



2015

Mapping and Estimating Vegetation Coverage in Iraqi Kurdistan Region using Remote Sensing and GIS



Applied Remote Sensing & GIS Center

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MAPPING AND ESTIMATING VEGETATION COVERAGE IN IRAQI KURDISTAN REGIONN

Abstract

Planning and land management are the important and priority responsibilities and tasks of the governmental sectors. Vegetation coverage is one of the important land cover types in Iraqi Kurdistan region that its management rests with the Ministry of Agriculture and Water Resources. Further, the Ministry ability to complete these tasks (management and planning) is hampered by the paucity of comprehensive information on the vegetation coverage with its ratio and distribution. The aim of this project was to estimate and map vegetation coverage in Iraqi Kurdistan Region (Erbil, Sulaymaniyah, Garmian, Halabja and Duhok) using remote sensing and GIS techniques. This is one of the main objectives of the General Directorate (G.D.) of Horticulture, Forestry and Rangeland at the Ministry of Agriculture and Water Resources that will enable G. D. to have comprehensive overview of the vegetation coverage statues within Kurdistan region-Iraq. Due to that, the G.D. of Horticulture, Forestry and Rangeland takes this task under its responsibility to supervising and implementing this project. It has been achieved by Applied Remote Sensing & GIS (ARS&GIS) Center at the University of Zakho, cooperation with the specialized persons from Salahaddin University, University of Garmian, and Directorate of Forests and Range in Duhok.

It is worthy to mention that this approach was achieved for two different areas of Kurdistan Region within two different years and two different datasets. In 2014, the project of vegetation coverage of Duhok Governorate was carried out with Landsat OLI images. While in 2015, the vegetation coverage project was implemented for Erbil, Sulaymaniyah, Halabja and Garmian together with RapidEye images. Therefore, the presented results within this document at some part separately reported as two projects.

The results showed that the ratio of the vegetation area is about 12.44% of the total area of Kurdistan Region from which 9.05% of Erbil, 9.1% of Suliamaniyah, 10.04% of Halabja, 4.4% of Garmian, and 27.58% of Duhok. The maximum coverage of the vegetation exists in the north and east of the study area. Moreover, the ratio of vegetation coverage is also reported based on the elevation but only for Erbil, Sulaymaniyah and Garmian. This is due to the required objectives of the implemented project in 2015. The maximum coverage of the vegetation is shown between the 500 - 1500 m above the mean sea level. In addition, the vegetation coverage area over districts of the study area is obtained. For the carried out project in 2014, the maximum vegetation coverage is found in Amedi, and the minimum vegetation coverage is depicted in Bardarash. Meanwhile, the maximum and minimum vegetation coverage of the implemented project in 2015, found in Mergasur, and in Khanaqin, respectively. Such a project needs to be conducted at least every ten years in order to have comprehensive information of the vegetation coverage with its distribution that enable the Ministry of Agriculture and Water Resources to have good management and planning programs.

LIST OF TABLES

Table 1: Administrative team	12
Table 2: Technical team	12
Table 3: Fieldwork Team.....	13
Table 4: Specification of RapidEye image	20
Table 5: Specification of Landsat image	21
Table 6: Vegetation coverage area based on elevation for the second part of the study area.	32
Table 7: Vegetation coverage distribution over all districts of the study area.....	41
Table 8: Artificial forest projects in Erbil.	72
Table 9: Artificial forest projects in Sulaymaniyah.	75
Table 10: Artificial forest projects in Garmian.....	79
Table 11: Artificial forest projects in Halabja.....	81
Table 12: Artificial forest projects in Duhok.	83
Table 13: Arficial forest in Erbil, Sulaimany, Dohuk, Halabja and Garmian Administration	92
Table 14: Artificial forest projects in Erbil with their geographical location of each individual projects.	99
Table 15: Artificial forest projects in Sulaymaniyah with their geographical location of each individual projects.	103
Table 16: Artificial forest projects in Garmian with their geographical location of each individual projects. ...	109
Table 17: Artificial forest projects in Halabja with their geographical location of each individual projects.	110
Table 18: Artificial forest projects in Duhok with their geographical location of each individual projects.	112
Table 19: Area of artificial forest for Erbil directorate	125
Table 20: Area of artificial forest for Sulaimany directorate.	129
Table 21: Area of artificial forest for Dohuk directorate	134
Table 22: Area of artificial forest for Halabja directorate.....	141

LIST OF FIGURES

Figure 1: (a) Map of Iraq with the Kurdistan Region, (b) The first part of the study area (Duhok).	15
Figure 2: (a) Map of Iraq with the Kurdistan Region, (b) The second part of the study area: Erbil, Sulaymaniyah and Garmian.	16
Figure 3: Digital Elevation Model (DEM) image of the study area with 30 m resolution retrieved from (ASTER-GDEM, 2013).....	17
Figure 4: The selected area (blue color) by the MA&WR for the study area, with the real area (green color) of the study area.....	19
Figure 5: RapidEye image of the ordered study area (second part of the study area) displayed in color composite view with Landsat image of the missing parts.	22
Figure 6: Landsat image of the first part of the study area (Duhok) displayed in color composite view.	23
Figure 7: A work flow sketch showing the step-by-step to the used approach.	25
Figure 8: Vegetation coverage with its ratio based on the ordered study area (second part).....	29
Figure 9: Vegetation coverage with its ratio based on the correct study area (second part).	30
Figure 10: Vegetation coverage with its ratio for the project of Duhok area in 2014 (first part).	31
Figure 11: (a) Vegetation coverage based on elevation for the second part of the study area, (b) Zoom-in part of Erbil, (c) Zoom-in part of Suliyaniyah, (d) Zoom-in part of Garmian.	33
Figure 12: Vegetation coverage distribution in Erbil Governorate.....	35
Figure 13: Vegetation coverage distribution in Sulaymaniyah Governorate.....	36
Figure 14: Vegetation coverage distribution in Garmian Administrative.....	37
Figure 15: Vegetation coverage distribution in Halabja Governorate.....	38
Figure 16: Vegetation coverage distribution in Duhok Governorate.	39
Figure 17: Vegetation coverage distribution in Mergasur district.....	42
Figure 18: Vegetation coverage distribution in Soran district.	43
Figure 19: Vegetation coverage distribution in Choman district.....	44
Figure 20: Vegetation coverage distribution in Rawanduz district.	45
Figure 21: Vegetation coverage distribution in Shaqlawa district.....	46
Figure 22: Vegetation coverage distribution in Khabat district.	47
Figure 23: Vegetation coverage distribution in Erbil district.	48
Figure 24: Vegetation coverage distribution in Dashti Hawler district.	49
Figure 25: Vegetation coverage distribution in Koya district.	50
Figure 26: Vegetation coverage distribution in Makhmur district.	51
Figure 27: Vegetation coverage distribution in Raniya district.	52
Figure 28: Vegetation coverage distribution in Pishdar district.	53
Figure 29: Vegetation coverage distribution in Dukan district.	54
Figure 30: Vegetation coverage distribution in Sharbazher district.	55
Figure 31: Vegetation coverage distribution in Penjwin district.	56
Figure 32: Vegetation coverage distribution in Sulaymaniya district.	57

Figure 33: Vegetation coverage distribution in Sharazur district.....	58
Figure 34: Vegetation coverage distribution in Darbandikhan district.....	59
Figure 35: Vegetation coverage distribution in Chamchamal district.	60
Figure 36: Vegetation coverage distribution in Kalar district.	61
Figure 37: Vegetation coverage distribution in Kfri district.....	62
Figure 38: Vegetation coverage distribution in Khanaqin district.	63
Figure 39: Vegetation coverage distribution in Halabja district.	64
Figure 40: Vegetation coverage distribution in Duhok district.....	65
Figure 41: Vegetation coverage distribution in Semel district.	66
Figure 42: Vegetation coverage distribution in Zakho district.	67
Figure 43: Vegetation coverage distribution in Amedi district.	68
Figure 44: Vegetation coverage distribution in Akre district.	69
Figure 45: Vegetation coverage distribution in Shekhan district.	70
Figure 46: Vegetation coverage distribution in Bardarash district.....	71
Figure 47: Artificial forest projects in Erbil with two zoom in samples	74
Figure 48: Artificial forest projects in Sulaymaniyah with two zoom in samples	78
Figure 49: Artificial forest projects in Garmian with two zoom in samples.....	80
Figure 50: Artificial forest projects in Halabja with zoom in sample	82
Figure 51: Artificial forest projects in Duhok with two zoom in samples	91
Figure 52: Satellite image of the study area and some sample location with and without vegetation coverage, at the top is a part of Mergasur district, at the right button is a part of Khanaqin district, at the left is a part of Kfri district.	96
Figure 53: (a) Map of Iraq, (b) Map of Kurdistan Region-Iraq with vegetation coverage distribution.....	97
Figure 54: Vegetation coverage distribution in Kurdistan Region-Iraq.	98
Figure 55: Map of Arifical Forest Projects in Kurdistan.	124

CONTENTS

MAPPING AND ESTIMATING VEGETATION COVERAGE IN IRAQI KURDISTAN REGIONN	3
LIST OF TABLES	4
LIST OF FIGURES.....	5
CONTENTS	7
SECTION 1: BACKGROUND OF THE PROJECT	9
SECTION2: INTRODUCTION	11
SECTION 3: PROJECT TEAM	12
3.1 THE ADMINISTRATIVE TEAM:	12
3.2 THE TECHNICAL TEAM:.....	12
3.3 THE FIELDWORK TEAM	13
SECTION 4: STUDY AREA OF THE PROJECT	14
SECTION 5: PROJECT OBJECTIVES	18
SECTION 6: SATELLITE DATA	19
6.1 Specification of the used RapidEye images.....	20
6.2 Specification of the used Landsat images	21
SECTION 7: SOFTWARE AND HARDWARE	24
7.1 Software	24
7.2 Hardware	24
SECTION 8: METHODS	25
8.1 Training and validation data.....	26
8.2 Digital Image Classification.....	26
8.3 Normalized Difference Vegetation Index (NDVI)	26
8.4 Digital Elevation Model (DEM)	27
SECTION 9: RESULTS	28
9.1 Vegetation Coverage Area Over Whole Study Area	28
9.2 Vegetation Coverage Area Based on Elevation	32
9.3 Vegetation Coverage Area of Each Adminstrative	34
9.4 Vegetation Coverage Area of Each District	40
9.5 Mapping Artificial Forests	72
9.6 Some observations of differences between the old survey and the new survey:	91

SECTION 10: THE EFFECTIVE FACTORS ON THE AREA OF SURVEYED FORESTS IN KURDISTAN REGION	93
REFERENCES	94
APPENDIX.....	96

SECTION 1: BACKGROUND OF THE PROJECT

Field surveys conducting and access to information in any field or subject was one of the important tasks to show the real face of the field or topic. A careful attention must be drawn to data and information that have been collected. This is significant to have successful plans and programs that can be used for management and development.

The process of collecting information and data in different fields was one of the tasks of the Ministry of Agriculture and Water Resources in various stages and seasons to clarify verify the vision of the ministry and make the necessary assessments of past, present and future. This will enable the ministry to have a concrete plans for a better management.

Forests and pastures of Iraqi Kurdistan Region and the information of green spaces ratio with changes and their effects and management are one of the important things that the Ministry of Agriculture and Water Resources has to take care.

The General Directorate of Horticulture, Pastures and Forests realized from the beginning that there are deficiencies of information and data especially regarding natural forests. As it is known, the majority of natural forests is located in the Kurdistan Region and is estimated to be 97% of the natural forest areas in Iraq.

For the purpose of accurate estimation of the area of forests and green spaces, we do not have sufficient and accurate information, except for the survey conducted by the British expert in the field of forests (G. W. Chapman) between the years 1947-1949. However, advanced technologies and advanced equipment had not been used in the survey compared to our time and no further surveys were carried out until 1999. FAO conducted a survey of the forests under the (oil-for-food program). That survey; however, relied on old data and was done in a desk format and was away from the use of any modern technology equipment. It is clear that there are several climatic, environmental and natural changes have occurred during the past 60-70 years in the Kurdistan Region.

Based on the aforementioned reality, the General Directorate of Horticulture, Forestry and Pastures initiated seriously in 2010. Later in 2011, an approval was made to do a forest survey in the Kurdistan Region via satellite images with determining some other goals of the project and the most important one is to know the difference between forest changes in the past and present.

After the distribution of the tender in coordination with the concerned authorities in the Office of the Ministry of Agriculture and Water Resources and two experts of (RS & GIS) from Salahaddin University; the project was announced. Several companies were applied for the tender and later a local company got the tender. However, during the implementation we faced many administrative and legal problems from the local company. In the end, the case was referred to the courts and the project failed.

Despite of the all above obstacle, the project needed to be run again to cover the lack of the forest data. Although the financial crisis that faced Kurdistan region after 2014, the project has been implemented in 2015 using local capacity and in the form of direct implementation. It was noticed that the project cost was very slight compared to the tender mentioned in 2011. One of the encouraging steps to currying out the project again was the step that the Directorate of Forestry and Pastures of Dohuk governorate taken in 2014. The Directorate of Forestry and Pastures of Dohuk governorate with association of Applied Remote Sensing and Geographic Information Systems Center from University of Zakho implement a project of determining the proportion of green spacesin Duhok governorate. Their project was presented at the Ministry of Agriculture and Water Resources as the results and the advantage of the project were discussed. The ministry proposed to do the same project in the other governorates. Although the project showed us only the proportion of green areas and does not achieve the goals of 2010; but it was a good start to cooperate with academic staff from from Kurdistan Region Universities and get benefit of their experience. Beside of that, the database of the project will serve as a major basis for the future in our ministry in the field of surveys through utilizing satellite images.

So we offer our thanks and appreciation to the project's executors and we hope to achieve all our goals in the future.

Husien Hama Kareem

General Director of Horticulture, Forest and Rangelands

SECTION2: INTRODUCTION

Assessing and mapping vegetation is an important task for managing natural resources as it provides a base for all living beings and plays an essential role in affecting global climate change, such as influencing terrestrial CO₂ (Mustafa, Tolpekin, & Stein, 2014). Vegetation mapping also presents valuable information for understanding the natural and man-made environments through quantifying vegetation cover. Such an assessment and information of vegetation cover is essential for the Ministry of Agriculture and Water Resource in Kurdistan Region-Iraq, in order to initiate vegetation protection and restoration programs. Moreover, this information is important to create a proper and future plan for protecting and increasing the vegetation coverage areas in Kurdistan.

The definition of vegetation is assemblages of plant species and the ground cover they provide (Burrows, 1990). It is a general term, without specific reference to particular taxa, life forms, structure, spatial extent, or any other specific botanical or geographic characteristics. However, Measures of remotely sensed vegetation cover and density include foliage cover (Armston, Denham, Danaher, Scarth, & Moffiet, 2009), woody and non-woody cover (Furby, Caccetta, Wallace, Lehmann, & Zdunic, 2009; Radford, 2005), and absorbed photosynthetically active radiation (Myneni, Ramakrishna, Nemani, & Running, 1997). Therefore, the vegetation coverage in this project that based on remote sensed data includes the above materials that mention in previous sentence. Briefly, it includes: trees and shrubs within the forestry and horticulture sectors, and planets that reach the greenness level at the satellite image time acquisition.

Traditional methods including field surveys, however, are not effective to acquire vegetation covers. This is due to the fact that they are time consuming, and often too expensive; especially when a large area required to be covered. To overcome to this limitation, the technology of remote sensing and Geographical Information System (GIS) consider being an alternative option to achieve such a task. This is because it offers a practical and economical means to study vegetation cover (Acharya & Ray, 2005). For this advantage, enormous efforts have been made by researchers and application specialists to delineate vegetation cover by applying remote sensing imagery.

Mapping and estimation of vegetation coverage in the whole Kurdistan Region of Iraq have not been explored and analyzed properly. Therefore, based on the official request from the Ministry of Agriculture and Water Resources in Erbil, this project is implemented using modern techniques, remote sensing and GIS.

SECTION 3: PROJECT TEAM

The project team consists of three main parts: Administrative team, Technical team, and Fieldwork team. It is worthy to mention that this project has been assigned to the Applied Remote Sensing & GIS (ARS&GIS) Center at the University of Zakho. However, people were involved in the implementation of this project as an expert and specialized in the field of remote sensing, GIS, and forestry.

3.1 THE ADMINISTRATIVE TEAM:

Table 1: Administrative team

No	Name	Position
1.	Hussen Hama Kareem	G.D. of Horticulture, Forest and Rangeland
2.	Najat Sofe Hariri	G.D. of Horticulture and Forest and Rangeland \ D. of Planning and Follow-up
3.	Dildar Abdulla Rahman	G.D. of Horticulture and Forest and Rangeland \ D. of Forest
4.	Husain Muhamadameen Hasan	G.D. of Division \ D. of Accounts
5.	Karwan Asaad Abdullah	G.D. of Planning and Follow-up \ D. of IT
6.	Dawan Sherwan Mohammed	G.D. of Planning and Follow-up \ D. of GIS

3.2 THE TECHNICAL TEAM:

Table 2: Technical team

No	Name	Specialization & task	Government / institute sector
1.	Dr. Yaseen Taha Mustafa	Applied Remote Sensing & GIS, (Team Leader)	University of Zakho
2.	Dr. Sarkawt Ghazi Salar	GIS in Geology (Team Member)	University of Garmian
3.	Dr. Ahmed AbdulGafoor Khatab	Atmospheric Remote Sensing (Team Member)	University of Garmian
4.	Mr. Fuad Mohammad Ahmad	Geoinformatics in Soil (Team Member)	Salahaddin University
5.	Mr. Hendaf Nasurdeen Habeeb	Geoinformatics in Forestry (Team Member)	Direktorate of Forests and Range in Duhok

3.3 THE FIELDWORK TEAM

The fieldwork team (Table 3) was the staff of the forest directorates from Erbil, Sulaymaniyah, Garmian, and Duhok.

Table 3: Fieldwork Team

No	Name	Directorate of Forests and Range
1.	Sabah Rashed khorsheed	Erbil
2.	Khabat muhamadamen Darwesh	
3.	Azad Kareem Mohamad	Sulaymaniyah and Halabja
4.	Kandish Jalal Abdulla	
5.	Hemn Mahmud Karim	Garmian
6.	Mardin Mohamad Hameed	
7.	Sharmin Salh Faraj	Duhok
8.	Hendaf Nasurlddeen Habeeb	
9.	Kaman Kadian	

SECTION 4: STUDY AREA OF THE PROJECT

The study area has been divided into two parts: The first part is Duhok Governorate and the second part is Erbil, Sulaymaniyah, Garmian and Halabja. This is because each part has been implemented individually in two different years with different objectives and datasets. Duhok Governorate is approximately between latitudes $36^{\circ}18'12.64''$ and $37^{\circ}20'33.55''$ N, and longitudes $42^{\circ}20'25.36''$ and $44^{\circ}17'40.50''$ E in the northwestern of Iraq, at 430 – 2500 m above the sea level and it covers about 11066 km^2 . It is surrounded by Turkey from the north, Syria from the east, Ninevah from the south and Erbil from west (Figure 1). Duhok Governorate consists of seven districts: Duhok, Semel, Zakho, Amedi, Akre, Shekhan, Bardarash.

The second part of the study area includes Erbil, Sulaymaniyah, Garmian and Halabja which constitute two-thirds of Iraq's Kurdistan region, and located between latitudes $34^{\circ}00'10''$ – $37^{\circ}20'12''$ N and longitudes $43^{\circ}01'30''$ – $46^{\circ}18'25''$ E. It has a border international with Iran from east, and Turkey from north; and has a national border with Ninevah from west, Kirkuk and Salah ad-Din from south west and Diyala from south. The location of the study area is shown in Figure 2. Erbil Governorate covers an area about 15038.93 km^2 and consists of 10 districts, they are: Mergasur, Soran, Choman, Rawanduz, Shaqlawa, Khabat, Erbil, Dashti Hawler, Koysinjaq, and Makhmur. Sulaymaniyah Governorate area is about 15654.62 km^2 and consists of 8 districts, they are: Ranya, Pishdar, Dukan, Sharbazher, Penjwin, Suliamaniya, Sharazur, Darbandikhan and Chamchamal. In addition, the area of Garmin Administration is 7711.05 km^2 and consists of 3 districts, they are: Kalar, Kfri, and Khanaqin. Finally, Halabja Governorate are is about 909.20 . The study area has a big variation in terms of elevation that is between 100 m and 3565 m above sea level, as shown in Figure 3.

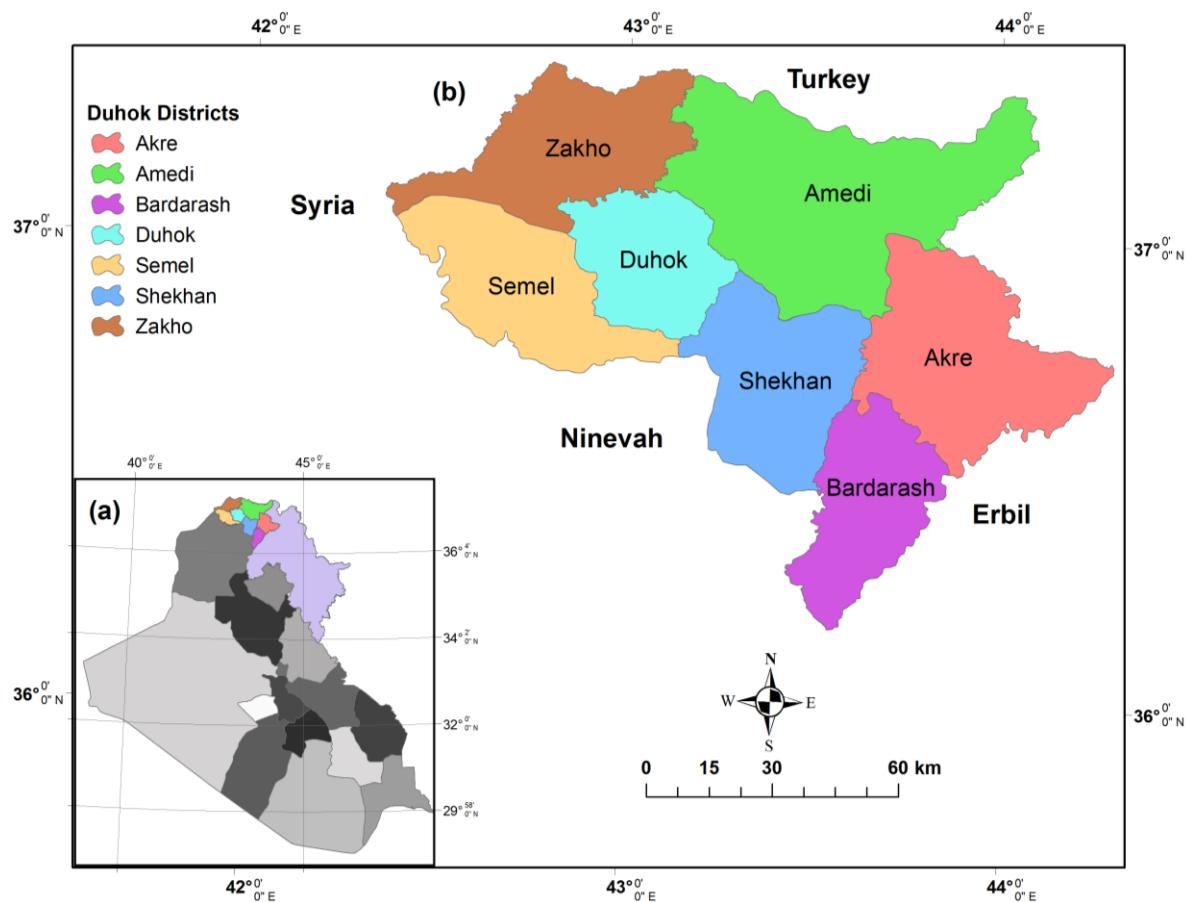


Figure 1: (a) Map of Iraq with the Kurdistan Region, (b) The first part of the study area (Duhok).

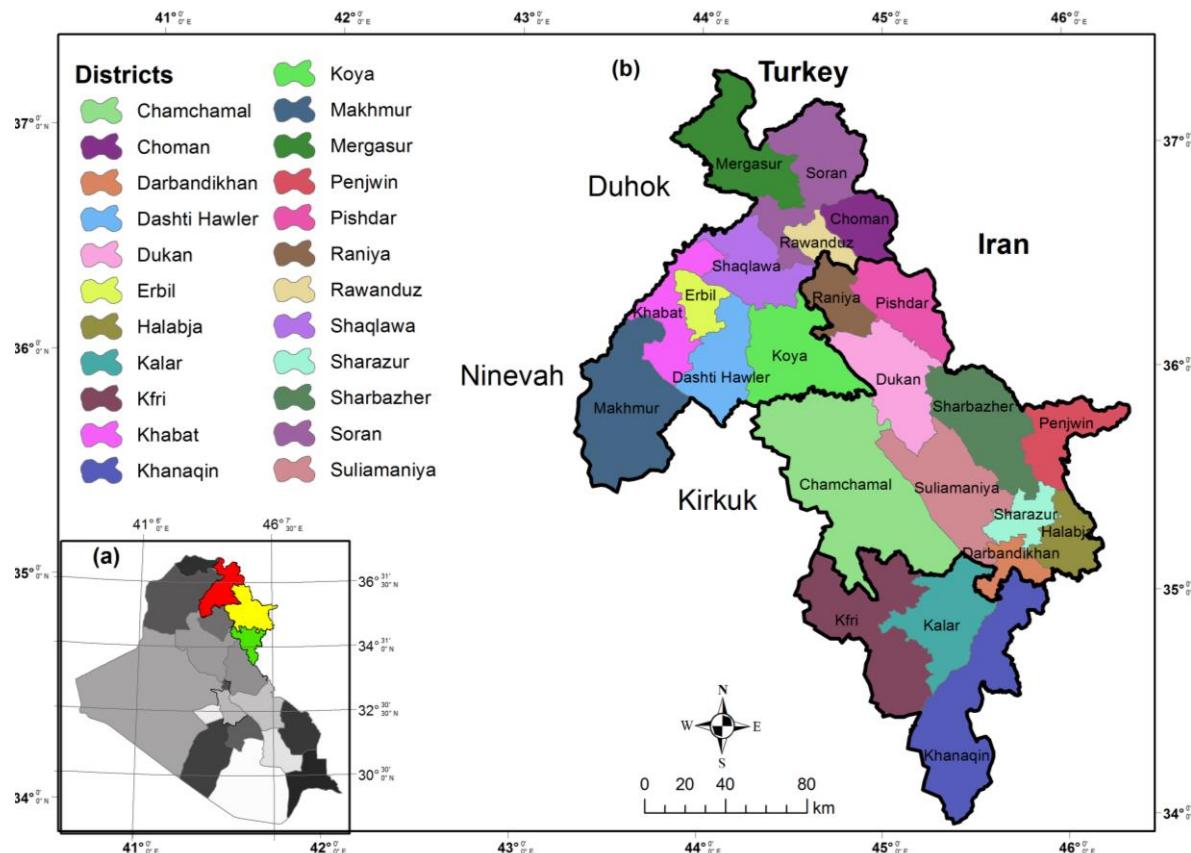


Figure 2: (a) Map of Iraq with the Kurdistan Region, (b) The second part of the study area: Erbil, Sulaymaniyah and Garmian.

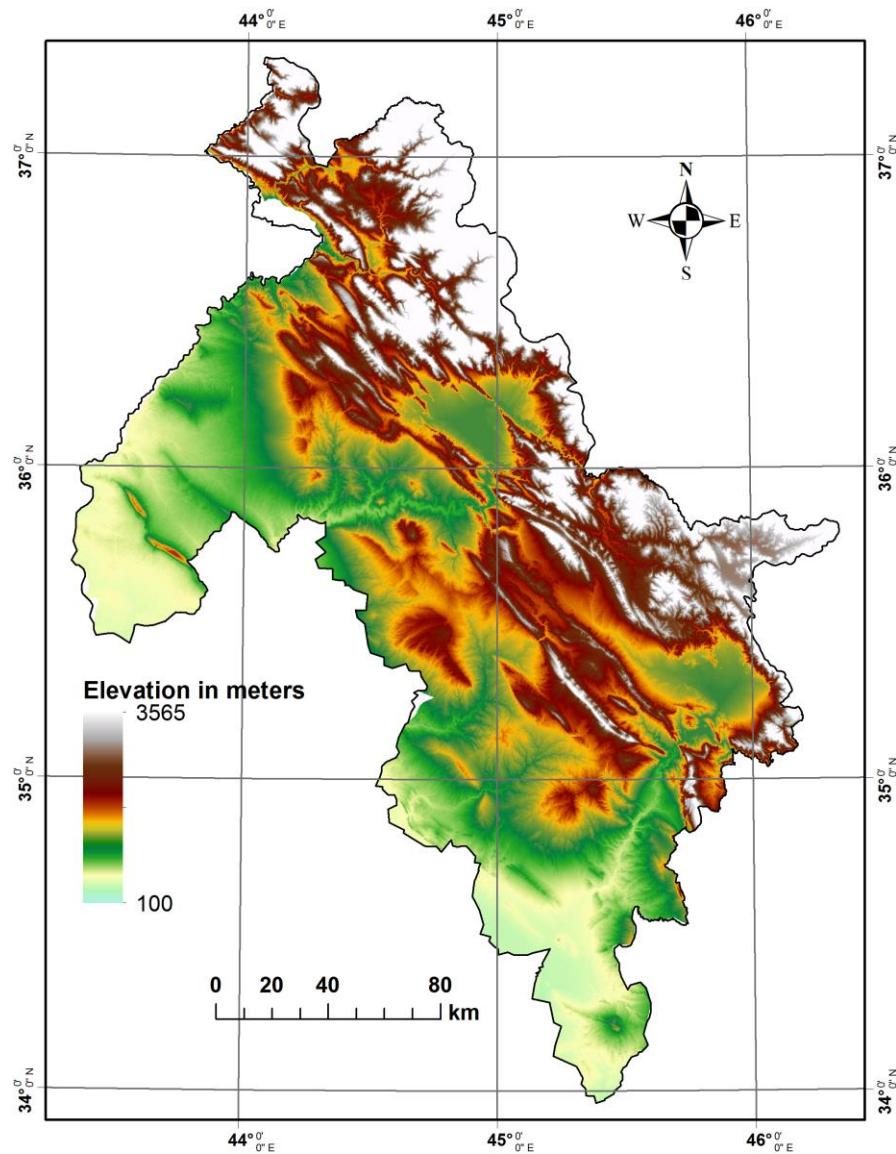


Figure 3: Digital Elevation Model (DEM) image of the study area with 30 m resolution retrieved from (ASTER-GDEM, 2013)

SECTION 5: PROJECT OBJECTIVES

The main objective of this project is to map and estimate the ratio of the vegetation coverage in the study area of Kurdistan Region-Iraq. However, to achieve this objective, the following specific objectives are required to be implemented:

- 3.1 Map and estimate the vegetation coverage over the whole study area;**
- 3.2 Map and estimate the vegetation coverage based on the elevation (mean sea level) over the whole second part of the study area;**
- 3.3 Map and estimate the vegetation coverage for each administrative area: Erbil, Sulaymaniyah, Garmian and Halabja;**
- 3.4 Map and estimate the vegetation coverage for each district of study area;**
- 3.5 Map and estimate area of all artificial forests (planted forest) over the whole study area.**

Note: The listed objectives above were designed for the project of 2015. However, the objectives of the implemented project in 2014 for Duhok Governorate included only mapping and estimation of vegetation coverage of the whole Governorate with its districts separately.

SECTION 6: SATELLITE DATA

The satellite data that has been used in the project of 2015 were RapidEye imageries. These data have been ordered by the technical team at the Ministry of Agriculture and Water Resources from FUGROMAPS Company (that is located in Beirut, Lebanon). However, the ordered area (Figure 4) of the study area that has been ordered does not represent the real study area. There are some parts were missing and some other parts suppose not to be included. The missing area are: sub-districts of Chamchamal district [*Shwan(Qaranaw)*, *Qarahanjir*, and half of the area of *Takiya Jabari*], and *Nawjul* sub-district of Kfri district, and half area of *Khanaqin* sub-district. While the extra area that included in the ordered area which supposed to be not included are: Jalawla, Qarah tapah, and Didis. Therefore, the project was implemented based on area that has been ordered by the Ministry of Agriculture and Water Resources. However, the missing parts were compensate by Landsat images and implemented. Moreover, Landsat OLI imageries were used for vegetation coverage project of 2014 for Duhok Governorate. The time acquisition of Landsat data that were used in Duhok project was in August.

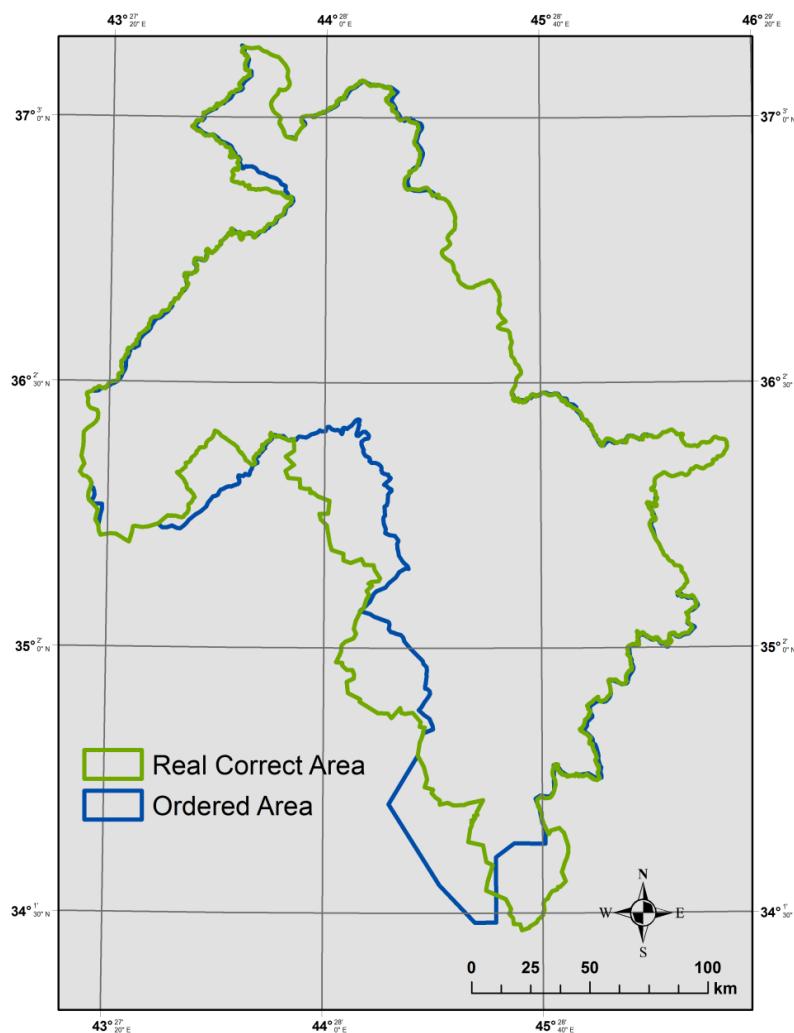


Figure 4: The selected area (blue color) by the MA&WR for the study area, with the real area (green color) of the study area

The date of the acquisition of the RapidEye imageries was among three months: June, July and August, and this is based on the availability of the images within that period.

6.1 SPECIFICATION OF THE USED RAPIDEYE IMAGES

Figure 4 represent the RapidEye image that covers the studied area that has been ordered by the Ministry of Agriculture and Water Resources. This map (Figure 5) resulting from a combination of three bands 5, 3, and 2 (NIR, Red, and Green).

Table 4: Specification of RapidEye image

Mission Characteristics	Information												
Number of Satellites	5												
Spacecraft Lifetime	7 years												
Orbit Altitude	630 km in Sun-synchronous orbit												
Equator Crossing Time	11:00 an (approximately)												
Sensor Type	Multi-spectral push broom imager												
Spectral Bands	<p>Capable of capturing any of the following spectral bands</p> <table> <thead> <tr> <th>Name</th> <th>(Spectral Bands nm)</th> </tr> </thead> <tbody> <tr> <td>Blue</td> <td>440 – 510</td> </tr> <tr> <td>Green</td> <td>520 – 590</td> </tr> <tr> <td>Red</td> <td>630 – 685</td> </tr> <tr> <td>Red Edge</td> <td>690 – 730</td> </tr> <tr> <td>NIR</td> <td>760 – 850</td> </tr> </tbody> </table>	Name	(Spectral Bands nm)	Blue	440 – 510	Green	520 – 590	Red	630 – 685	Red Edge	690 – 730	NIR	760 – 850
Name	(Spectral Bands nm)												
Blue	440 – 510												
Green	520 – 590												
Red	630 – 685												
Red Edge	690 – 730												
NIR	760 – 850												
Ground sampling distance (nadir)	6.5 m												
Pixel size (Orthorectified)	5 m												
Swath Width	77 km												
On board data storage	Up to 1500 km of image data per orbit												
Revisit time	Daily (off-nadir) / 5.5 days (at nadir)												
Image capture capacity	4 million sq km / day												
Bit Depth	8 bit												

Product type	Enhanced and mosaicked Ortho - Level 3A: RapidEye Ortho Product - Radiometric, sensor and geometric corrections applied to the data. All products have been rectified using a DTED Level 1 SRTM DEM or better, and with appropriate ground control can meet an accuracy of 6m 1 -sigma (12.7 m CE90). The highest accuracy achieved by these products will meet 1:25,000 NMAS standards.
File Format	GeoTiff
Map Projection	UTM
UTM Zone	38N
Datum	WGS84

6.2 SPECIFICATION OF THE USED LANDSAT IMAGES

Figure 6 represent the Landsat image that covers the first part of the study area (Duhok Governorate). This image acquired in August 2014.

Table 5: Specification of Landsat image

Mission Characteristics	Information																								
Series Number	8																								
Spacecraft Lifetime	5-10 years																								
Orbit Altitude	705 km in Sun-synchronous orbit																								
Equator Crossing Time	10:00 a.m. +/- 15 minutes																								
Sensor Type	Multi-spectral push broom imager																								
Spectral Bands	Capable of capturing any of the following spectral bands: <table> <thead> <tr> <th>Name</th> <th>(Spectral Bands μm)</th> </tr> </thead> <tbody> <tr> <td>Coastal / Aerosol</td> <td>0.43 – 0.45</td> </tr> <tr> <td>Blue</td> <td>0.45 – 0.51</td> </tr> <tr> <td>Green</td> <td>0.53 – 0.59</td> </tr> <tr> <td>Red</td> <td>0.64 – 0.67</td> </tr> <tr> <td>NIR</td> <td>0.85 – 0.88</td> </tr> <tr> <td>SWIR1</td> <td>1.57 – 1.65</td> </tr> <tr> <td>SWIR2</td> <td>2.11 – 2.29</td> </tr> <tr> <td>Panchromatic</td> <td>0.50 – 0.68</td> </tr> <tr> <td>Cirrus</td> <td>1.36 – 1.38</td> </tr> <tr> <td>LWIR1</td> <td>10.60 – 11.19</td> </tr> <tr> <td>LWIR2</td> <td>11.50 – 12.51</td> </tr> </tbody> </table>	Name	(Spectral Bands μm)	Coastal / Aerosol	0.43 – 0.45	Blue	0.45 – 0.51	Green	0.53 – 0.59	Red	0.64 – 0.67	NIR	0.85 – 0.88	SWIR1	1.57 – 1.65	SWIR2	2.11 – 2.29	Panchromatic	0.50 – 0.68	Cirrus	1.36 – 1.38	LWIR1	10.60 – 11.19	LWIR2	11.50 – 12.51
Name	(Spectral Bands μm)																								
Coastal / Aerosol	0.43 – 0.45																								
Blue	0.45 – 0.51																								
Green	0.53 – 0.59																								
Red	0.64 – 0.67																								
NIR	0.85 – 0.88																								
SWIR1	1.57 – 1.65																								
SWIR2	2.11 – 2.29																								
Panchromatic	0.50 – 0.68																								
Cirrus	1.36 – 1.38																								
LWIR1	10.60 – 11.19																								
LWIR2	11.50 – 12.51																								
Ground sampling distance (nadir)	30 – 100 m																								
Pixel size (Orthorectified)	15 -30																								

Swath Width	185 km
Revisit time	16 days
Bit Depth	12 bit
File Format	GeoTiff
Map Projection	UTM
UTM Zone	38N
Datum	WGS84

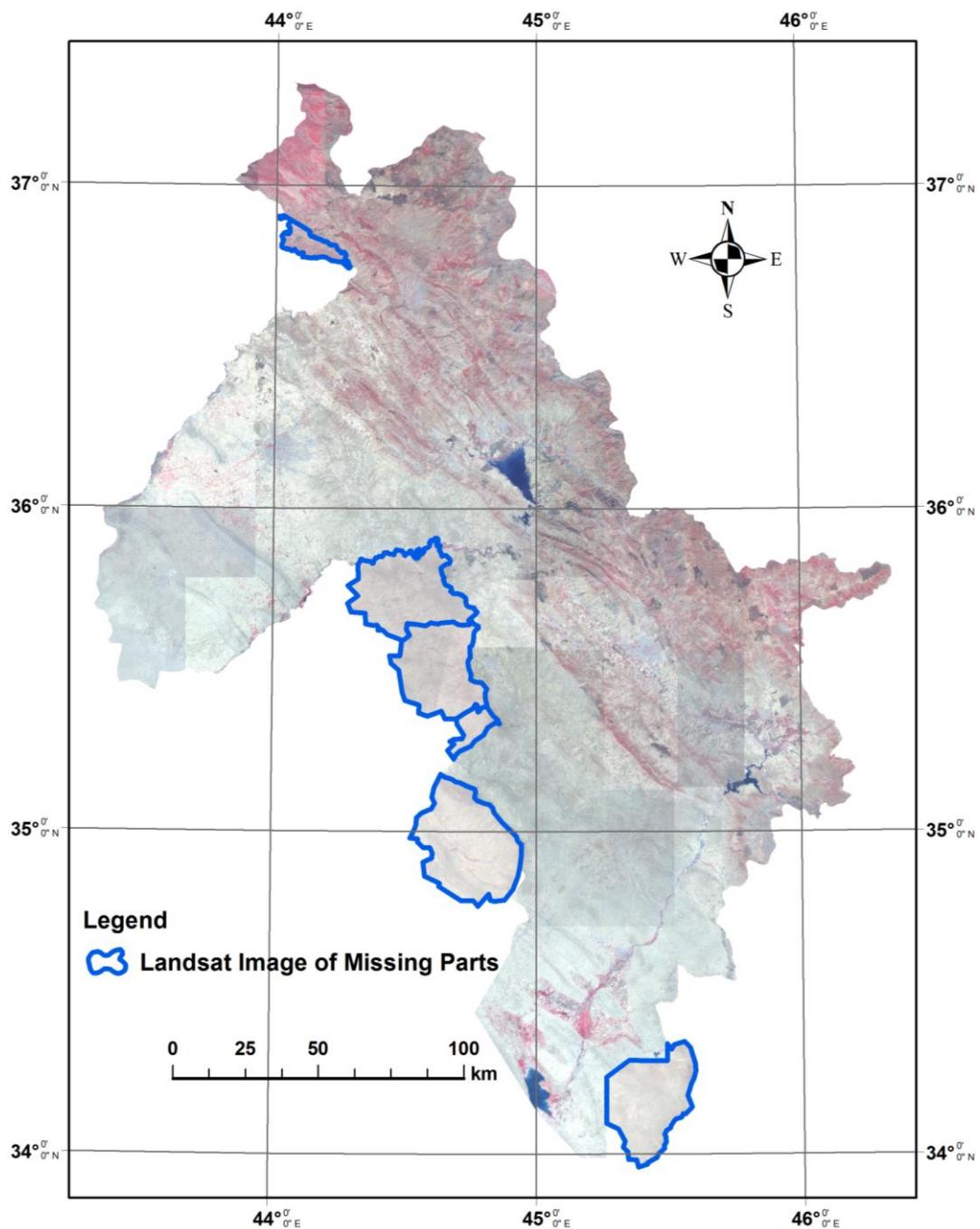


Figure 5: RapidEye image of the ordered study area (second part of the study area) displayed in color composite view with Landsat image of the missing parts.

