائم نقشه ها
Wet land
اراضی مرطوب
Reed bed
RB
نیزار
Swamp
SW
باطلاق و مرداب
Barren land
اراضی بایر
Sandy / Dune
SD
شنزار و تپه شنی
Fixed
SD1
تثبیت شده
Bare land
B
فاقد پوشش گیاهی یا پوشش کم
Outcrop
OC
بیرون زدگی سنگی
Salty land without vegetation
SL1
شور بدون پوشش گیاهی
Salty land with vegetation
SL2
شور با پوشش گیاهی
Urban area
محدودهٔ شهری
Old part
محدودهٔ قدیمی
Village
نقاط روستائی
Installations
U1
تأسیسات
Airport
فرودگاه
Important Range Species
گیاهان مرتعی مهم
Haloxilon
Ha
تاغ
Escarulla
Es
جاز
Artemizia herba alba
Ah
درمنه دشتی
Artemizia asheri
Aa
درمنه کوهی
Cuzinia
Cu
سرپوشک
Daphneh
Da
شوخ یا خوشک
Agropyron
Ag
قیاق
Astragalus
As
گون
International boundary
مرز بین المللی
Province boundary
مرز استان
Township boundary
مرز شهرستان
Highway
آزادراه - بزرگراه
Main road
راه اصلی
Secondary road
راه فرعی
Railway
راه آهن
Elevation point
1000
نقطهٔ ارتفاعی
Contoure lines
خطوط منحنی میزان
0 2 4 6 8 10 Km
Agricultural area
اراضی زراعی
Without limitation/ Low limitation
I1
بدون محدودیت یا با محدودیت کم
With limitation
I2
با محدودیت
Orchard
O
مجتمع‌های درختی و باغات
Mixed agriculture / orchard
IO
مخلوط زراعت و باغ
Mixed orchard / agriculture
OI
مخلوط باغ و زراعت
Dry farming
DF
زراعت دیم
Tea
T
چایکاری
Olive
OL
زیتون کاری
Date palm
P
نخلستان
Range land
اراضی مرتعی
High density
R1
متراکم
Medium density
R2
نیمه متراکم
Low density
R3
کم تراکم
Mixed range / Dry farming
RD
مخلوط مرتع و دیم
Forest / Wood land
اراضی جنگلی و بیشه زار
High density forest
F1
متراکم
Medium density forest
F2
نیمه متراکم
Low density forest
F3
کم تراکم
Mixed forest / orchard
FO
مخلوط جنگل و باغ
Afforestation
AF
جنگل مصنوعی (دست کاشت)
Surface water bodies
منابع آب سطحی
Sea
SE
دریا
Natural lake
L
دریاچهٔ طبیعی
Dam lake
L1
دریاچهٔ سد
Reservoir
L2
آب بند
Fish pond
FP
استخر پرورش ماهی
Permanent river
رودخانه دائمی
Seasonal river
رودخانه فصلی
Canal
کانال
Scale 1:200000
مقیاس

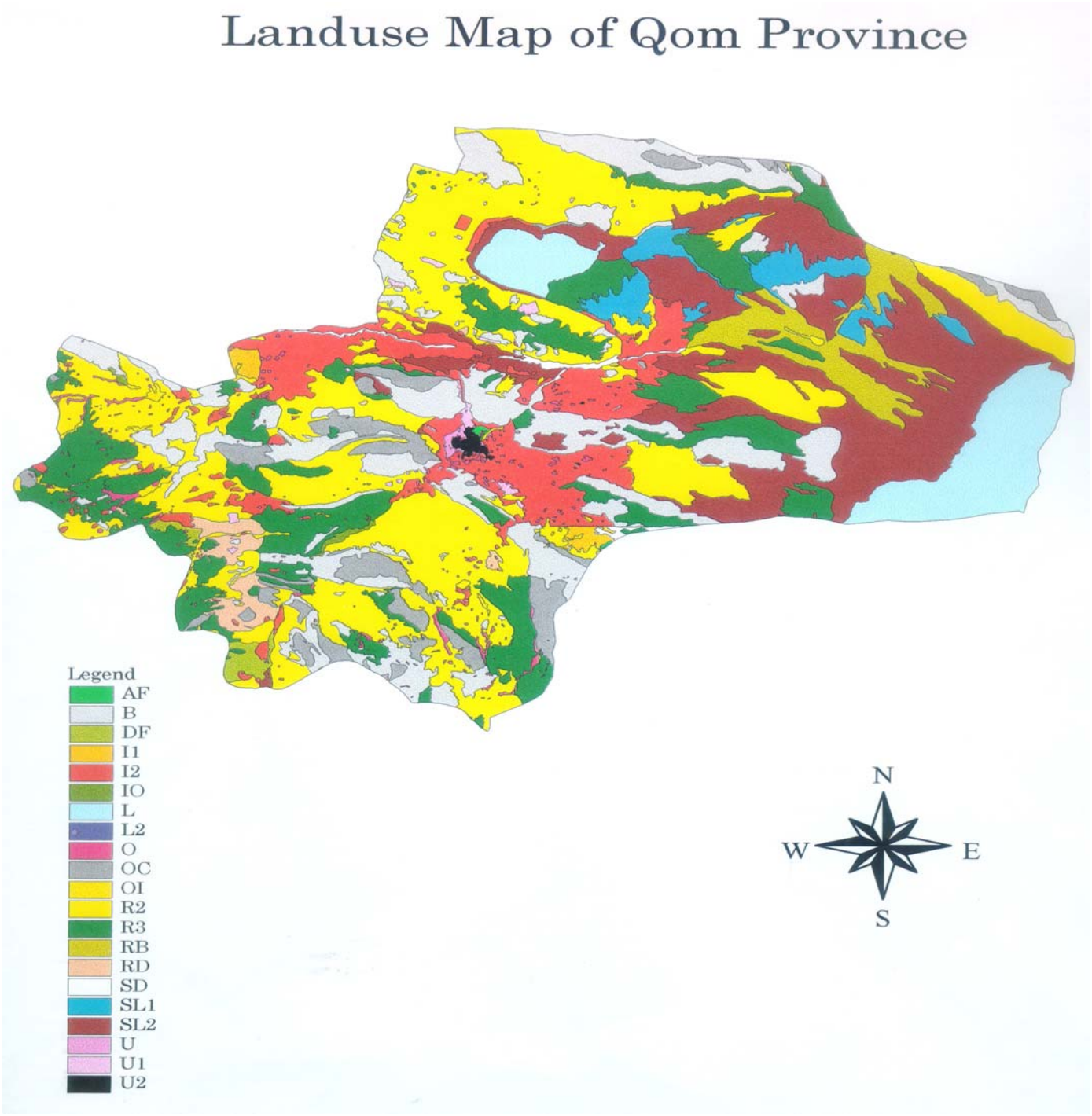

Landuse Map of Qom Province
Legend
AF
B
DF
I1
I2
IO
L
L2
O
OC
OI
R2
R3
RB
RD
SD
SL1
SL2
U
U1
U2
N
W
E
S

Figure 2.