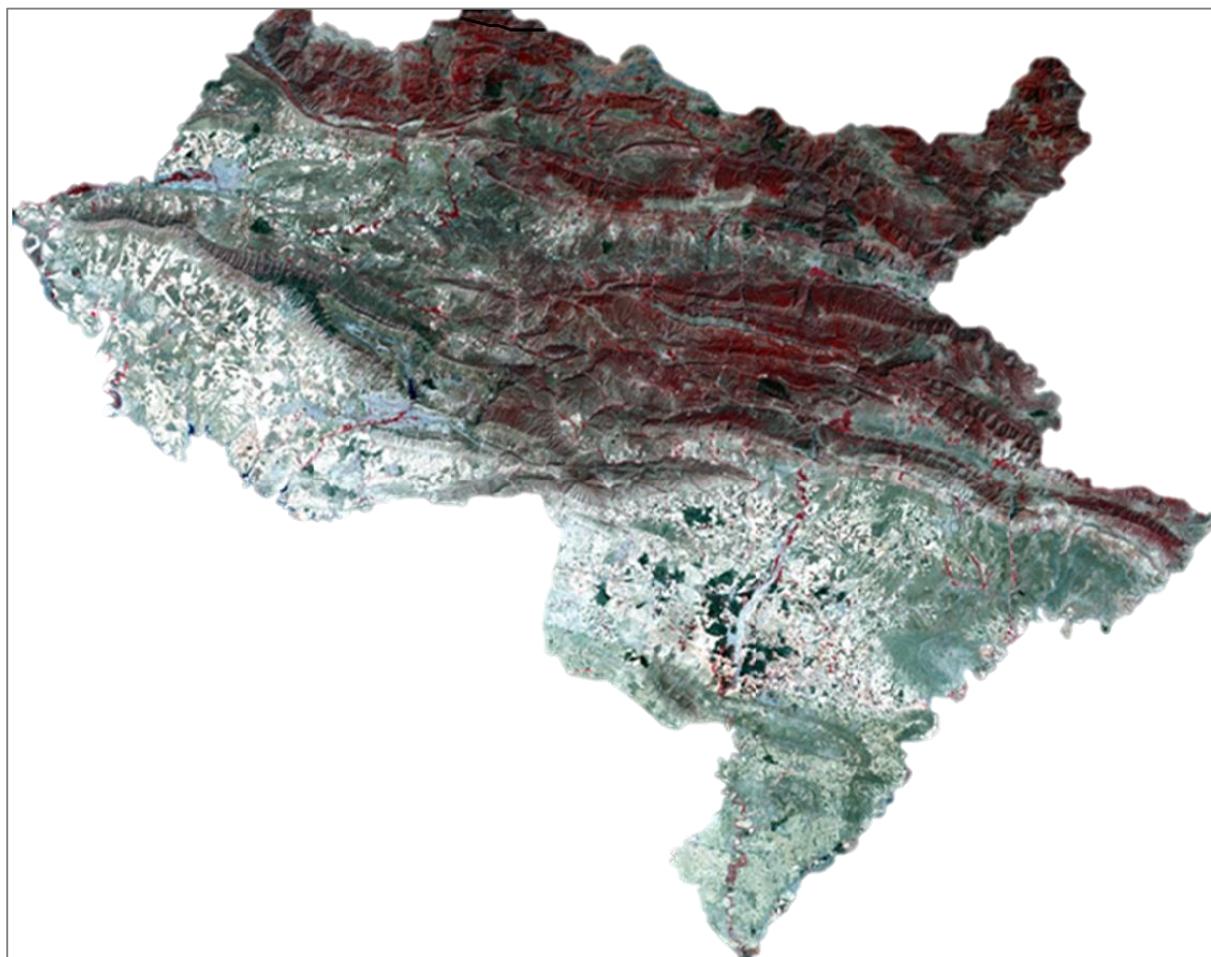


Figure 6: Landsat image of the first part of the study area (Duhok) displayed in color composite view.

SECTION 7: SOFTWARE AND HARDWARE

7.1 SOFTWARE

Professional software was used in this project for image processing and producing maps. They are:

- **ENVI:** stands for Environment for Visualizing Images and developed by IDL (Interactive Data Language) (AVIRIS, 2004). ENVI version 5.3 was used in this project.
- **ArcGIS:** is a comprehensive system for collecting, organizing, managing, analyzing, and distributing geographic information (ESRI, 2013). ArcGIS version 10.2 was used in this project.
- **ERDAS ER Mapper:** is a powerful, yet simple to use geospatial imagery processing application. This solution enhances your geographic data to make it more meaningful and allow you to extract quantitative information and solve problems.
- **BaseCamp:** used and work with serial GPS devices, to transfer the data from GPS in to Computer machine
- **MapSource:** works and used with Gamin GPS.

7.2 HARDWARE

As hardware, the GPS Garmin S78 was used in this project.

SECTION 8: METHODS

The step by step of the approach that has been used in this project is shown in Figure 7.

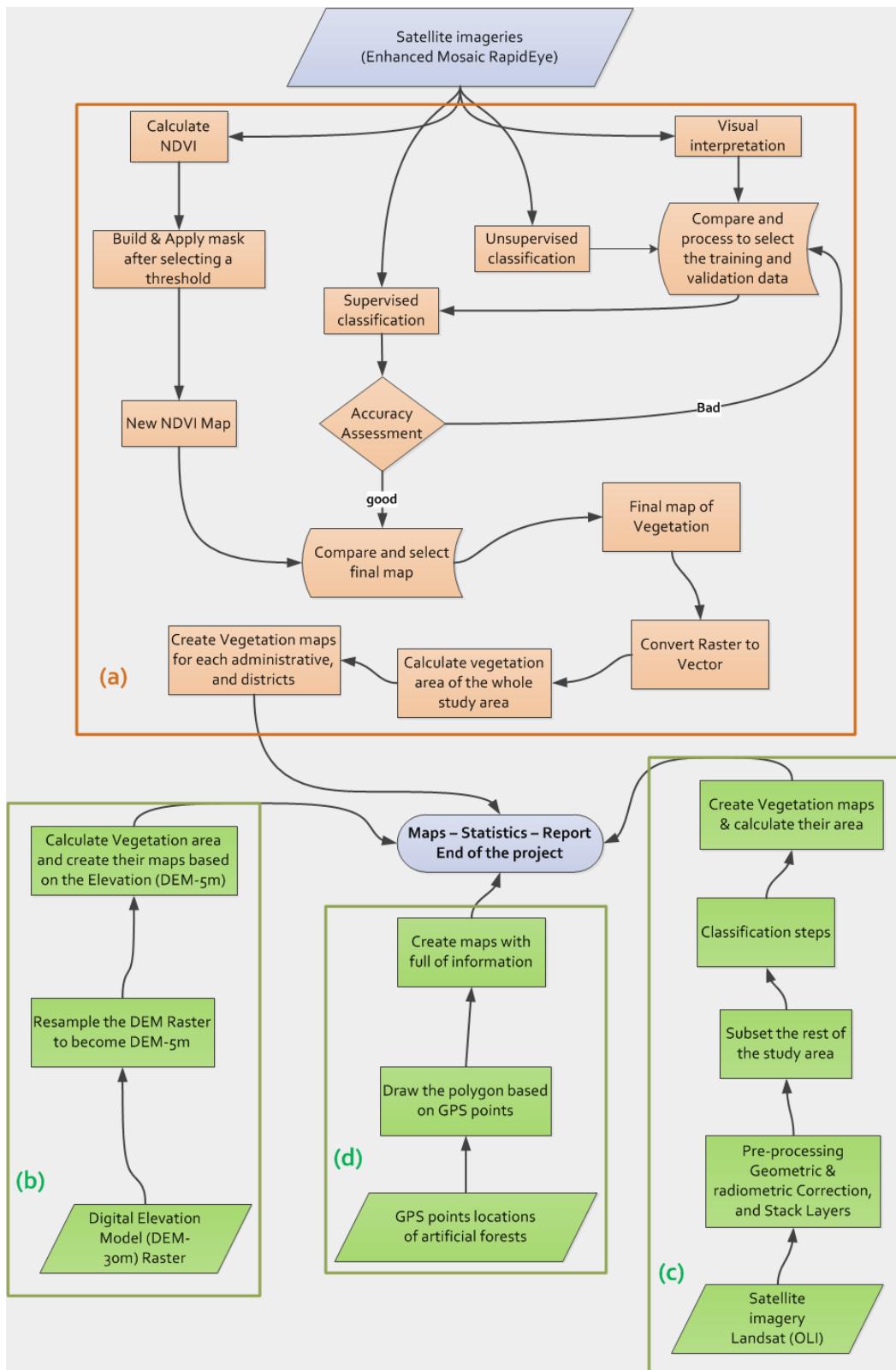


Figure 7: A work flow sketch showing the step-by-step to the used approach.

8.1 TRAINING AND VALIDATION DATA

This step is important for the purpose of classification. In this step some samples of different land types were selected for both training and validation. It achieved based on two techniques. First technique was including unsupervised image classification to initially get the sense of how many land types exist and identify them. Second technique was including visual interpretation of the study area to identify the land types and especially vegetation land type and uses these evidences with what we got from the first technique (unsupervised classification).

8.2 DIGITAL IMAGE CLASSIFICATION

This step includes digital classification of the RE image. Digital image classification technique in RS is one of the important techniques amongst the most significant technique. It has been used in numerous applications such as determining the land use type, and identifying delineation forest type (Huang, Lu, & Zhang, 2014; Rehman, Gao, Wang, & Wang, 2013). The classification technique can be defined as a process of sorting pixels separating features into classes or areas based on their data file values in remotely sensed imagery.

Generally, the classification technique is categorized into two approaches: unsupervised and supervised classification. The unsupervised classification does not need prior knowledge (training samples) of the area and the classification results may not represent the study area in detail. The widely used algorithms as an unsupervised classification are IsoData, and K-mean (Tso & Mather, 2009). Meanwhile, the supervised classification needs prior knowledge of the study area and better results may be concluded by using this type of classification (Lillesand, Kiefer, & Chipman, 2008). There are also several algorithms work under supervision and have been used by researchers to classify satellite imagery. In this project three classifiers were used: Maximum likelihood (ML), Neural Network (NN), and Support vector Machine (SVM). The selected classifier later was based on the best resulted accuracy.

8.3 NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI)

NDVI is the most popular vegetation indices which are uses for the vegetation monitoring. It concerns all the green vegetation which is using some combination of Red and NIR reflectance, and can be calculated using Equation 1 (Nouri, Beecham, Anderson, & Nagler, 2014). It has a low reflection in the visible part of the electromagnetic spectrum range for healthy vegetation due to the chlorophyll and other pigment absorption. Simultaneously, it has a high reflectance in the near-infrared part of the electromagnetic spectrum rang.

$$\text{NDVI} = \frac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}} \quad (1)$$

where NIR and Red are the near-infrared and the Red-reflectance bands of RE imagery, respectively. This index has been found to be a strong vegetation signal and is mostly used to distinguish the vegetation area from non-vegetation area (Wenwen, Jinling, Jindi, & Zhiqiang, 2011). The values range of NDVI is between -1 to +1, where -1 to 0 represent the non-vegetation features as a bare surface, built up area and water body, however, greater than 0 display vegetation cover. The main purpose of this step is to mask out non-vegetated areas such as pastures, home-sites, and roads; and keep vegetated area only.

8.4 DIGITAL ELEVATION MODEL (DEM)

This data is frequently used to refer to digital representation of continuous elevation values over a topographic surface by a regular array of z-values, referenced to a common datum. DEMs are typically used to represent terrain relief. This data is ASTER Global DEM with spatial resolution of 30 m (ASTRE-GDEM, 2013); however, it resampled to 5 m in order to match with the spatial resolution of RE images. This data used in the project of 2015 only to identify the vegetation ratio based on the elevation values in DEM data. Moreover, contour lines of the study area were also created from this data. The vegetation map that based on the elevation was produced in six levels: 5 – 500m, 500 – 1000m, 1000 – 1500m, 1500 – 2000m, 2000 – 2500m, and higher than 2500m.

SECTION 9: RESULTS

The results are shown as maps and tables. They are the outcome of passing all the steps of the methodology that have been illustrated in the previous sections and shown in Figure 7.

9.1 VEGETATION COVERAGE AREA OVER WHOLE STUDY AREA

Figure 8 represents the resulted outcome from part (a) of work flow in Figure 7 for the project of 2015. Among the three classifiers, the Maximum Likelihood performed best results with overall accuracy of 96.5% and Kappa coefficients of 0.95. These results were compared and justified with the created NDVI map that is resulted from selecting a proper threshold which enables us to distinguish between vegetated and non-vegetated objects.

The total area of vegetation coverage is 3319.38 km^2 , which accounted for 8.9% of the total second part of the study area (37420.01 km^2) that has been ordered by the Ministry of Agriculture and Water Resources (Figure 8). Meanwhile, taking in the consideration the missing parts that were implemented using Landsat OLI, the total area of vegetation coverage is 3216.01 km^2 . This vegetation area accounted for 8.2% of the total study area (39313.83 km^2) and is shown in Figure 9. The resulted map that is shown in Figure 9 and vegetation area performed by implementing and integrating steps in part (a) with part (c) of Figure 7.

Figure 10 represent the map of the vegetation coverage in Duhok Governorate for the project of 2014. This map resulted based on the same methodology that has been designed for the project of 2015. The overall accuracy of the resulted map was 92%. The total area of vegetation coverage in Duhok is 3052.6052 km^2 , which counted for 27.58% of the total area of the first part of the study area, Duhok (11066 km^2).

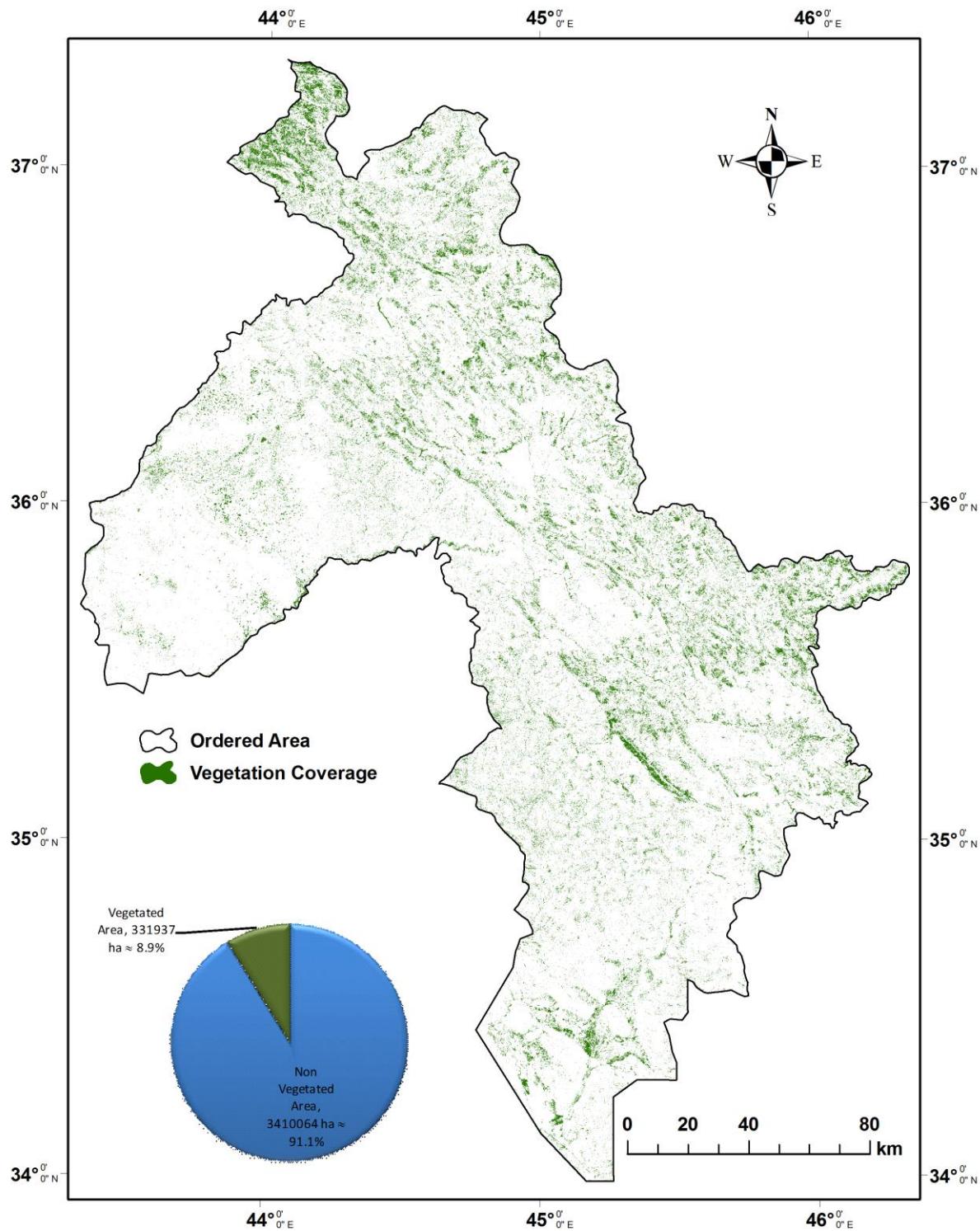


Figure 8: Vegetation coverage with its ratio based on the ordered study area (second part).

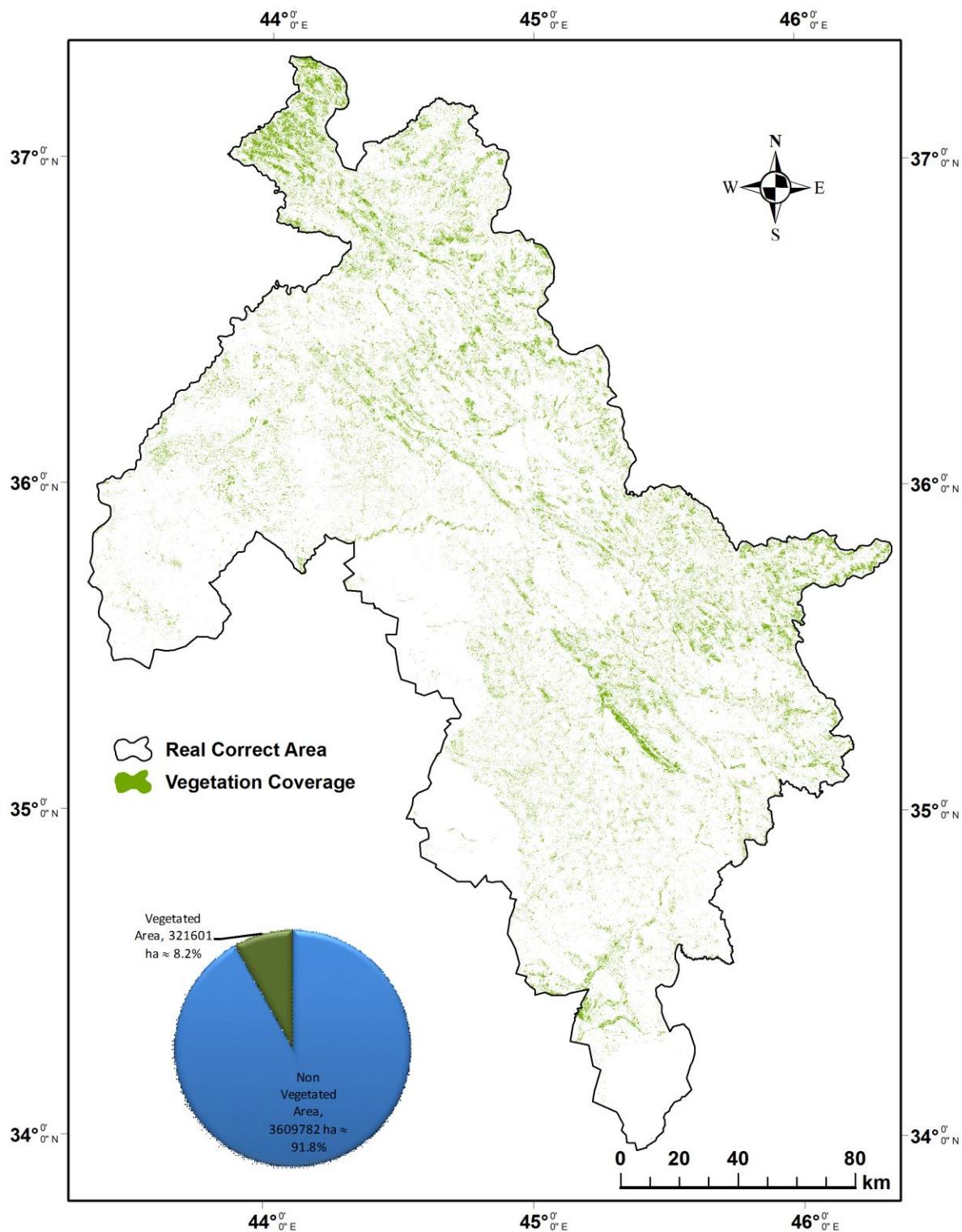


Figure 9: Vegetation coverage with its ratio based on the correct study area (second part).

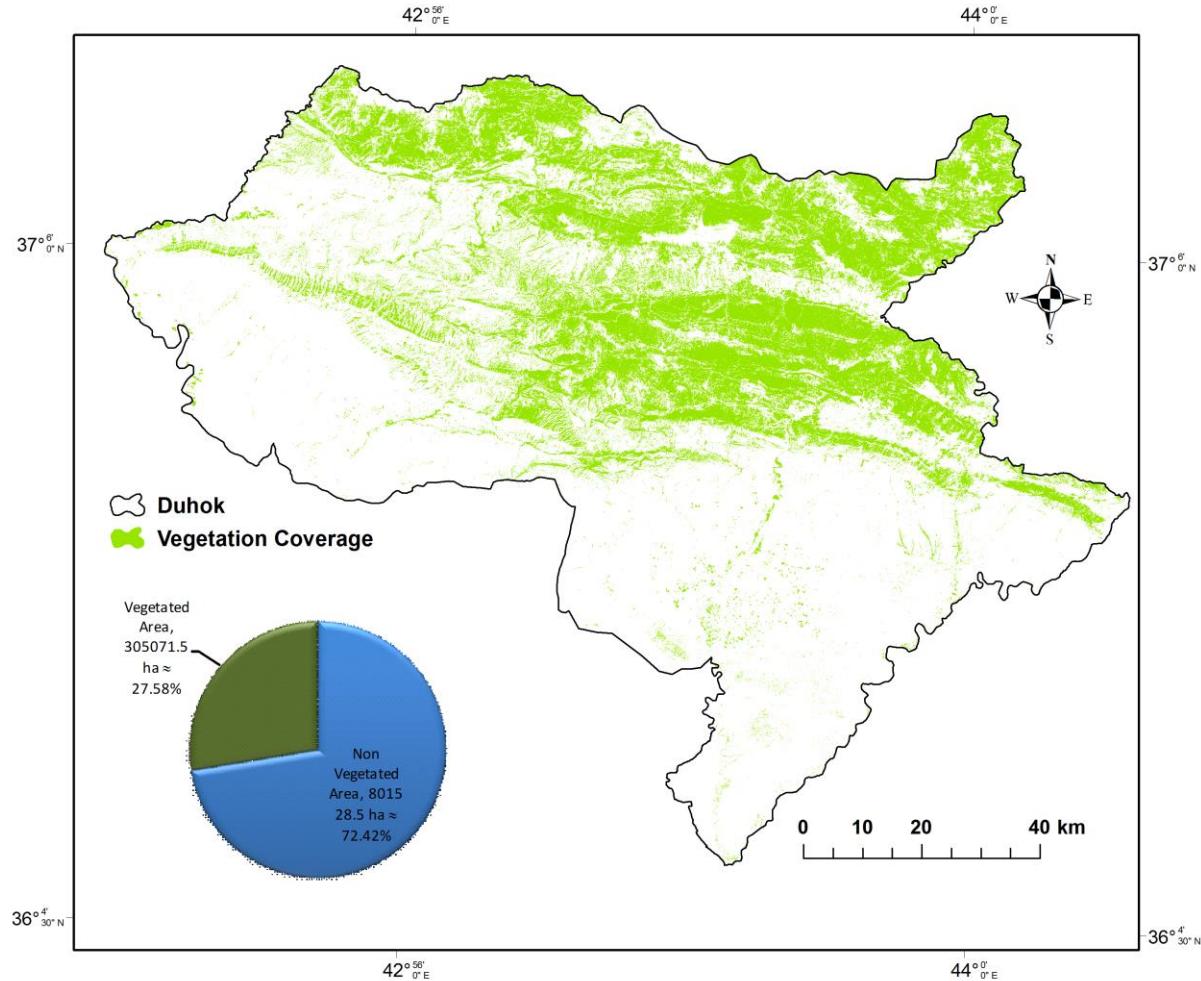


Figure 10: Vegetation coverage with its ratio for the project of Duhok area in 2014 (first part).

Figure 52 in the appendix shows some zoom-in samples location of the second part of the study area with and without resulted vegetation area. At the top of the Figure is a part of Mergasur district while at the right button is a part of Khanaqin district and left button is a part of Kfri district. From the zoom-in samples of Figure 52, we notice that only the vegetation was considered with regardless to any other land types (as buildings, streets, rocks, water, or soil). This is indicating and ensuring the success of the resulting output of this project and the methodology that has been followed. Moreover, Figure 53 represents the distribution of the vegetation coverage in Kurdistan Region-Iraq.

9.2 VEGETATION COVERAGE AREA BASED ON ELEVATION

This is only concerned to the second part of the study area (project of 2015). The resulted output of this section is based on the followed steps in part (b) after parts (a) and (c) implemented of Figure 7. Vegetation coverage area based on elevation is shown in Table 6. It is clearly shown that the maximum area of vegetation exists within the elevation between 500 – 1000 m and between 1000 – 1500 m, as it reaches 1021.22 km^2 and 1040.82 km^2 , respectively. Moreover, the less area of vegetation (579.31 km^2 , and 469.35 km^2) after the previous two elevation levels exists with the elevation between 5 – 500 m, and between 1500 – 2000 m, respectively. Whereas, within the higher elevation between 2000 – 2500 m and higher than 2500 m, a minimum area of vegetation exists with 68.36 km^2 , and 36.96 km^2 , respectively. Figure 11 shows the vegetation distribution over whole study area with six levels of elevation.

Table 6: Vegetation coverage area based on elevation for the second part of the study area.

Elevation (m)	Vegetation area (km^2)
5-500	579.31
500-1000	1021.22
1000-1500	1040.82
1500-2000	469.35
2000-2500	68.36
2500--	36.95

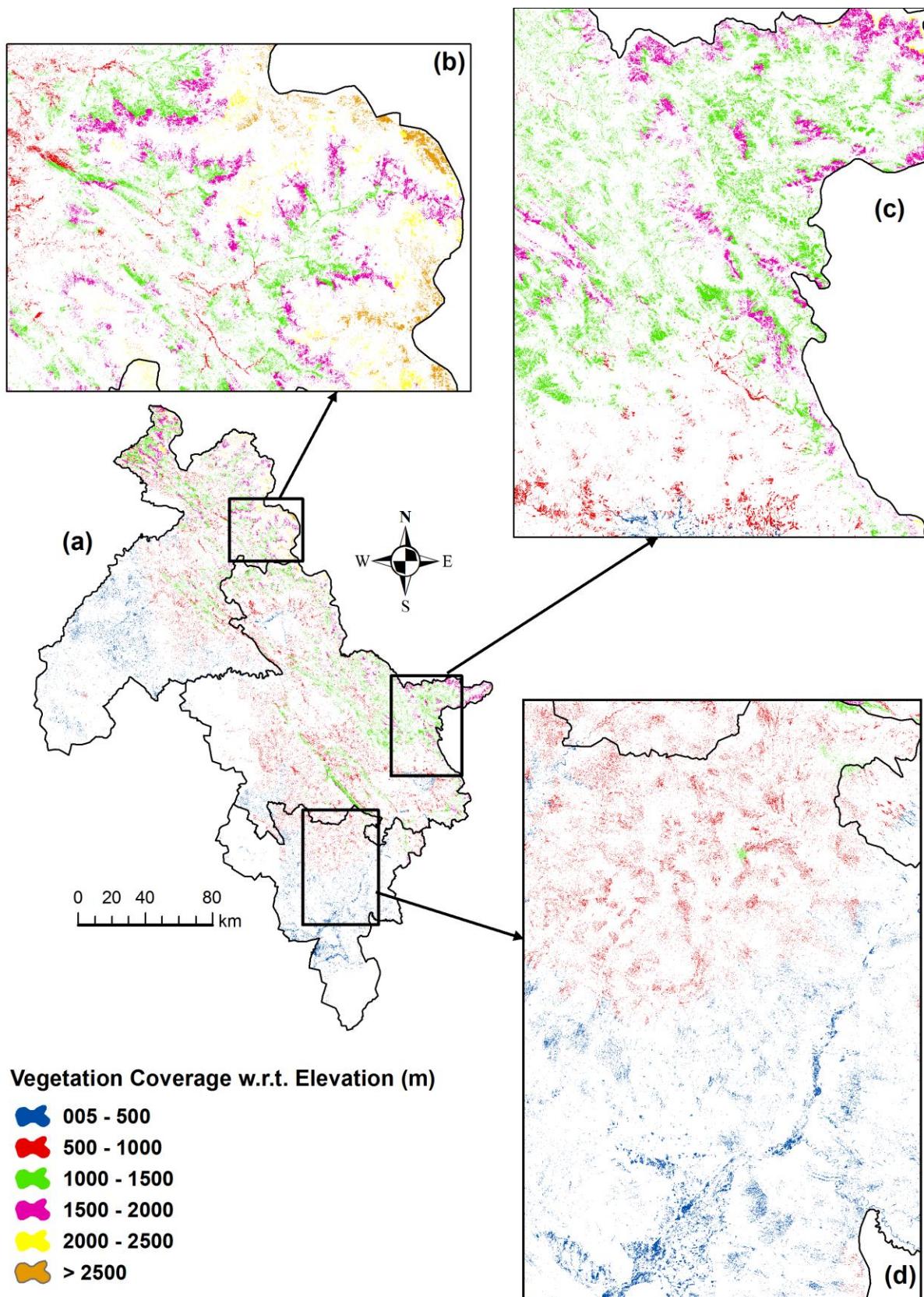


Figure 11: (a) Vegetation coverage based on elevation for the second part of the study area, (b) Zoom-in part of Erbil, (c) Zoom-in part of Suliyaniyah, (d) Zoom-in part of Garmian.

9.3 VEGETATION COVERAGE AREA OF EACH ADMINISTRATIVE

Vegetation coverage area of Erbil Governorate is 1359.75 km² while the total area of Erbil Governorate is about 15038.93 km². Therefore, the ratio of vegetation in Erbil is around 9.05%. The vegetation coverage accounted for 9.1% from the total area of Sulaymaniyah (15654.62 km²), as the total area of vegetation coverage is 1426.24 km². Moreover, the area of Garmian is about 7711.05 km² in which 341.11 km² is the vegetation coverage area. Hence, vegetation accounted for 4.4% of the total area of Garmian. In addition, the vegetation coverage area of Halabja Governorate is 91.28 while the total area of Halabja Governorate is 909.20 that leads to have 10.04% of the vegetation ratio. Finally, the vegetation coverage area of Duhok Governorate is 3052.6052 km² with ratio of 27.58% from the total area of Duhok Governorate (11066 km²). Figures 12-16 represent the map of vegetation coverage distribution in Erbil, Sulaymaniyah, Garmian, Halabja and Duhok

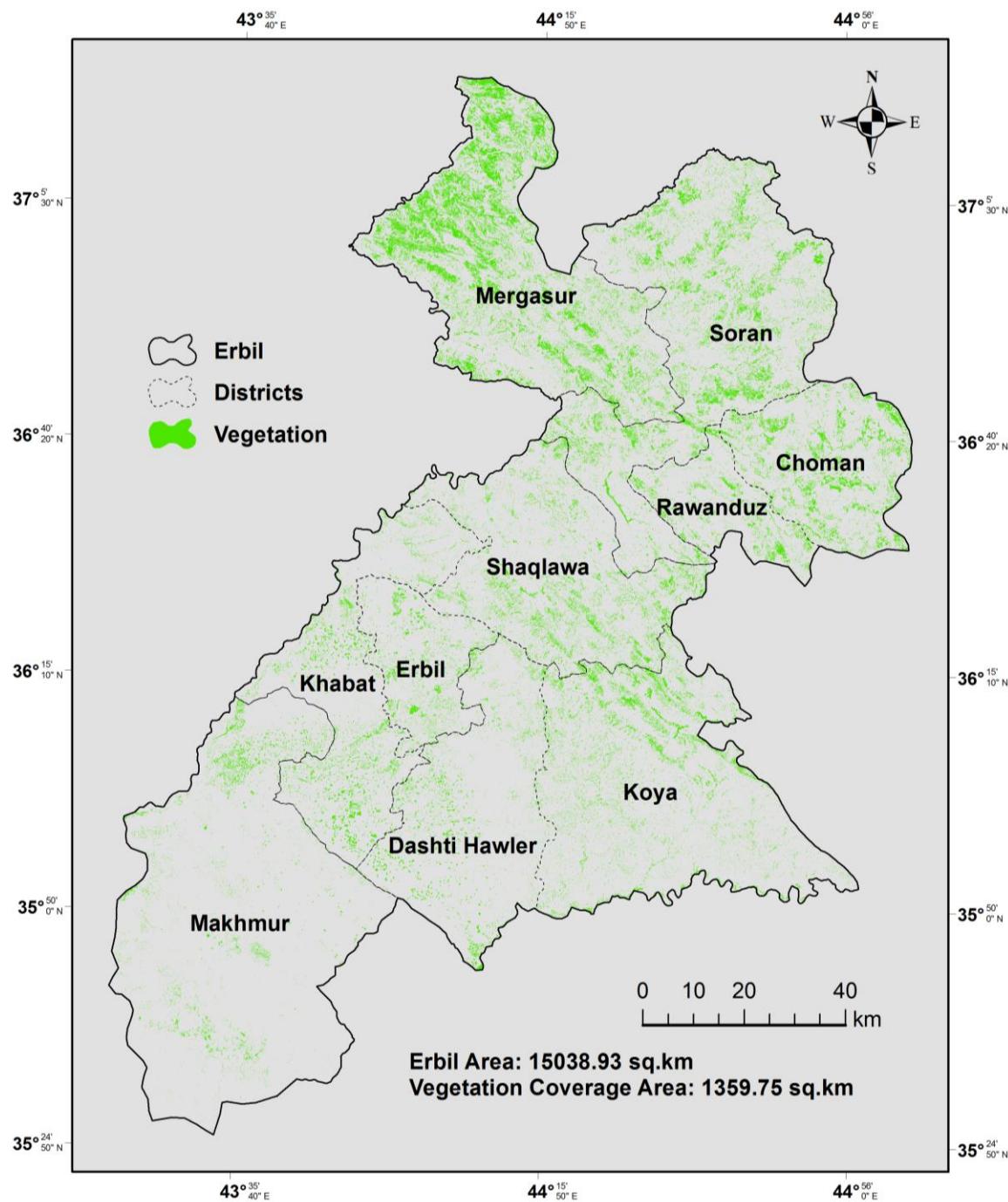


Figure 12: Vegetation coverage distribution in Erbil Governorate.

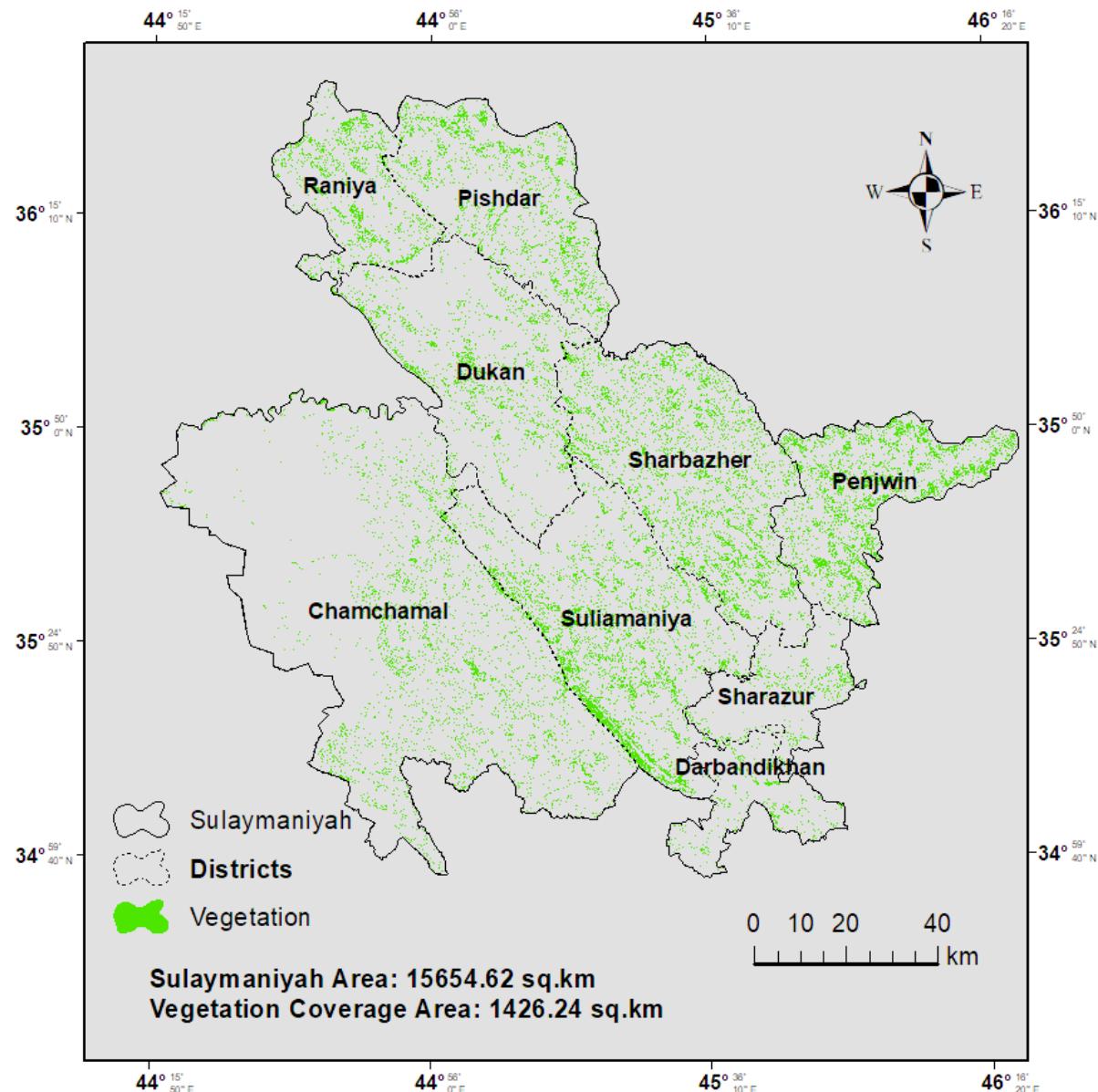


Figure 13: Vegetation coverage distribution in Sulaymaniyah Governorate.

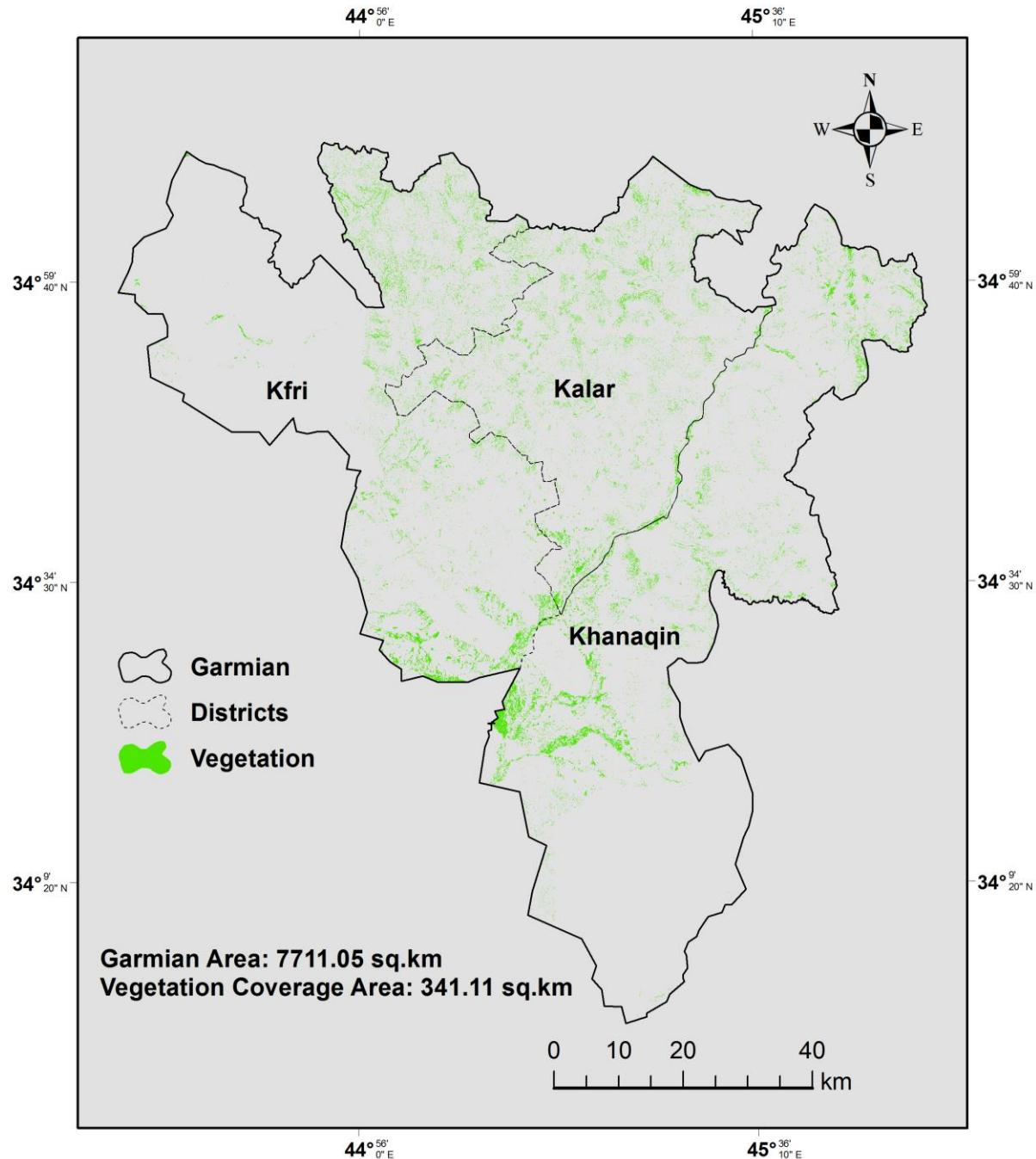


Figure 14: Vegetation coverage distribution in Garmian Administrative.