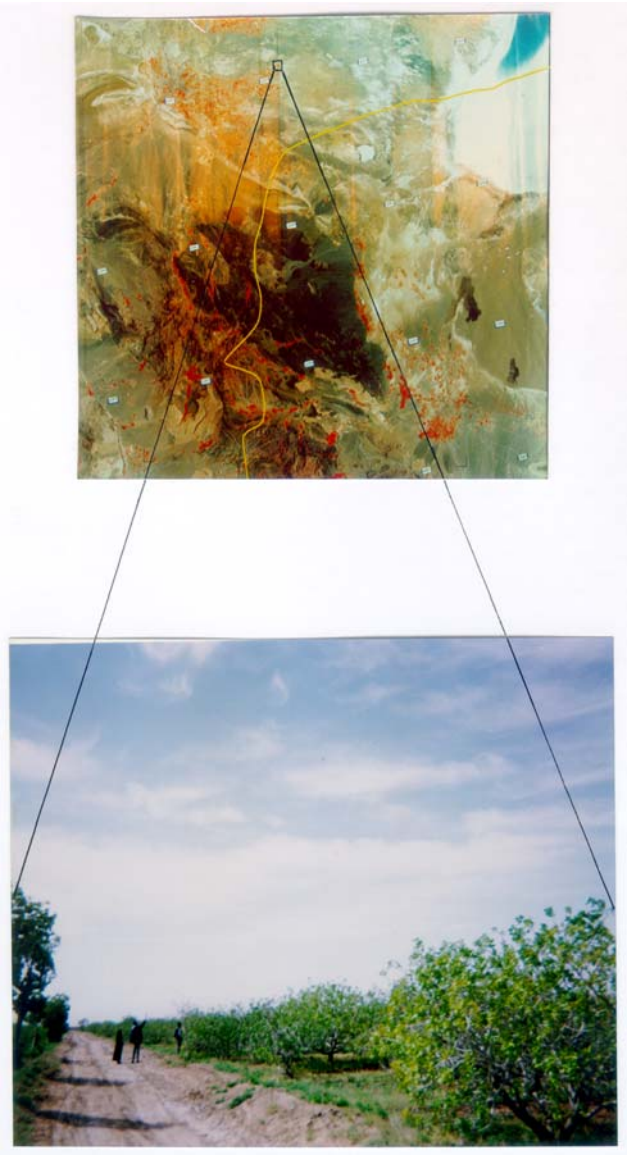
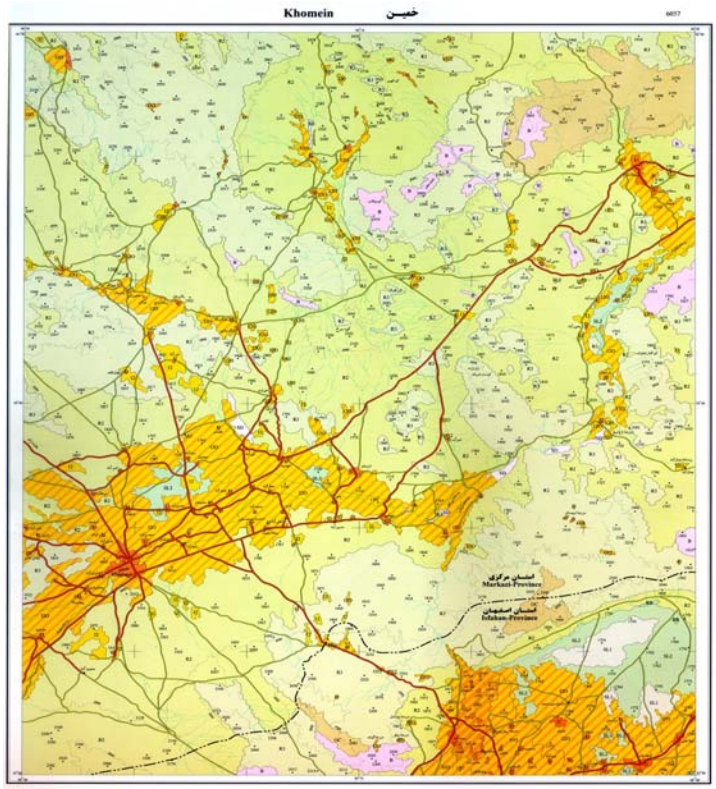


Figure 3.ground truth by GPS

Figure 4. Land use/land cover map of khomein Scale1:100000.