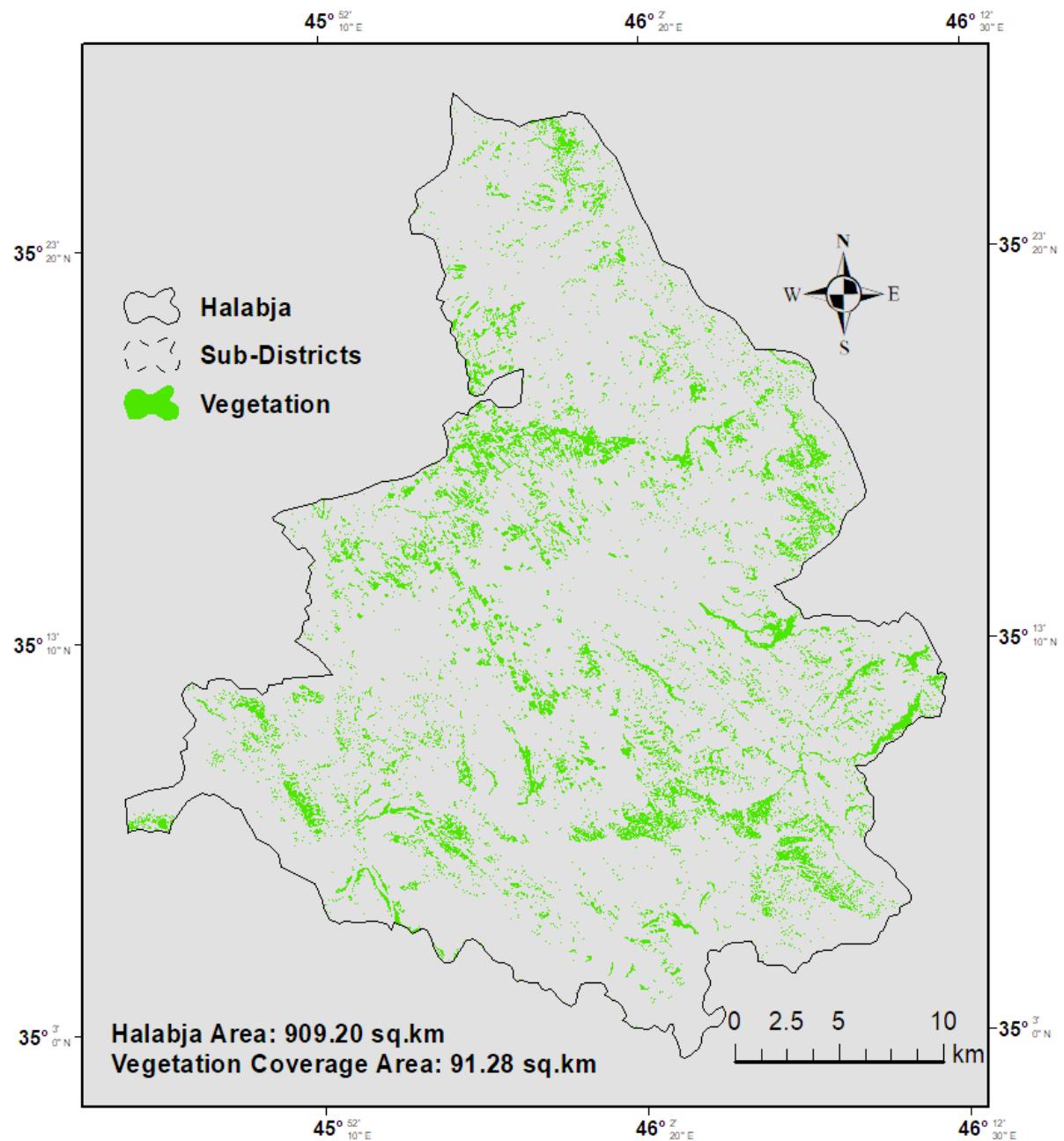


Figure 15: Vegetation coverage distribution in Halabja Governorate.

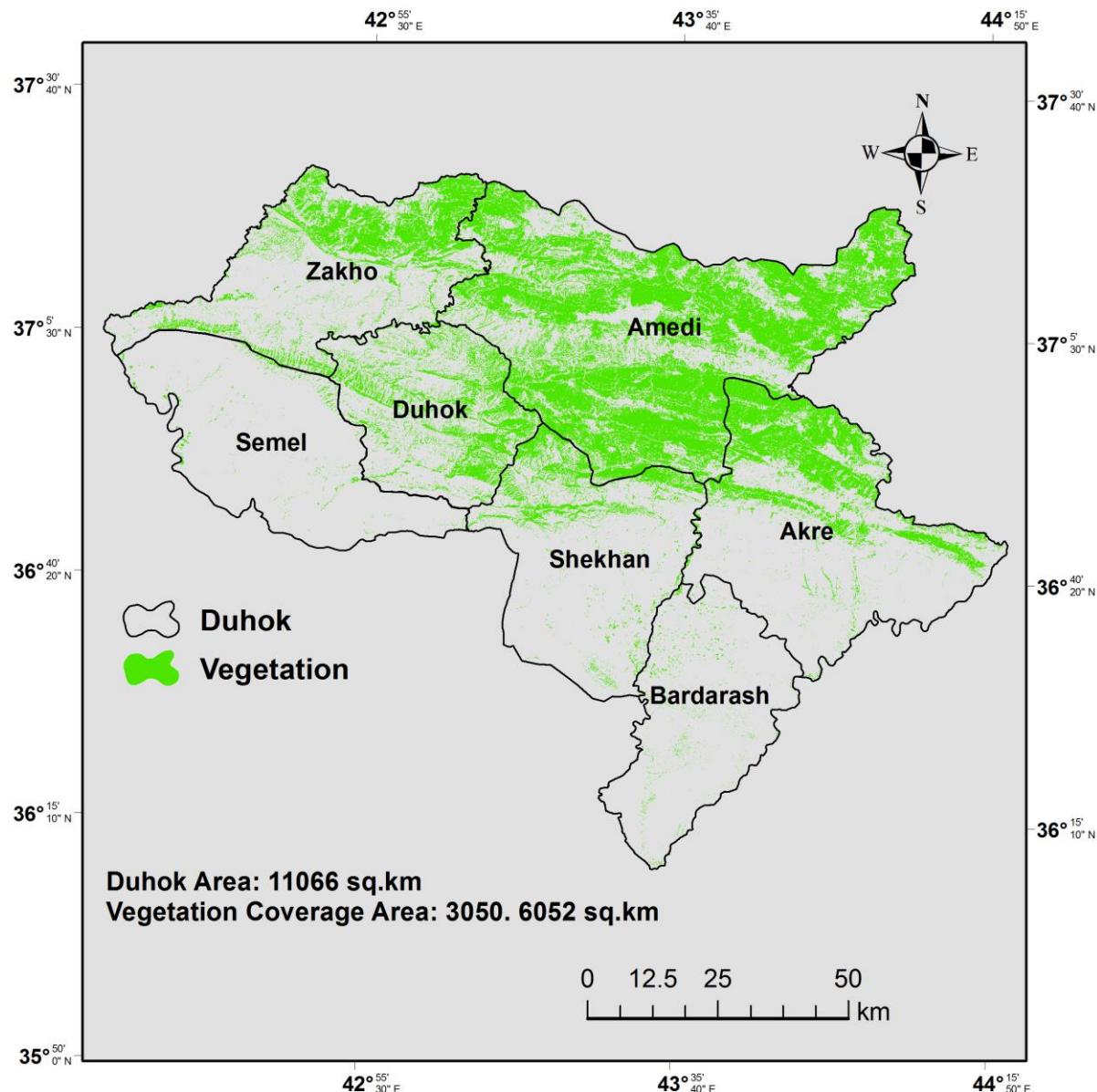


Figure 16: Vegetation coverage distribution in Duhok Governorate.

9.4 VEGETATION COVERAGE AREA OF EACH DISTRICT

Vegetation coverage area of all districts is calculated and mapped. The calculated vegetation area of each district is reported in Table 7. Based on the resulted vegetation ratio of the project of 2015, the maximum coverage area of vegetation exists in Mergasur districts with 21.65%, followed by Penjwin district with 18.53%. While, the minimum vegetation coverage ratio is 2.49% that exists in Makhmur district. In addition, the maximum and minimum vegetation coverage of Duhok project 2014 are Amedi and Bardarash, respectively. Figure 17-46 are the maps of the vegetation coverage distribution of all districts in the study area.

Table 7: Vegetation coverage distribution over all districts of the study area

Year	Governorate	District	Area in Km ²		Area in hectares		Vegetation Ratio %
			District	Vegetation	District	Vegetation	
2015	Erbil	Mergasur	1935.48	419.11	193548	41911	21.65
		Soran	2151.32	244.76	215132	24476	11.38
		Choman	891.74	117.42	89174	11742	13.17
		Rawanduz	475.52	46.42	47552	4642	9.76
		Shaqlawa	1437.70	126.30	143770	12630	8.79
		Khabat	1219.40	78.65	121940	7865	6.45
		Erbil	553.29	40.10	55329	4010	7.25
		Dashti Hawler	1370.92	61.80	137092	6180	4.51
		Koya	2049.64	149.48	204964	14948	7.29
		Makhmur	2954.09	73.54	295409	7354	2.49
2014	Duhok	Raniya	869.76	89.01	86976	8901	10.23
		Pishdar	1378.21	150.62	137821	15062	10.93
		Dukan	1808.72	128.10	180872	12810	7.08
		Sharbazher	2033.63	268.77	203363	26877	13.22
		Penjwin	1147.63	212.62	114763	21262	18.53
		Suliamaniya	2129.56	263.36	212956	26336	12.37
		Sharazur	641.01	36.29	64101	3629	5.66
		Darbandikhan	546.02	31.40	54602	3140	5.75
		Chamchamal	5100.08	246.07	510008	24607	4.82
		Halabja	909.20	91.28	90920	9128	10.04
2014	Garmian	Kalar	1752.31	96.33	175231	9633	5.50
		Kfri	2888.66	117.69	288866	11769	4.07
		Khanaqin	3070.08	127.09	307008	12709	4.14
2014	Duhok	Duhok	1065	288.73	106500	28873	27.11
		Semel	1375	24.18	137500	2418	1.75
		Zakho	1453	417	145300	41700	28.69
		Amedi	2774	1659	277400	165900	59.80
		Akre	1832	454.87	183200	45487	24.82
		Shekhan	1416	185.2742	141600	18527.42	13.08
		Bardarash	1150.33	23.539	115033	2353.9	2.04
Total			50379.3	6268.803	5037930	626880.3	12.44

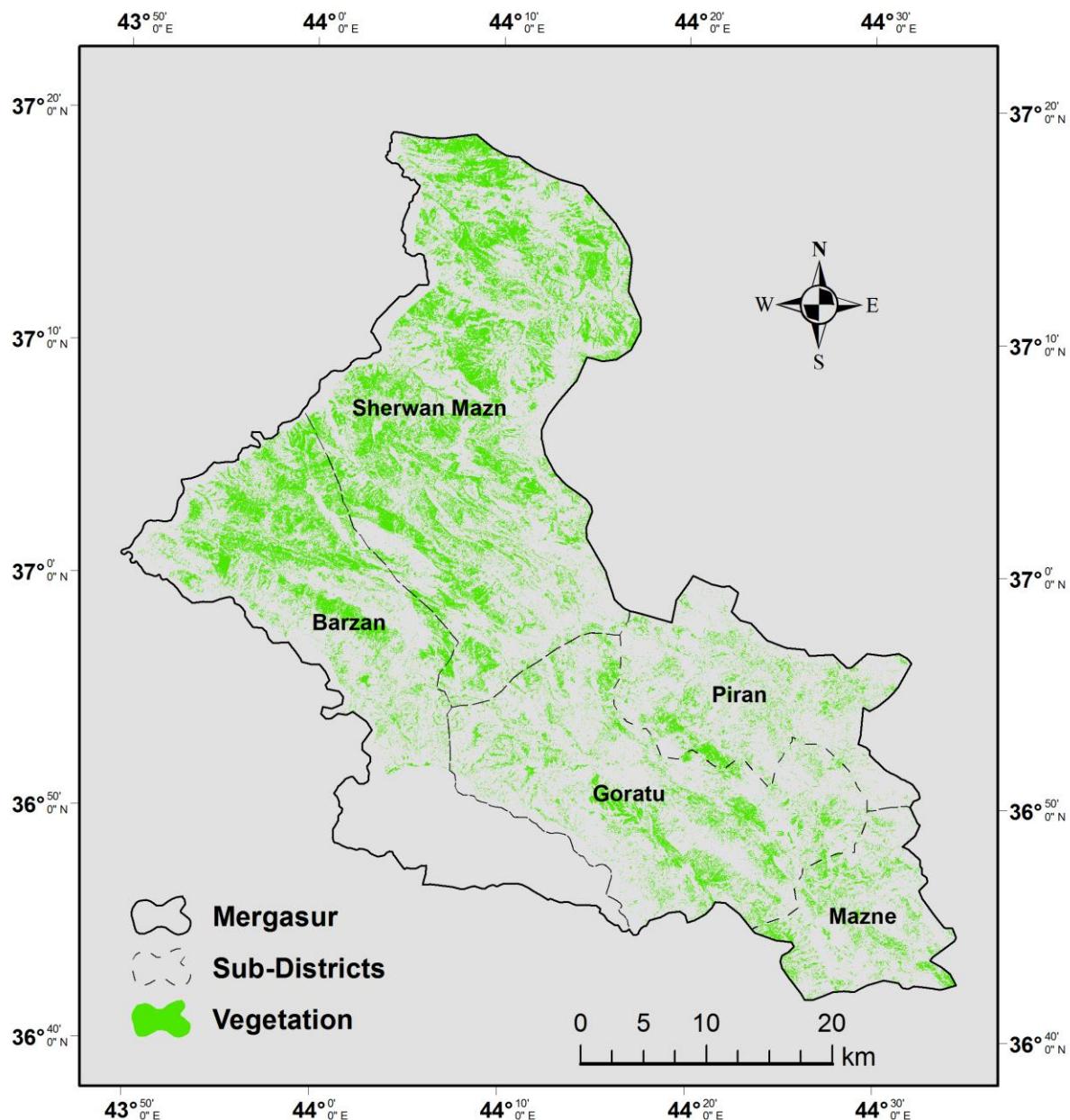


Figure 17: Vegetation coverage distribution in Mergasur district.

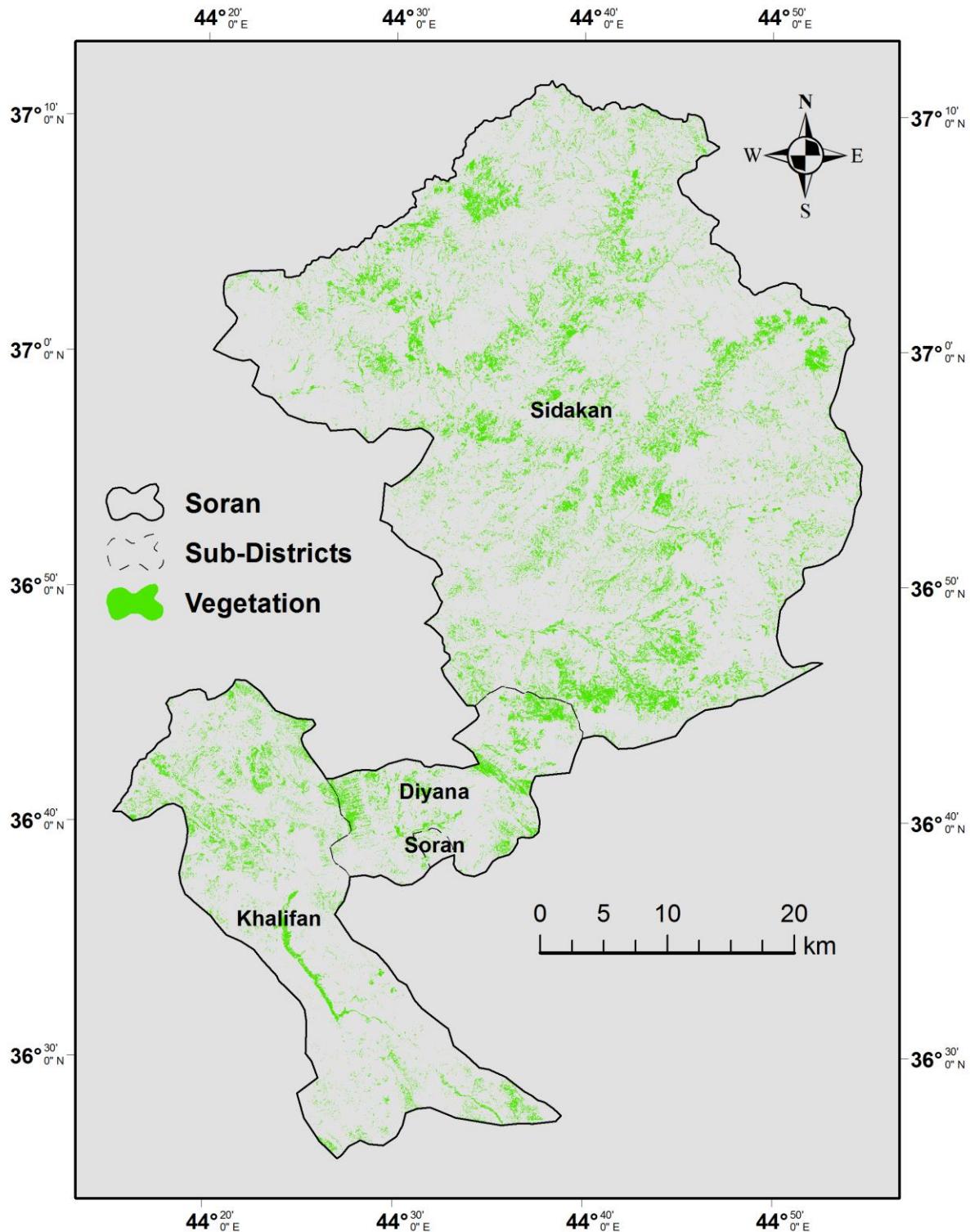


Figure 18: Vegetation coverage distribution in Soran district.

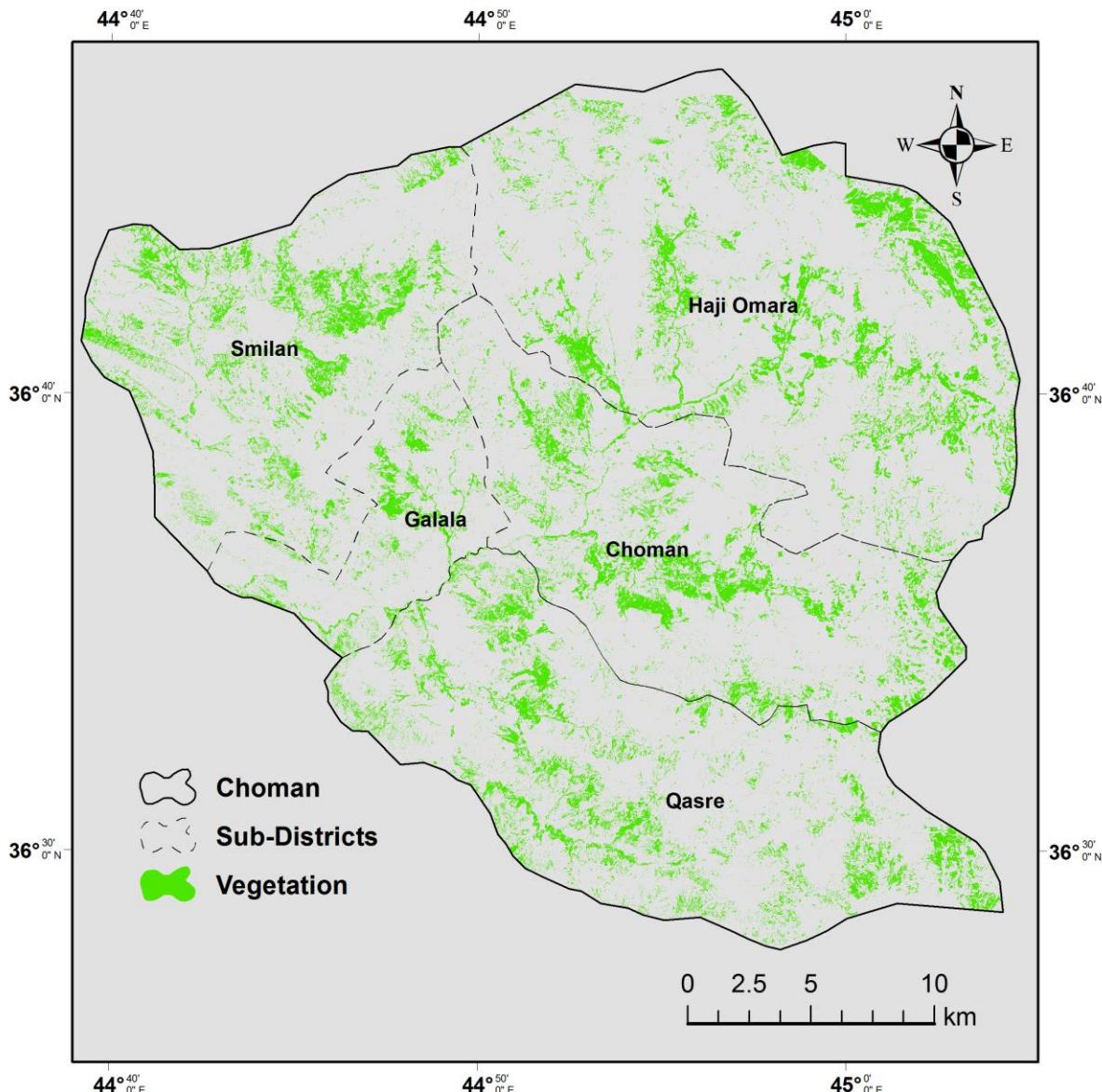


Figure 19: Vegetation coverage distribution in Choman district.

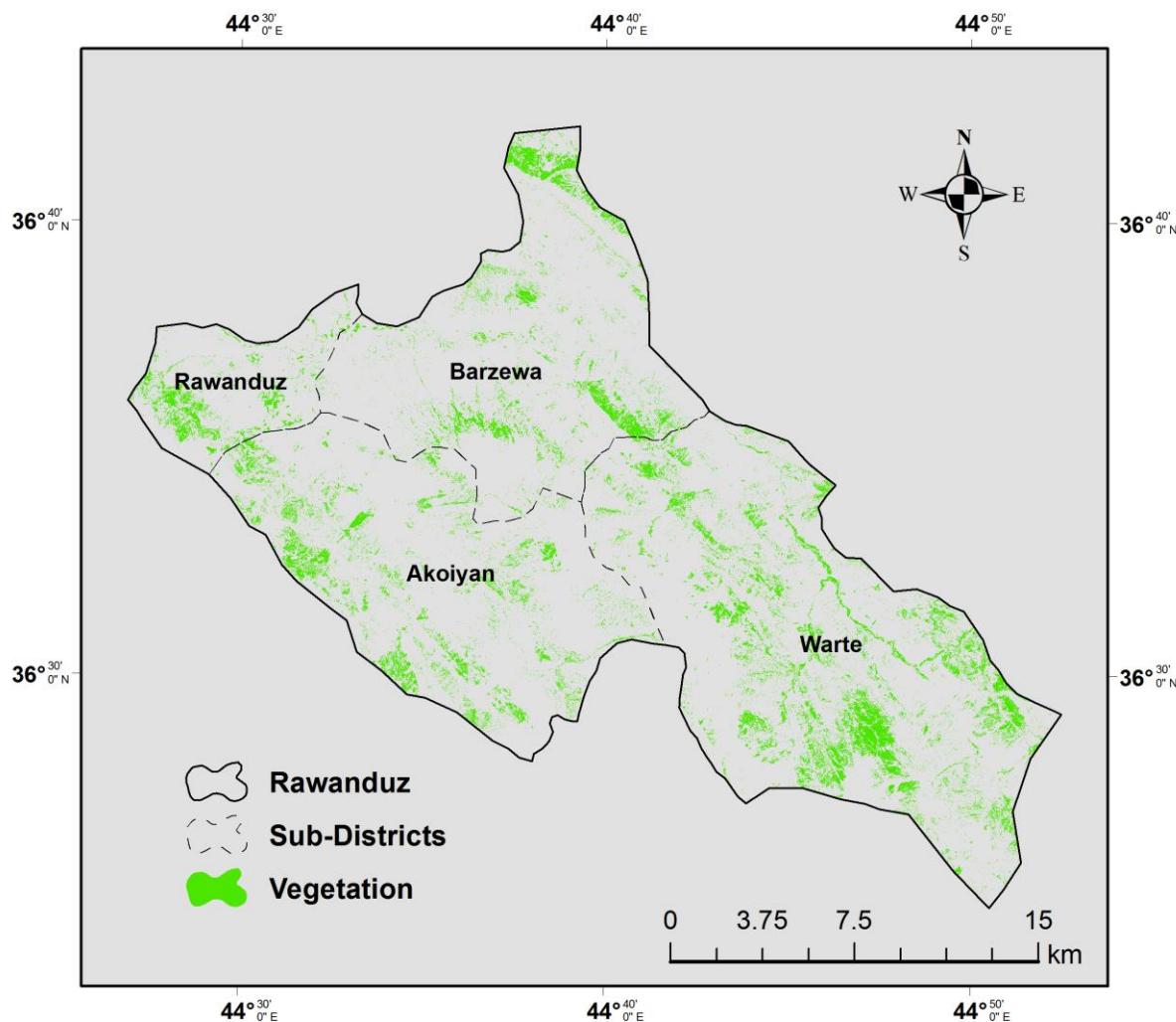


Figure 20: Vegetation coverage distribution in Rawanduz district.

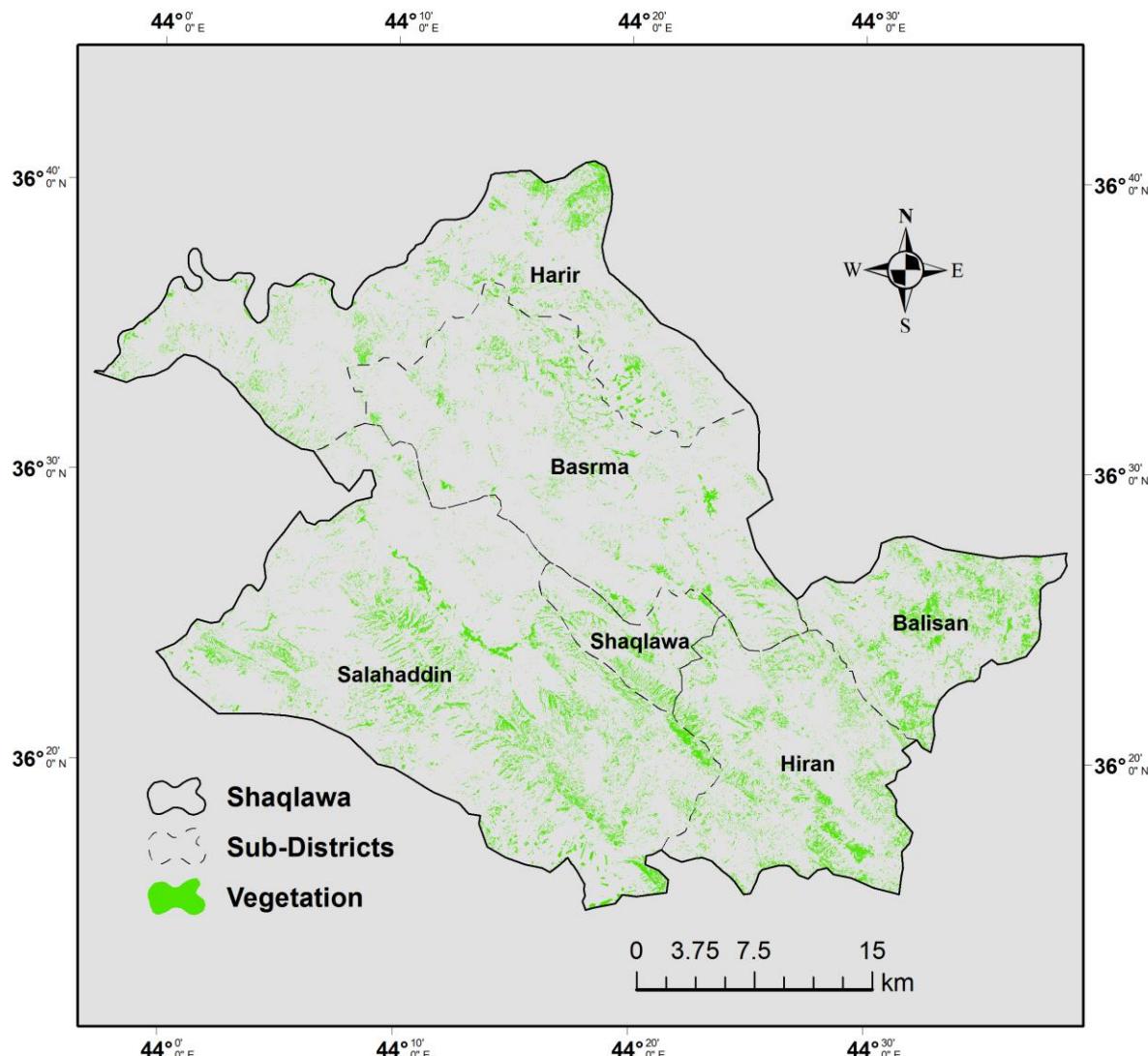


Figure 21: Vegetation coverage distribution in Shaqlawa district.

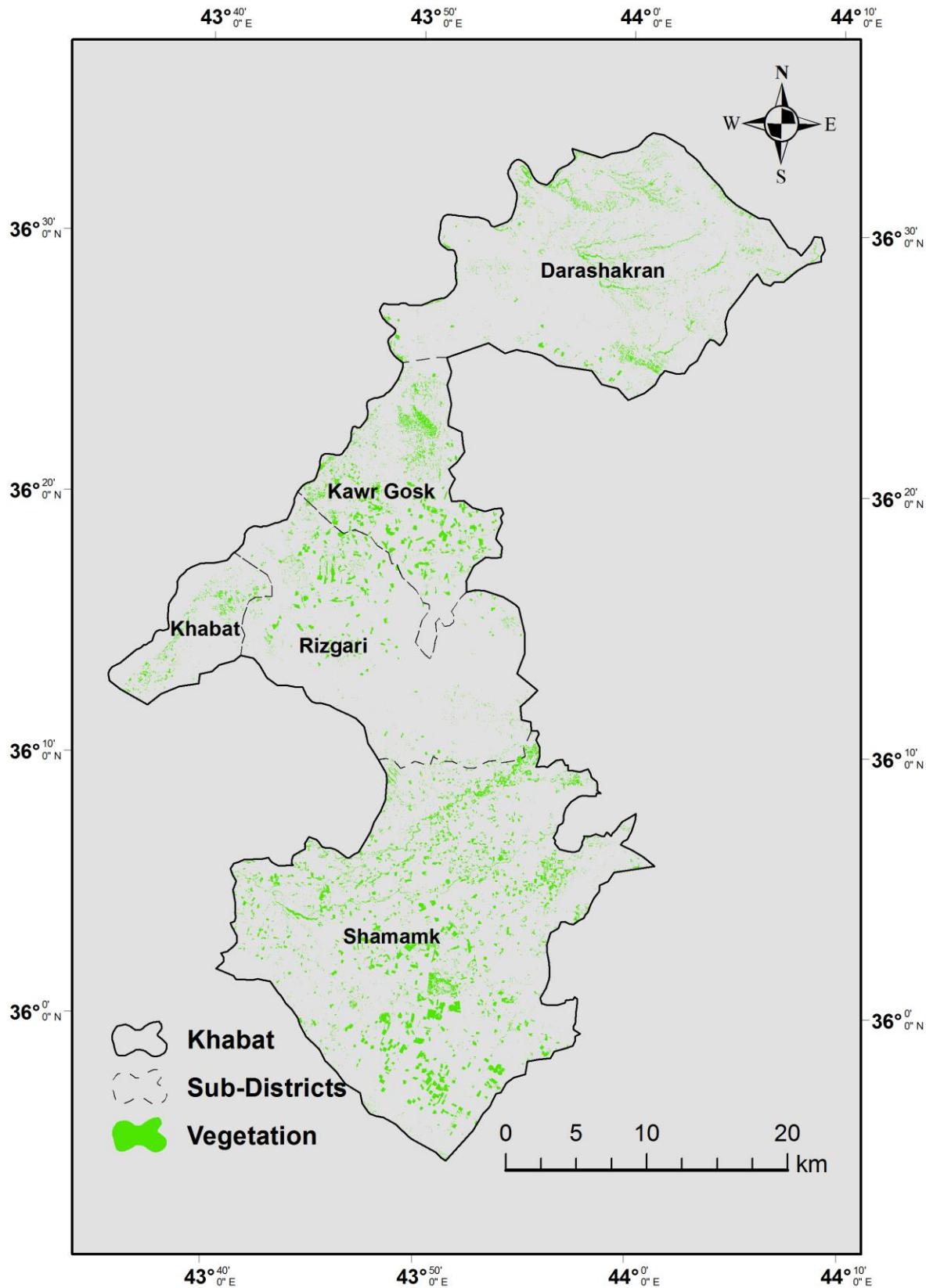


Figure 22: Vegetation coverage distribution in Khabat district.

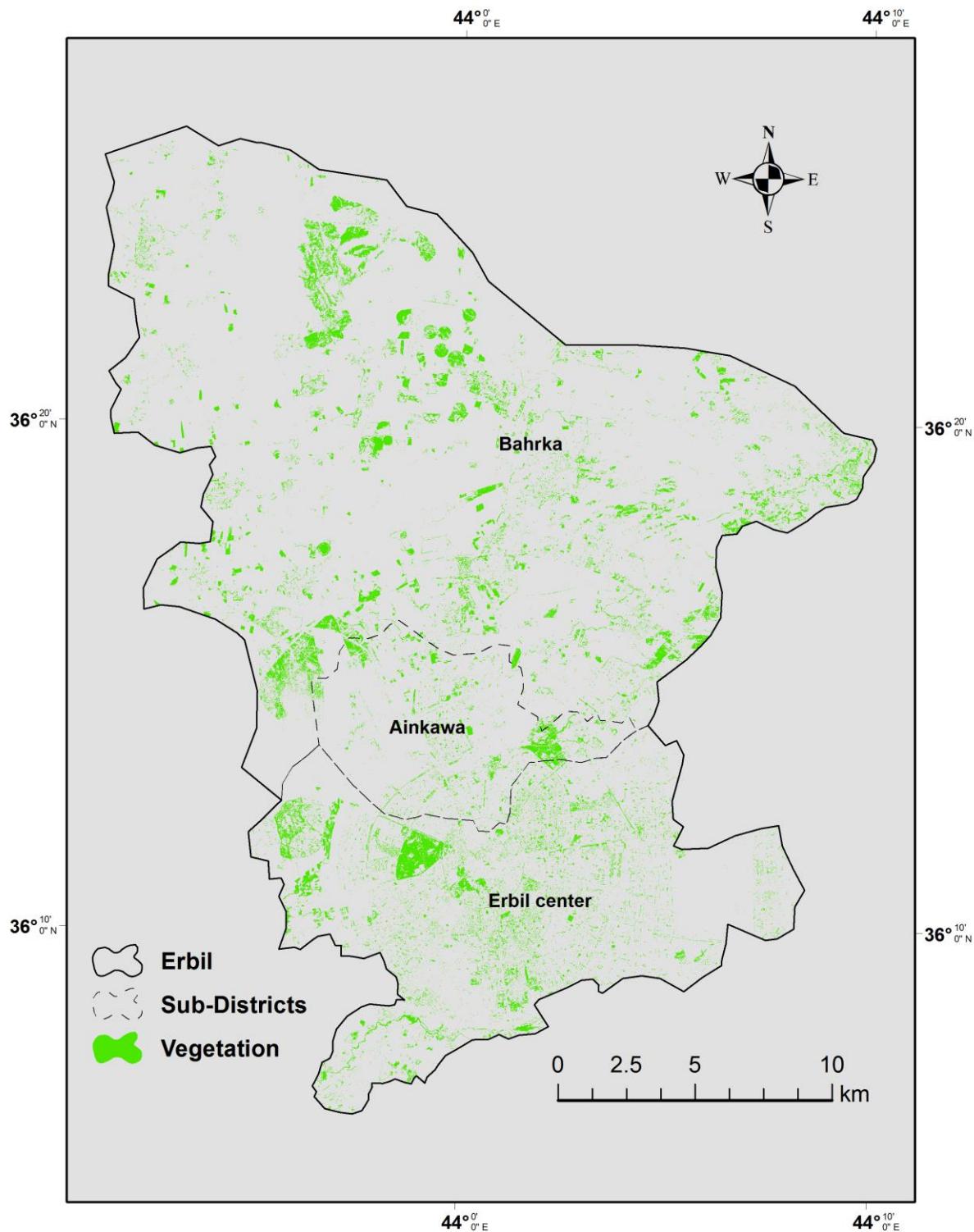


Figure 23: Vegetation coverage distribution in Erbil district.

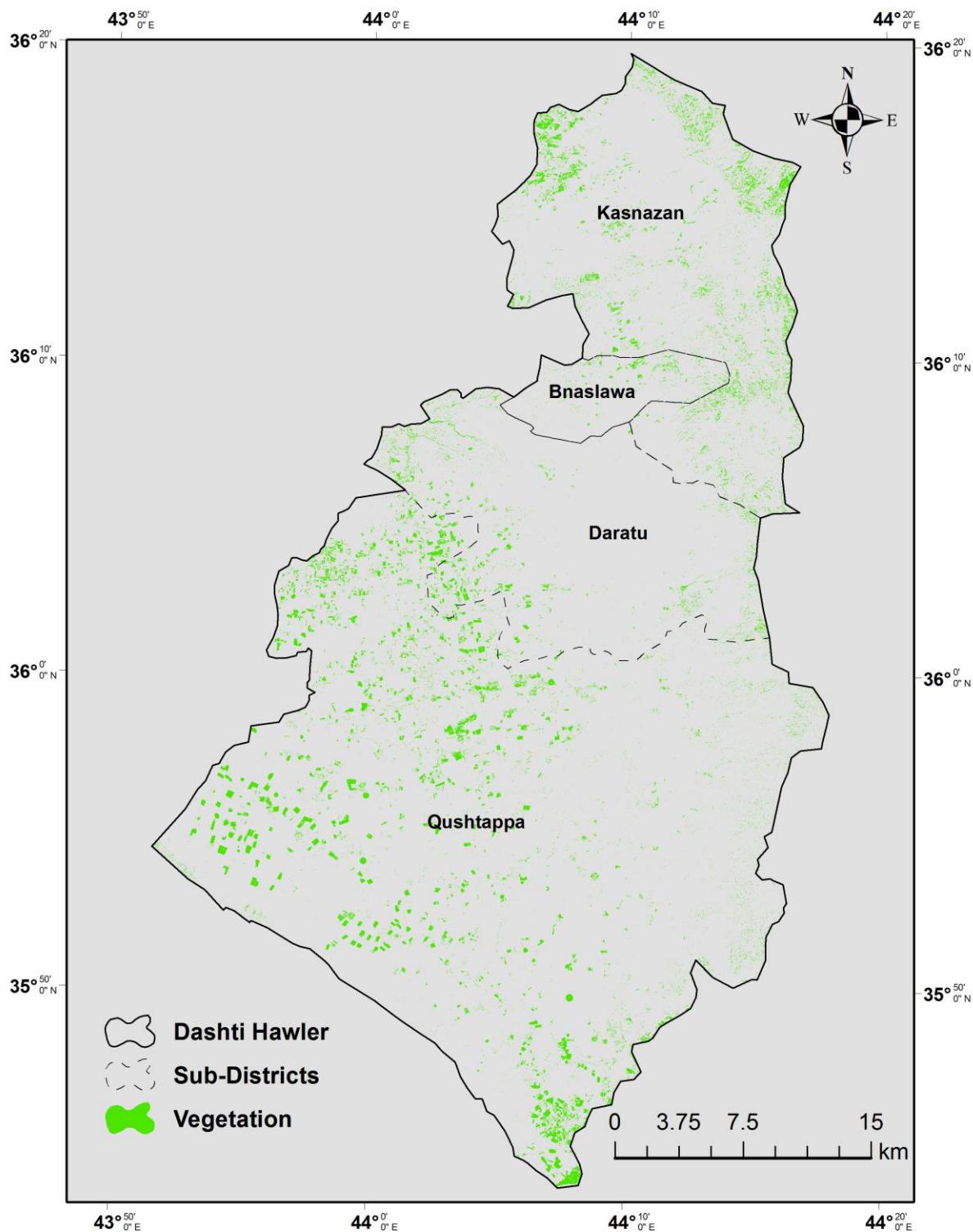


Figure 24: Vegetation coverage distribution in Dashti Hawler district.

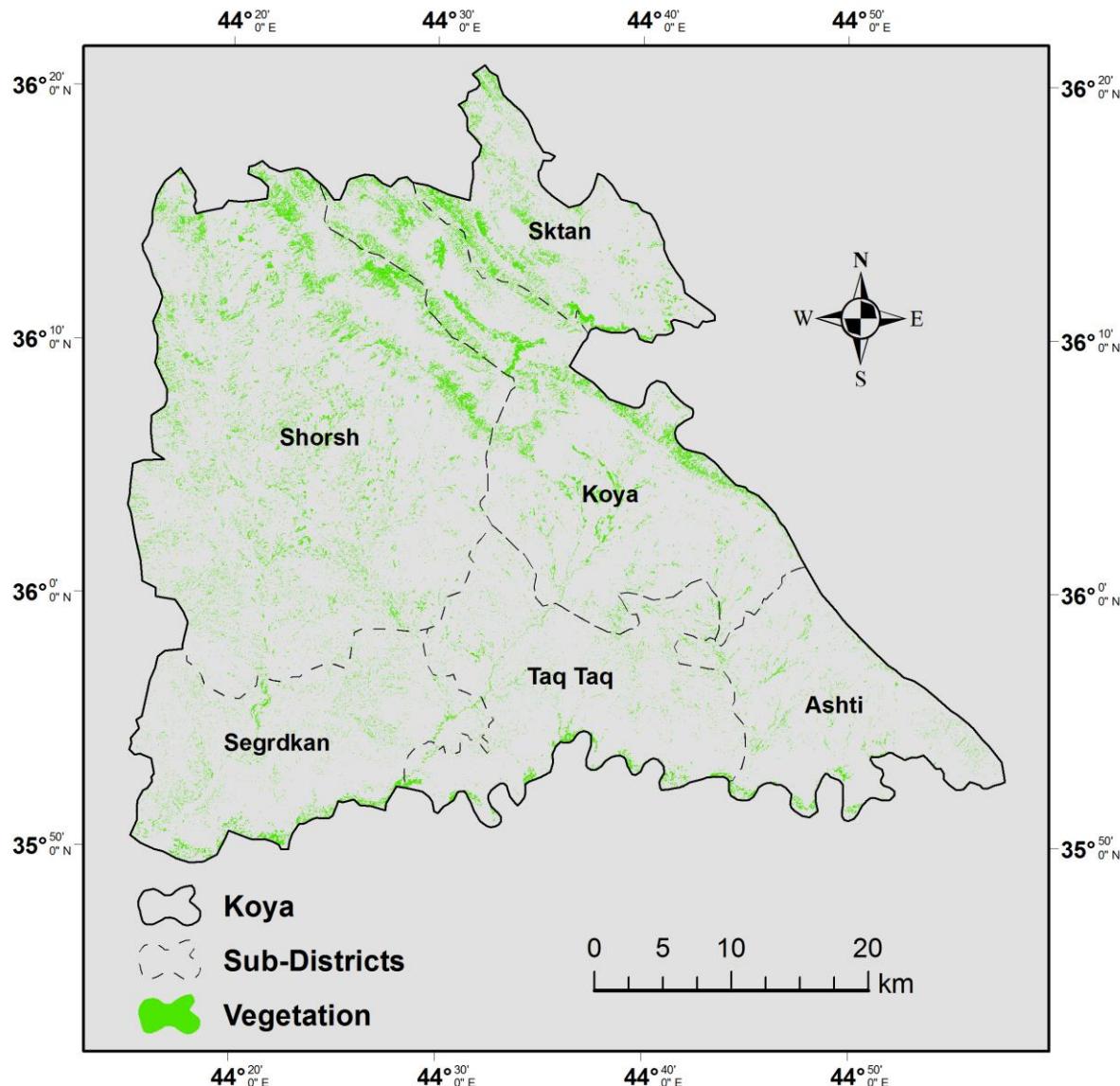


Figure 25: Vegetation coverage distribution in Koya district.

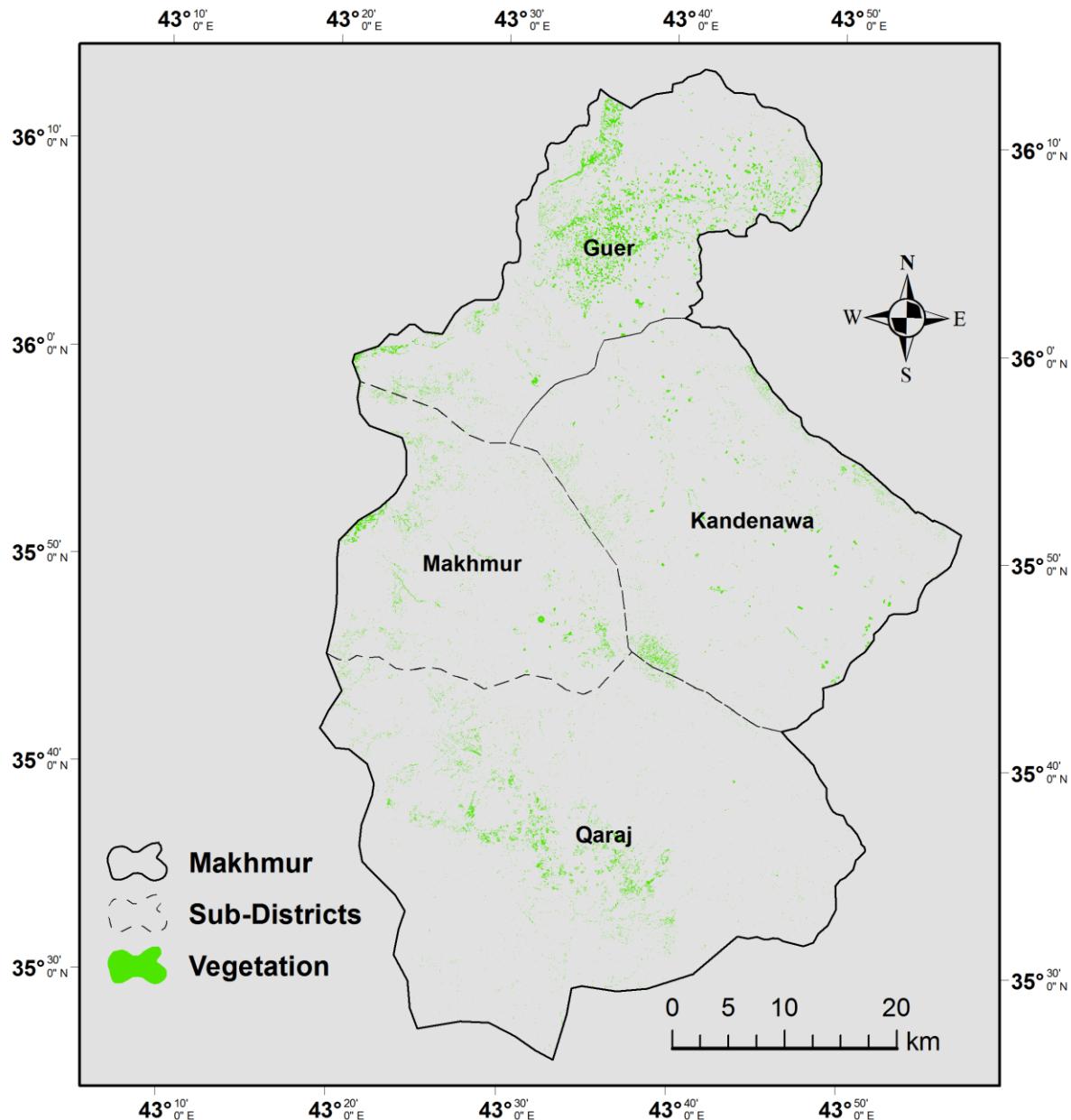


Figure 26: Vegetation coverage distribution in Makhmur district.

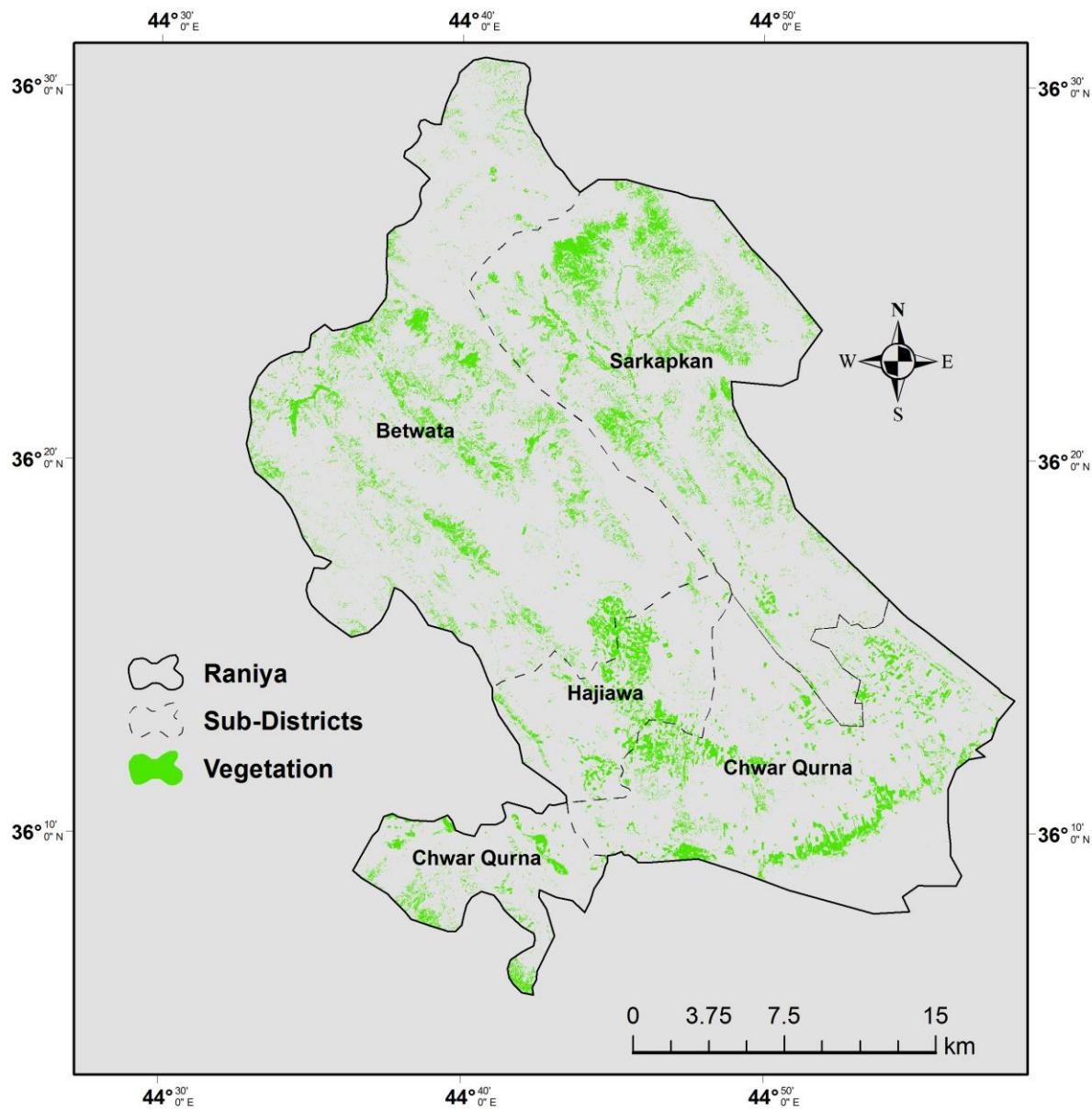


Figure 27: Vegetation coverage distribution in Raniya district.

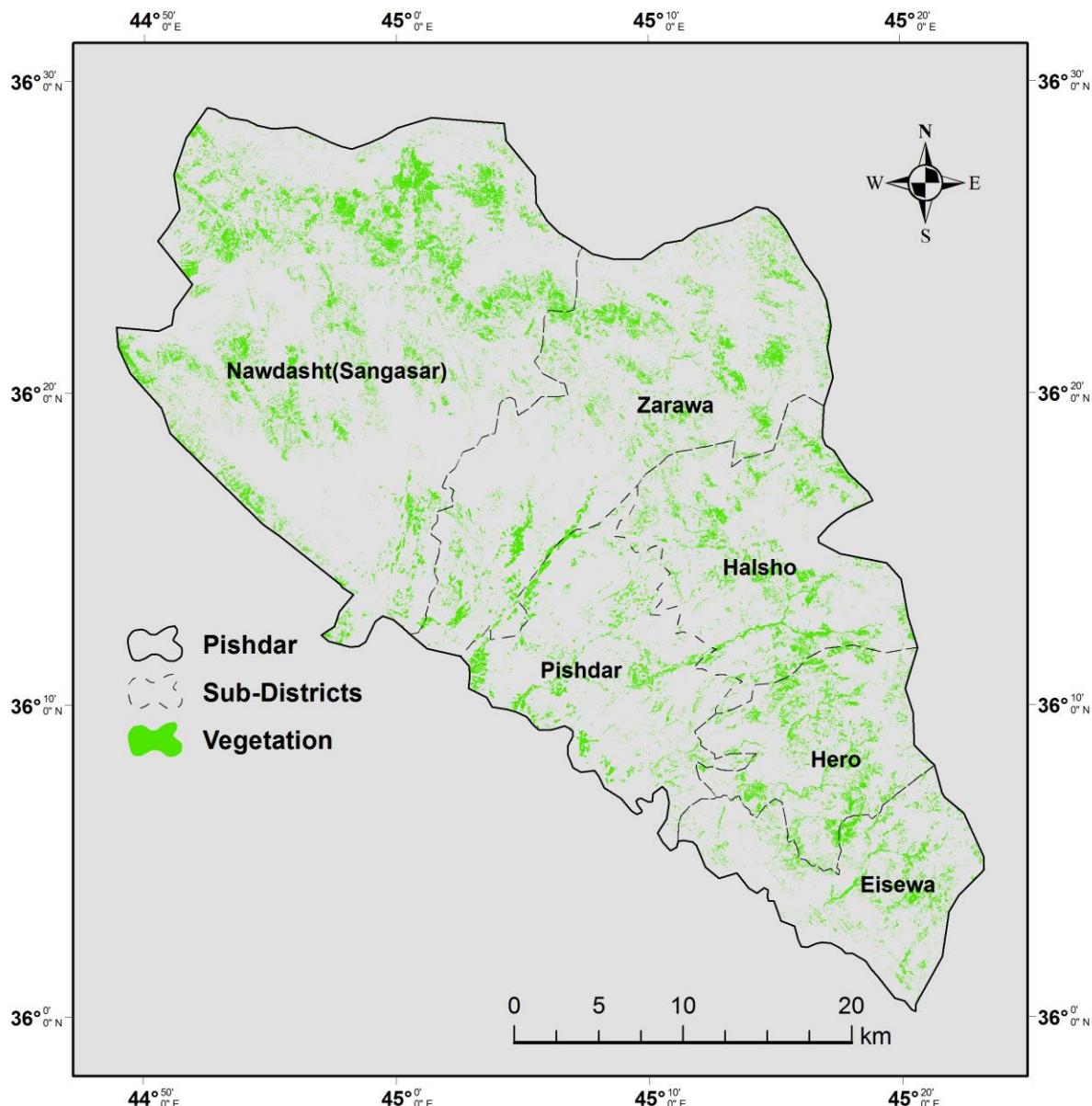


Figure 28: Vegetation coverage distribution in Pishdar district.

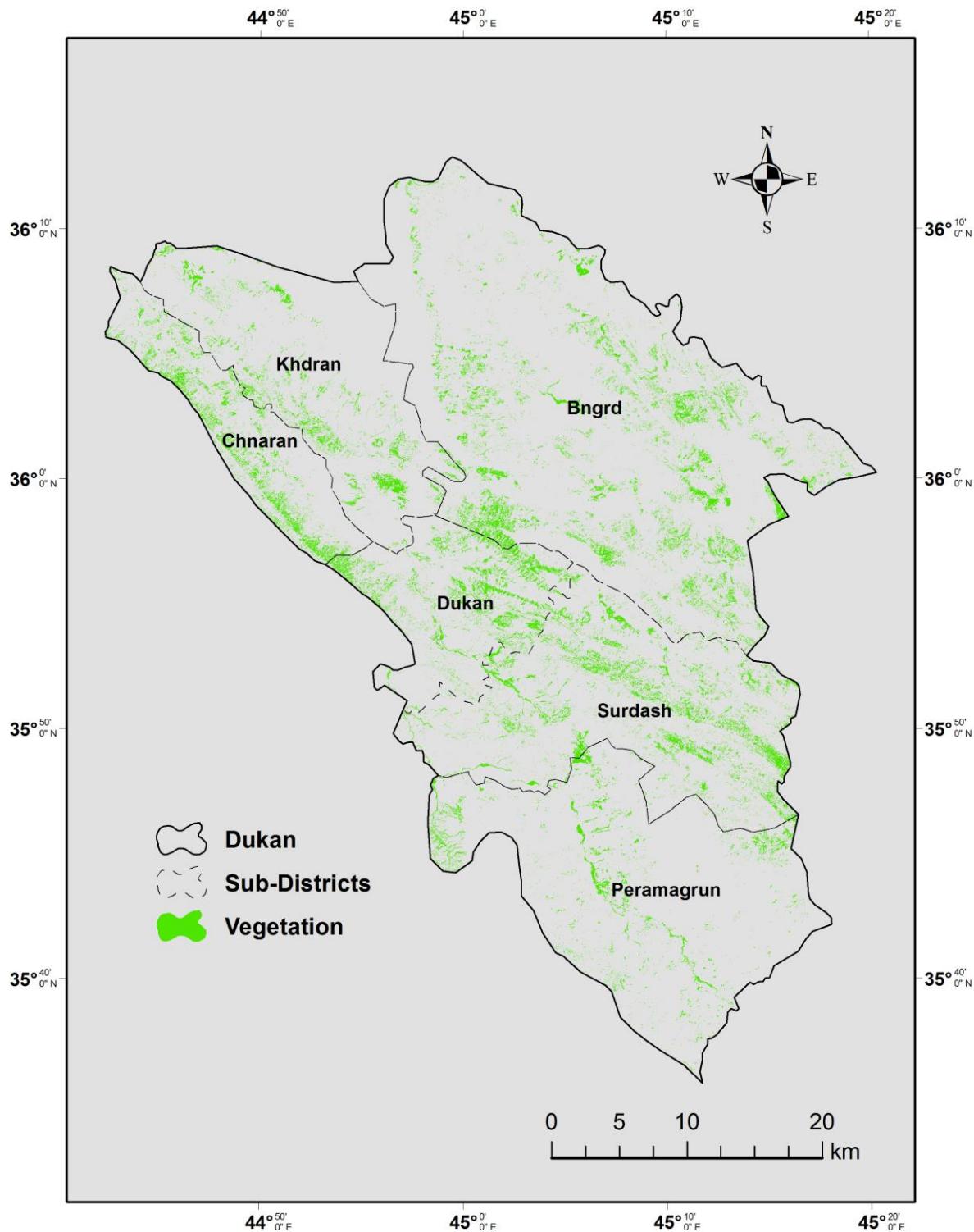


Figure 29: Vegetation coverage distribution in Dukan district.

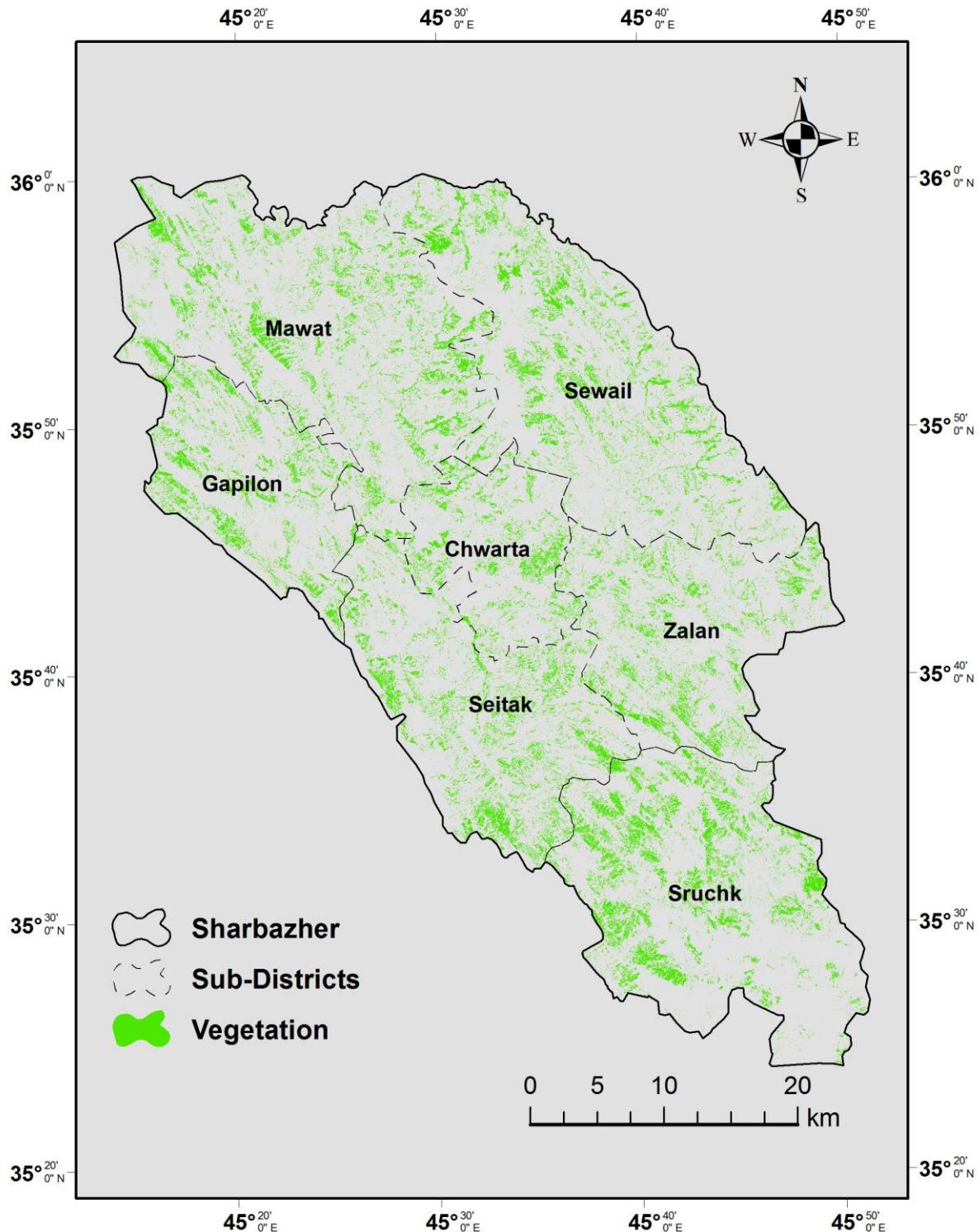


Figure 30: Vegetation coverage distribution in Sharbazher district.

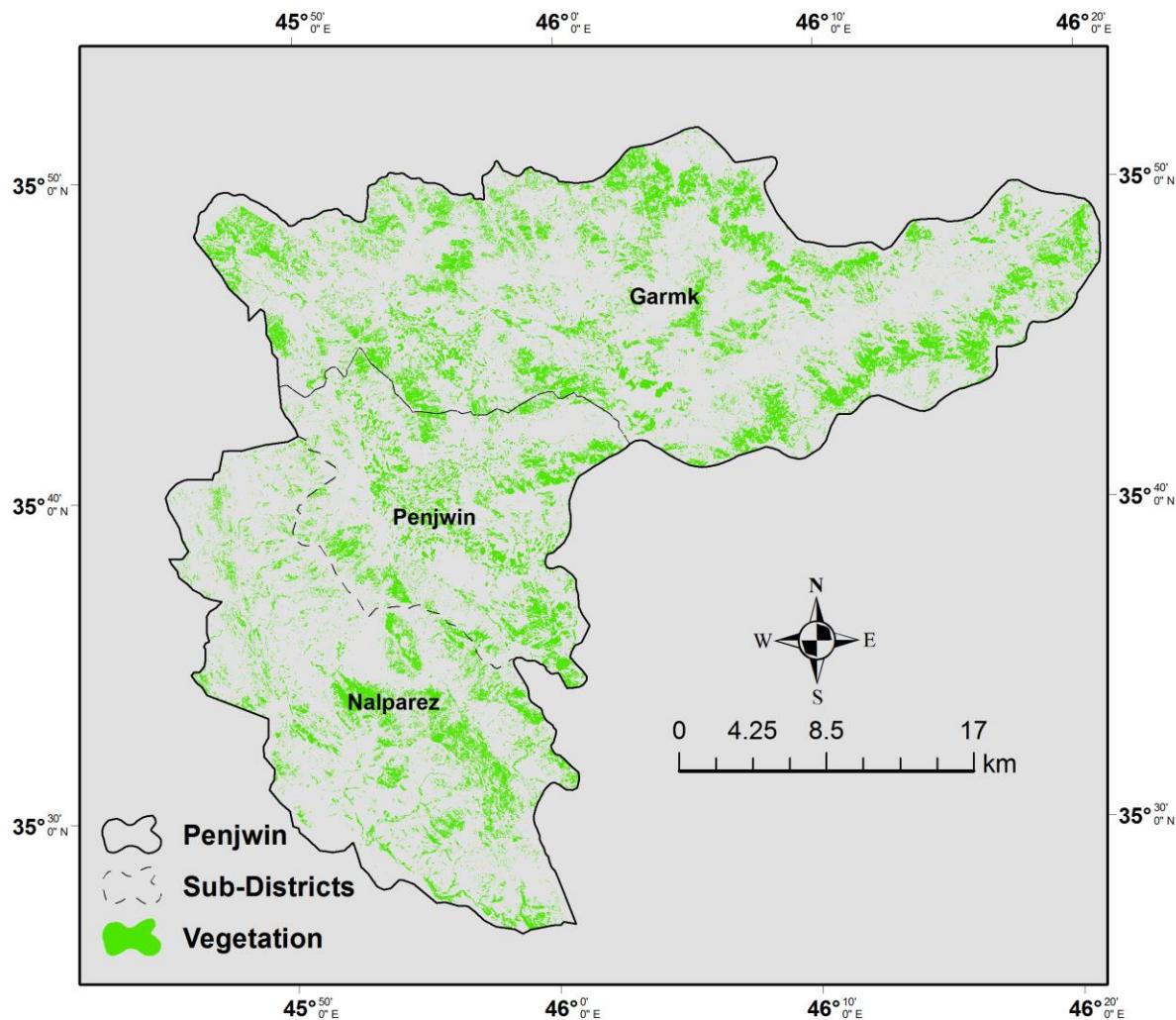


Figure 31: Vegetation coverage distribution in Penjwin district.

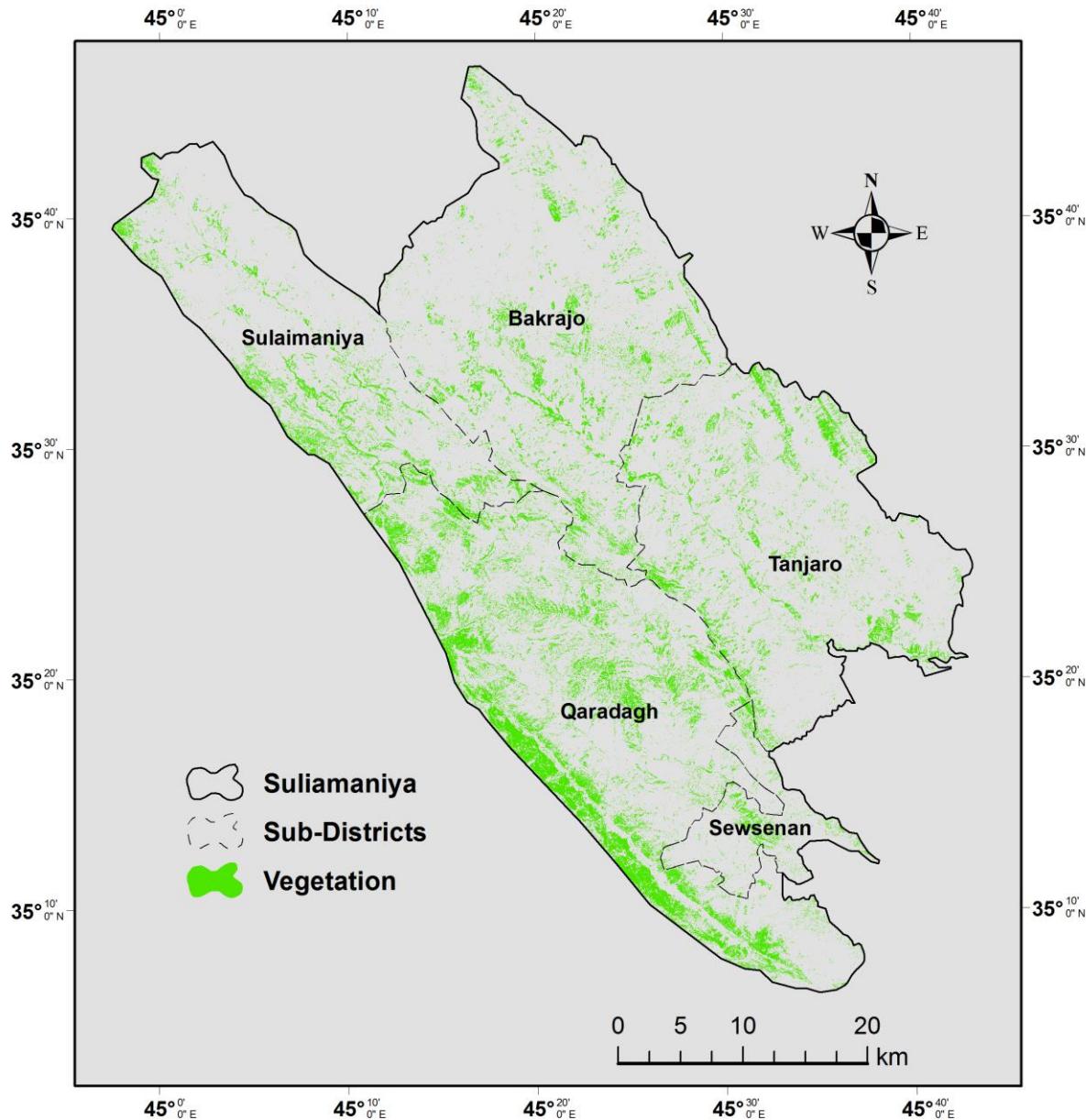


Figure 32: Vegetation coverage distribution in Sulaymaniyah district.

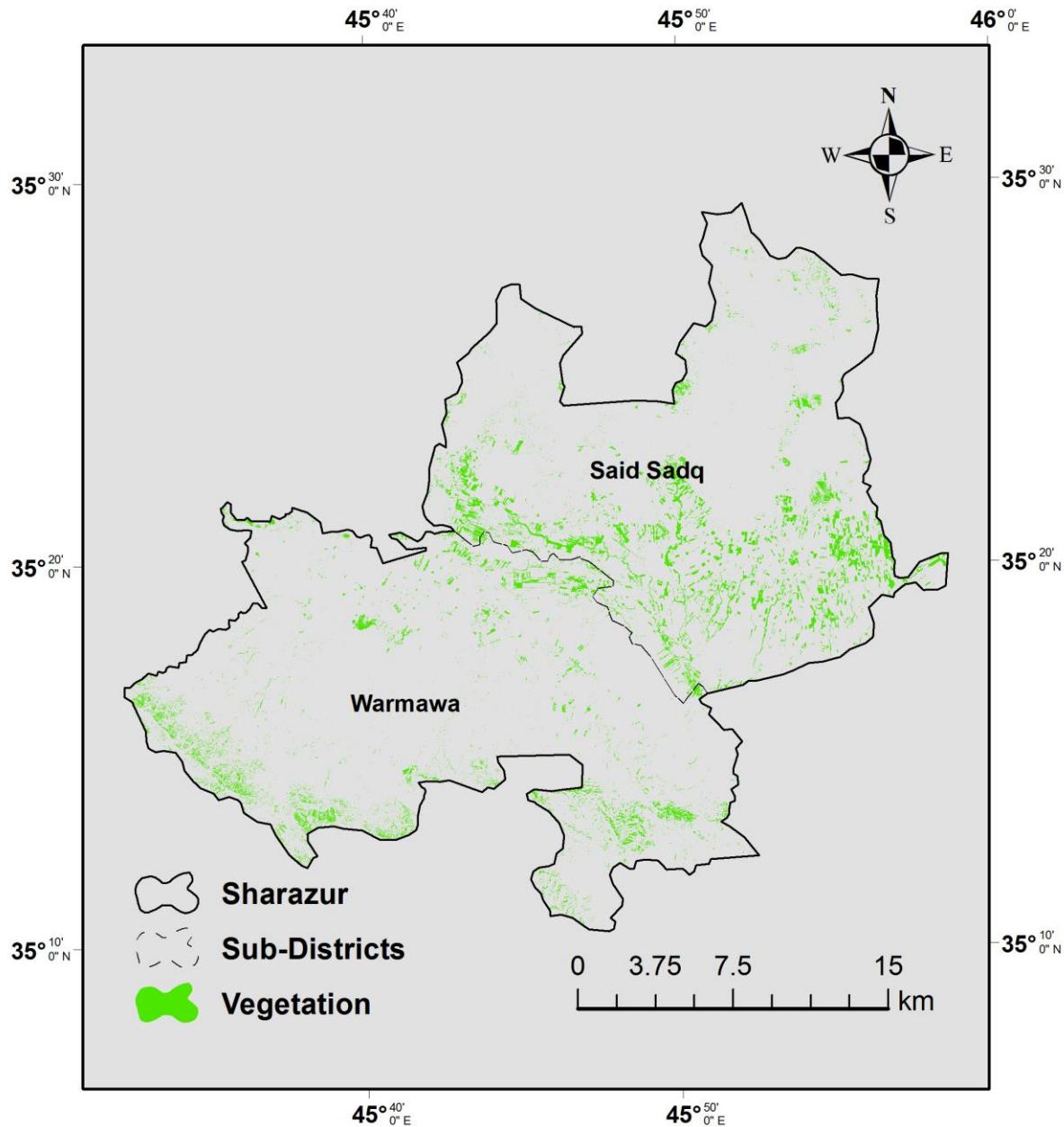


Figure 33: Vegetation coverage distribution in Sharazur district.

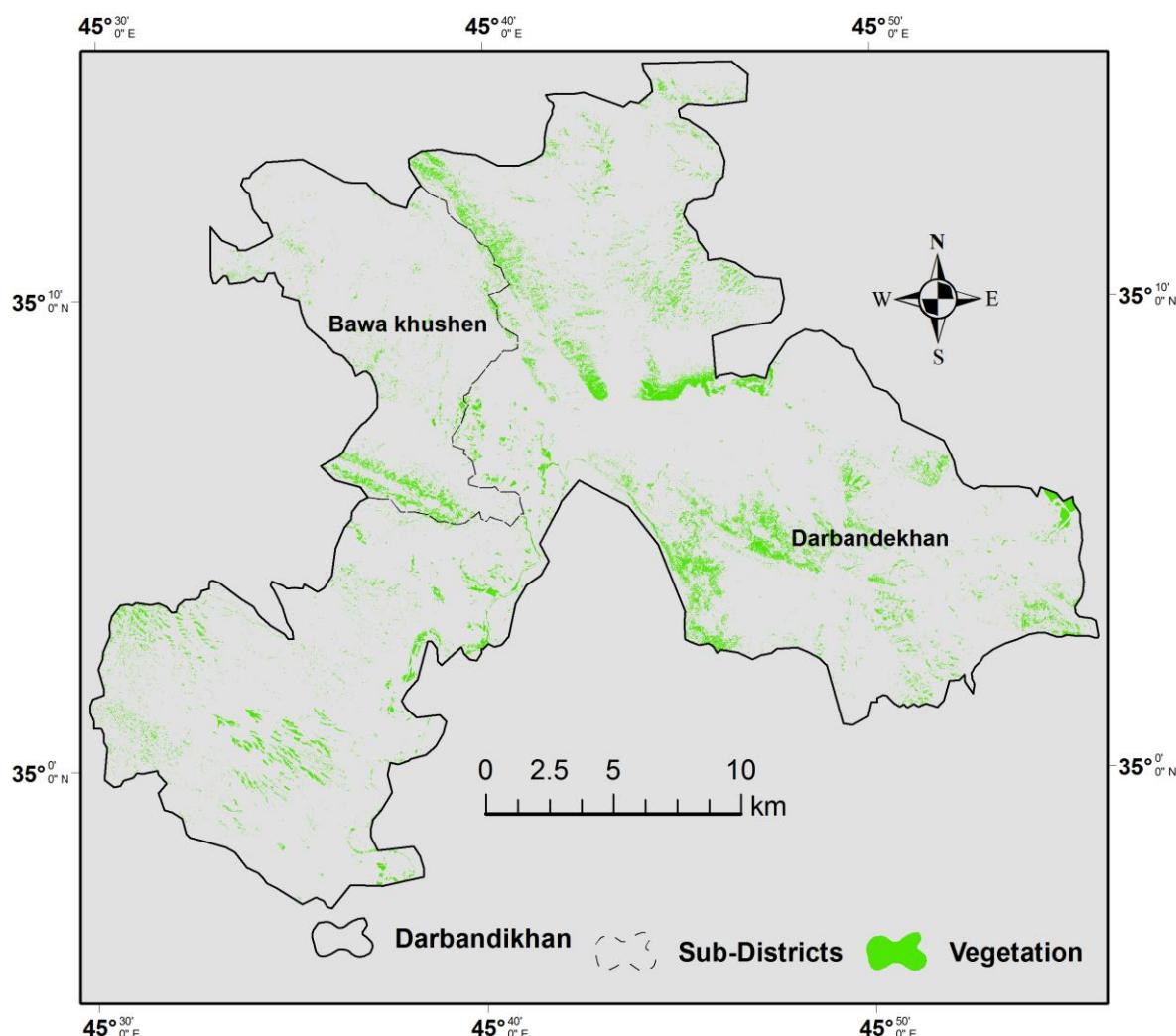


Figure 34: Vegetation coverage distribution in Darbandikhan district.

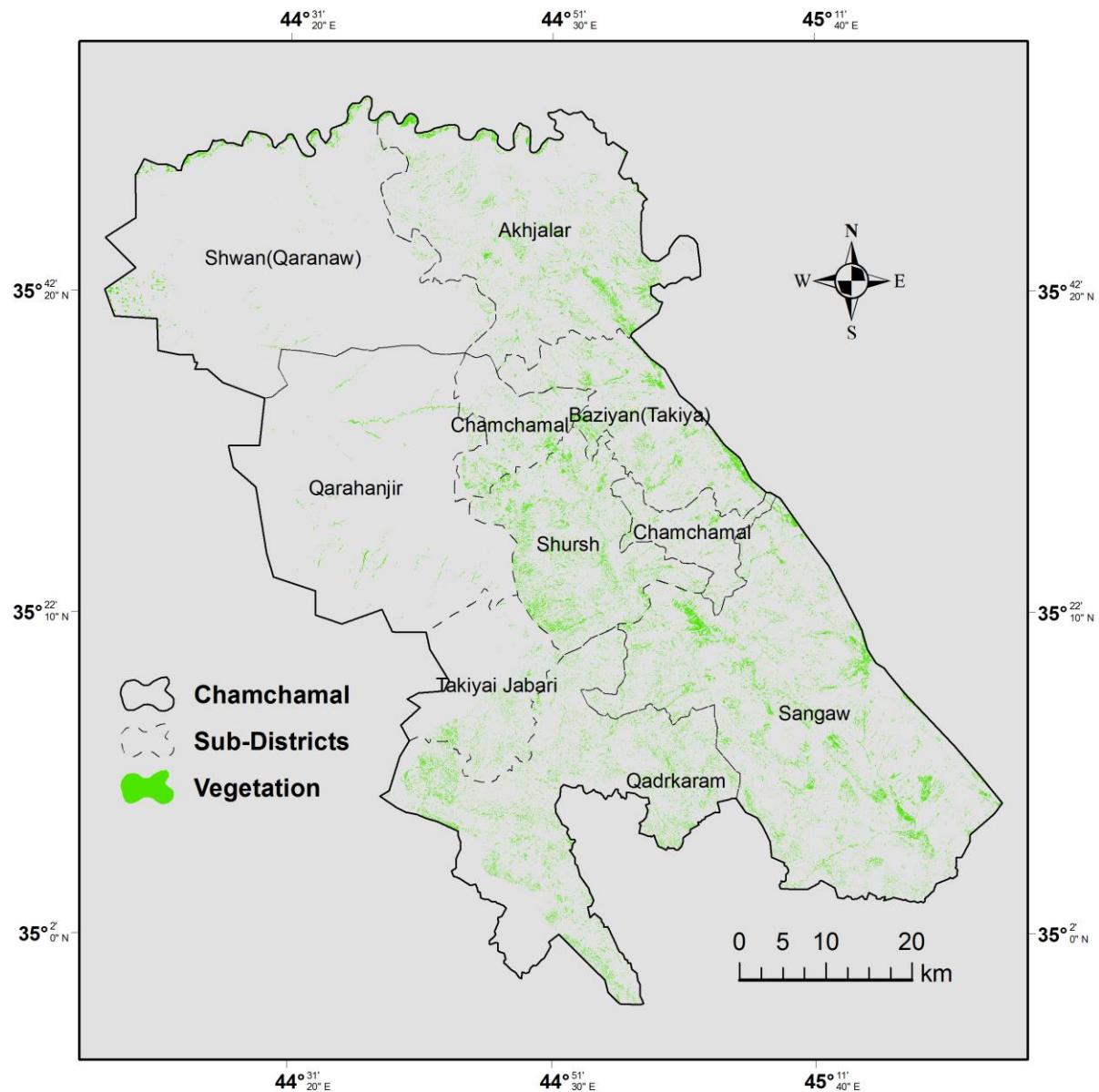


Figure 35: Vegetation coverage distribution in Chamchamal district.

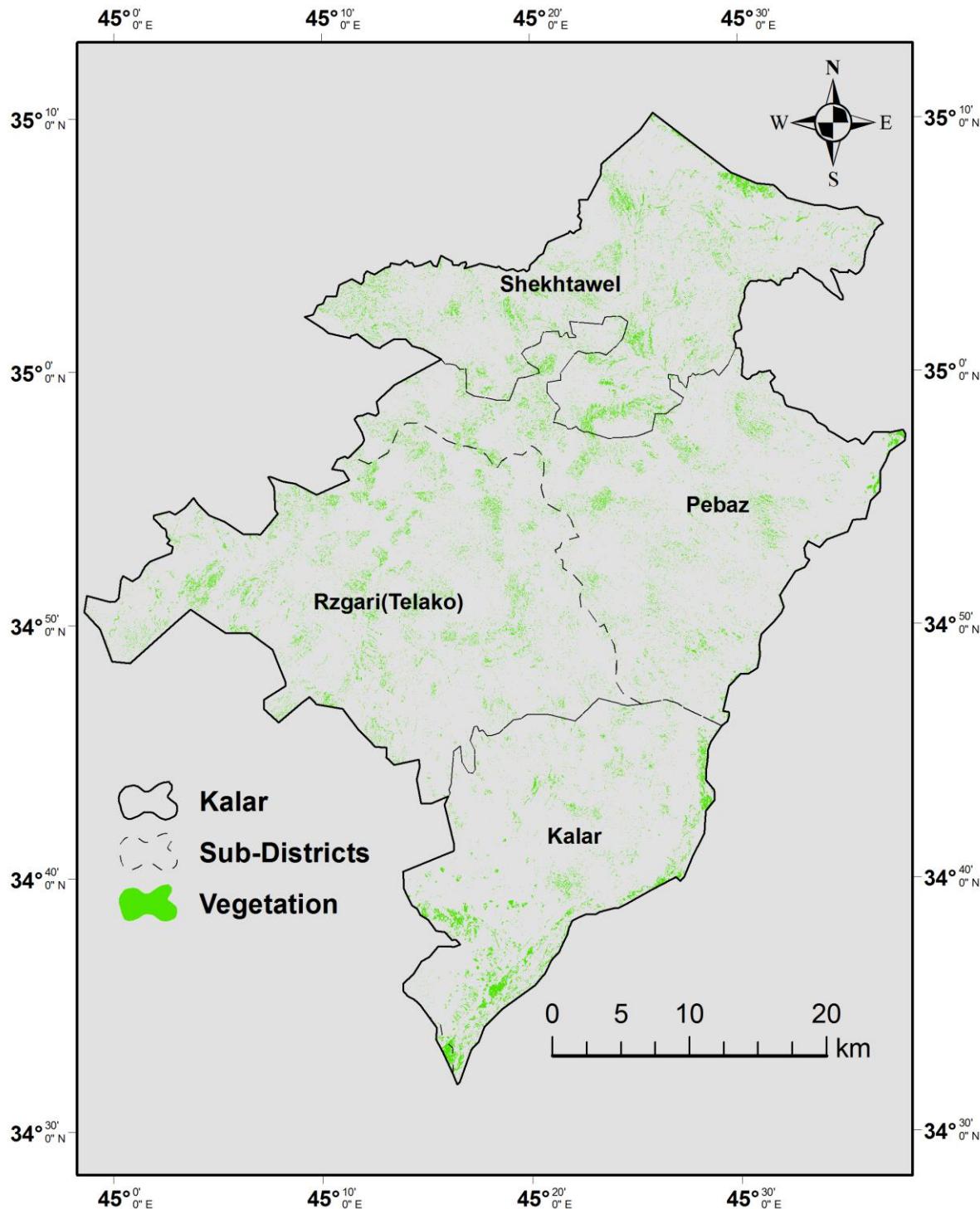


Figure 36: Vegetation coverage distribution in Kalar district.