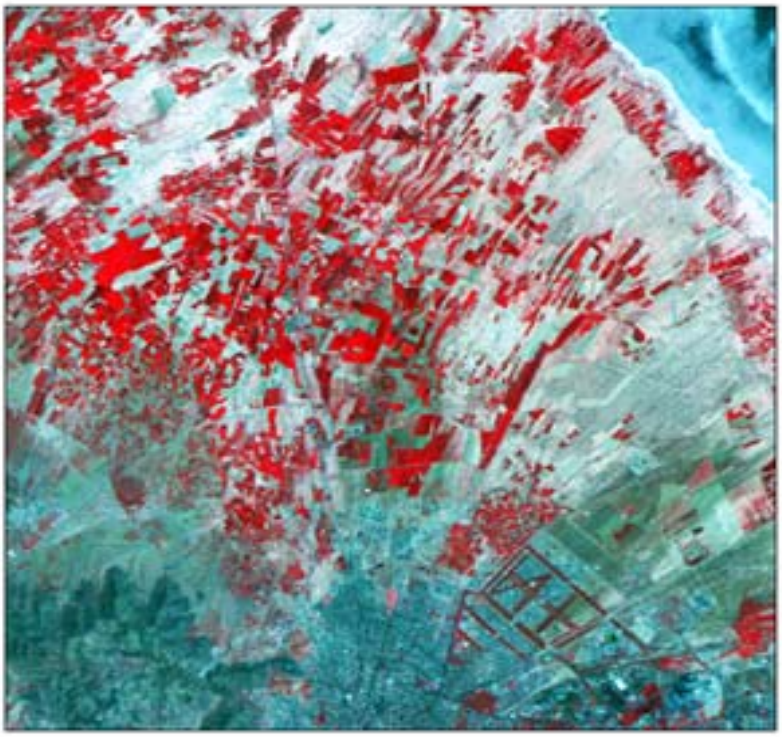
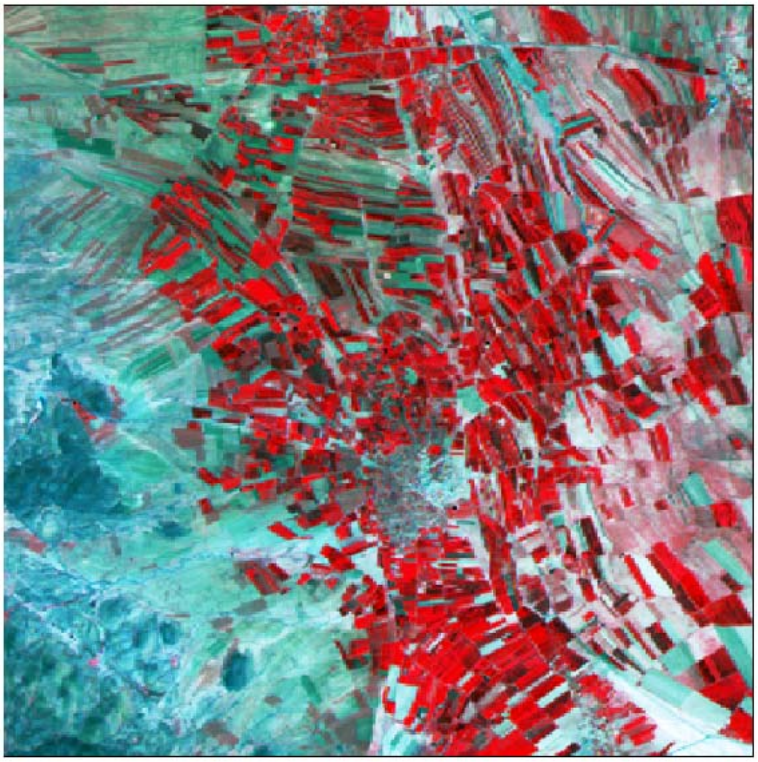