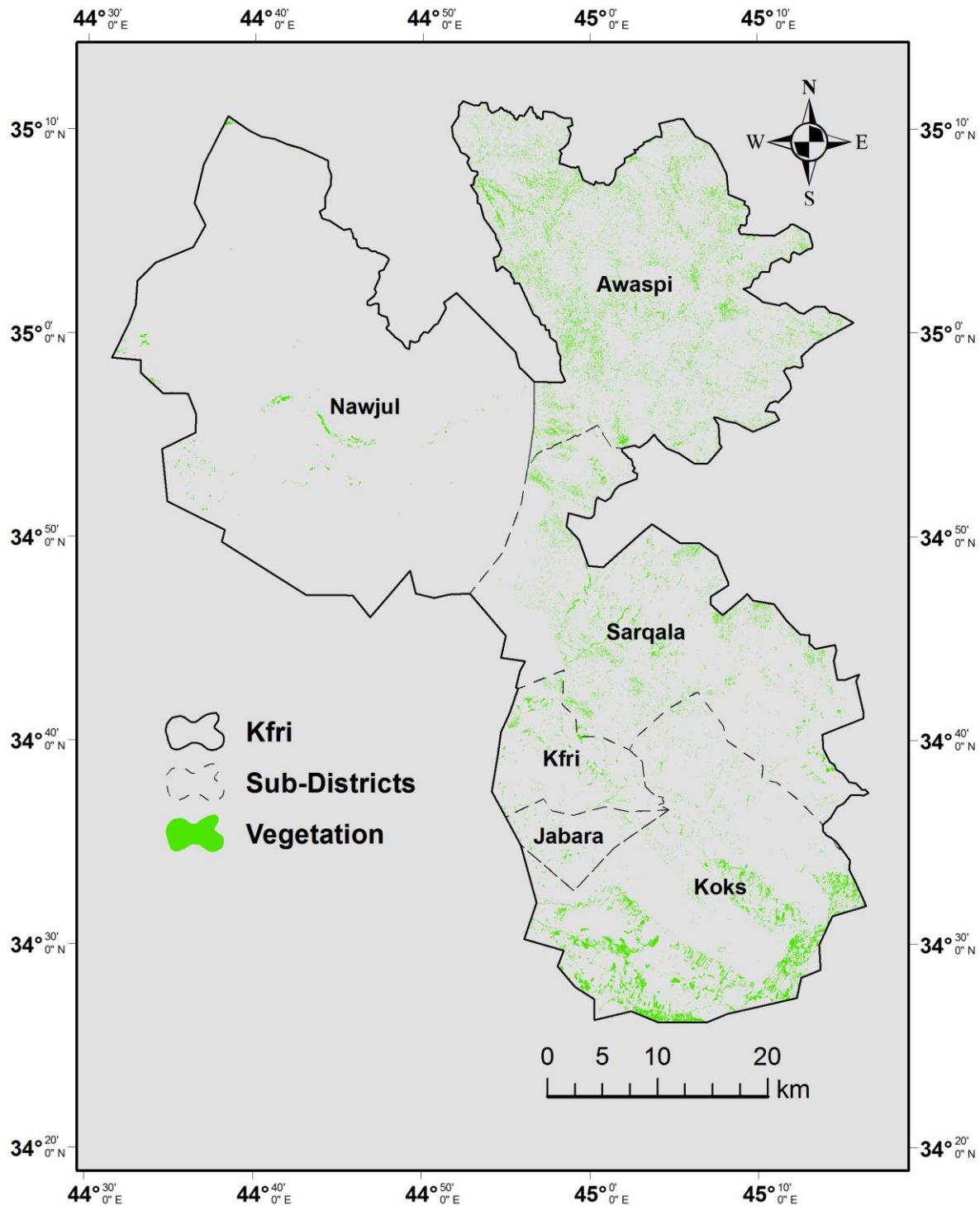


Figure 37: Vegetation coverage distribution in Kfri district.

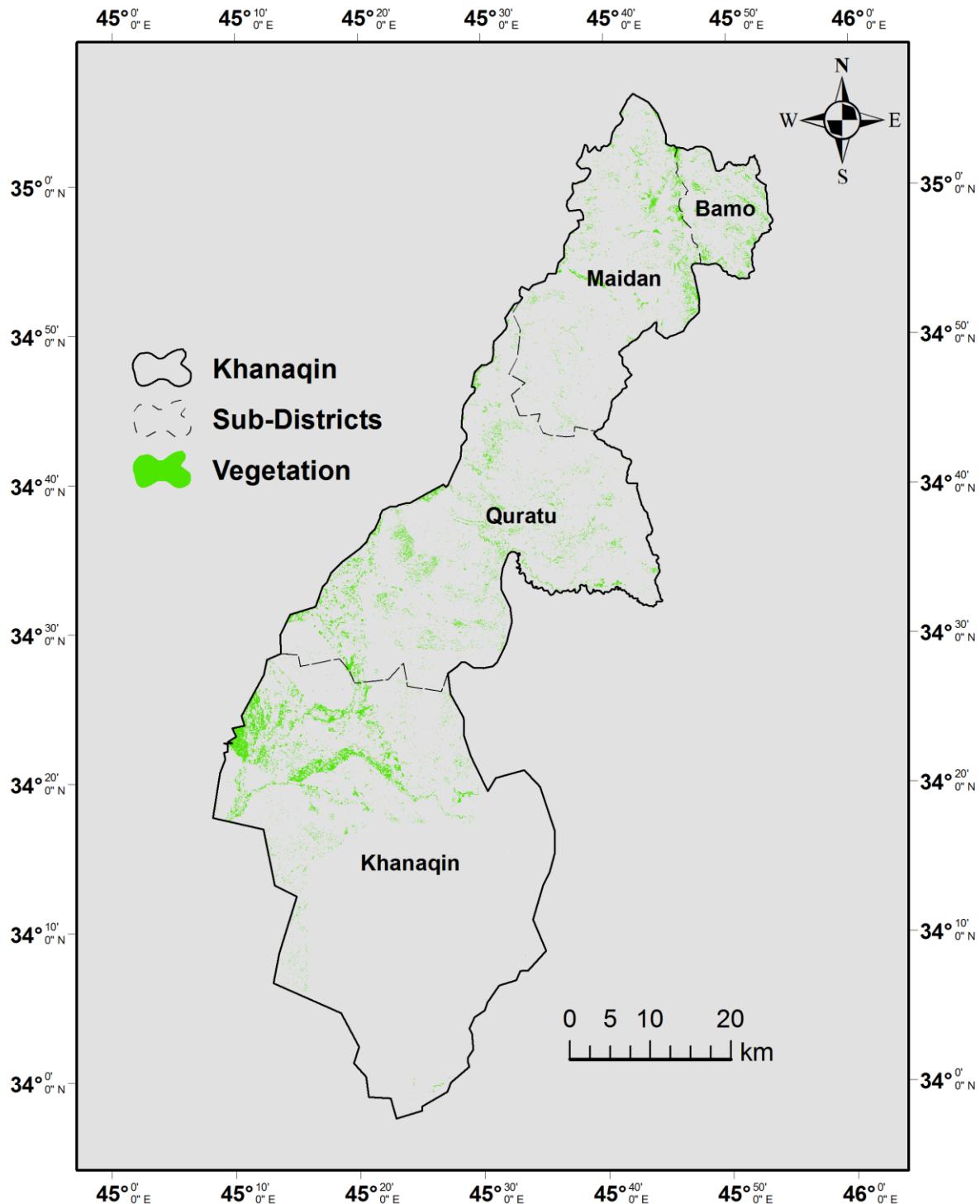


Figure 38: Vegetation coverage distribution in Khanaqin district.

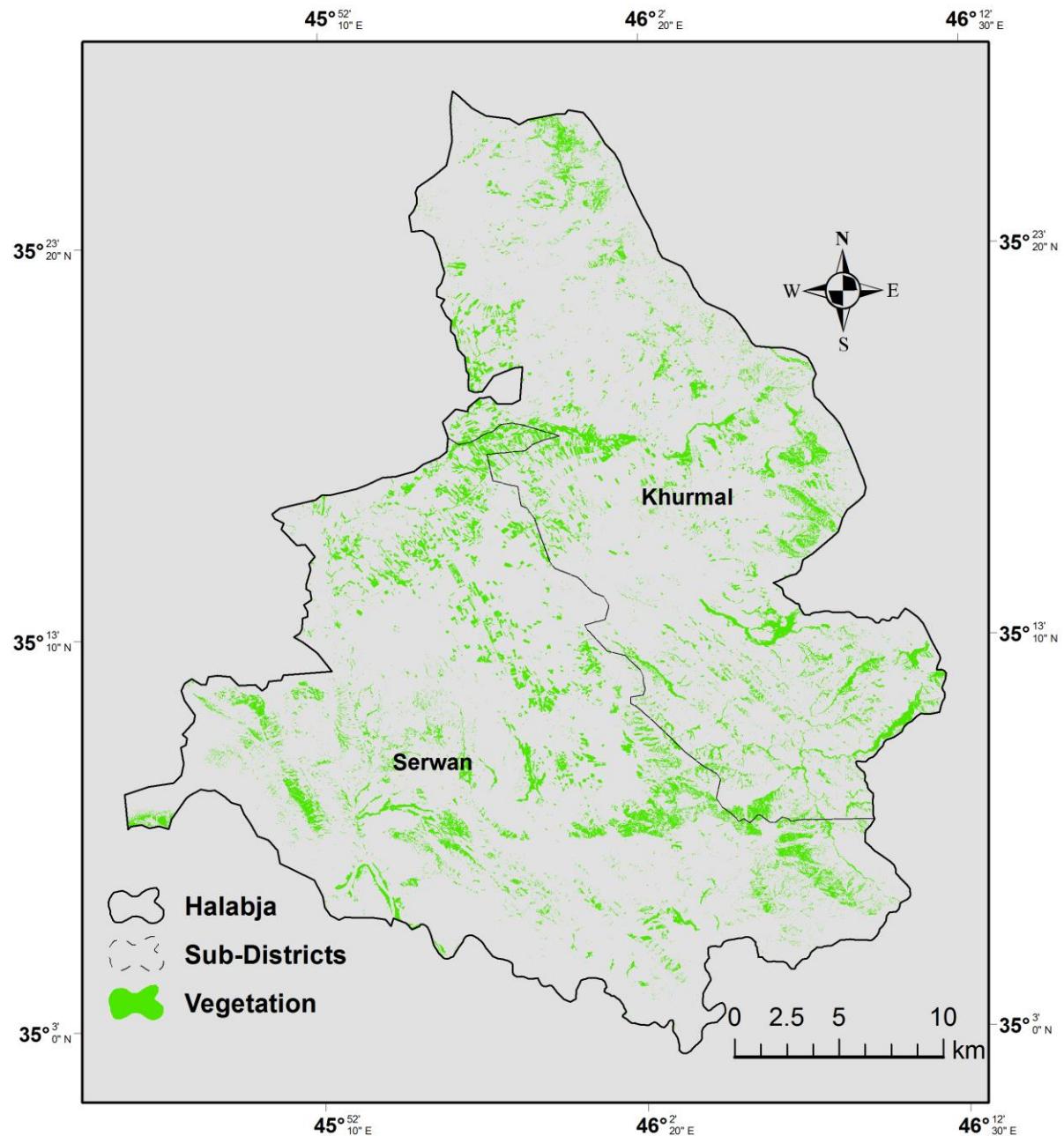


Figure 39: Vegetation coverage distribution in Halabja district.

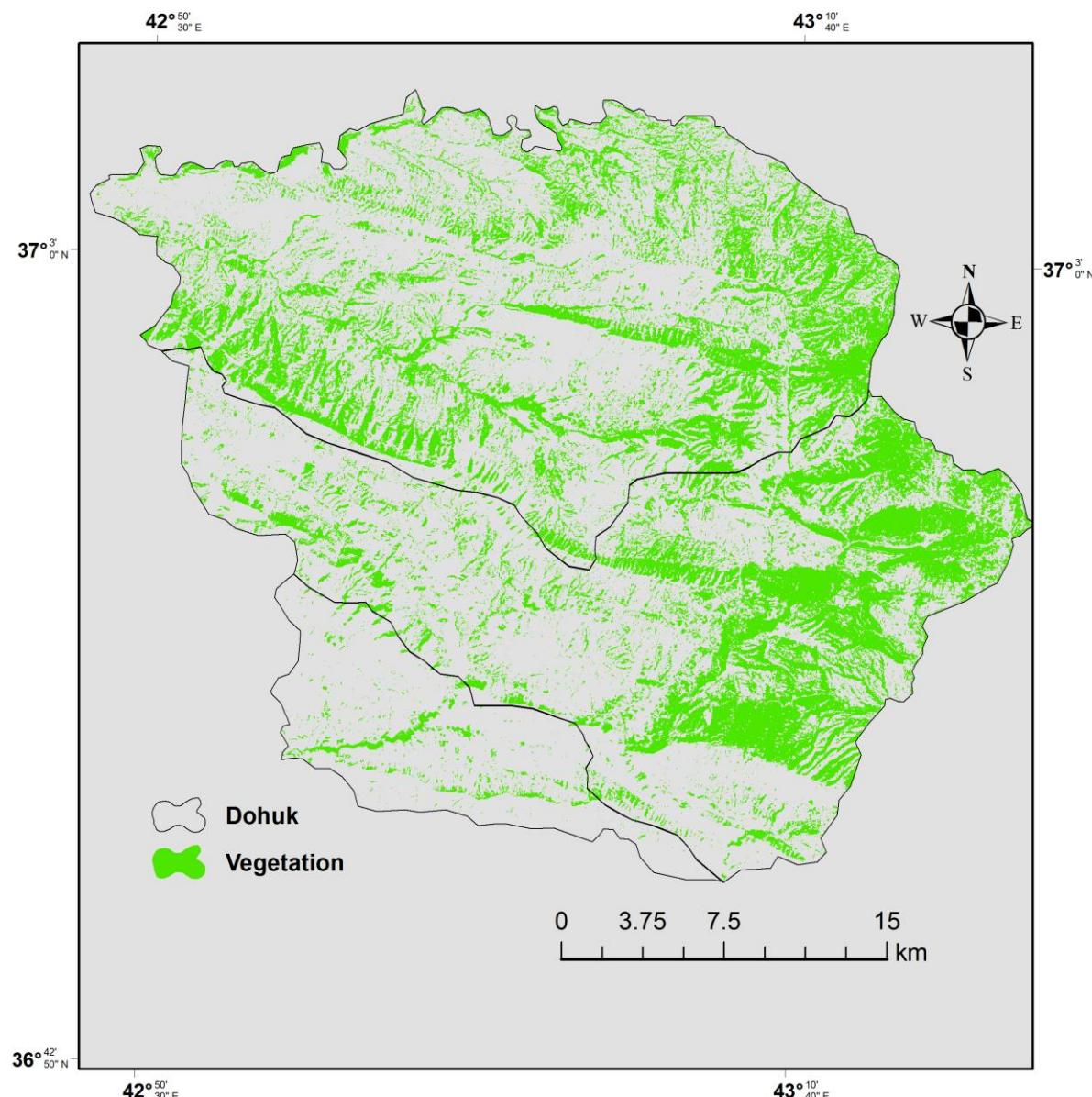


Figure 40: Vegetation coverage distribution in Duhok district.

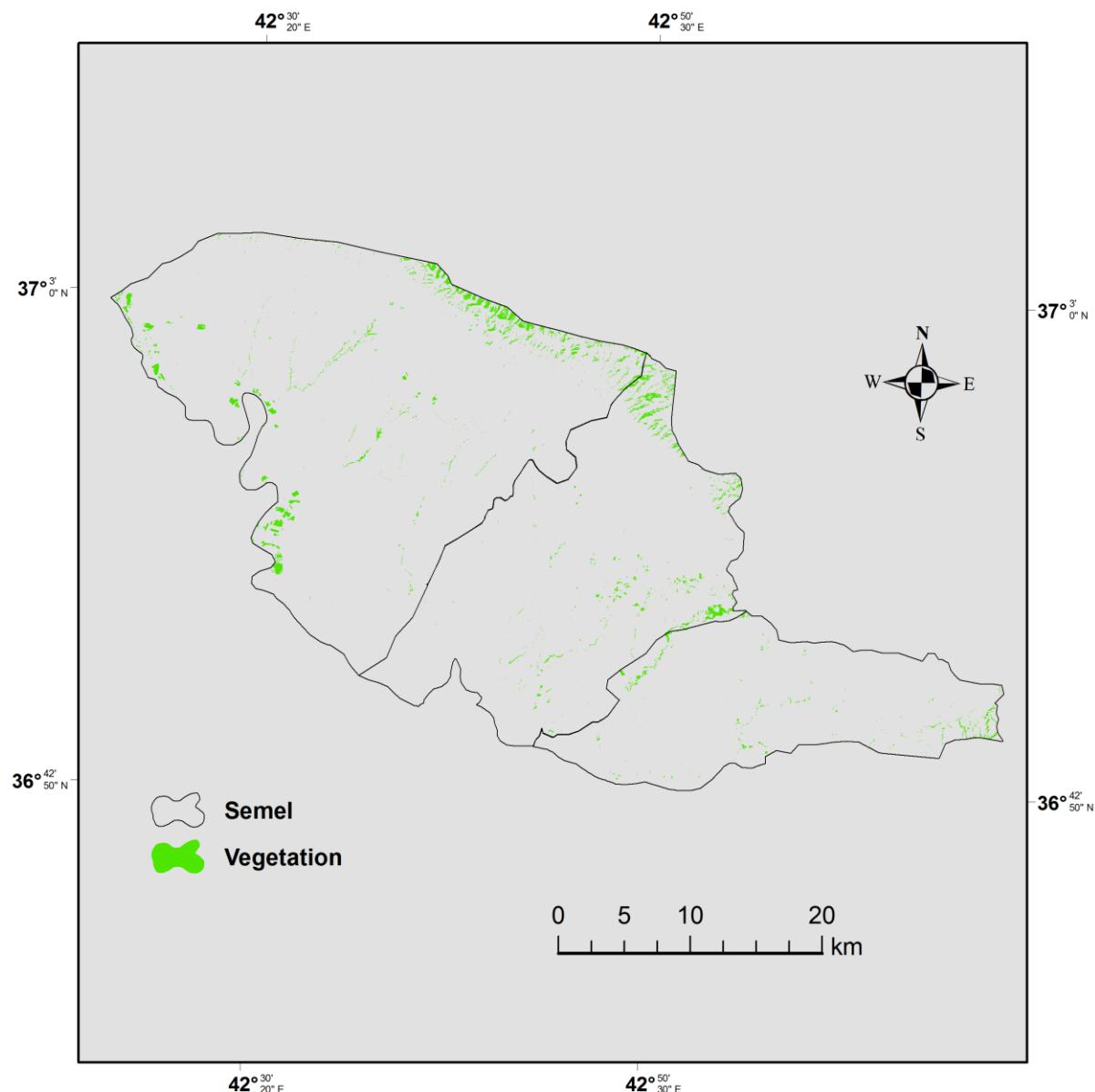


Figure 41: Vegetation coverage distribution in Semel district.

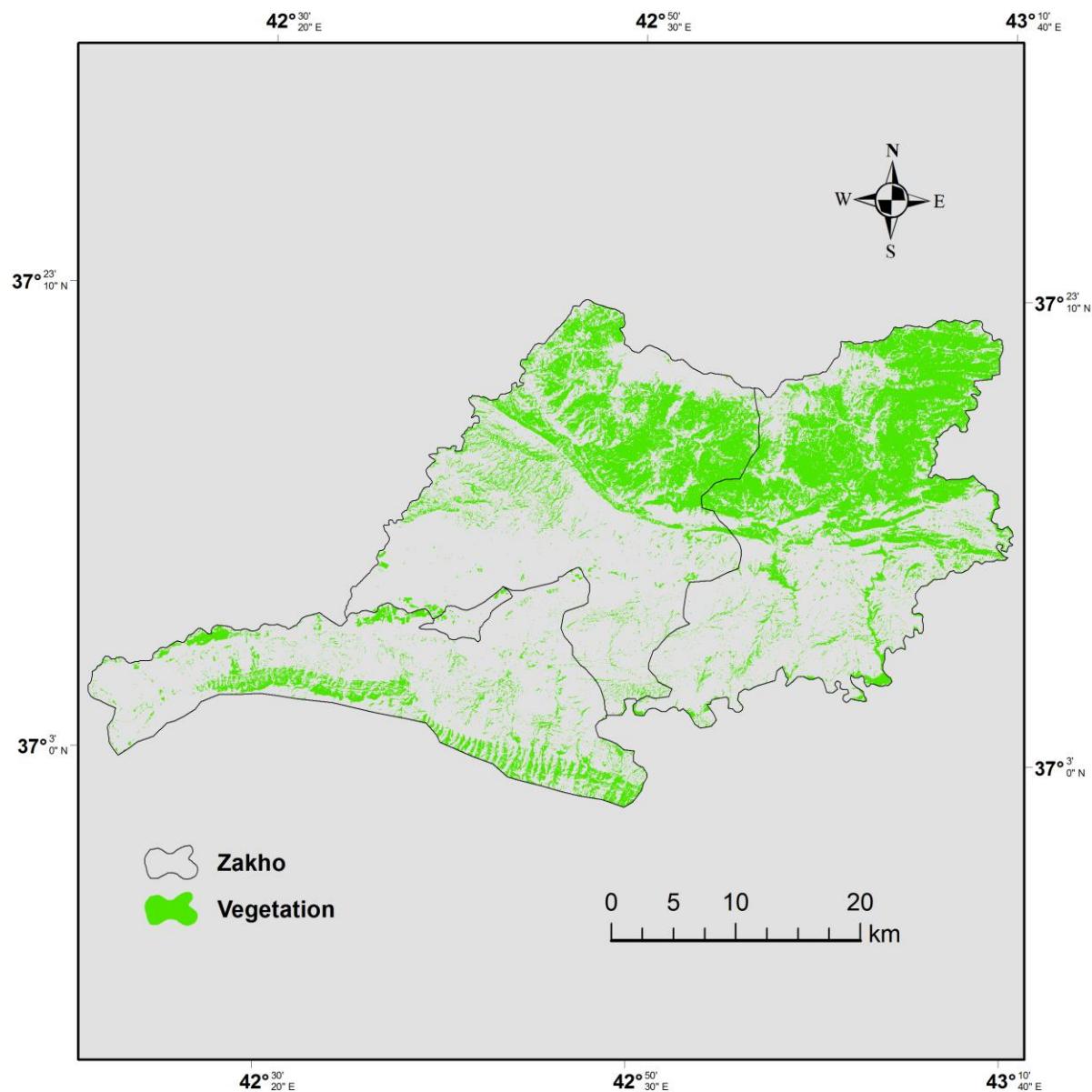


Figure 42: Vegetation coverage distribution in Zakho district.

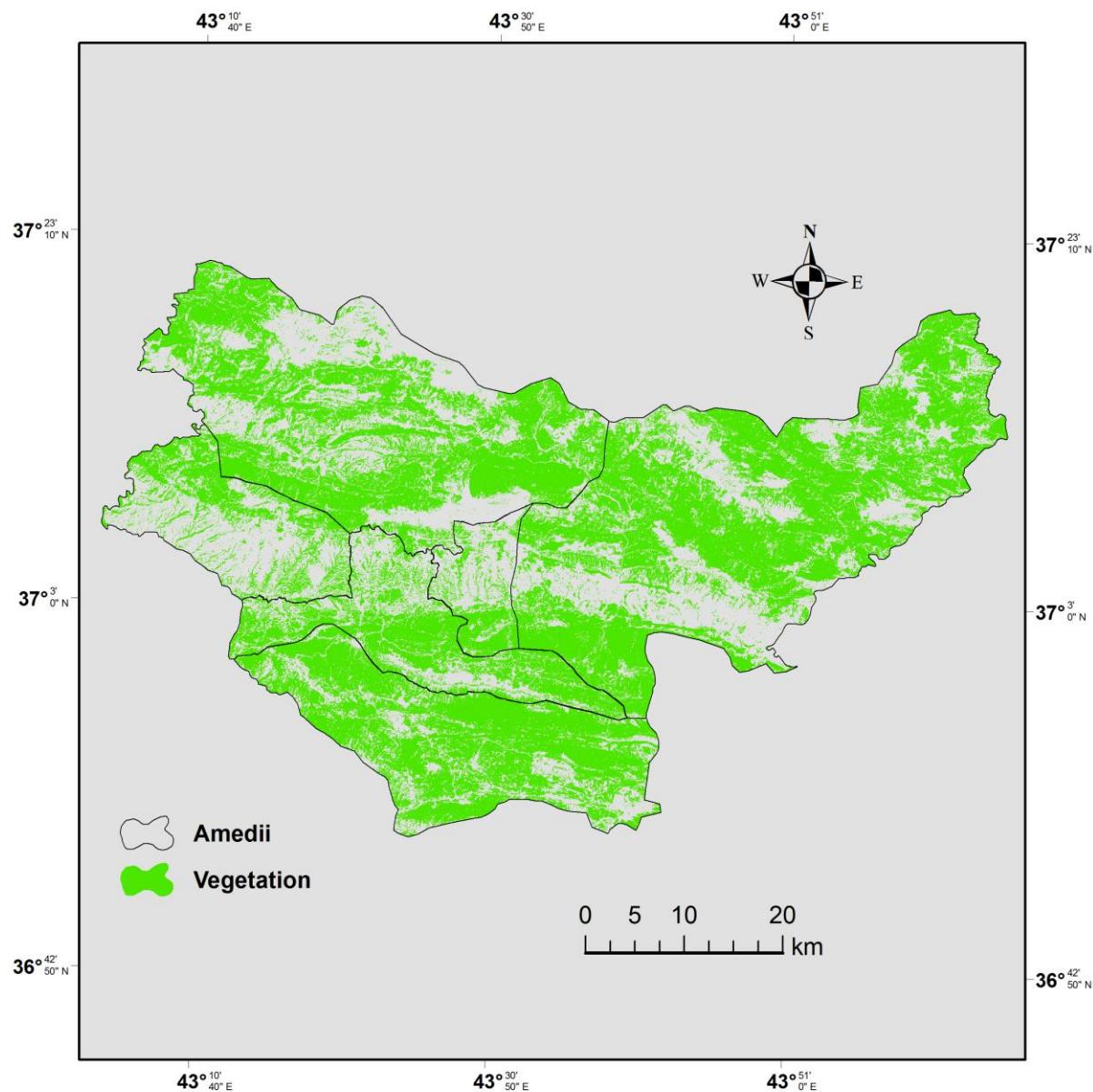


Figure 43: Vegetation coverage distribution in Amedi district.

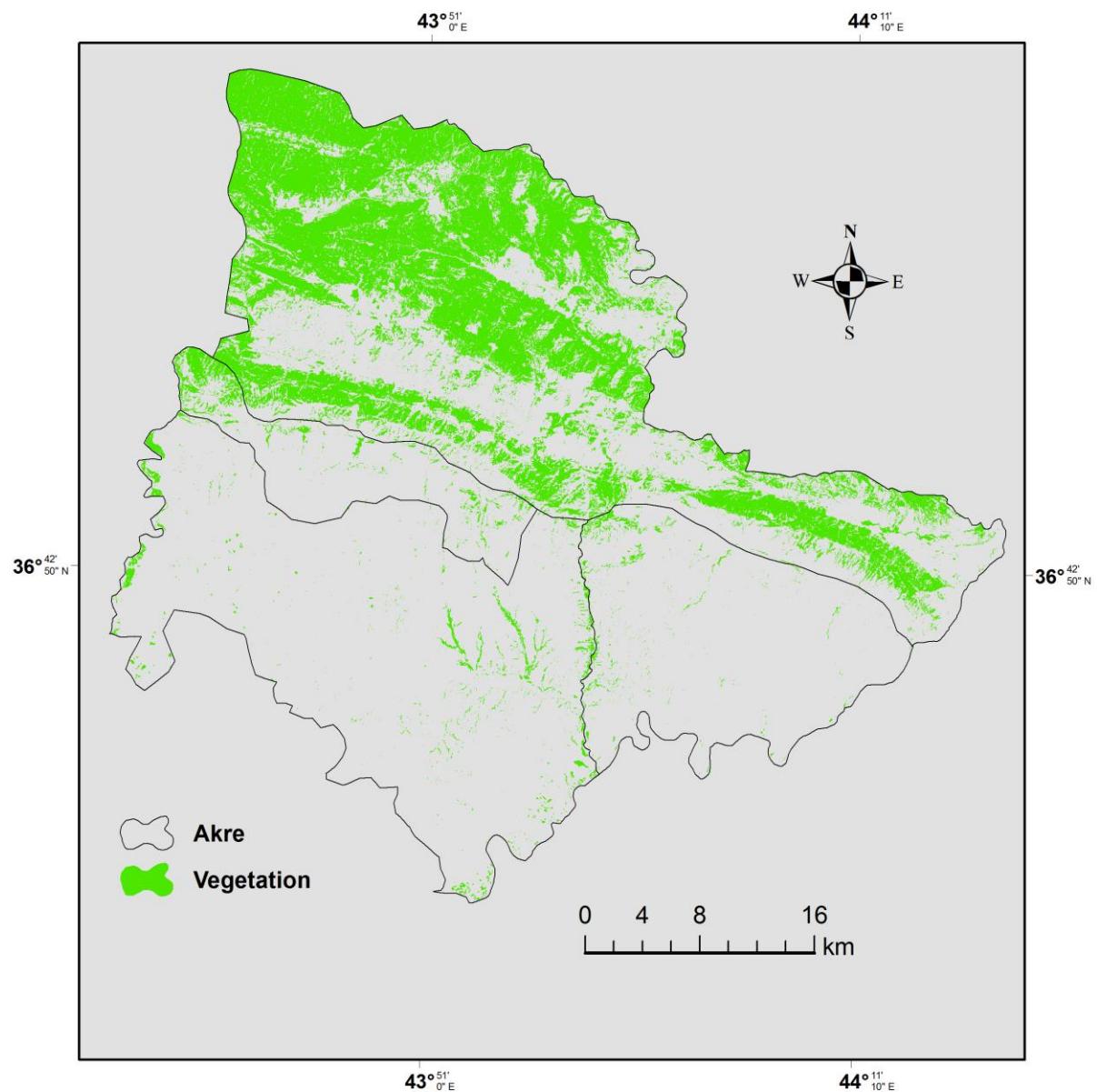


Figure 44: Vegetation coverage distribution in Akre district.

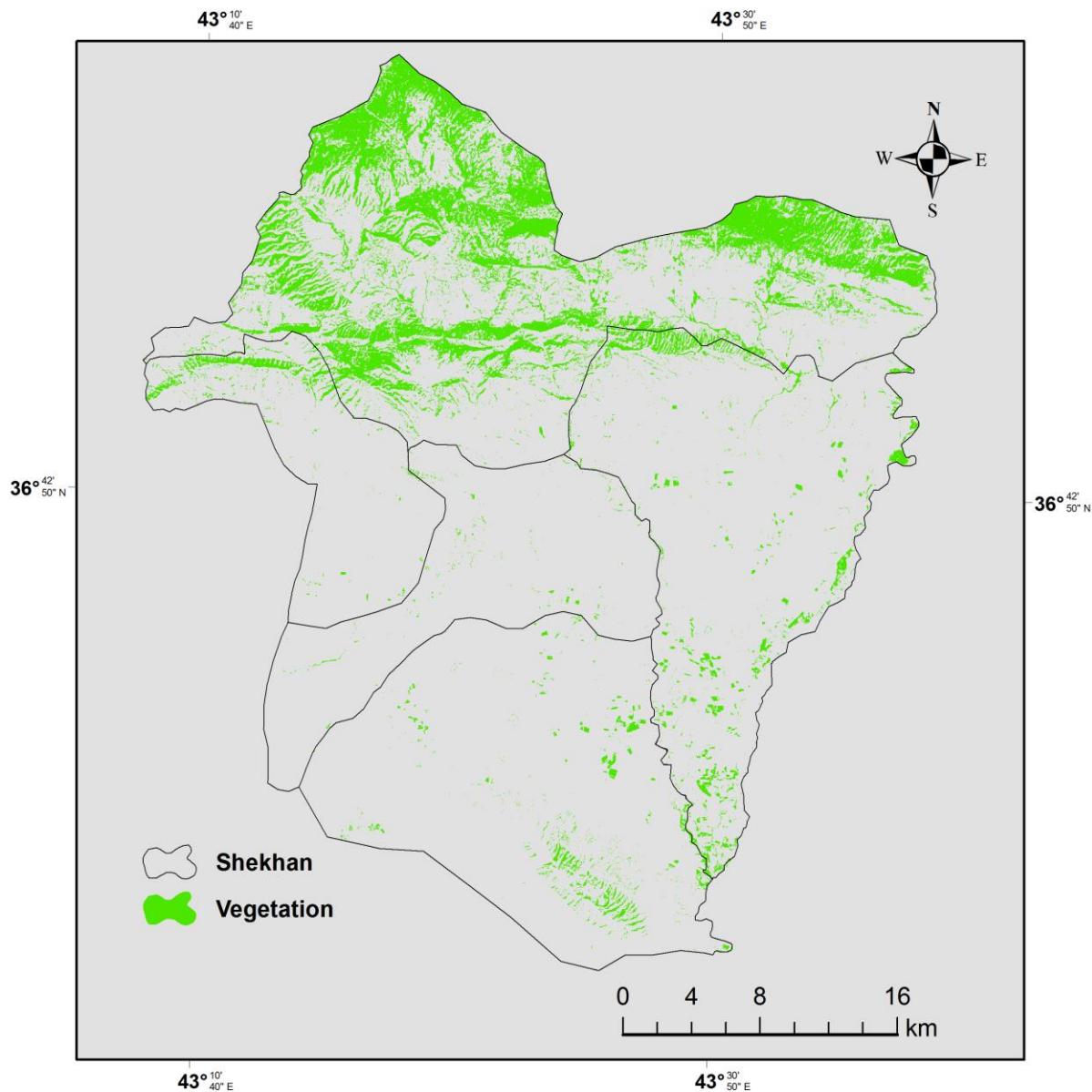


Figure 45: Vegetation coverage distribution in Shekhan district.

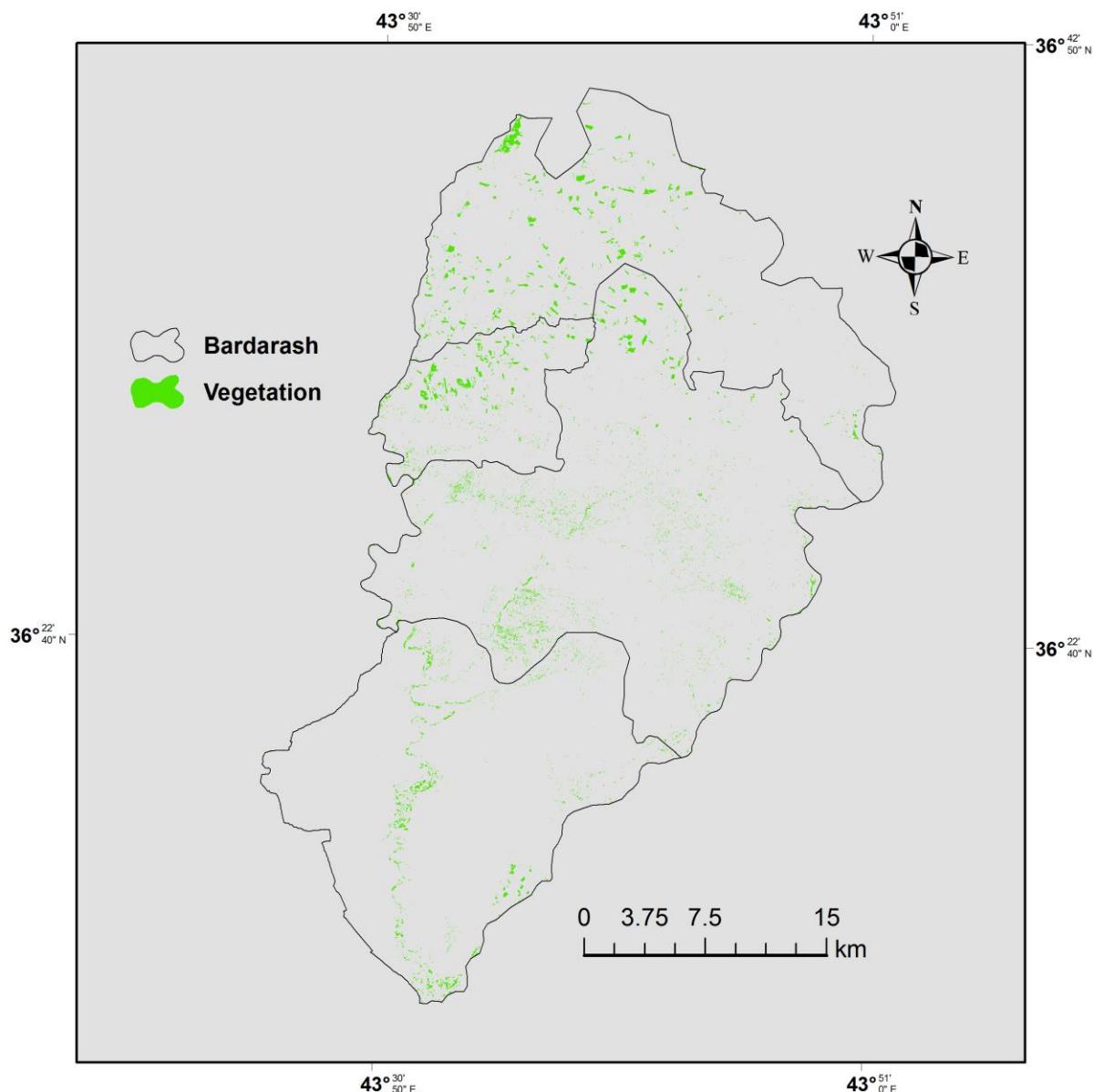


Figure 46: Vegetation coverage distribution in Bardarash district.

9.5 MAPPING ARTIFICIAL FORESTS

In this section artificial forests locations with their information of each governorate have been drawn and projected after GPS data of each project (artificial forests) had been collected as shown in the Table 7. The total area of all artificial forest projects in Kurdistan is 35472 Dunam. A map of all aritificial forest projects in whole Kurdistan Region is shown in Figure 55.

The artificial forest projects of Erbil are shown in Table 8. This table contains information of each project that was implemented in Erbil. Moreover, the geographical location of each individual project with their information in Erbil governorate is shown in the Table 14 in the Appendix. The number of the projects is “38” and the area of each project is also shown in the table. A map of these projects is shown in Figure 47.

Table 8: Artificial forest projects in Erbil.

No.	District	Project Name	Plantation	Tree Types	Area in (Dunam)
1	Erbil district	Darstani Bansalawa	1999	Cupressus, Eucalyptus	129.12
2	Bestana - quştapa	Darstane Bestana	1977	Cupressus, Olea europaea, Melia	898.35
3	Erbil district	Regai Kerkuk/45	1978	Cupressus, Pinus Brutia, Olea europaea,	81.00
4	Erbil	Regai Mosel	1977	Cupressus, Pinus Brutia, Thuja,	20.60
5	xabat	Darstane Xabat	1984	Cupressus, Pinus Brutia, Eucalyptus	577.64
6	Mexmor	Darstane Mexmor	2012	Cupressus, Pinus Brutia, Olea europaea	77.54
7	Mexmor	Darstane debaga	2012	Cupressus, Olea europaea, Casuarina,	109.50
8	Koye	Darstane Digala	1977	Yoca, Olea europaea, Pinus Brutia, Melia	120.36
9	Koye	Darstane Taq Taq	1976	Cupressus, Pinus Brutia, Olea europaea,	187.44
10	Koye	Darstane Koye	1977	Cupressus, Pinus Brutia, Olea europaea,	1323.66
11	Erbil/Kasnazar	Darstane Kasnazan	1977	Cupressus, Pinus Brutia	19.90
12		Kani Shawerd		Cupressus, Pinus Brutia	86.46

13		kolichi eshq		Cupressus, Pinus Brutia	26.39
14		Monoment		Cupressus, Pinus Brutia	70.98
15		Dawrobari Monoment		Cupressus, Pinus Brutia	89.72
16		Chot saidi Kasnazan		Cupressus, Pinus Brutia	98.37
17		kasnazan		Cupressus, Pinus Brutia	544.96
18	Erbil	Darstane xanzad	1984	Cupressus, Pinus Brutia, Thuja, Tu	404
19	Shaqlawa	Darestana Sala7din	1977	Cupressus, Pinus Brutia, Olea europaea	385.72
20		sala7aden		Cupressus, Pinus Brutia, Olea europaea	894.80
21		7ujran + tawska		Cupressus, Pinus Brutia, Olea europaea	542.40
22		Shera swar		Cupressus, Pinus Brutia, Olea europaea	106.06
23	Shaqlawa	Darestana Shaqlawa	1977	Cupressus, Pinus Brutia, Olea europaea	359.91
24	Shaqlawa	Hiran	1977	Cupressus, Pinus Brutia, Olea europaea	2.26
25	Shaqlawa	Darstane Harir	2003	Cupressus, Pinus Brutia	146.11
26	Soran	Darstane xalefan	1977	Cupressus, Pinus Brutia, Thuja, Tu	0
27	Soran	Darstane Soran	1984	Cupressus, Pinus Brutia, Thuja, Tu	388.83
28	Shaqlawa	Parke darstane Hawdiyan	2015	Pinus Brutia, Melia Azedarach, Thuja,	36.91
29	Soran	Darstane Rawandoz	1978	Pinus Brutia, Oak, Cupressus, Pistachio,	738.74
30	choman	Darstane .Galala	1994	Cupressus, Pinus Brutia	251.75
31	choman	Darstane Choman	1994	Cupressus, Pinus Brutia	20.40
32		Bardarshan		Cupressus, Pinus Brutia	20.56
33		Darmanawa + Hajimeran		Cupressus, Pinus Brutia	49.17
34	Soran	darstane mergasur	2001	Cupressus, Pinus Brutia,Olea	71.16

35	Soran	Darstane Sidakan	2001	Cupressus, Pinus Brutia, Thuja,	18.15
36	Soran	Darstane Barzan	1977		0
37	Hawler	Namamgaha-Nawand	1998	Cupressus, Pinus Brutia, Thuja,	79.16
38	Hawler	Namamgah-Berzewa	2002	Cupressus, Pinus Brutia, Thuja, Tu	10.74
Total					8988.84

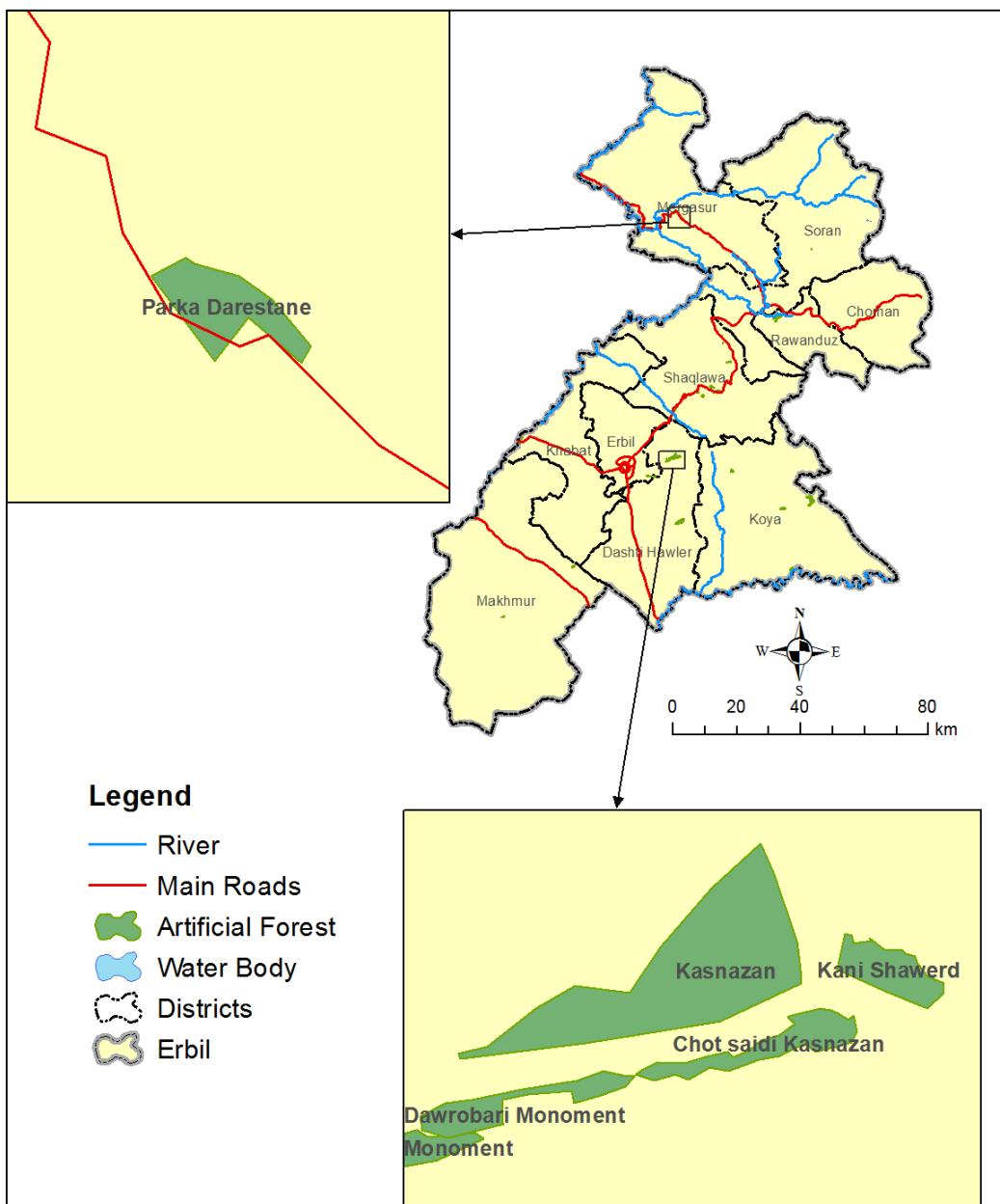


Figure 47: Artificial forest projects in Erbil with two zoom in samples

Table 9 shows the information of the implemented projects in Sulaymaniyah, where number of the projects is “64” and the area of each project is reported in the table as Dunam unit. Meanwhile, the geographical information of each project in Sulaymaniyah is shown in Table 15 in the Appendix. These projects were drawn and shown in Figure 48.

Table 9: Artificial forest projects in Sulaymaniyah.

No.	District	Project Name	Plantation	Tree Types	Area in(Dunam)
1	City	Xarachiyian	1985	Pinus Brutia, Oak, Pistachio, Almond, Eucalyptus, Olive	200
2	City	Chanaxchiyan	2003	Pinus Brutia, Oak, Pistachio, Almond, Eucalyptus, Olive	160
3	City	Razyia	2013	Pinus Brutia, Arizonika, Thuja, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	165
4	City	Regai gerdi chaq chaq	1998	Pinus Brutia, Arizonika, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	278
5	City	Kani-shaetan	1977	Pinus Brutia, Arizonika, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	510
6	City	Tasloja	1955	Pinus Brutia, Arizonika, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	
7	City	Bayinchan	1977	Pinus Brutia, Arizonika, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	
8	City	Haroota	2005	Pinus Brutia, Arizonika, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	920
9	City	darbandi-bazeen	1953	Pinus Brutia, Arizonika, Thuja, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	360
10	City	Hawareshar	2004	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus, Oak,	80
11	City	Azmer	1999	Pinus Brutia, Thuja, Arizonika, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	2520
12	City	Goizha	1947	Pinus Brutia, Arizonika, Oak, Cupressus, Pistachio, Almond, Cedrus libani, Olive	2080
13	City	Dabashan	1973	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus, Oak,	480
14	City	Shex-Waisawa	2011	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus, Oak,	480
22	peshdar	Qaladeze	1978	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus, Oak,	810

23	peshdar	Sangasar	1978	Pinus Brutia, Eucalyptus, Olive,	80
24	rания	Kiwa rash	1978	Pinus Brutia, Thuja, Cupressus	500
25	rания	Kelka Kolina	2001	Pinus Brutia ,Thuja, Cupressus	
26	Dukan	Dukan	1955	Pinus Brutia ,Thuja, Cupressus	316
27	Dukan	Secretary of the President of the Republic	2000	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	
28	Dukan	Ashur Hotel	2000	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	
29	Dukan	dabani villagetourism	2000	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	
30	Dukan	Qashqole	1977	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	
31	Dukan	Bngrd	2000	Pinus Brutia, Cupressus	40
32	Dukan	Piramagron	2011	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	20
33	Dukan	Kani wotman	1977	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	214
34	Dukan	Xalakan	1977	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	
35	Dukan	Arisha Xalakan	1976	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	
36	Dukan	Xedran	2005	Pinus Brutia, Almond, Eucalyptus, Olive, Thuja, Cupressus	480
37	saidssadeq	Keresa	2003	Pinus Brutia, Oak, Pistachio, Almond, Eucalyptus, Olive	160
38	saidssadeq	Sarai sojan axa	1972	Pinus Brutia, Oak, Pistachio, Almond, Eucalyptus, Olive	400
39	saidssadeq	Barzencha	2001	Pinus Brutia, Oak, Pistachio, Almond, Eucalyptus, Olive	40
40	saidssadeq	Said sadeq	2003	Pinus Brutia, Oak, Pistachio, Almond, Eucalyptus, Olive	66
41	Sharbasher	Sora qalat	1977	Pinus Brutia, Pistachio, Almond	3
42	Sharbasher	Qalacholan	1999	Pinus Brutia, Pistachio, Almond	445
43	Sharazor	Warmawa	1980	Pinus Brutia, Pistachio, Almond, Eucalyptus, Olive	200
44	Sharazor	Mirade	1980	Pinus Brutia, Pistachio, Almond, Eucalyptus, Olive	181
45	Qaradax	Qarax	1976	Pinus Brutia, Pistachio, Almond	897
46	Qaradax	Kopan	1976	Pinus Brutia,Thuja, Cupressus, Pistachio, Almond	
47	Penjwen	Kawalos	1977	Pinus Brutia, Almond, Eucalyptus, Olive, Cupressus, Oak	560
48	Penjwen	Nalparez	1977	Pinus Brutia, Almond, Eucalyptus, Olive, Cupressus, Oak	
49	Penjwen	Karemek	2004	Pinus Brutia, Almond, Eucalyptus, Olive, Cupressus, Oak	120

50	Penjwen	kani Sepika Kilo	2000	Pinus Brutia, Almond, Eucalyptus, Olive, Cupressus, Oak	
51	Darbandixan	Perke	1973	Pinus Brutia, Almond, Eucalyptus	124
52	Darbandixan	Tunel	2001	Pinus Brutia, Almond, Eucalyptus	
53	Darbandixan	Chenara	2001	Pinus Brutia, Almond, Eucalyptus	
54	chamchamal	Azchalar	1977	Pinus Brutia, Eucalyptus, Olive	80
55	chamchamal	Bani Maqan	2008	Pinus Brutia, Arizonika, Thuja, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	665
56	chamchamal	Qarahanjeer	1978	Pinus Brutia, Arizonika, Thuja, Oak, Cupressus, Pistachio, Almond, Eucalyptus, Olive	1120
57	chamchamal	Sangaw	1978	Pinus Brutia	32
58	chamchamal	Shewasor	2001	Pinus Brutia, Eucalyptus, Olive	80
59	City	Sarchenar Nersury	1948	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	35
61	Rania	Shazad saib Nersury	1999	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	36
62	Dukan	Dukan Nersury	1998	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	4
63	Darbandixan	Derbandixan Nersury	1999	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	14
64	chamchamal	Bani Maqan Nersury	2008	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	25
Total					15980

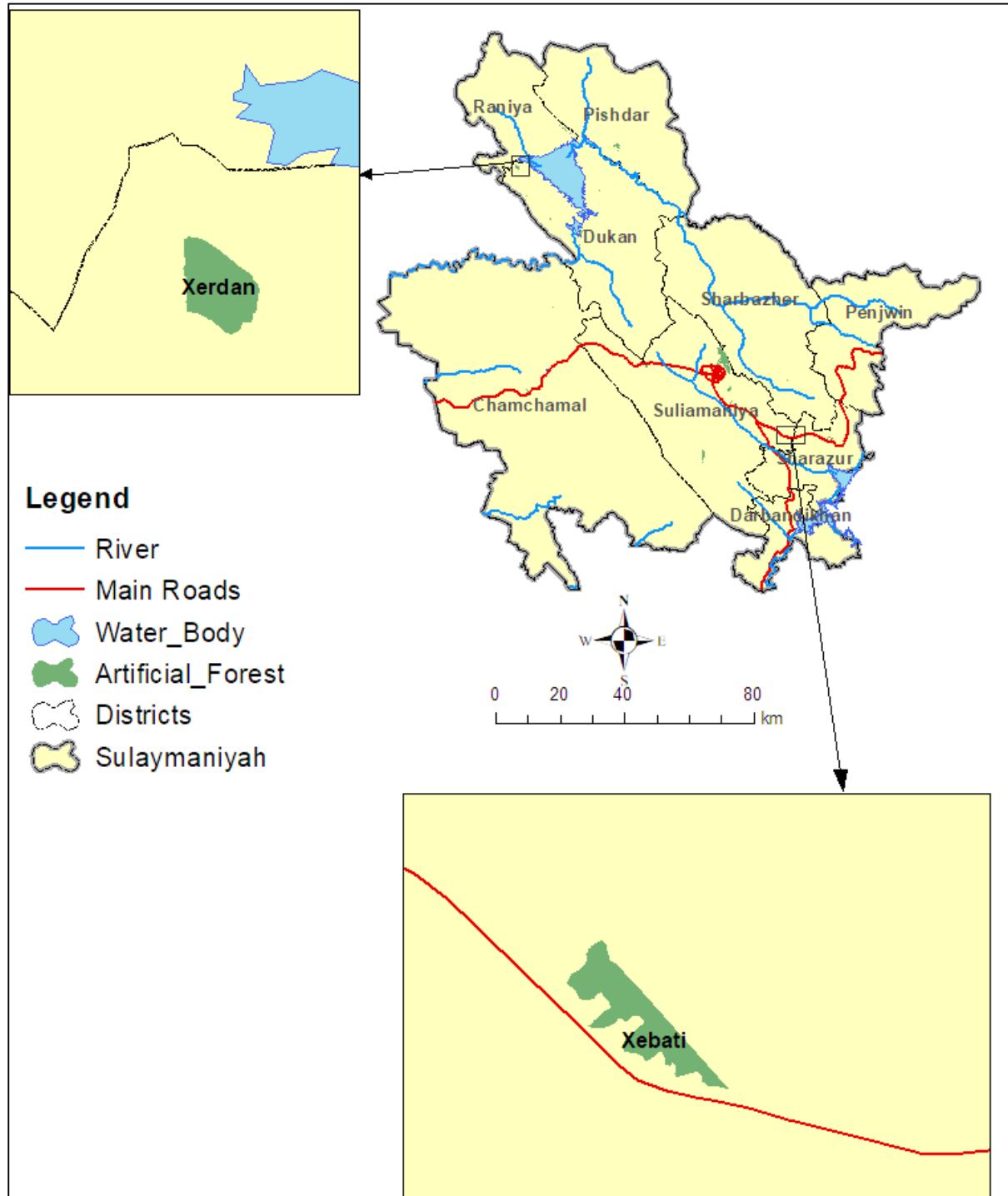


Figure 48: Artificial forest projects in Sulaymaniyah with two zoom in samples

The minimum number of projects was appeared in Garmian as they reach “6” that is shown in table 10 and the geographical location of each project is reported in Table 16 in the Appendix. Figure 49 represent the map of these projects in Garmian.

Table 10: Artificial forest projects in Garmian.

No.	Project Name	Place	Administrative	Plantation Year	Tree Types	Area in Dunam
1.	parki Darestana Bawashwar u sawz krdni bandawe bawa shaswar	Kefri	Kefri	2013	Pinus Brutia, kenari, Melia Azedarach, Marus , Vachellia, Eucalyptus, Cupressus, Casuarina, .,Washingtonia,Dodonaea,albizya, moringa	80.26124
2.	Parki darstana darwazai kfri	kalar	kfri	2014-2015	Melia Azedarach,Eucalyptus,Casuarina, Ulmus,Dodonaea,Albizia	45.94076
3.	Parki darstani Hejar	kalar	kalar	2011-2012	Pinus Brutia, kenari, Melia Azedarach, Marus , Vachellia, Eucalyptus, Cupressus, Casuarina, .,washngtonya,Olea europaea,platanus occidentalis,Dodonaea,albizya	299.3045
4.	parki darstani Mezari Anfal	kalar	kalar	2013	Melia Azedarach,Marus ,albizya,Cupressus, Casuarina	42.47084
5.	darstani Peshtinay Sawzai	kalar	kalar	2012-2013	Melia Azedarach, Marus , Casuarina, Eucalyptus,Albizia	50.67116
6.	Regai Mezar	Rezkari	Rezkari	2013	Melia Azedarach,Washingtonia,Albizia, Eucalyptus	12.66592
Total						531.3144

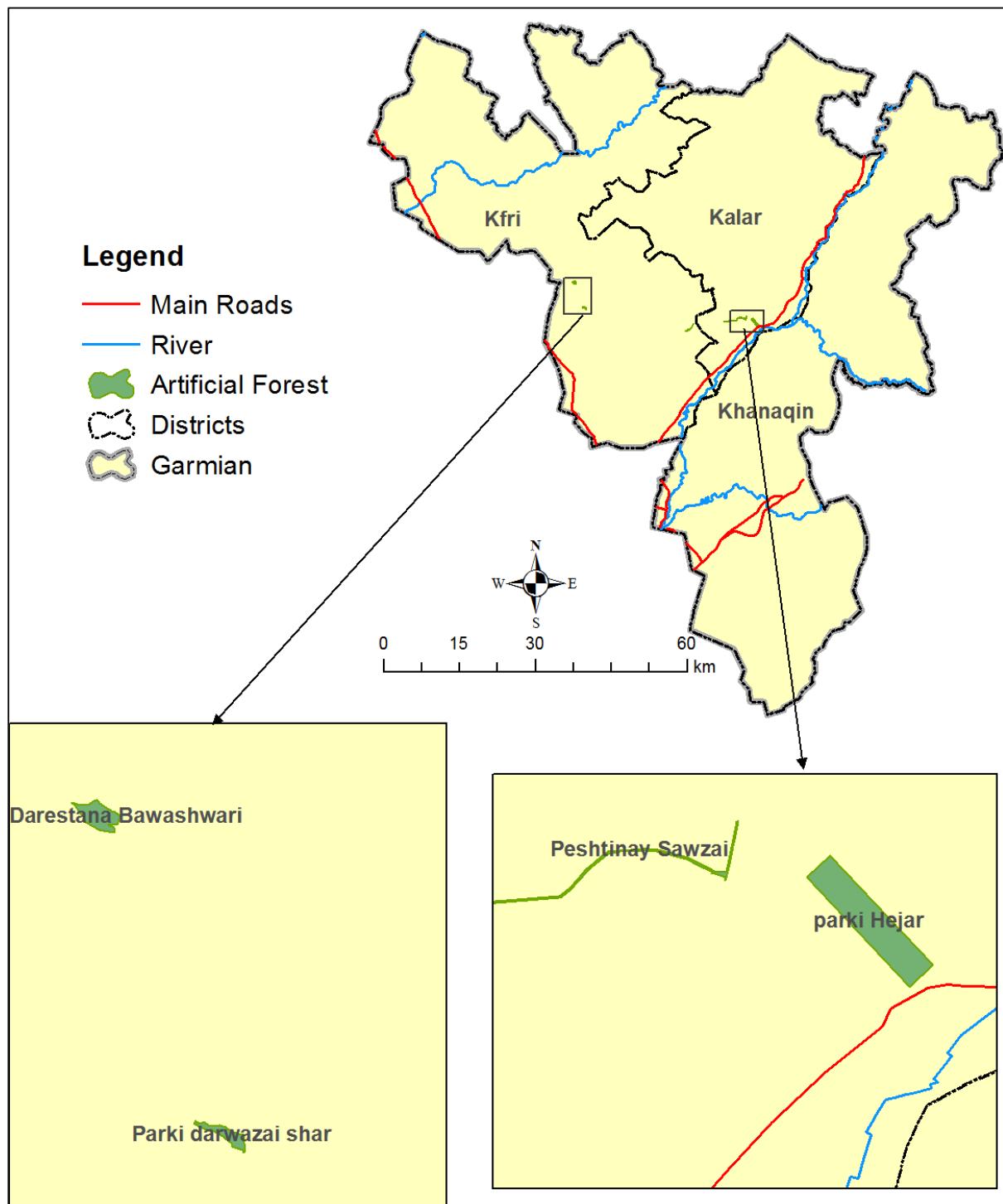


Figure 49: Artificial forest projects in Garmian with two zoom in samples

The area of artificial forests in Halabja is reported in Table 11 with a total area of 1905 Duman. Figure 50 shows the map of artificial forests in Halabja. The number of project is “8” and the geographical location of each project is reported in Table 17 in the Appendix.

Table 11: Artificial forest projects in Halabja.

No.	District	Name Project	Plantation	Tree Types	Area in (Dunam)
1	City	Bayara	2003	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	12
2	City	Xurmal	2003	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	133
3	City	Regabani-Halabja	1998	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	20
4	City	Gulan	1973	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	900
5	City	Jalil	1973	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	720
6	City	Ababaili	1973		
7	City	Anab	2003		
8	City	Sirwan Nersury	2000	Pinus Brutia, Arizonika, Thuja, Cupressus, Pistachio, Almond, Eucalyptus, Olive	120
Total					1905

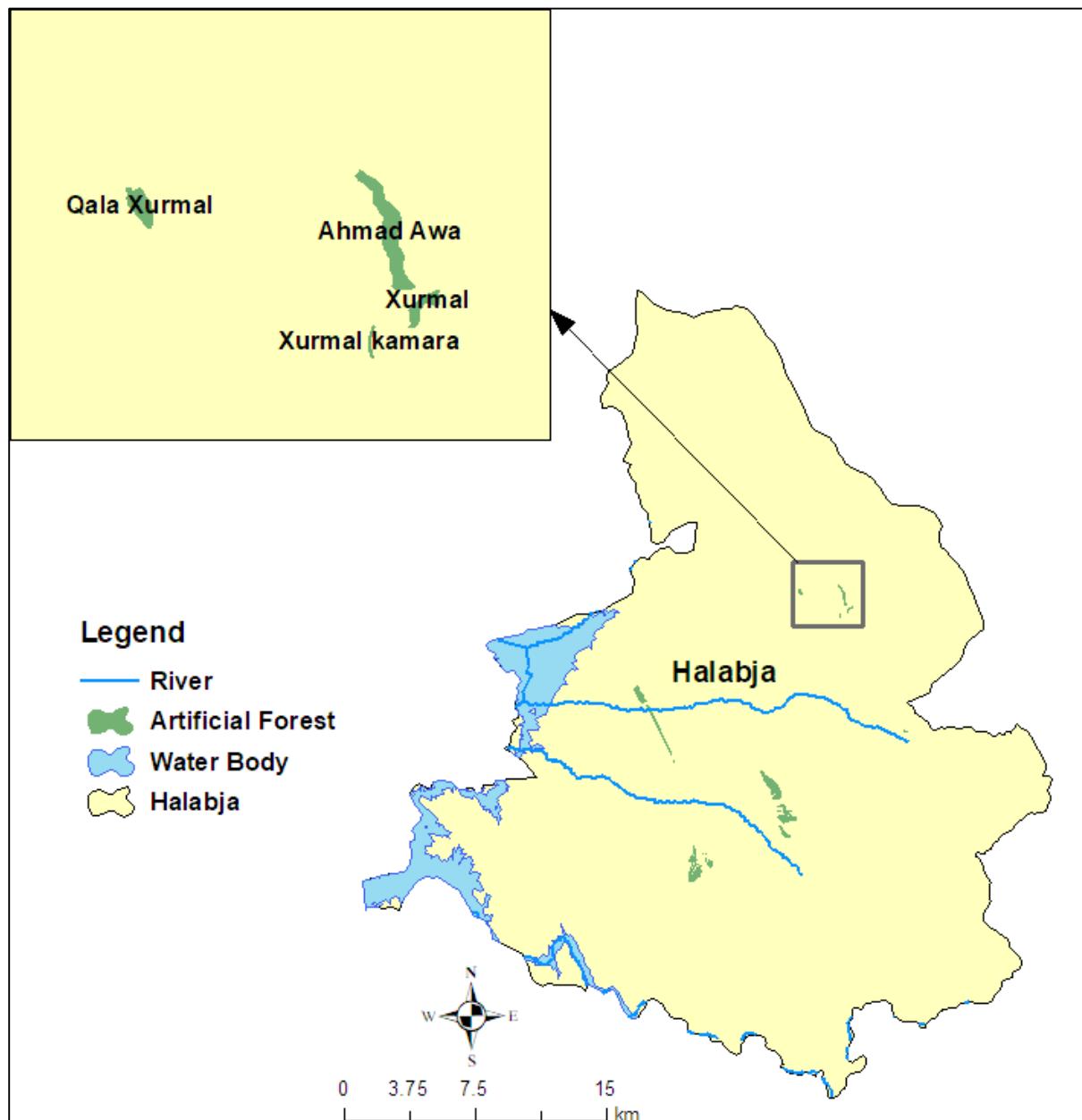


Figure 50: Artificial forest projects in Halabja with zoom in sample

The information of the artificial forest projects in Duhok are presented in Table 12. The number of the projects is “131” and the area of each project is presented in the table in Dunam unite. Moreover, more details of each project with their geographical location are presented in table 18 in the Appendix. A map of these projects are produced and shown in Figure 51.

Table 12: Artificial forest projects in Duhok.

No.	Project Name	Place	Administrative	Plantation Years	Tree Types	Area in Dunam
1.	Bashqal	Akre	Akre	1978	Pinus Brutia	105.7002
2.	Mamei	Akre	Akre	1978	Pinus Brutia	53.68
3.	Bihok	Akre	Akre	2004	Olea europaea, Pinus Brutia	204.1457
4.	Kre Ashxal	Akre	Akre	2002	Pinus Brutia	12.141
5.	Kre Niska	Akre	Akre	1975	Pinus Brutia	36.9186
6.	Kre Dinarte	Dinarte	Akre	1978	Pinus Brutia	22.54
7.	Gomerk	Akre	Akre	2002	Pinus Brutia	35.412
8.	Gulan	Akre	Akre	1978	Pinus Brutia	31.39
9.	Mehat	Mehat	Akre	1978	Pinus Brutia	410.4
10.	Mezar	Bejel	Akre	2012	Pinus Brutia, Cupressus, Olea europaea, Eucalyptus	34.70221
11.	Besht Gomerke	Akre	Akre	1978	Pinus Brutia	1.312228
12.	Saremyia	Akre	Akre	1999	Pinus Brutia, Cupressus	9.89
13.	Kerdasin wa7a	Kerdasin	Akre	2012	Pinus Brutia, Melia Azedarach, Cupressus	31.801
14.	Xanaki	Bejel	Akre	1978	Pinus Brutia	79.72
15.	Xerka	Akre	Akre	1978	Pinus Brutia	78.52
16.	Bare Kar	Amedi	Amedi	1977	Pinus Brutia	24.4383
17.	Belichanke	Amedi	Amedi	1977	Pinus Brutia	7.89

18.	Bebade	Amedi	Amedi	1976	Pinus Brutia	26.4674
19.	Bin Amedi	Amedi	Amedi	1983	Pinus Brutia,Almond	67.80335
20.	Botia	Amedi	Amedi	1983	Pinus Brutia	4.161852
21.	Chapa Seke	Amedi	Amedi	1983	Pinus Brutia	19.5489
22.	Dere	Amedi	Amedi	1977	Pinus Brutia, Cedrus libani	77.00215
23.	Hamzike	Amedi	Amedi	1982	Pinus Brutia	2.9031
24.	Kanya Senje	Amedi	Amedi	1976	Pinus Brutia	8.394
25.	Metlawish	Amedi	Amedi	1973	Pinus Brutia	110.7252
26.	Moqbara Amedi	Amedi	Amedi	1977	Pinus Brutia	34.63285
27.	Sar Mela	Amedi	Amedi	1976	Pinus Brutia	8.1382
28.	Seka	Amedi	Amedi	1971	Pinus Brutia	65.50095
29.	Sharifa	Amedi	Amedi	1973	Pinus Brutia	2.5217
30.	Ta7te	Amedi	Amedi	1976	Pinus Brutia	7.172052
31.	Shewa Qor	Bardarash	Bardarash	2013	Eucalyptus, Pinus Brutia	3.188332
32.	Aski Kalak	Bardarash	Bardarash	2012	Eucalyptus, Pinus Brutia	82.794
33.	Parka Newroz	Bardarash	Bardarash	2004	Pinus Brutia	8.79546
34.	Parka Bardarash	Bardarash	Bardarash	2012	Pinus Brutia, Cupressus, washintonia,Yobalibtus, Thuja	68.86052
35.	Gere Borchi	Bardarash	Bardarash	2009	Pinus Brutia	6.726924
36.	Zambil Frosh	Batifa	Zakho	1979	Pinus Brutia	15.67664

37.	Tobxane	Batifa	Zakho	1979	Pinus Brutia	31.32953
38.	Gre Zalgahe	Batifa	Zakho	2000	Pinus Brutia, Haci Bahif	4.188572
39.	Gre Liwaye	Batifa	Zakho	2005	Pinus Brutia	11.18057
40.	Doryana Bahnona	Batifa	Zakho	1979 -2010	Pinus Brutia	7.165984
41.	Sirye	Deralok	Amedi	1979	Pinus Brutia	20.57584
42.	D.Sheladeze	Sheladeze	Amedi	1979	Pinus Brutia	41.38521
43.	Gere Barxa	Sheladeze	Amedi	1979	Pinus Brutia	27.41201
44.	Chalke	Deralok	Amedi	2004-2007	Pinus Brutia	46.34535
45.	D. Sheladeze- 2	Deralok	Amedi	1979	Pinus Brutia	37.80644
46.	Kani Mase	Kani Mase	Kani Mase	2006	Pinus Brutia	12.93666
47.	Kani falan	Qasrok	Shekhan	2007	Pinus Brutia,Eucalyptus	25.93347
48.	Nifa Chade	Ba3adre	Shekhan	2012	Pinus Brutia, Cupressus, Washintonyia, Crataegusr, Thuja	20.33228
49.	Parka Ba3adre	Ba3adre	Shekhan	2014	Pinus Brutia, Cupressus, WashintonyiaCrataegusr, Thuja	58.86778
50.	Raxe Chade	Ba3adre	Shekhan	2009	Melia Azedarach, Pinus Brutia, Eucalyptus	30.93167
51.	Ba3adre Wa7a	Ba3adre	Shekhan	2013	Eucalyptus	18.8689
52.	Mela Berwan wa7a	Qasrok	Shekhan	2006	Pinus Brutia, Cupressus, Eucalyptus	11.87195

53.	Nifa Chade	Faida	Semel	2009-2010	Melia Azedarach,Eucalyptus	57.4114
54.	Raxe Chade	Faida	Semel	2009-2010	Melia Azedarach,Eucalyptus,Pinus Brutia	21.09018
55.	Gali Zakho	Batel	Semel	2000	Pinus Brutia	0.236288
56.	Parka Aloka	Semel	Semel	1979	Eucalyptus, Pinus Brutia, Cupressus	117.7605
57.	Qasara	Faida	Semel	2000	Eucalyptus	63.69134
58.	Semel wa7a	Semel	Semel	2000	Melia Azedarach, Pinus Brutia, Cupressus, Eucalyptus,	10.1
59.	Chiyaye Zawa	Semel	Semel	2000	Pinus Brutia	53.3471
60.	Zanko Dohuk	Semel	Semel	1997	Pinus Brutia	34.21
61.	Gre Batele	Semel	Semel	2003	Pinus Brutia	12.55
62.	Gre Mesha	Semel	Semel	2000	Pinus Brutia	4.1
63.	Pesht Fendaeq	Semel	Semel	2006	Pinus Brutia	12.98
64.	Smailava	Semel	Semel	2007	Pinus Brutia	0.9
65.	Gre Alai	Semel	Semel	2002	Pinus Brutia,Cupressus	15.8
66.	Aradin	Sersenk	Amedi	1989	Pinus Brutia	20.98876
67.	Bada Rashk	Sersenk	Amedi	1996-1988	Pinus Brutia	35.46766
68.	Bare Ta7te	Sersenk	Amedi	1998	Pinus Brutia, Pinus pinea, Cupressus	41.37104
69.	Bare kar	Sersenk	Amedi	1981	Pinus Brutia	55.78775
70.	Kani Chenark	Sersenk	Amedi	1989	Pinus Brutia	2.473448

71.	Gre Bote	Sersenk	Amedi	1986-2005	Pinus Brutia, Cupressus, Cupressus arizonica, Pinus pinea	81.75394
72.	Rostink	Sersenk	Amedi	1979	Pinus Brutia	16.52031
73.	Saida va	Sersenk	Amedi	1975	Pinus Brutia	27.95
74.	Sardarav	Sersenk	Amedi	1996	Pinus Brutia, Cupressus	19.35389
75.	Siyaratika	Sersenk	Amedi	1970-1975	Pinus Brutia	141.074
76.	Tajika	Sersenk	Amedi	1985	Pinus Brutia, Cupressus	16.63888
77.	MergaDeresh	Sersenk	Amedi	2000	Pinus Brutia	37.29
78.	Barbanke	Sersenk	Amedi	2000	Pinus Brutia	33.58
79.	Mefraq	Sersenk	Amedi	2000	Pinus Brutia	18.97
80.	Darhozan	Darkar	Zakho	2000	Pinus Brutia	148.2117
81.	Darkar 3acham	Darkar	Zakho	2000	Pinus Brutia	9.345596
82.	Gerk sendi	Zakho	Zakho	2000	Pinus Brutia	2.160212
83.	Raxe Chade	Rezkari	Zakho	2008	Pinus Brutia	1.348244
84.	Telkabar	Darkar	Zakho	2000	Pinus Brutia	44.80078
85.	Zakho Wa7a	Rezkari	Zakho	1976 -2008	Pinus Brutia	2.891
86.	Bade karma	Bade	Duhok	1974	Pinus Brutia	99.6
87.	Bade Gre Hachi	Bade	Duhok	1974	Pinus Brutia	3.229752
88.	Bade sare 7asiye	Bade	Duhok	1974	Pinus Brutia	50.48

89.	Bade me3askar	Bade	Duhok	1974	Pinus Brutia	577.07233
90.	Bakoze	Bakoz	Duhok	1974	Pinus Brutia	117.0632
91.	Darkala Kersis	Darkal	Duhok	1970	Pinus Brutia	2.479452
92.	Chapet Xabolka	Bade	Duhok	1970	Pinus Brutia	7.028052
93.	Besere	Duhok	Duhok	1974	Pinus Brutia	6.515352
94.	Bana Bade	Bade	Duhok	1974	Pinus Brutia	4.899352
95.	Kavlasene	Bakera	Duhok	1970	Pinus Brutia, , Pinus pinea, Cupressus	6.195452
96.	Gali zawita	Zawita	Duhok	1997	Pinus Brutia	109.9434
97.	Gali Qantara	Zawita	Duhok	1970	Pinus Brutia	1.4939
98.	Eminke	Zawita	Duhok	1974	Pinus Brutia	10.75905
99.	Ekmala	Bade	Duhok	1974	Pinus Brutia	114.9251
100.	Piomara	Bade	Duhok	1999	Pinus Brutia	77.1658
101.	Merga Deresh	Bakera	Duhok	1970	Pinus Brutia, Pinus Brutia , Pinus pinea	54.68
102.	Moqbarat zawita	Zawita	Duhok	1970	Pinus Brutia	20.2705
103.	Lomana	Bakera	Duhok	1970	Pinus Brutia, Pinus Brutia , Pinus pinea	26.1703
104.	Komal Gaha Bakera	Bakera	Duhok	1970	Pinus Brutia	17.2857
105.	Kandala	Zawita	Duhok	1970 -1974	Pinus Brutia	370.9416

106.	Gundek Nabi	Bakera	Duhok	1974	Pinus Brutia	5.2231
107.	Ger Bechik	Duhok	Duhok	1998	Pinus Brutia, Olea europaea	63.64
108.	Raxe chade	Zawita	Duhok	2012	Pinus Brutia, Cupressus,Melia Azedarach	34.65301
109.	Qarqarava	Bade	Duhok	1974	Pinus Brutia	23.4787
110.	Rega Zawita	Zawita	Duhok	1974	Pinus Brutia	43.84951
111.	Sendore	Sendor	Duhok	1974	Pinus Brutia	504.8416
112.	Sad Duhok	Duhok	Duhok	1998-1999	Pinus Brutia	3.254652
113.	Zawita wa7a	Zawita	Duhok	2012	Pinus Brutia, Cupressus, Melia Azedarach	5.030656
114.	Zewa Shafiq	Duhok	Duhok	1974	Pinus Brutia	60.83915
115.	Zawita	Zawita	Duhok	1974	Pinus Brutia	326.8567
116.	Gali	Duhok	Duhok	1970 - 1998	Pinus Brutia	84.6832
117.	Keshabara	Duhok	Duhok	1970	Pinus Brutia	25.5392
118.	sarke	Zawita	Duhok	1974	Pinus Brutia	339.24
119.	Reka Siyaratika	Zawita	Duhok	2000-2016	Pinus Brutia,Cupressus,Pinus Brutia , Pinus pinea	105.44
120.	Bablo	Zawita	Duhok	1970	Pinus Brutia	25.793
121.	Baroshke	Duhok	Duhok	2010	Pinus Brutia,Olea europaea	24.94
122.	Besere	Duhok	Duhok	1996	Pinus Brutia	38.04
123.	Nzarke	Duhok	Duhok	2010	Pinus Brutia,Olea europaea	53.2

124.	Kamaka	Zawita	Duhok	1974	Pinus Brutia	55.04
125.	Mangeshk	Mangeshk	Duhok	1970-1974	Pinus Brutia	7.55
126.	Rashanke	Zawita	Duhok	1996-1997	Pinus Brutia	998
127.	Bakera sare	Zawita	Duhok	1970	Pinus Brutia	28.87
128.	Kerdahol	Atrish	Shekhan	1970	Pinus Brutia	12.49
129.	Nordinava	Atrish	Shekhan	1997	Pinus Brutia	71.1
130.	Chamanke	Chamanke	Chamanke	2008	Pinus Brutia	9.21
131.	Meze	Chamanke	Chamanke	2008	,Cupressus,Robinnia	18.16
132.	Mashtal Zakho	Zakho	Zakho		Diferent trees	11.30193724
133.	Mashtal Akre	Akre	Akre		Diferent trees	23.175468
134.	Mashtal Malta	Mallta	Mallta		Diferent trees	15.66718376
Total						8068.206411

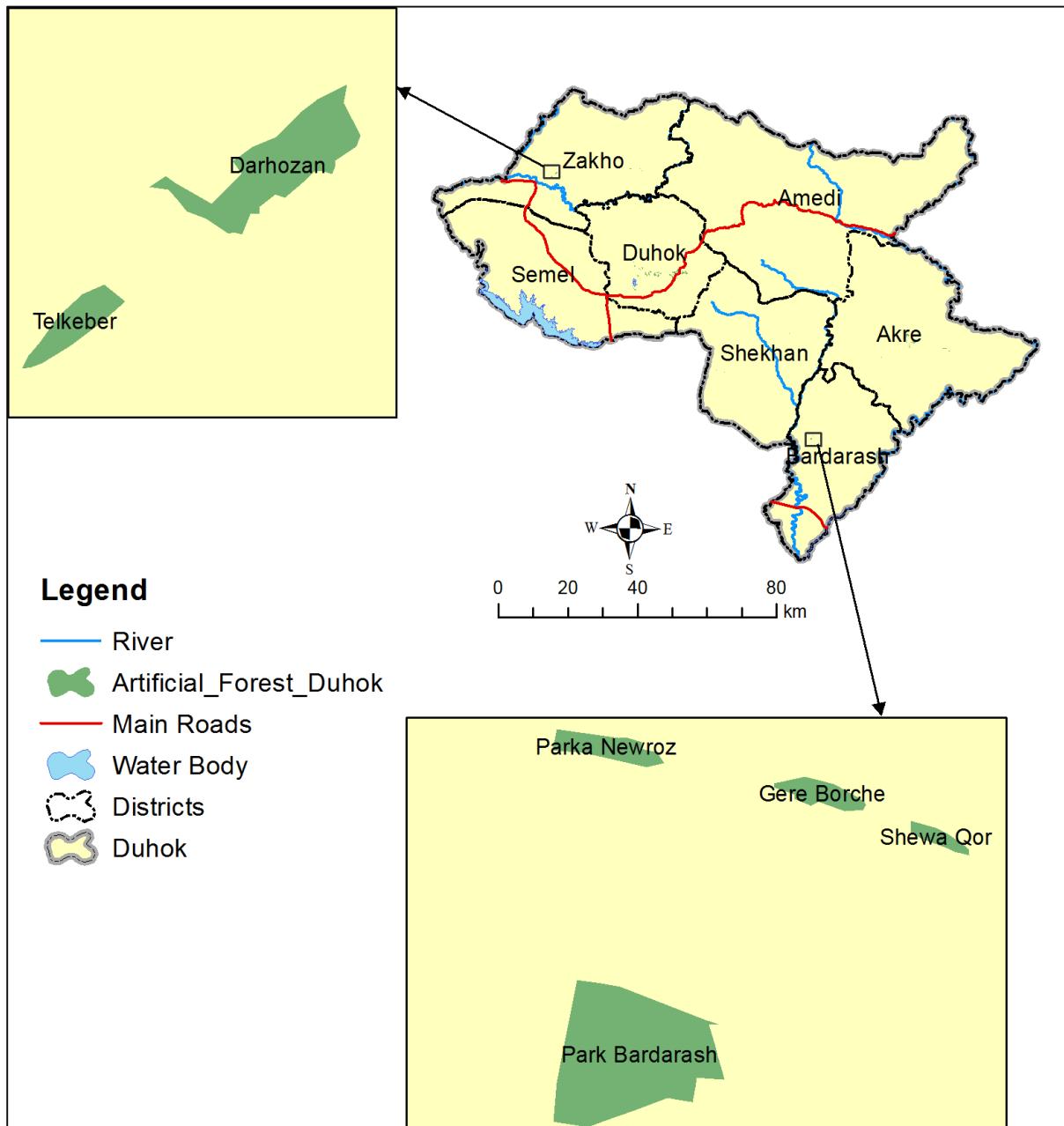


Figure 51: Artificial forest projects in Duhok with two zoom in samples

9.6 SOME OBSERVATIONS OF DIFFERENCES BETWEEN THE OLD SURVEY AND THE NEW SURVEY:

1. In the past, land areas were allocated to artificial forests by the Ministry of Agriculture and Water Resources, but were not actually fully planted with trees. However, statistically the areas were counted as forested area within forest areas. In the new survey by GPS (which determined the boundary areas of the planted trees) the differences of planted trees area in the past and current survey was clearly identified.

2- Since in the past most of the areas of artificial forests were not subject to legal procedures such as: (a) the allocation of land for forest projects (b) in terms of transfer of ownership to the Directorate of Forests and Pasture in the Governorates and the absence of a law to limit (c) to protect forests and prevent the work of any other projects within the forest or (d) use Land by other institutions till year 2012. Later then some of these spaces were included within Master Plan and allocated for housing projects or other non-agricultural sector, after in 2012, the law No. (10) For 2012 has issued for forest protection in the Kurdistan Region. It provides the protection of forests from any excess or change of ownership or allocation of other projects.

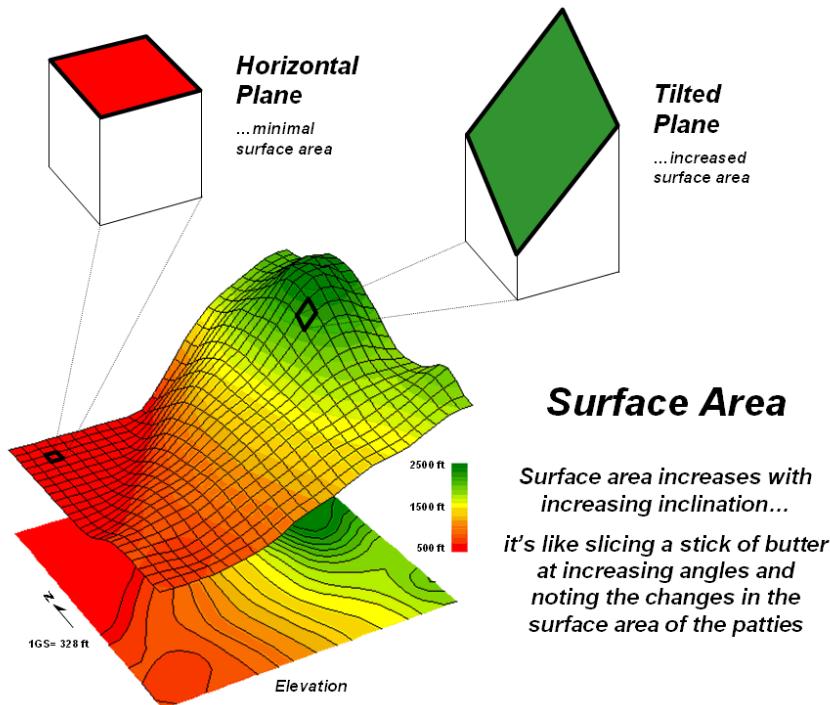
The area differences of planted trees of each project within Erbil, Sulaimany, Dohuk, and Halabja are shown in Tables 19-22, respectively.

Table 13: Artificial forest in Erbil, Sulaimany, Dohuk, Halabja and Garmian Administration

No.	Governate	Old Area(Dunam)	New Area using GPS(Dunam)	Differences(Dunam)
1	Erbil	15879	8988	-6891
2	Sulaimany	24271	15980	-8291
3	Dohuk	16671	8068	-8603
4	Halabja	1842	1905	63
5	Garmian	531	531	0
Total		59194	35472	-23722

SECTION 10: THE EFFECTIVE FACTORS ON THE AREA OF SURVEYED FORESTS IN KURDISTAN REGION

- 1- The availability of the satellite image has a major impact on the results of some areas. For example, RapidEye images for Garmian must be taken in June while the images that covered Garmian were acquired at the end of July and August where the hot summer already caused decreased of the vegetation coverage. This may produce underestimation of the vegetation coverage of that area.
- 2- The estimated forest area will also be affected by the ground surface inclination (slope). The estimated forest area may increase as the ground surface tilted from a horizontal plane (planimetric) to tilted plane. Therefore, surface area can be calculated by dividing the planimetric area by the cosine of the slope angle. By doing this, the certainty of the estimated forest area my reduced.