Figure 5,6 area with limitation and without limitation



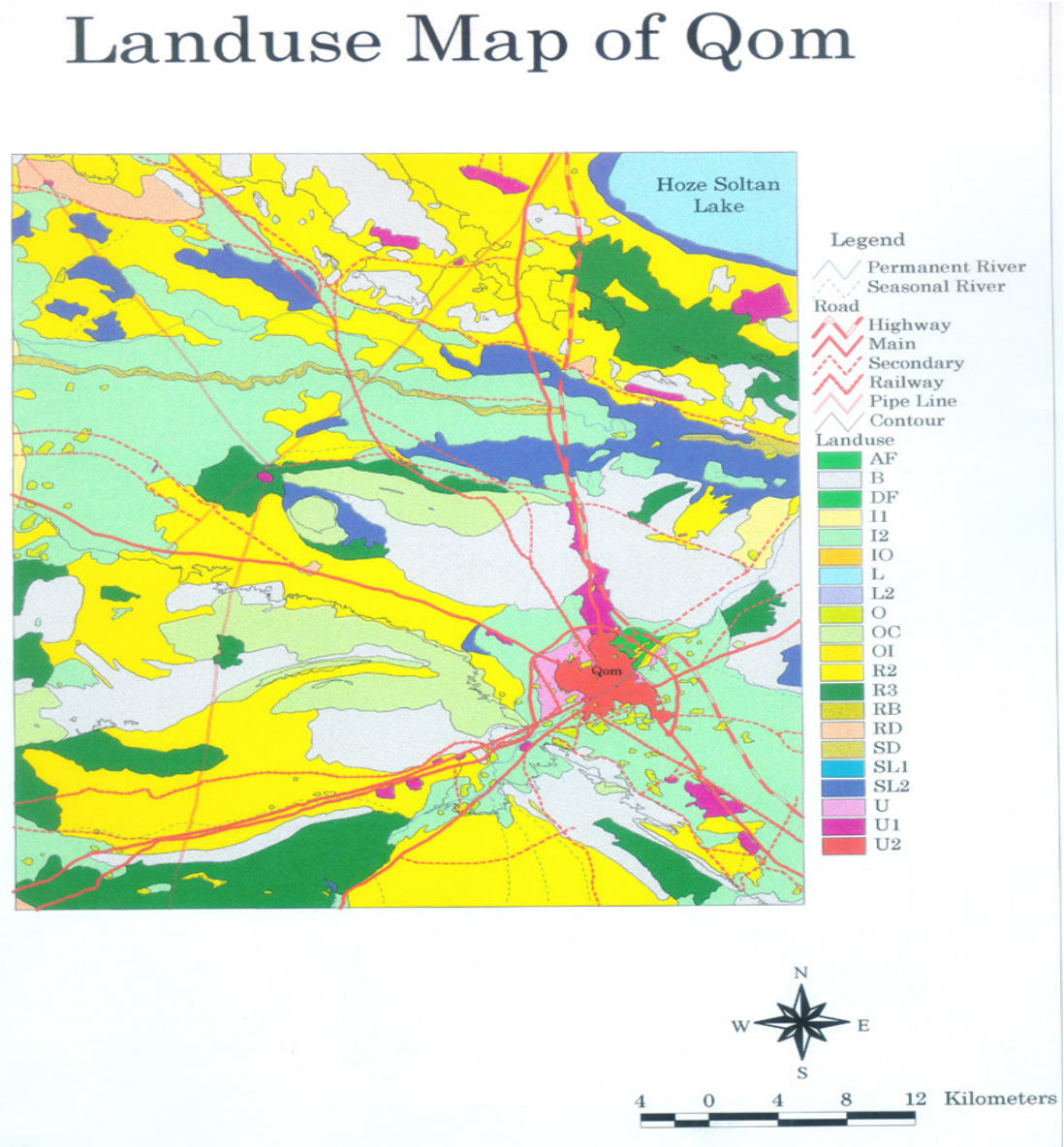


Figure 7.

Majid Ghiassi far
Agricultural Statistics & Information
Dept. (A.S.I.D).
Ministry of Agriculture, Tehran Iran.
Tel: 0098 21 612 2104
Fax: 0098 21 650 377.
Email: ghiassi@asid.moa.or.ir