It should be reported that there are some natural and human made factors counts problems that face forests in Kurdistan Region. Such a major problems can be summarized as:

- 1- Climate change by annual rainfall rate decline and rising atmospheric temperature
- 2- Fire by burning them due many causes
- 3- Deforestation by cutting and plugging the forests for many purposes and causes.

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APPENDIX

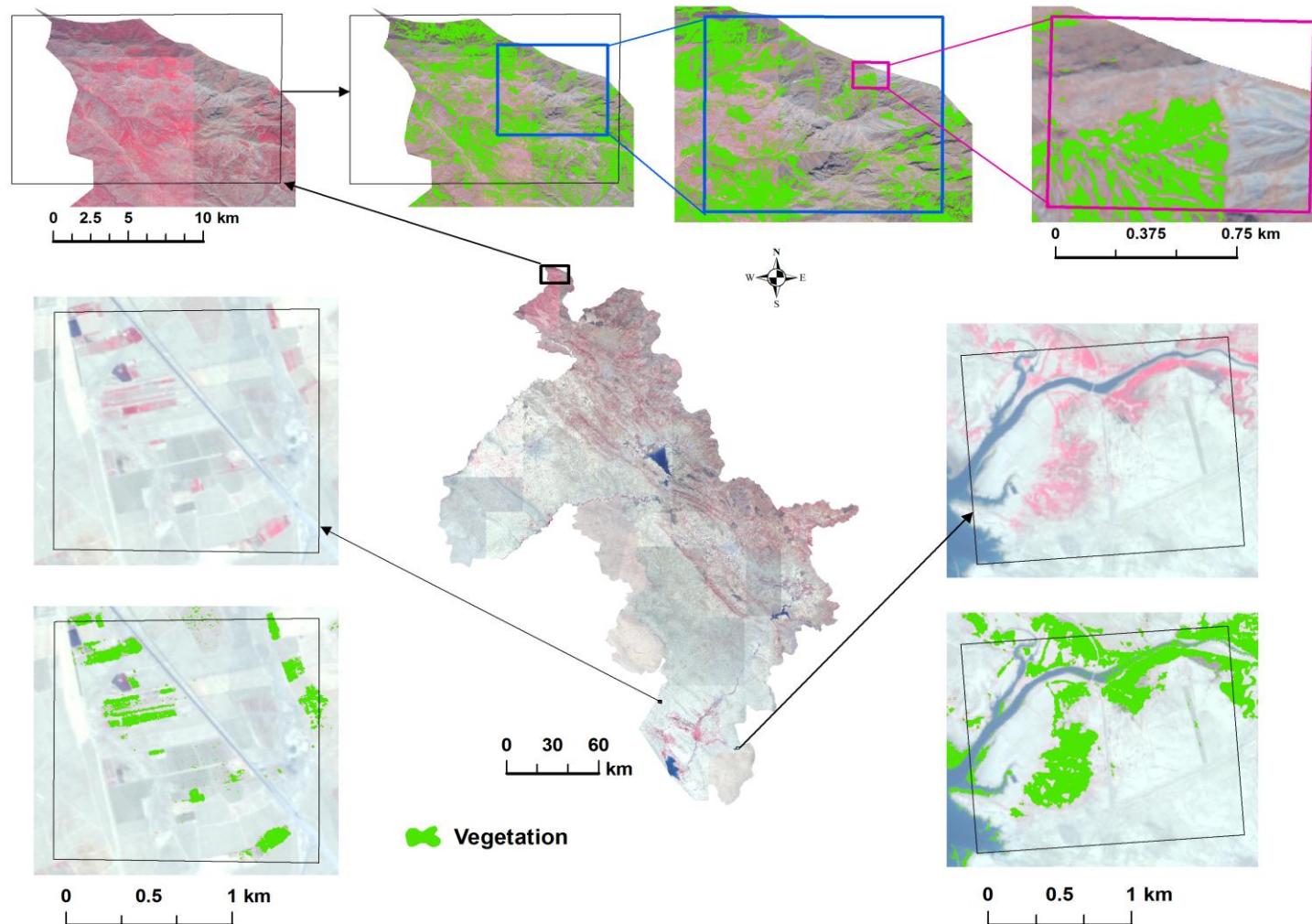


Figure 52: Satellite image of the study area and some sample location with and without vegetation coverage, at the top is a part of Mergasur district, at the right button is a part of Khanaqin district, at the left is a part of Kfri district.

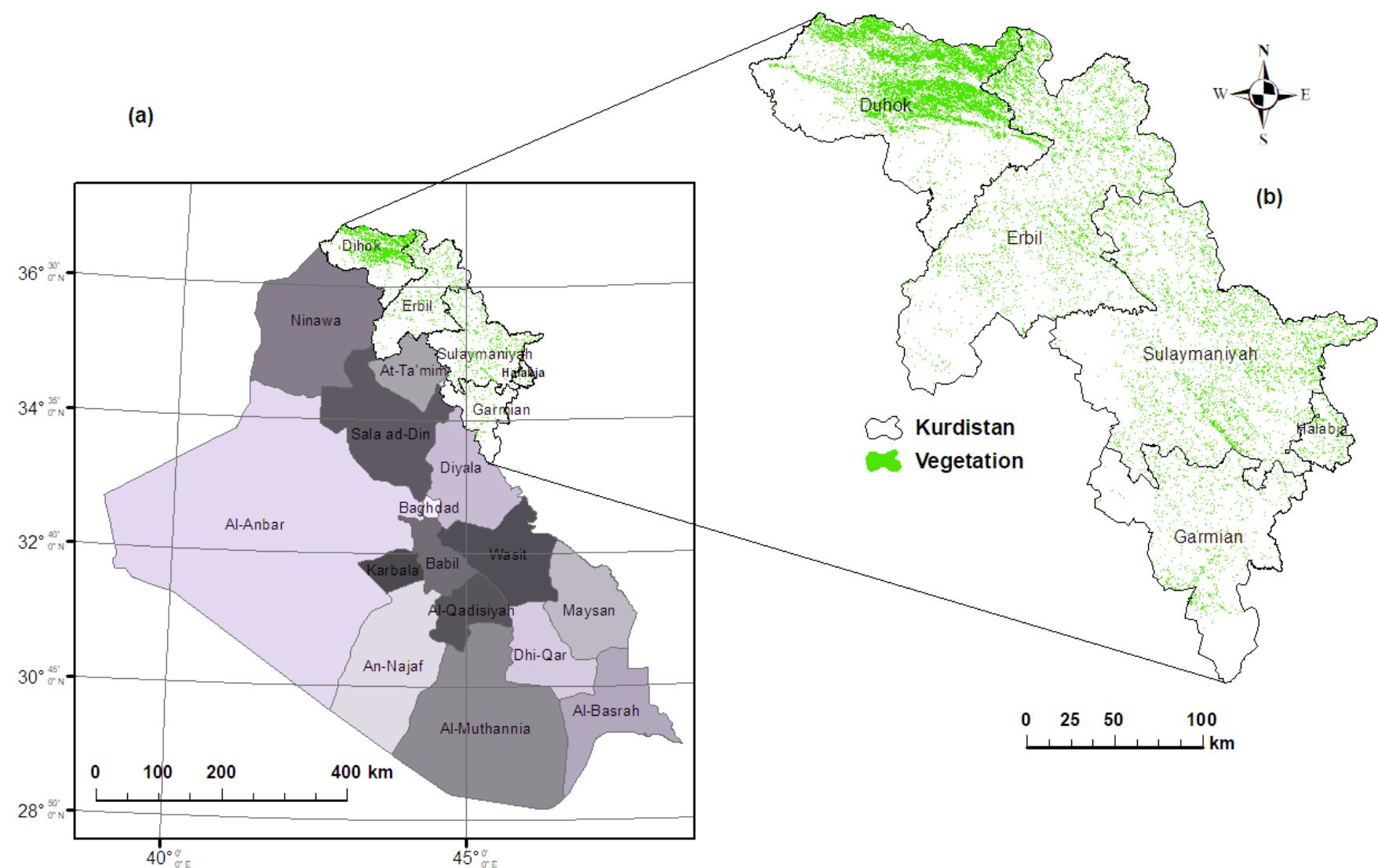


Figure 53: (a) Map of Iraq, (b) Map of Kurdistan Region-Iraq with vegetation coverage distribution.

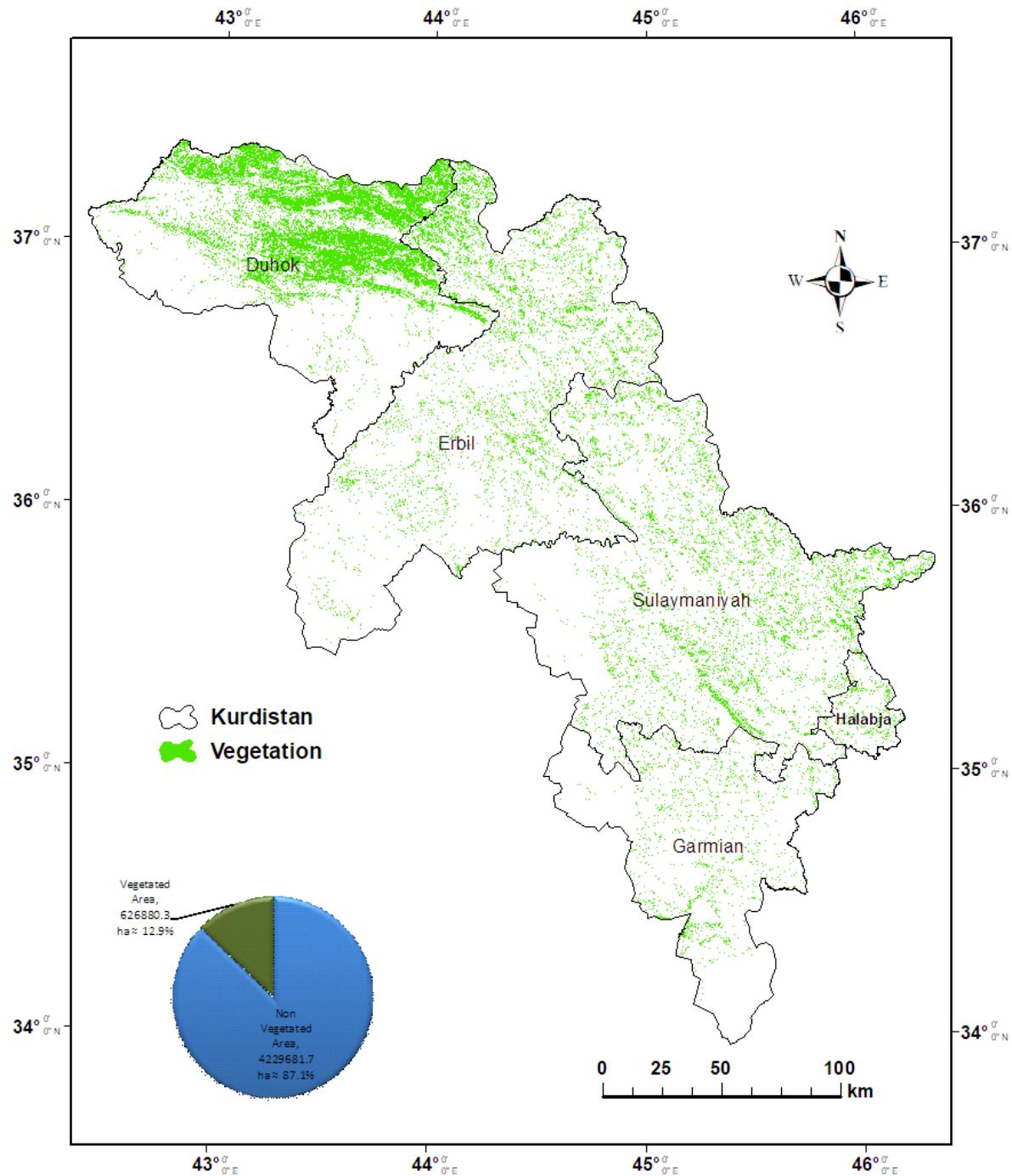


Figure 54: Vegetation coverage distribution in Kurdistan Region-Iraq.

Table 14: Artificial forest projects in Erbil with their geographical location of each individual projects.

No.	Project Name	X	Y	Place	Adminstrative	Plantation Year
1.	Soran	44.50198000	36.6460650	Soran	Soran	
2.	Soran	44.53792000	36.6333100	Soran	Soran	
3.	Soran	44.52908000	36.6428400	Soran	Soran	
4.	Xanzad	44.55853000	36.6651600	Hawler	Hawler	
5.	Soran	44.55973000	36.6495200	Soran	Soran	
6.	Kasnazar	44.17689000	36.2208000	Hawler	Hawler	
7.	Namamgah-Berzewa	44.63407000	36.6294800	Hawler	Hawler	2002
8.	Namamgaha-Nawand	44.01375000	36.2216500	Hawler	Hawler	
9.	Bansalawa_1	44.10400208	36.1635943	Bansalawa	dashti Hawler	1999
10.	Bansalawa_2	44.10645695	36.1642479	Bansalawa	dashti Hawler	1999
11.	Bestana	44.20559417	36.0366460			
12.	D.talala	44.82778828	36.6093936	Choman	Soran	1994
13.	D.Choman	44.88051093	36.6271927	Choman	Soran	1994
14.	Bardarsha	44.87932241	36.6314660	Choman	Soran	1994
15.	Derman awa	44.89209972	36.6462296	Choman	Soran	1994

16.	Dibaka_1	43.83530790	35.9087864	Mexmor	Mexmor	2012
17.	Dibaka_2	43.83389030	35.9056846	Mexmor	Mexmor	2012
18.	Dikala_1	44.38565276	36.1822970	Dikala	Koye	1977
19.	Dikala_2	44.38277397	36.1780734	Dikala	Koye	1977
20.	Harir_1	44.34781108	36.5611069	Harir	Shaqlawa	2003
21.	Harir_2	44.34694438	36.5625334	Harir	Shaqlawa	2003
22.	Harir_3	44.35097837	36.5441451	Harir	Shaqlawa	2003
23.	Harir_4	44.35015954	36.5432489	Harir	Shaqlawa	2003
24.	Harir_5	44.37615403	36.4334370	Harir	Shaqlawa	2003
25.	Harir_6	44.38482125	36.4564825	Harir	Shaqlawa	2003
26.	Harir_7	44.37135761	36.4890884	Harir	Shaqlawa	2003
27.	Hawdiyian	44.48991584	36.6902203	Hawdiyian	Shaqlawa	2015
28.	Hiran_1	44.49573444	36.2766848	Hiran	Shaqlawa	1977
29.	Hiran_2	44.49521878	36.2759399	Hiran	Shaqlawa	1977
30.	Kani Shawerd	44.19978939	36.2217015	Kasnazar	Hawler	1976
31.	kolichi esh	44.15663770	36.2150163	Kasnazar	Hawler	1977
32.	Monoment	44.16015446	36.2090969	Kasnazar	Hawler	1977

33.	Dawrobari Monoment	44.16866302	36.2125864	Kasnazar	Hawler	1977
34.	Chot saidi Kasnazan	44.19007803	36.2167127	Kasnazar	Hawler	1977
35.	Kasnazar	44.18278053	36.2215643	Kasnazar	Hawler	1976
36.	Koye	44.65859376	36.0888417	Koye	Koye	1977
37.	Koye	44.56118553	36.0751090	Koye	Koye	1977
38.	Koye	44.66143201	36.1009171	Koye	Koye	1977
39.	Koye	44.66371808	36.1083045	Koye	Koye	1977
40.	Darestana Sala7din	44.21701482	36.3903047	Sala7din	Shaqlawa	1977
41.	Masif_1	44.21417641	36.3931760	Masif	Shaqlawav	1977
42.	Masif_2	44.18197299	36.3542462	Masif	Shaqlawa	1976
43.	Hechran	44.28088155	36.3925369	Masif	Shaqlawa	1976
44.	Masif_3	44.18231235	36.3562713	Masif	Shaqlawa	1976
45.	Mexmor	43.59108705	35.7613617	Mexmor	Mexmor	2012
46.	Mexmor	43.59566103	35.7621442	Mexmor	Mexmor	2012
47.	Parka Darestane	44.20438876	36.8931047	Mergasor	Soran	2001
48.	Rawandoz	44.54108659	36.6160855	Soran	Soran	1978
49.	Regai Kerkuk	44.02340598	36.1135555	Qoshtaba	dashti Hawler	1978

50.	Regai Mosel_1	43.91818360	36.1829615	Hawler	Hawler	1977
51.	Regai Mosel_2	43.90894696	36.1902369	Hawler	Hawler	1977
52.	Regai Mosel_3	43.90578743	36.1925909	Hawler	Hawler	1977
53.	Sidakan_1	44.66141096	36.8079927	Sidakan	Soran	2001
54.	Sidakan_2	44.65981320	36.8096427	Sidakan	Soran	2001
55.	Darestana Shaqlawa_1	44.33977344	36.4063929	Shaqlawa	Shaqlawa	1977
56.	Darestana Shaqlawa_2	44.31332462	36.4185002	Shaqlawa	Shaqlawa	1977
57.	Darestana Shaqlawa_3	44.31198857	36.4174152	Shaqlawa	Shaqlawa	1977
58.	Darestana Shaqlawa_4	44.32024932	36.4023328	Shaqlawa	Shaqlawa	1977
59.	Darestana Shaqlawa_5	44.34893018	36.4026041	Shaqlawa	Shaqlawa	1977
60.	Shaswar	44.26285991	36.4028661	Sala7din	Shaqlawa	1977
61.	Taq Taq	44.59400685	35.9048519	Koye	Koye	1976
62.	Xabat_1	43.64493067	36.2564057	Xabat	xabat	1976
63.	Xabat_2	43.64654995	36.2658208	Xabat	Xabat	1976
64.	Xabat_3	43.65089302	36.2685783	Xabat	Xabat	1976
65.	Xabat_4	43.67199311	36.2673852	Xabat	Xabat	1976

Table 15: Artificial forest projects in Sulaymaniyah with their geographical location of each individual projects.

No.	Project Name	X	Y	Place	Administrative	Plantation Year
1.	Asholax	45.8568464	35.360429	Said sadeq	Said sadeq	
2.	Asholax	45.8539210	35.358570	Said sadeq	Said sadeq	
3.	Do qala	45.8711045	35.543901	Nalparez	Penjwin	
4.	Do qala	45.8632304	35.553411	Nalparez	Penjwin	
5.	Sangaw	45.1693559	35.300234	Chamchamal	Chamchamal	
6.	Sangaw	45.1734624	35.291921	Chamchamal	Chamchamal	
7.	Sangaw	45.1724762	35.293689	Chamchamal	Chamchamal	
8.	Sangaw	45.1707656	35.291697	Chamchamal	Chamchamal	
9.	Sangaw	45.1683932	35.292974	Chamchamal	Chamchamal	
10.	Sangaw	45.1702267	35.294957	Chamchamal	Chamchamal	
11.	sangaw	45.1679114	35.295014	Chamchamal	Chamchamal	
12.	Qarahanjir	44.6468051	35.499086	Chamchamal	Chamchamal	
13.	Qarahanjir	44.6243358	35.493380	Chamchamal	Chamchamal	
14.	Penjwin	45.9146959	35.622114	Penjwin	Penjwin	
15.	Penjwin	45.9118993	35.627484	Penjwin	Penjwin	
16.	Penjwin	45.9089138	35.622456	Penjwin	Penjwin	
17.	Penjwin	45.9085542	35.617252	Penjwin	Penjwin	
18.	Aersha	44.8712334	35.994929	Dukan	Dukan	
19.	Aresha	44.8764980	35.992654	Dukan	Dukan	
20.	Aersha	44.8725789	35.994044	Dukan	Dukan	
21.	Darwazai Rania	44.8608227	36.229352	Rania	Rania	
22.	Darwazai Rania	44.8599283	36.232532	Rania	Rania	
23.	Meradi	45.6924613	35.245403	Sharazor	Sharazor	
24.	Meradi	45.6873972	35.243394	Sharazor	Sharazor	
25.	zaraean	45.6613465	35.311623	Sharazor	Sharazor	

26.	Zaraean	45.6602695	35.308748	Sharazor	Sharazor	
27.	Zarayan	45.6656935	35.308336	Sharazor	Sharazor	
28.	Baziyian-tasloja	45.1279503	35.610566	Sul	Nawand	
29.	Baziyian-tasloja	45.1152693	35.613768	Sul	Nawand	
30.	Baziyian-tasloja	45.0499416	35.642222	Sul	Nawand	
31.	Baziyian-tasloja	45.1349746	35.605272	Sul	Nawand	
32.	Baziyian-tasloja	45.0424603	35.643264	Sul	Nawand	
33.	Baziyian-tasloja	45.1247408	35.612231	Sul	Nawand	
34.	Baziyian-tasloja	45.1211054	35.613272	Sul	Nawand	
35.	Baziyian-tasloja	45.0184655	35.645654	Sul	Nawand	
36.	Baziyian-tasloja	45.1581789	35.587844	Sul	Nawand	
37.	Baziyian-tasloja	45.1478874	35.595473	Sul	Nawand	
38.	Baziyian-tasloja	45.0035579	35.646675	Sul	Nawand	
39.	Baziyian-tasloja	45.0874002	35.618395	Sul	Nawand	
40.	Baziyian-tasloja	45.0184655	35.645654	Sul	Nawand	
41.	Baziyian-tasloja	45.0798742	35.623303	Sul	Nawand	
42.	Dukan-Tasloja	45.1158723	35.790991	Sul	Dukan	
43.	Dukan-Tasloja	45.1984446	35.681062	Sul	Dukan	
44.	Dukan-Tasloja	45.1140637	35.791506	Sul	Dulan	
45.	Dukan-Tasloja	45.1207938	35.782194	Sul	Dukan	
46.	Dukan-Tasloja	45.1220408	35.780021	Sul	Dukan	
47.	Dukan-Tasloja	45.1203229	35.780364	Sul	Dukan	
48.	Dukan-Tasloja	45.1254244	35.771330	Sul	Dukan	
49.	Dukan-Tasloja	45.1331544	35.758211	Sul	Dukan	
50.	Dukan-Tasloja	45.1805913	35.704671	Sul	Dukan	
51.	Dukan-Tasloja	45.1800488	35.707125	Sul	Nawand	
52.	Dukan-Tasloja	45.0184655	35.645654	Sul	Dukan	
53.	Dukan-Tasloja	45.1812224	35.705844	Sul	Dukan	
54.	Dukan-Tasloja	45.1792620	35.706205	Sul	Dukan	

55.	Suli-Arbat	45.4583383	35.492267	Sul	Nawand	
56.	Suli-Arbat	45.4548013	35.495920	Sul	Nawand	
57.	Suli-Arbat	45.4600750	35.490465	Sul	Nawand	
58.	Suli-Arbat	45.5687578	35.441296	Sul	Nawand	
59.	Suli-Arbat	45.5493694	35.456340	Sul	Nawand	
60.	Suli-Arbat	45.4772894	35.475458	Sul	Nawand	
61.	Suli-Arbat	45.5756756	35.433571	Sul	Nawand	
62.	Suli-Arbat	45.4567231	35.493902	Sul	Nawand	
63.	Suli-Arbat	45.4625410	35.487906	Sul	Nawand	
64.	Suli-Arbat	45.5766200	35.434477	Sul	Nawand	
65.	Suli-Arbat	45.4686863	35.481659	Sul	Nawand	
66.	Suli-Arbat	45.4526670	35.498086	Sul	Nawand	
67.	Suli-Arbat	45.4535216	35.495427	Sul	Nawand	
68.	Suli-Arbat	45.4557345	35.493093	Sul	Nawand	
69.	Suli-Arbat	45.4593719	35.489347	Sul	Nawand	
70.	Suli-Arbat	45.4648952	35.483656	Sul	Nawand	
71.	Suli-Arbat	45.4713810	35.477537	Sul	Nawand	
72.	Suli-Arbat	45.5711298	35.439172	Sul	Nawand	
73.	Dabashan	45.4582369	35.592196	Sul	Nawand	
74.	Dabashan	45.4509720	35.590903	Sul	Nawand	
75.	Dabashan	45.4527981	35.598513	Sul	Nawand	
76.	Suli-Tasloja	45.2538983	35.587846	Sul	Nawand	
77.	Suli-Tasloja	45.3295940	35.578178	Sul	Nawand	
78.	Suli-Tasloja	45.3251039	35.579173	Sul	nawand	
79.	Suli-Tasloja	45.2827646	35.584600	Sul	Nawand	
80.	Suli-Tasloja	45.2982236	35.582851	Sul	Nawand	
81.	Suli-Tasloja	45.2466714	35.588492	Sul	Nawand	
82.	Suli-Tasloja	45.2842688	35.585137	Sul	Nawand	
83.	Suli-Tasloja	45.2744107	35.586259	Sul	Nawand	

84.	Suli-Tasloja	45.2939184	35.583988	Sul	Nawand	
85.	Suli-Tasloja	45.2988722	35.583437	Sul	Nawand	
86.	Suli-Tasloja	45.3025645	35.583009	Sul	Nawand	
87.	darbandi-bazean	44.9783864	35.644892	Sul	Nawand	
88.	darbandi-bazean	44.9790675	35.638735	Sul	Nawand	
89.	Alay	45.1831104	35.591241	Bazean	Nawand	
90.	Alay	45.1714927	35.584524	Bazean	Nawand	
91.	Kani-shaetan	45.0082125	35.645121	Sul	Nawand	
92.	Sulimani-gerda	45.1426048	35.600850	Sul	Nawand	
93.	Bebejak	45.1377224	35.606737	bazean	Nawand	
94.	Shwankara	45.1868986	35.587589	Baziyian	Nawand	
95.	xarachiyian	45.5529651	35.450306	Sul	Nawand	
96.	Razyia	45.4953909	35.481466	Sul	Nawand	
97.	Mashtal-sarchenar	45.3762926	35.586577	Sul	Nawand	
98.	Hawareshar	45.4532321	35.617211	Sul	Nawand	
99.	ChaqChaq	45.3749380	35.587741	Sul	Nawand	
100.	Shex-Waisawa	45.4894098	35.517904	Sul	Nawand	
101.	Azmer-haroota	45.4699970	35.611519	Sul	Nawand	
102.	Sangasar	44.9866920	36.230428	Peshdar	Peshdar	
103.	Monoment Rania	44.8626016	36.227454	Rania	Rania	
104.	Shazadsaib	44.9166755	36.247954	Rania	Rania	
105.	sardaryiachai Dukan	44.9788678	35.958627	Dukan	Dukan	
106.	Mashtal Dukan	44.9638139	35.926313	Dukan	Dukan	
107.	Bngrd	45.0463308	36.072183	Dukan	Dukan	
108.	kanimazo	44.7984098	36.048722	Dukan	Dukan	
109.	Barzenga	45.6888200	35.541602	Sorcha	Said sadeq	
110.	Sarawsb7axan	45.8331978	35.377584	Said sadeq	Said sadeq	
111.	Kanispika	45.8748574	35.529182	Penjwin	Penjwin	

112.	Tasar	45.8777778	35.354006	Said sadeq	Said sadeq	
113.	KiewPenjwin	45.9378638	35.658758	Penjwin	Penjwin	
114.	xabatidalawau	44.8747842	35.784269	Axgeler	Chamchamal	
115.	MashtalBanimaqan	44.7843233	35.498752	Chamchamal	Chamchamal	
116.	Shewasor	44.9249399	35.595649	Chamchamal	Chamchamal	
117.	Xerdan	44.7629570	36.137412	Nawand	Nawand	2005
118.	Tasloja_1	45.2070764	35.590825	Tasloja	Nawand	1955
119.	Tasloja_2	45.2053966	35.585395	Tasloja	Nawand	1955
120.	derbandi	44.9836354	36.223753	Rania	Rania	1978
121.	Kiwa rash	44.9259450	36.244682	Rania	Rania	1978
122.	Qarahanjeer	44.6427337	35.491998	Qarahanjeer	Chamchamal	
123.	Qarahanjeer	44.6492561	35.492541	Qarahanjeer	Chamchamal	
124.	Basha qach	45.3910193	35.317145	Basha qach	Qaradax	1976
125.	Koban_2	45.3964874	35.329536	Qaradax	Qaradax	
126.	Koban_3	45.4004964	35.320662	Qaradax	Qaradax	
127.	Qaradax_2	45.3968609	35.313014	Qaradax	Qaradax	1976
128.	Qaradax_3	45.4014219	35.318748	Qaradax	Qaradax	1976
129.	Qaradax_1	45.4000252	35.337010	Qaradax	Qaradax	1976
130.	Qaladeze_1	45.1091084	36.184510	Qaladeze	Qaladeze	1978
131.	Qaladeze_2	45.1143697	36.193260	Qaladeze	Qaladeze	1978
132.	Qaladeze_3	45.1063042	36.195308	Qaladeze	Qaladeze	1978
133.	Qaladeze_4	45.0963247	36.197980	Qaladeze	Qaladeze	1978
134.	Qaladeze_5	45.1070820	36.202219	Qaladeze	Qaladeze	1978
135.	Qaladeze_6	45.1108829	36.181529	Qaladeze	Qaladeze	1978
136.	Kolos	45.8800077	35.504607		Penjwin	1977
137.	Kani wotman_1	44.7944303	36.058206	Dukan	Dukan	1955
138.	Kani wotman_2	44.7926546	36.061020	Dukan	Dukan	1955
139.	Haroota	45.4779349	35.591120	Nawand	Nawand	2005
140.	Kereza	45.7451404	35.384345	Said sadeq	Said sadeq	2003

141.	Goizha	45.4789741	35.579235	Nawand	Nawand	1947
142.	Dukan_1	44.9757151	35.920264	Dukan	Dukan	1955
143.	Dukan2	44.9739202	35.931287	Dukan	Dukan	1955
144.	Dukan3	44.9657416	35.946753	Dukan	Dukan	1955
145.	Chenara_2	45.7014640	35.225089	Derbandixan	Derbandixan	1973
146.	Chenara_1	45.7038315	35.225419	Derbandixan	Derbandixan	1973
147.	Tunel	45.6917360	35.122863	Derbandixan	Derbandixan	1973
148.	Xebati	45.6706093	35.389490			2003
149.	Bani Maqan_1	44.7908811	35.500784	Chamchamal	Chamchamal	
150.	Bani Maqan_2	44.7983788	35.501403	Chamchamal	Chamchamal	
151.	Bani Maqan_3	44.8035682	35.503351	Chamchamal	Chamchamal	
152.	Bani Maqan_4	44.8095509	35.502567	Chamchamal	Chamchamal	
153.	Bani Maqan_5	44.7992823	35.510688	Chamchamal	Chamchamal	
154.	Bayinchan	45.0605483	35.631444	Baziyian	Nawand	1953
155.	Chamchamal	44.8854044	35.746621	Axter	Chamchamal	

Table 16: Artificial forest projects in Garmian with their geographical location of each individual projects.

No.	Project Name	X	Y	Place	Admins t-rative	Plantat-ion Year
1.	parki Darestana Bawashwar u sawz krdni bandawe bawa shaswar	44.968718900	34.730964047	Kefri	Kefri	2013
2.	Parki darstana darwazai kfri	44.990721631	34.685568202	kalar	kfri	2014-2015
3.	Parki darstani Hejar	45.357760812	34.659495775	kalar	kalar	2011-2012
4.	parki darstani Mezari Anfal	45.212152648	34.645808662	kalar	kalar	2013
5.	darstani Peshtinay Sawzai	45.317909578	34.664289294	kalar	kalar	2012-2013
6.	Regai Mezar	45.221418920	34.653038664	Rezkari	Rezkari	2013

Table 17: Artificial forest projects in Halabja with their geographical location of each individual projects.

No .	Project Name	X	Y	Place	Administra-tive	Plantation Year
1.	Regabani-Halabja	45.9614353	35.213163	Halabja	Halabja	
2.	Regabani-Halabja	45.9512278	35.231459	Halabja	Halabja	
3.	Anab	46.0229941	35.199654	Halabja	Halabja	
4.	Ababaili	46.0303257	35.175758	Halabja	Halabja	
5.	Mashtal Serwan	45.9403622	35.247550	Halabja	Halabja	
6.	Qala Xurmal	46.0418564	35.299771	Xurmal	Halabja	2003
7.	Xurmal	46.0727357	35.290446	Halabja	Halabja	2003
8.	Xurmal kamara	46.0670154	35.287346	Halabja	Halabja	2003
9.	Jalil_1	46.0273517	35.186729	Halabja	Halabja	1973
10.	Jalil_2	46.0275749	35.184593	Halabja	Halabja	1973
11.	Jalil_3	46.0291085	35.189255	Halabja	Halabja	1973
12.	Jalil_4	46.0319294	35.186191	Halabja	Halabja	1973
13.	Jalil_5	46.0324540	35.182813	Halabja	Halabja	1973
14.	Gulan_10	45.9807327	35.161985	Halabja	Halabja	1970
15.	Gulan_9	45.9821383	35.163531	Halabja	Halabja	1970

16.	Gulan_8	45.9834277	35.160064	Halabja	Halabja	1970
17.	Gulan_7	45.9794636	35.164035	Halabja	Halabja	1970
18.	Gulan_6-1	45.9714224	35.163077	Halabja	Halabja	1970
19.	Gulan_6-2	45.9794690	35.165174	Halabja	Halabja	1970
20.	Gulan_5	45.9736501	35.165178	Halabja	Halabja	1970
21.	Gulan_4	45.9742515	35.165516	Halabja	Halabja	1970
22.	Gulan_3	45.9735886	35.168128	Halabja	Halabja	1970
23.	Gulan_2	45.9739109	35.155704	Halabja	Halabja	1970
24.	Gulan_1	45.9725787	35.160964	Halabja	Halabja	1970
25.	Biyara	46.1072713	35.227223	Biyara	Halabja	2003
26.	Ahmad Awa	46.0690873	35.297194	Ahmad	Halabja	2003

Table 18: Artificial forest projects in Duhok with their geographical location of each individual projects.

No.	Project Name	X	Y	Place	Administrative	Plantation Year
1.	Wa7a-1	43.768333	36.677601	Gerdasin	Akre	2012
2.	Wa7a-2	43.765299	36.675367	Gerdasin	Akre	2012
3.	Wa7a-3	43.824159	36.718226	Gerdasin	Akre	2012
4.	Wa7a-4	43.821782	36.716368	Gerdasin	Akre	2012
5.	Wa7a-5	43.815379	36.711804	Gerdasin	Akre	2012
6.	Wa7a-6	43.808961	36.707133	Gerdasin	Akre	2012
7.	Wa7a-7	43.786393	36.690753	Gerdasin	Akre	2012
8.	Wa7a-8	43.789054	36.692704	Gerdasin	Akre	2012
9.	Wa7a-9	43.790387	36.693659	Gerdasin	Akre	2012
10.	Wa7a-10	43.793256	36.695726	Gerdasin	Akre	2012
11.	Wa7a-11	43.795681	36.697466	Gerdasin	Akre	2012
12.	Wa7a-12	43.798152	36.699311	Gerdasin	Akre	2012
13.	Wa7a-13	43.801211	36.701558	Gerdasin	Akre	2012
14.	Wa7a-14	43.804064	36.703649	Gerdasin	Akre	2012
15.	Wa7a-15	43.807771	36.706313	Gerdasin	Akre	2012
16.	Wa7a-16	43.759608	36.670992	Gerdasin	Akre	2012
17.	Wa7a-17	43.762863	36.673548	Gerdasin	Akre	2012
18.	Wa7a-18	43.774095	36.681833	Gerdasin	Akre	2012
19.	Wa7a-19	43.779177	36.685486	Gerdasin	Akre	2012
20.	Wa7a-20	43.782383	36.687756	Gerdasin	Akre	2012
21.	Wa7a-21	43.784531	36.689422	Gerdasin	Akre	2012
22.	Bashqal	43.906497	36.743953	Akre	Akre	1978
23.	Bihok	43.879212	36.749855	Akre	Akre	2004
24.	Kre Ashxal	43.893341	36.733937	Akre	Akre	2002
25.	Kre Dinarte	43.98911	36.802833	Dinarte	Akre	1978
26.	Kre Niska	43.898748	36.743213	Akre	Akre	1975

27.	Gomerk	43.905518	36.740569	Akre	Akre	2002
28.	Besht Gomerke	43.900688	36.738432	Akre	Akre	1978
29.	Mezar	44.019519	36.720515	Bejel	Akre	2012
30.	Mamei	43.906264	36.754864	Akre	Akre	1978
31.	Mehat	43.882309	36.760613	Mahat	Akre	1978
32.	Gulan	43.891399	36.730073	Akre	Akre	1978
33.	Saremyia	43.890398	36.736733	Akre	Akre	1999
34.	Xerka	43.910174	36.746677	Akre	Akre	1978
35.	Xanaki	44.00566	36.727082	Bejel	Akre	1978
36.	Belichanke	43.445918	37.090492	Amedi	Amedi	1977
37.	Barekar	43.421159	37.088524	Amedi	Amedi	1977
38.	Barekar	43.413346	37.090676	Amedi	Amedi	1977
39.	Barekar	43.414744	37.089379	Amedi	Amedi	1977
40.	Barekar	43.417244	37.087744	Amedi	Amedi	1977
41.	Barekar	43.41327	37.089426	Amedi	Amedi	1977
42.	Bebade	43.447679	37.099982	Amedi	Amedi	1976
43.	Binamedi	43.493885	37.095896	Amedi	Amedi	1983
44.	Binamedi	43.492799	37.09258	Amedi	Amedi	1983
45.	Botia	43.4331	37.092836	Amedi	Amedi	1983
46.	Botia	43.432717	37.093722	Amedi	Amedi	1983
47.	Chapa serke	43.498164	37.097604	Amedi	Amedi	1983
48.	Chapa serke	43.497351	37.097224	Amedi	Amedi	1983
49.	Chapa serke	43.498056	37.095689	Amedi	Amedi	1983
50.	Chapa serke	43.499484	37.095038	Amedi	Amedi	1983
51.	Dere	43.507547	37.093559	Amedi	Amedi	1977
52.	Dere	43.515814	37.093102	Amedi	Amedi	1977
53.	Hamzike	43.423605	37.088877	Amedi	Amedi	1982
54.	Kania senje	43.499667	37.101419	Amedi	Amedi	1976
55.	Metlawesh	43.464751	37.100811	Amedi	Amedi	1973

56.	Metlawesh	43.459977	37.099046	Amedi	Amedi	1973
57.	Metlawesh	43.462154	37.09807	Amedi	Amedi	1973
58.	Metlawesh	43.473998	37.095894	Amedi	Amedi	1973
59.	Moqbara	43.503732	37.091507	Amedi	Amedi	1977
60.	Metlawesh	43.473998	37.095894	Amedi	Amedi	1973
61.	Seke	43.475279	37.101976	Amedi	Amedi	1971
62.	Seke	43.473276	37.099795	Amedi	Amedi	1971
63.	Sharifa	43.455356	37.100968	Amedi	Amedi	1973
64.	Tahte	43.495775	37.103588	Amedi	Amedi	1976
65.	Beldesh Mefraq	43.303812	36.810248	Atrish	Shexan	2000
66.	Kerdahol	43.346059	36.850147	Atrish	Shexan	1997
67.	Kerdahol	43.347367	36.849559	Atrish	Shexan	1997
68.	Kerdahol	43.34651	36.845943	Atrish	Shexan	1998
69.	Kerdahol	43.344853	36.849019	Atrish	Shexan	2000
70.	Kerdahol	43.342474	36.844556	Atrish	Shexan	1979
71.	Askikalak	43.64025	36.27973	Bardarash	Bardarash	2012
72.	Askiklak	43.62998	36.27222	Bardarash	Bardarash	2012
73.	Shewa Qor	43.59291	36.49681	Bardarash	Bardarash	2013
74.	Parka Newroz	43.58106	36.49925	Bardarash	Bardarash	2004
75.	Park Bardarash	43.582	36.49044	Bardarash	Bardarash	2012
76.	Gere Borche	43.58874	36.49802	Bardarash	Bardarash	2009
77.	Zambil Frosh	42.9844	37.17901	Batifa	Zakho	1979
78.	Tobxane	43.01238	37.17949	Batifa	Zakho	1979
79.	Gere Zalgahe	43.0178	37.18313	Batifa	Zakho	2000
80.	Gere Liwaye 3	43.02099	37.17457	Batifa	Zakho	2005
81.	Gere Liwaye 2	43.0213	37.17695	Batifa	Zakho	2005
82.	Gere Liwaye 1	43.01948	37.17882	Batifa	Zakho	2005
83.	Doryiana Bahnona 3	43.01765	37.1941	Batifa	Zakho	2010
84.	Doryiana Bahnona 2	43.01824	37.19245	Batifa	Zakho	2010

85.	Doryiana Bahnona 1	43.01693	37.19174	Batifa	Zakho	1979
86.	Chamanke-1	43.387866	36.945314	Chamanke	Chamanke	2008
87.	Chamanke-2	43.387993	36.946659	Chamanke	Chamanke	2008
88.	Meze-1	43.400131	36.942962	Chamanke	Chamanke	2008
89.	Meze-2	43.406609	36.939761	Chamanke	Chamanke	2008
90.	Meze-3	43.407475	36.938895	Chamanke	Chamanke	2008
91.	Sirye	43.81874	37.01946	Deralok	Amedi	1979
92.	forest Sheladeze	43.79835	37.02859	Sheladeze	Amedi	1979
93.	Kerka	43.78092	37.03593	Sheladeze	Amedi	1979
94.	Chelke	43.66588	37.05312	Deralok	Amedi	2004-2007
95.	Grebarxa	43.79768	37.03193	Deralok	Amedi	1979
96.	Mashatal zakho	42.65232	37.15694	Zakho	zakho	
97.	Mashatal Malta	42.93576	36.85862	Duhok	Duhok	
98.	Bablo	43.128008	36.873517	Zawita	dohuk	2000
99.	bakera sare	43.171978	36.954684	Bakera	dohuk	1978
100.	bakera sare	43.170041	36.951548	Bakera	dohuk	1978
101.	Baroshke	43.021887	36.862455	dohuk	dohuk	1980
102.	Besere-1	43.058904	36.853669	dohuk	dohuk	1974
103.	Besere-2	43.062883	36.855374	dohuk	dohuk	1974
104.	Besere-3	43.063313	36.857417	dohuk	dohuk	1974
105.	Besere-4	43.0608	36.860984	dohuk	dohuk	1974
106.	Kamaka	43.059901	36.961328	Mangeshk	dohuk	1974
107.	Kavlasene	43.213936	36.991964	Mangeshk	dohuk	1974
108.	Mangeshk	43.068205	37.038839	Mangeshk	dohuk	1974
109.	merga deresh	43.215314	37.002252	siyaratika	dohuk	1970
110.	merga deresh	43.218913	37.001675	siyaratika	dohuk	1970
111.	merga deresh	43.219312	36.998688	siyaratika	dohuk	1970
112.	Nzarke	43.055878	36.856976	dohuk	dohuk	2010
113.	Rashanke	43.170262	36.918795	Zawita	dohuk	1996-1997

114.	Piomara	42.990083	36.905803	Zawita	dohuk	1974
115.	Reka siyaratika	43.204256	36.979941	siyaratika	dohuk	1974
116.	Reka siyaratika	43.208738	36.983797	siyaratika	dohuk	1974
117.	Sarke	43.215867	36.98336	Bakera	dohuk	1999
118.	Sarke	43.211695	36.975371	Bakera	dohuk	1999
119.	Bade karma	43.080452	36.91167	Bade	dohuk	1974
120.	Bade gre haci	43.106654	36.906266	Bade	dohuk	1974
121.	bade sare	43.088532	36.909839	Bade	dohuk	1974
122.	Bade mo3askar	43.128988	36.908144	Bade	dohuk	1974
123.	Bade mo3askar	43.130961	36.912702	Bade	dohuk	1974
124.	Bade mo3askar	43.14367	36.917614	Bade	dohuk	1974
125.	Bakoze	43.023468	36.91872	Bakoze	dohuk	1974
126.	Dargal kersis	43.120453	36.941686	dakale	dohuk	1970
127.	chapet xabolka	43.120593	36.912193	Bade	dohuk	1970
128.	Besere-5	43.067632	36.862973	dohuk	dohuk	1974
129.	Besere-6	43.069667	36.863178	dohuk	dohuk	1974
130.	Besere-7	43.070782	36.862662	dohuk	dohuk	1974
131.	Bania bade	43.125333	36.909691	Bade	dohuk	1974
132.	Bakoze	43.029151	36.922952	Bakoze	dohuk	1974
133.	Bakoze	43.030344	36.920001	Bakoze	dohuk	1974
134.	Bakoze	43.019285	36.920251	Bakoze	dohuk	1974
135.	Kavlasene	43.181458	36.972597	Bakera	dohuk	1970
136.	Kavlasene	43.177934	36.965509	Bakera	dohuk	1970
137.	Gale zawita	43.152217	36.915717	Zawita	dohuk	1997
138.	Gale zawita	43.151441	36.924195	Zawita	dohuk	1997
139.	Gale qantara	43.162822	36.948709	Zawita	dohuk	1970
140.	Eminke	43.092655	36.864148	Zawita	dohuk	1974
141.	Ekmala	43.038684	36.903365	Bade	dohuk	1974
142.	Ekmala	43.040883	36.907532	Bade	dohuk	1974

143.	Piomara	42.993966	36.888093	Bade	dohuk	1999
144.	Merga deresh	43.192725	36.974664	Bakera	dohuk	1970
145.	moqbarat zawita	43.144177	36.89942	Zawita	dohuk	1970
146.	Lomana	43.187679	36.970669	Bakera	dohuk	1970
147.	komalgaha bekera	43.169266	36.969906	Bakera	dohuk	1970
148.	Kanadal	43.126017	36.900557	Zawita	dohuk	1974
149.	Kanadal	43.120656	36.910188	Zawita	dohuk	1970
150.	kondek nabi	43.18065	36.974369	Bakera	dohuk	1974
151.	ger bechik	43.014533	36.902252	dohuk dam	dohuk	1998
152.	raxed chde	43.131053	36.89427	Zawita	dohuk	2012
153.	raxed chde	43.131475	36.894287	Zawita	dohuk	2012
154.	raxed chde	43.132686	36.897892	Zawita	dohuk	2012
155.	raxed chde	43.133529	36.9005	Zawita	dohuk	2012
156.	Qarqarava	43.033437	36.913062	Bade	dohuk	1974
157.	reka zawita	43.123397	36.885503	Zawita	dohuk	1974
158.	raxed chde	43.093364	36.865632	Zawita	dohuk	2012
159.	raxed chde	43.114924	36.877366	Zawita	dohuk	2012
160.	raxed chde	43.10006	36.869773	Zawita	dohuk	2012
161.	raxed chde	43.125739	36.887172	Zawita	dohuk	2012
162.	Sendore	43.055782	36.905029	Sendor	dohuk	1974
163.	dohuk dam	42.999444	36.879756	dohuk	dohuk	1999
164.	Sendore	43.073626	36.905542	Sendor	dohuk	1974
165.	dohuk dam	43.007774	36.876307	dohuk	Dohuk	1998
166.	reka zawita	43.114432	36.87635	Zawita	Dohuk	1974
167.	reka zawita	43.116658	36.878109	Zawita	Dohuk	1974
168.	reka zawita	43.120618	36.879188	Zawita	Dohuk	1974
169.	reka zawita	43.122398	36.883239	Zawita	Dohuk	1974
170.	reka zawita	43.121428	36.883401	Zawita	Dohuk	1974
171.	zawita waha	43.126126	36.888275	Zawita	Dohuk	2012

172.	zawita waha	43.128125	36.890373	Zawita	Dohuk	2012
173.	zawita waha	43.128668	36.890975	Zawita	Dohuk	2012
174.	zawita waha	43.12933	36.891638	Zawita	Dohuk	2012
175.	Sendore	43.044028	36.902614	Sendor	Dohuk	1974
176.	Sendore	43.053051	36.910677	Sendor	Dohuk	1974
177.	zawita waha	43.120136	36.881854	Zawita	Dohuk	2012
178.	zawita waha	43.120608	36.882348	Zawita	Dohuk	2012
179.	zawita waha	43.122189	36.884052	Zawita	Dohuk	2012
180.	zawita waha	43.125046	36.887098	Zawita	Dohuk	2012
181.	zewa shafiq	43.000971	36.936717	dohuk dam	Dohuk	1974
182.	zewa shafiq	43.004691	36.927186	dohuk dam	Dohuk	1974
183.	Zawita	43.165975	36.912505	Zawita	Dohuk	1974
184.	Zawita	43.147265	36.909127	dohuk	Dohuk	1974
185.	Gali Dohuk	43.00115	36.87475	dohuk	Dohuk	1998
186.	Gali Dohuk	43.005345	36.874361	dohuk	Dohuk	1970
187.	Gali Dohuk	42.999602	36.871681	dohuk	Dohuk	1970
188.	Gali Dohuk	43.002239	36.869762	dohuk	Dohuk	1970
189.	Gali Dohuk	42.996245	36.871568	dohuk	Dohuk	1970
190.	Gali Dohuk	43.004871	36.867663	dohuk	Dohuk	1970
191.	Keshabara	43.009615	36.867687	dohuk	Dohuk	1970
192.	Keshabara	43.008604	36.865218	dohuk	Dohuk	1970
193.	Mashatal Akre	43.8648	36.73249	Akre	Akre	
194.	Zakho Waha	42.643365	37.049466	GaliZakho	Zakho	2000
195.	Zakho Waha	42.644519	37.049239	GaliZakho	Zakho	2000
196.	Darhozan	42.742317	37.162566	Darkar	Zakho	2000
197.	Darkar Ajem	42.826494	37.204331	Darkar	Zakho	2000
198.	Darkar Ajem	42.827521	37.205948	Darkar	Zakho	2000
199.	Gerg Sindy	42.827616	37.20573	Zakho	Zakho	2000
200.	Road_Side	42.673562	37.110938	Rezgari	Zakho	2008

201.	Telkeber	42.728573	37.153481	Darkar	Zakho	2000
202.	Zakho Waha	42.675886	37.127735	Rezgari	Zakho	2008
203.	Zakho Waha	42.678145	37.128719	Rezgari	Zakho	1976
204.	Barbanke	49.267039	37.042926	Sersenk	Sersenk	1989
205.	Barbanke	43.263542	37.041002	Sersenk	Sersenk	2000
206.	Barbanke	43.261476	37.041788	Sersenk	Sersenk	2000
207.	Mefraqa siyare	43.22325	37.001025	Sersenk	Sersenk	2000
208.	Saidava	43.261257	37.040191	Sersenk	Sersenk	1975
209.	Siyaratika	43.219274	37.008055	Sersenk	Sersenk	1970-1975
210.	Araden	43.333456	37.072161	Sersenk	Sersenk	1989
211.	Araden	43.334822	37.075288	Sersenk	Sersenk	1989
212.	Araden	43.33216	37.070768	Sersenk	Sersenk	1989
213.	Bade rashe	43.323809	37.043316	Sersenk	Sersenk	1988
214.	Bade rashe	43.32164	37.041407	Sersenk	Sersenk	1988
215.	Bare Ta7te	43.320592	37.03663	Sersenk	Sersenk	1998
216.	Bare Ta7te	43.321927	37.036245	Sersenk	Sersenk	1998
217.	Barekar	43.404849	37.0937	Sersenk	Sersenk	1981
218.	Barekar	43.405668	37.092491	Sersenk	Sersenk	1981
219.	Kani chenar	43.321004	37.057747	Sersenk	Sersenk	1998
220.	Kre Bote	43.353745	37.091777	Sersenk	Sersenk	1986-2005
221.	Kre Bote	43.352616	37.089399	Sersenk	Sersenk	1986-2005
222.	Kre Bote	43.350129	37.087003	Sersenk	Sersenk	1986-2005
223.	Kre Bote	43.350072	37.087873	Sersenk	Sersenk	1986-2005
224.	Kre Bote	43.346771	37.083901	Sersenk	Sersenk	1986-2005
225.	Kre Bote	43.339505	37.07726	Sersenk	Sersenk	1986-2005
226.	Kre Bote Sideroad	43.346042	37.072722	Sersenk	Sersenk	1986-2005
227.	Kre Bote Sideroad	43.346967	37.069241	Sersenk	Sersenk	1986-2005
228.	Rostink	43.261651	37.025343	Sersenk	Sersenk	1979
229.	Rostink	43.237762	37.022622	Sersenk	Sersenk	1979

230.	Saidava	43.250417	37.025583	Sersenk	Sersenk	1975
231.	Sar Darav	43.308322	37.033059	Sersenk	Sersenk	1996
232.	Sar Darav	43.3062	37.031886	Sersenk	Sersenk	1996
233.	Siyaratika	43.228544	37.010785	Sersenk	Sersenk	1970-1975
234.	Siyaratika	43.22338	37.013021	Sersenk	Sersenk	1970-1975
235.	Tajika	43.283874	37.030614	Sersenk	Sersenk	1985
236.	Tajika	43.272508	37.029323	Sersenk	Sersenk	1985
237.	GreAlai	42.884029	36.850859	Dohuk	Semel	2002
238.	Gre Batele	42.684962	36.966286	Batele	Semel	2003
239.	Gre mesha	42.922835	36.777142	Dohuk	Semel	2000
240.	Gre pesht fendaqe	42.958452	36.842171	Dohuk	Semel	2006
241.	Gre Zankoye	42.931217	36.856979	Dohuk	Semel	1997
242.	Mefraqa semailava	42.656911	36.971308	Batele	Semel	2007
243.	Mefraqa semailava	42.65653	36.971812	Batele	Semel	2007
244.	Waha	42.863972	36.856263	Dohuk	Semel	2000
245.	Waha zankye	42.928261	36.853685	Dohuk	Semel	1997
246.	Zanko	42.927395	36.857559	Dohuk	Semel	1997
247.	Faida Milddle Road 1	42.921729	36.796503	Faida	Semel	2009_2010
248.	Faida Middle Road 2	42.923045	36.799604	Faida	Semel	2009_2010
249.	Faida Side Road	42.921024	36.796595	Faida	Semel	2009_2010
250.	Gali Zakho	42.645935	37.033576	Batele	Semel	2000
251.	Park Aloka	42.920664	36.847077	Semel	Semel	1979
252.	Qasara forest	42.935906	36.834915	Faida	Semel	2000
253.	Semil Waha 1	42.827394	36.875919	Semel	Semel	2000
254.	Semil Waha 2	42.826337	36.876932	Semel	Semel	2000
255.	Semil Waha 3	42.824371	36.878899	Semel	Semel	2000
256.	Semil Waha 4	42.820133	36.881828	Semel	Semel	2000
257.	Semil Waha 5	42.82329	36.878877	Semel	Semel	2000
258.	Semil Waha 6	42.827082	36.875166	Semel	Semel	2000

259.	Zawa mountain 1	42.942303	36.835212	Semel	Semel	2000
260.	Zawa Mountain 2	42.942394	36.837519	Semel	Semel	2000
261.	Zawa Mountain 3	42.948316	36.837762	Semel	Semel	2000
262.	zawa Mountain 4	42.939704	36.835241	Semel	Semel	2000
263.	Kani Falan 1	43.50767	36.76042	Qasrok	Shekhan	2007
264.	Kani falan 2	43.504	36.7586	Qasrok	Shekhan	2007
265.	Nifa Chade	43.2793	36.66337	Baadre	Shekhan	2012
266.	Park Baadre	43.2452	36.72446	Baadre	Shekhan	2014
267.	RoadSide 1	43.24996	36.74668	Baadre	Shekhan	2009
268.	Road Side 2	43.25056	36.74715	Baadre	Shekhan	2009
269.	Road Side 3	43.24757	36.69194	Baadre	Shekhan	2009
270.	Road Side 4	43.24814	36.69216	Baadre	Shekhan	2009
271.	Waha 1	43.24965	36.66993	Baadre	Shekhan	2013
272.	Waha 2	43.2526	36.66911	Baadre	Shekhan	2013
273.	Waha 3	43.25576	36.66823	Baadre	Shekhan	2013
274.	Waha 4	43.25779	36.66765	Baadre	Shekhan	2013
275.	Waha 5	43.25984	36.66707	Baadre	Shekhan	2013
276.	Waha 6	43.26238	36.66636	Baadre	Shekhan	2013
277.	Waha 7	43.27505	36.66354	Baadre	Shekhan	2013
278.	Waha 8	43.27715	36.66314	Baadre	Shekhan	2013
279.	Waha 9	43.2795	36.66267	Baadre	Shekhan	2013
280.	Waha 10	43.28088	36.6624	Baadre	Shekhan	2013
281.	Waha 11	43.29457	36.66043	Baadre	Shekhan	2013
282.	Waha 12	43.29101	36.66116	Baadre	Shekhan	2013
283.	Waha 13	43.28886	36.66152	Baadre	Shekhan	2013
284.	Waha 14	43.287	36.662	Baadre	Shekhan	2013
285.	Waha 15	43.28157	36.66301	Baadre	Shekhan	2013
286.	Waha 16	43.27696	36.66389	Baadre	Shekhan	2013
287.	Waha 17	43.29263	36.66015	Baadre	Shekhan	2013

288.	Waha 18	43.29478	36.65974	Baadre	Shekhan	2013
289.	Waha 19	43.29678	36.65936	Baadre	Shekhan	2013
290.	Waha 20	43.3059	36.65762	Baadre	Shekhan	2013
291.	Waha 21	43.31227	36.65638	Baadre	Shekhan	2013
292.	Waha 22	43.31574	36.6557	Baadre	Shekhan	2013
293.	Waha 23	43.27294	36.66467	Baadre	Shekhan	2013
294.	Waha 24	43.27113	36.66503	Baadre	Shekhan	2013
295.	Waha 25	43.26907	36.66549	Baadre	Shekhan	2013
296.	Waha 26	43.26648	36.66613	Baadre	Shekhan	2013
297.	Waha 27	43.26438	36.66669	Baadre	Shekhan	2013
298.	Waha 28	43.26234	36.66724	Baadre	Shekhan	2013
299.	Waha 29	43.26057	36.66772	Baadre	Shekhan	2013
300.	Waha 30	43.25935	36.66806	Baadre	Shekhan	2013
301.	Waha 31	43.25812	36.66841	Baadre	Shekhan	2013
302.	Waha 32	43.25672	36.66881	Baadre	Shekhan	2013
303.	Waha 33	43.25472	36.66938	Baadre	Shekhan	2013
304.	Waha 34	43.25137	36.67031	Baadre	Shekhan	2013
305.	Waha 35	43.24854	36.67108	Baadre	Shekhan	2013
306.	Waha MQ 1	43.58132	36.65463	Qasrok	Shekhan	2006
307.	Waha MQ 2	43.58148	36.65505	Qasrok	Shekhan	2006
308.	Waha MQ 3	43.58552	36.65972	Qasrok	Shekhan	2006
309.	Waha MQ 4	43.58687	36.66061	Qasrok	Shekhan	2006
310.	Waha MQ 5	43.58975	36.66382	Qasrok	Shekhan	2006
311.	Waha MQ 6	43.58896	36.66551	Qasrok	Shekhan	2006
312.	Waha QM 7	43.59012	36.6696	Qasrok	Shekhan	2006
313.	Waha MQ 8	43.59182	36.6719	Qasrok	Shekhan	2006
314.	Waha MQ 9	43.59262	36.67277	Qasrok	Shekhan	2006
315.	Waha MQ 10	43.59253	36.67376	Qasrok	Shekhan	2006
316.	Waha MQ 11	43.59263	36.67575	Qasrok	Shekhan	2006

317.	Waha MQ 12	43.59298	36.67639	Qasrok	Shekhan	2006
318.	Waha MQ 13	43.59285	36.67752	Qasrok	Shekhan	2006
319.	Waha MQ 14	43.59311	36.67888	Qasrok	Shekhan	2006
320.	Waha MQ 15	43.59315	36.68057	Qasrok	Shekhan	2006
321.	Waha MQ 16	43.5934	36.68156	Qasrok	Shekhan	2006
322.	Waha MQ 17	43.59366	36.68238	Qasrok	Shekhan	2006
323.	Waha MQ 18	43.59336	36.68238	Qasrok	Shekhan	2006
324.	Waha MQ 19	43.59429	36.68468	Qasrok	Shekhan	2006
325.	Waha MQ 20	43.59417	36.68561	Qasrok	Shekhan	2006
326.	Waha MQ 21	43.59482	36.68678	Qasrok	Shekhan	2006
327.	Waha MQ 22	43.59494	36.68787	Qasrok	Shekhan	2006
328.	Waha MQ 23	43.59547	36.68828	Qasrok	Shekhan	2006
329.	Waha MQ 24	43.5961	36.68948	Qasrok	Shekhan	2006
330.	Waha MQ 25	43.5958	36.68955	Qasrok	Shekhan	2006
331.	waha MQ 26	43.59696	36.691	Qasrok	Shekhan	2006
332.	Waha MQ 27	43.59736	36.69186	Qasrok	Shekhan	2006
333.	waha MQ 28	43.59732	36.69299	Qasrok	Shekhan	2006
334.	Kanimase	43.44827	37.22832	Kanimase	Kanimase	2006

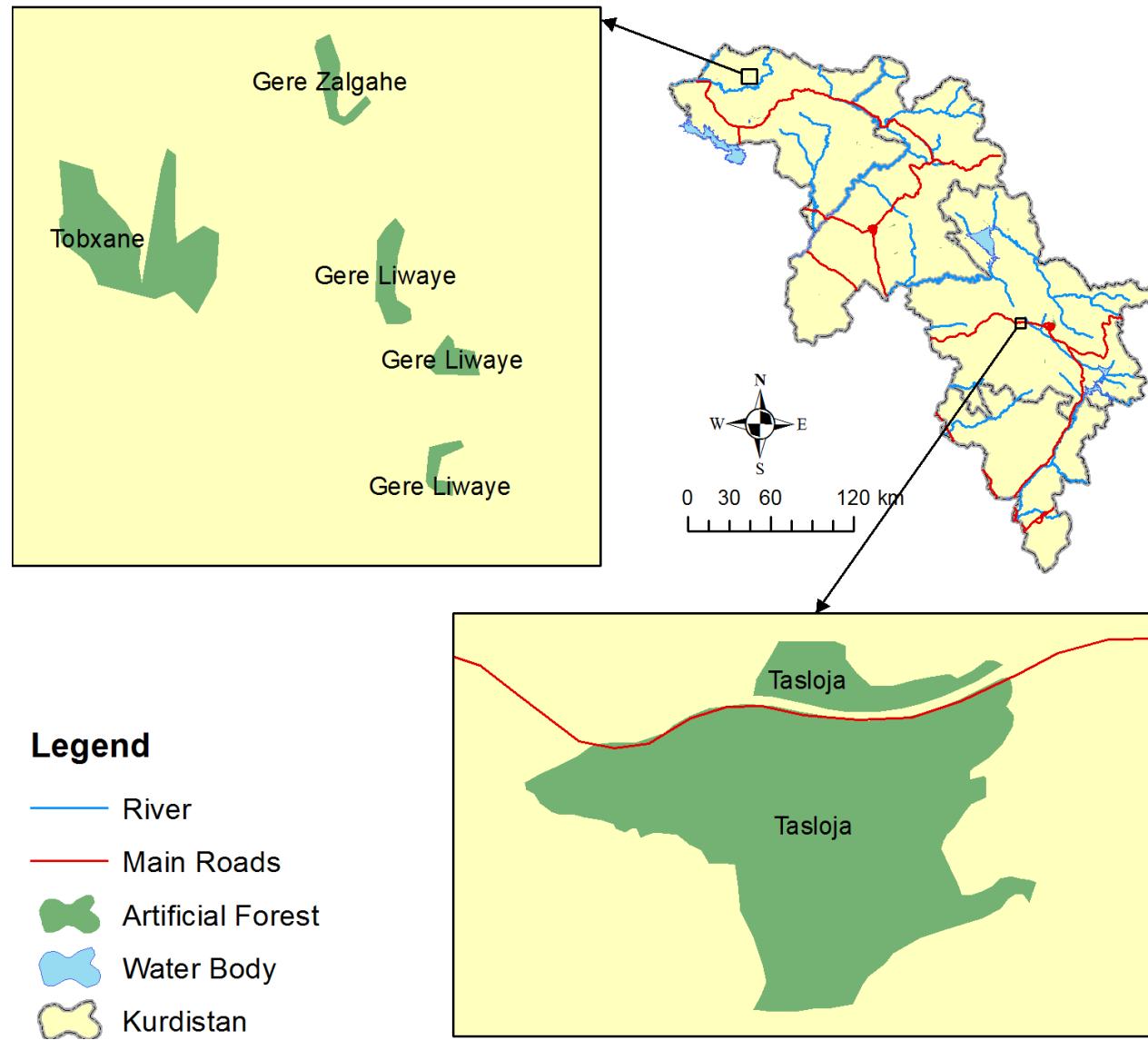


Table 19: Area of artificial forest for Erbil directorate

No.	Governorate	District	Project name	Plantation	old Area(Dunam)	New Area using GIS(Dunam)	Differences	The reasons
1	Erbil	Erbil district	Darstani Bansalawa	1999	143	129.12	-13.88	12 dunam Turned into municipal land and the rest to a petrol station
2	Erbil	Bestana - quştapa	Darstane Bestana	1977	780	898.35	118.35	Vegetation area are increased
3	Erbil	Erbil district	Regai Kerkuk/45	1978	255	81.00	-174.00	Exceeded by an exhibition of cars and investment projects 95 dunam and kirkuk dual carriageway 79 dunam.
4	Erbil	Erbil	Regai Mosel	1977	235	20.60	-214.40	Area are decreased 40 dunam exceed from star light company, 40 dunam petrol station ,100 dunam syas company, 25 dunam asfalat company ,10 dunam hotel
5	Erbil	xabat	Darstane Xabat	1984	996	577.64	-418.36	In general collection forest area 88 dunam turned into theme park, 20 turned into fish project and decreased area add to municipality boundary
6	Erbil	Mexmor	Darstane Mexmor	2012	90	77.54	-12.46	The method of calculation the planted area in past was not correct.
7	Erbil	Mexmor	Darstane debaga	2012	100	109.50	9.50	The method of calculation the planted area in past was not correct.
8	Erbil	Koye	Darstane Digala	1977	215	120.36	-94.64	Area are decreased turned into municipality boundary

9	Erbil	Koye	Darstane Taq Taq	1976	221	187.44	-33.56	Area are decreased turned into municipality boundary
10	Erbil	Koye	Darstane Koye	1977	1609	1323.66	-285.34	Area are decreased due to allocated to the University of koya.
11	Erbil	Erbil/Kasnazar	Darstane Kasnazan	1977	2500	19.90	-1563.15	Total area are decreased 200 dunam for zoo 140 dunam for Residential complex clare mont company 200 dunam for titanic garden project and the rest of area turned into dashtiproject ,ozal city and majide land
12	Erbil		Kani Shawerd			86.46		
13	Erbil		kolichi eshq			26.39		
14	Erbil		Monoment			70.98		
15	Erbil		Dawrobari Monoment			89.72		
16	Erbil		Chot saidi Kasnazan			98.37		
17	Erbil		kasnazan			544.96		
18	Erbil	Erbil	Darstane xanzad	1984	1700	404	-1296	Total decreased area turned into green land village , the rest area turned into shwayfat school 40 dunam and khanzad hotel 284 dunam
19	Erbil	Shaqlawa	Darestana Sala7din	1977	2678	385.72	-749.02	Area are decreased 50 dunam pirmam - koye road,15 donmu stone factory ,15 dunam new dual carriageway, and the rest of area 470 dunam exceed from hujran and tawska village boundary
20	Erbil		sala7aden			894.80		
21	Erbil		7ujran + tawska			542.40		

22	Erbil		Shera swar			106.06		
23	Erbil	Shaqlawa	Darestana Shaqlawa	1977	758	359.91	-398.09	exceed from municipality and tourism project
24	Erbil	Shaqlawa	Hiran	1977	2	2.26	0.26	The method of calculation the planted area in past was not correct
25	Erbil	Shaqlawa	Darstane Harir	2003	650	146.11	-503.89	Area are decreased 80 dunam Artesian well municipality boundary 243.89 exceeded and 180 dunam turn into basrma-qandel dual carriageway.
26	Erbil	Soran	Darstane xalefan	1977	80	0	-80.00	Area are decreased turned into petroll station and car exhibition
27	Erbil	Soran	Darstane Soran	1984	805	388.83	-416.17	Turned into municipality boundary and soran military corps
28	Erbil	Shaqlawa	Parke darstane Hawdiyan	2015	40	36.91	-3.09	The method of calculation the planted area in past was not correct
29	Erbil	Soran	Darstane Rawandoz	1978	760	738.74	-21.26	The method of calculation the planted area in past was not correct
30	Erbil	choman	Darstane .Galala	1994	165	251.75	86.75	Vegetation area are increased
31	Erbil	choman	Darstane Choman	1994	240	20.40	-149.87	Area are decreased due to the exceed
32	Erbil		Bardarshan			20.56		
33	Erbil		Darmanawa + Hajiomeran			49.17		
34	Erbil	Soran	darstane mergasur	2001	370	71.16	-298.84	Turned into a residential complex

35	Erbil	Soran	Darstane Sidakan	2001	40	18.15	-21.85	Turned into a residential complex
36	Erbil	Soran	Darstane Barzan	1977	358	0	-358.00	Turned into a municipality boundary
37	Erbil	Hawler	Namamgaha-Nawand	1998	79.16	79.16	0.00	20 dunam of forest area are given to fish project + researchs.
38	Erbil	Hawler	Namamgah-Berzewa	2002	10	10.74	0.74	The method of calculation the planted area in past was not correct
Total					15879.16	8988.84	-6890.32	

Table 20: Area of artificial forest for Sulaimany directorate.

No.	Governarate	District	Name Project	Plantation	old Area(Dunam)	New Area using GIS(Dunam)	Differences	The reasons
1	sulemani	City	Xarachiyian	1985	237	200	-37	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed.
2	sulemani	City	Chanaxchiyan	2003	252	160	-92	FOA organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed.
3	sulemani	City	Razyia	2013	165	165	0	
4	sulemani	City	Regai gerdi chaq chaq	1998	609	278	-331	Construction projects (for example apartments, and oil stations)
5	sulemani	City	Kani-shaetan	1977	900	510	-390	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed.
6	sulemani	City	Tasloja	1955				
7	sulemani	City	Bayinchan	1977				Slum constructions within forest area (forest projects)
8	sulemani	City	Haroota	2005	894	920	26	Increase the vegetation area yearly, and this was confirmed using GPS

9	selemani	City	darbandi-bazean	1953	250	360	110	The method of calculation the planted area in past was not correct.
10	selemani	City	Hawareshar	2004		80	80	The Hawari shar project has an area around 4000 dunam which is quit big area. However, all this area is not belong to forestry and only small area (around 80 dunam) belong to forestry.
11	selemani	City	Azmer	1999	2133	2520	387	Increase the vegetation area yearly, and this was confirmed using GPS
12	selemani	City	Goizha	1947	6000	2080	-3920	The method of calculation the planted area in past was not correct.
13	selemani	City	Dabashan	1973	763	480	-283	Construction projects (for example apartments, and oil stations) that belong to the governmental offices.
14	selemani	City	Shex-Waisawa	2011	500	480	-20	Some of the area that had been calculated in the past is within village of Shikh waisawa.
22	selemani	peshdar	Qaladeze	1978	1300	810	-490	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed.
23	selemani	peshdar	Sangasar	1978	120	80	-40	The method of calculation the planted area in past was not correct.
24	selemani	rania	Kiwa rash	1978	630	500	-130	Increase the vegetation area yearly, and this was confirmed using GPS
25	selemani	rania	Kelka Kolina	2001				The method of calculation the planted area in past was not correct.
26	selemani	Dukan	Dukan	1955	1400	316	-1084	FOA organization was calculating the area based on the number trees that

27	selemani	Dukan	Secretary of the President of the Republic	2000				is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed.
28	selemani	Dukan	Ashur Hotel	2000				
29	selemani	Dukan	dabani villagetourism	2000				
30	selemani	Dukan	Qashqole	1977				
31	selemani	Dukan	Bngrd	2000	55	40	-15	The method of calculation the planted area in past was not correct.
32	selemani	Dukan	Piramagron	2011	20	20	0	
33	selemani	Dukan	Kani wotman	1977	111	214	103	Construction projects (for example apartments, and oil stations) that belong to the governmental offices.
34	selemani	Dukan	Xalakan	1977				
35	selemani	Dukan	Arisha Xalakan	1976				
36	selemani	Dukan	Xedran	2005	92	480	388	In the reality it is 92 dunom, however, when project fenced, more area was included
37	selemani	saidssadeq	Keresa	2003	130	160	30	The method of calculation the planted area in past was not correct.
38	selemani	saidssadeq	Sarai sojan axa	1972	470	400	-70	Slum constructions within forest area (forest projects) and adding sara camp.
39	selemani	saidssadeq	Barzencha	2001	100	40	-60	FAW organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what
40	selemani	saidssadeq	Said sadeq	2003	135	66	-69	

41	selemani	Sharbasher	Sora qalat	1977	78	3	-75	the technology (GPS tracking) confirmed.
42	selemani	Sharbasher	Qalacholan	1999	285	445	160	Increase the vegetation area yearly, and this was confirmed using GPS
43	selemani	Sharazor	Warmawa	1980	500	200	-300	The method of calculation the planted area in past was not correct.
44	selemani	Sharazor	Mirade	1980	135	181	46	The method of calculation the planted area in past was not correct.
45	selemani	Qaradax	Qarax	1976	500	897	397	Increase the vegetation area yearly, and this was confirmed using GPS
46	selemani	Qaradax	Kopan	1976				
47	selemani	Penjwen	Kawalos	1977	1000	560	-440	The project is renewed, The method of calculation the planted area in past was not correct.
48	selemani	Penjwen	Nalparez	1977				
49	selemani	Penjwen	Karemk	2004	70	120	50	Increase the vegetation area yearly, and this was confirmed using GPS
50	selemani	Penjwen	kani Sepika Kilo	2000				
51	selemani	Darbandixan	Perke	1973	1442	124	-1318	The method of calculation the planted area in past was not correct. Moreover, some forested areas were burned.
52	selemani	Darbandixan	Tunel	2001				
53	selemani	Darbandixan	Chenara	2001				
54	selemani	chamchamal	Azchalar	1977	781	80	-701	The method of calculation the planted area in past was not correct.

55	selemani	chamchamal	Bani Maqan	2008	1200	665	-535	Construction projects (for example apartments, and oil stations) that belong to the governmental offices,The method of calculation the planted area in past was not correct.
56	selemani	chamchamal	Qarahanjeer	1978	600	1120	520	
57	selemani	chamchamal	Sangaw	1978	176	32	-144	
58	selemani	chamchamal	Shewasor	2001	120	80	-40	The method of calculation the planted area in past was not correct.
59	selemani	City	Sarchenar Nersury	1948	40	35	-5	The method of calculation the planted area in past was not correct.
61	selemani	Rania	Shazad saib Nersury	1999	24	36	12	The method of calculation the planted area in past was not correct.
62	selemani	Dukan	Dukan Nersury	1998	7	4	-3	The lower part of the nursery was not counted in the area calculation, and some other part of the nursery was given to the Dukan institute.
63	selemani	Darbandixan	Derbandixan Nersury	1999	27	14	-13	Part of the nursery was exchanged with Darbendikan Municipality
64	selemani	chamchamal	Bani Maqan Nersury	2008	20	25	5	The method of calculation the planted area in past was not correct.
Total					24271	15980	-8291	

Table 21: Area of artificial forest for Dohuk directorate

No.	Governarate	District	Name Project	Plantation	old Area(Dunam)	New Area using GIS(Dunam)	Collection area of all District	Differences	The reasons
1	Duhok	Akre	Bashqal	1978	4079	105.7002	1148.27	-2930.73	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed,some forested areas were burned.
2	Duhok	Akre	Mamei	1978		53.68			
3	Duhok	Akre	Bihok	2004		204.1457			
4	Duhok	Akre	Kre Ashxal	2002		12.141			
5	Duhok	Akre	Kre Niska	1975		36.9186			
6	Duhok	Akre	Kre Dinarte	1978		22.54			
7	Duhok	Akre	Gomerk	2002		35.412			
8	Duhok	Akre	Gulan	1978		31.39			
9	Duhok	Akre	Mehat	1978		410.4			
10	Duhok	Akre	Mezar	2012		34.70221			
11	Duhok	Akre	Besht Gomerke	1978		1.312228			
12	Duhok	Akre	Saremyia	1999		9.89			
13	Duhok	Akre	Kerdasin wa7a	2012		31.801			
14	Duhok	Akre	Xanaki	1978		79.72			
15	Duhok	Akre	Xerka	1978		78.52			
16	Duhok	Amedi	Bare Kar	1977	1062	24.4383	467.3	-594.7	Slum constructions within forest area (forest projects,The method of calculation the planted area in past was not correct.
17	Duhok	Amedi	Belichanke	1977		7.89			
18	Duhok	Amedi	Bebade	1976		26.4674			
19	Duhok	Amedi	Bin Amedi	1983		67.80335			
20	Duhok	Amedi	Botia	1983		4.161852			

21	Duhok	Amedi	Chapa Seke	1983		19.5489				
22	Duhok	Amedi	Dere	1977		77.00215				
23	Duhok	Amedi	Hamzike	1982		2.9031				
24	Duhok	Amedi	Kanya Senje	1976		8.394				
25	Duhok	Amedi	Metlawish	1973		110.7252				
26	Duhok	Amedi	Moqbara Amedi	1977		34.63285				
27	Duhok	Amedi	Sar Mela	1976		8.1382				
28	Duhok	Amedi	Seka	1971		65.50095				
29	Duhok	Amedi	Sharifa	1973		2.5217				
30	Duhok	Amedi	Ta7te	1976		7.172052				
31	Duhok	Bardarash	Shewa Qor	2013	268	3.188332	170.365	-97.635	forested areas were burned	
32	Duhok	Bardarash	Aski Kalak	2012		82.794				
33	Duhok	Bardarash	Parka Newroz	2004		8.79546				
34	Duhok	Bardarash	Parka Bardarash	2012		68.86052				
35	Duhok	Bardarash	Gere Borchi	2009		6.726924				
36	Duhok	Zakho	Zambil Frosh	1979	172	15.67664	69.55	-102.45	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed,some forested areas were burned,Construction projects (for example apartments, and oil stations) that belong to the governmental offices.	
37	Duhok	Zakho	Tobxane	1979		31.32953				
38	Duhok	Zakho	Gre Zalgahe	2000		4.188572				
39	Duhok	Zakho	Gre Liwaye	2005		11.18057				
40	Duhok	Zakho	Doryana Bahnona	1979 -2010		7.165984				
41	Duhok	Amedi	Sirye	1979	94	20.57584	173.53	79.53	same project became within Municipality bououndary,same	
42	Duhok	Amedi	D.Sheladeze	1979		41.38521				

43	Duhok	Amedi	Gere Barxa	1979		27.41201			forested areas were burned
44	Duhok	Amedi	Chalke	2004-2007		46.34535			
45	Duhok	Amedi	D. Sheladeze-2	1979		37.80644			
46	Duhok	Kani Mase	Kani Mase	2006	38	12.93666	12.93666	-25.06334	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed,
47	Duhok	Shekhan	Kani falan	2007	260	25.93347	166.8	-93.2	Some projects fall within the projects of roads and bridges,same forested areas were burned
48	Duhok	Shekhan	Nifa Chade	2012		20.33228			
49	Duhok	Shekhan	Parka Ba3adre	2014		58.86778			
50	Duhok	Shekhan	Raxe Chade	2009		30.93167			
51	Duhok	Shekhan	Ba3adre Wa7a	2013		18.8689			
52	Duhok	Shekhan	Mela Berwan wa7a	2006		11.87195			
53	Duhok	Semel	Nifa Chade	2009-2010	1391	57.4114	404.17	-986.83	same project became within Municipality bououndary,same forested areas were burned,FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed
54	Duhok	Semel	Raxe Chade	2009-2010		21.09018			
55	Duhok	Semel	Gali Zakho	2000		0.236288			
56	Duhok	Semel	Parka Aloka	1979		117.7605			
57	Duhok	Semel	Qasara	2000		63.69134			
58	Duhok	Semel	Semel wa7a	2000		10.1			
59	Duhok	Semel	Chiyaye Zawa	2000		53.3471			
60	Duhok	Semel	Zanko Dohuk	1997		34.21			
61	Duhok	Semel	Gre Batele	2003		12.55			
62	Duhok	Semel	Gre Mesha	2000		4.1			
63	Duhok	Semel	Pesht Fendaqe	2006		12.98			
64	Duhok	Semel	Smailava	2007		0.9			

65	Duhok	Semel	Gre Alai	2002		15.8			
66	Duhok	Amedi	Aradin	1989	722	20.98876	549.22	-172.78	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed, Lack of human awareness
67	Duhok	Amedi	Bada Rashk	1996-1988		35.46766			
68	Duhok	Amedi	Bare Ta7te	1998		41.37104			
69	Duhok	Amedi	Bare kar	1981		55.78775			
70	Duhok	Amedi	Kani Chenark	1989		2.473448			
71	Duhok	Amedi	Gre Bote	1986-2005		81.75394			
72	Duhok	Amedi	Rostink	1979		16.52031			
73	Duhok	Amedi	Saida va	1975		27.95			
74	Duhok	Amedi	Sardarav	1996		19.35389			
75	Duhok	Amedi	Siyaratika	1970-1975		141.074			
76	Duhok	Amedi	Tajika	1985		16.63888			
77	Duhok	Amedi	MergaDeresh	2000		37.29			
78	Duhok	Amedi	Barbanke	2000		33.58			
79	Duhok	Amedi	Mefraq	2000		18.97			
80	Duhok	Zakho	Darhozan	2000	2452	148.2117	208.7575	-2243.243	,FAO organization was calculating the area based on the number trees that is going to be planted,
81	Duhok	Zakho	Darkar 3acham	2000		9.345596			
82	Duhok	Zakho	Gerk sendi	2000		2.160212			
83	Duhok	Zakho	Raxe Chade	2008		1.348244			
84	Duhok	Zakho	Telkabar	2000		44.80078			
85	Duhok	Zakho	Zakho Wa7a	1976 -2008		2.891			
86	Duhok	Duhok	Bade karma	1974	4666	99.6	4536.2	-129.8	Lack of human awareness,Some projects fall within the projects of roads and bridge
87	Duhok	Duhok	Bade Gre Hachi	1974		3.229752			
88	Duhok	Duhok	Bade sare 7asiye	1974		50.48			
89	Duhok	Duhok	Bade me3askar	1974		577.07233			

90	Duhok	Duhok	Bakoze	1974		117.0632			
91	Duhok	Duhok	Darkala Kersis	1970		2.479452			
92	Duhok	Duhok	Chapet Xabolka	1970		7.028052			
93	Duhok	Duhok	Besere	1974		6.515352			
94	Duhok	Duhok	Bana Bade	1974		4.899352			
95	Duhok	Duhok	Kavlasene	1970		6.195452			
96	Duhok	Duhok	Gali zawita	1997		109.9434			
97	Duhok	Duhok	Gali Qantara	1970		1.4939			
98	Duhok	Duhok	Eminke	1974		10.75905			
99	Duhok	Duhok	Ekmala	1974		114.9251			
100	Duhok	Duhok	Piomara	1999		77.1658			
101	Duhok	Duhok	Merga Deresh	1970		54.68			
102	Duhok	Duhok	Moqbarat zawita	1970		20.2705			
103	Duhok	Duhok	Lomana	1970		26.1703			
104	Duhok	Duhok	Komal Gaha Bakera	1970		17.2857			
105	Duhok	Duhok	Kandala	1970 -1974		370.9416			
106	Duhok	Duhok	Gundek Nabi	1974		5.2231			
107	Duhok	Duhok	Ger Bechik	1998		63.64			
108	Duhok	Duhok	Raxe chade	2012		34.65301			
109	Duhok	Duhok	Qarqarava	1974		23.4787			
110	Duhok	Duhok	Rega Zawita	1974		43.84951			
111	Duhok	Duhok	Sendore	1974		504.8416			
112	Duhok	Duhok	Sad Duhok	1998-1999		3.254652			
113	Duhok	Duhok	Zawita wa7a	2012		5.030656			

114	Duhok	Duhok	Zewa Shafiq	1974		60.83915			
115	Duhok	Duhok	Zawita	1974		326.8567			
116	Duhok	Duhok	Gali	1970 - 1998		84.6832			
117	Duhok	Duhok	Keshabara	1970		25.5392			
118	Duhok	Duhok	sarke	1974		339.24			
119	Duhok	Duhok	Reka Siyaratika	2000-2016		105.44			
120	Duhok	Duhok	Bablo	1970		25.793			
121	Duhok	Duhok	Baroshke	2010		24.94			
122	Duhok	Duhok	Besere	1996		38.04			
123	Duhok	Duhok	Nzarke	2010		53.2			
124	Duhok	Duhok	Kamaka	1974		55.04			
125	Duhok	Duhok	Mangeshk	1970-1974		7.55			
126	Duhok	Duhok	Rashanke	1996-1997		998			
127	Duhok	Duhok	Bakera sare	1970		28.87			
128	Duhok	Shekhan	Kerdahol	1970	1390	12.49	83.59	-1306.41	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed,
129	Duhok	Shekhan	Nordinava	1997		71.1			Lack of human awareness,,Some projects fall within the projects of roads and bridge
130	Duhok	Chamanke	Chamanke	2008	27.37	9.21	27.37	0	
131	Duhok	Chamanke	Meze	2008		18.16			
132	Duhok	Zakho	Mashtal Zakho		11.3	11.30193724	11.3	0	

133	Duhok	Akre	Mashtal Akre		23.17	23.175468	23.17	0	
134	Duhok	Mallta	Mashtal Malta		15.667	15.66718376	15.667	0	
Total					16671.507	8068.2064	8068.19616	8603.31	

Table 22: Area of artificial forest for Halabja directorate

No.	Governorate	District	Name Project	Plantation	old Area(Dunam)	New Area using GIS(Dunam)	Differences	The reasons
1	Halabja	City	Bayara	2003	23	12	-11	The method of calculation the planted area in past was not correct.
2	Halabja	City	Xurmal	2003	245	133	-112	The method of calculation the planted area in past was not correct.
3	Halabja	City	Regabani-Halabja	1998	25	20	-5	Construction projects (for example apartments, and oil stations) that belong to the governmental offices.
4	Halabja	City	Gulan	1973	652	900	248	Increase the vegetation area yearly, and this was confirmed using GPS
5	Halabja	City	Jalil	1973	765	720	-45	FAO organization was calculating the area based on the number trees that is going to be planted. However, this calculation is not real and this what the technology (GPS tracking) confirmed.
6	Halabja	City	Ababaili	1973				
7	Halabja	City	Anab	2003				
8	Halabja	City	Sirwan Nersury	2000	132	120	-12	The method of calculation the planted area in past was not correct.
Total					1842	1905	63	

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