Determining and Mapping of Forest Species Using Remote Sensing and GIS in Amadiyah Province

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Abstract

The location indication was classified as a directed classification for all 44 species of trees present at the study site based on the projection of the tree coordinates on the false-color satellite images, which were taken from the location of these trees and their reflectivity measured in the laboratory. Where the satellite image was classified, based on the points taken for trees as field training areas, the visual output image classified by the directed classification method included 23 classes and represents the distribution of trees and shrubs at the site. The classification accuracy of vegetation and non-vegetation covers was also assessed by taking (334) ground control points for the various land targets and vegetation covers to determine this accuracy. Thus, we obtained a total accuracy of the classified statement (82.1%). This indicates that the accuracy of the overall classification is good, acceptable, and reliable. The percentage was high for all varieties, reaching (93%) for the frothy mug, weeping willow, and wild amethyst, and the lowest (75%) for olives, grassy slopes, and flat barren soils, and this was also acceptable. Through this accuracy, we can determine the extent to which the classification matches these goals and covers, and the possibility of relying on the prepared map for its future use. The number of each tree type was estimated by determining the coverage area for each tree type and the total area to cover the total type in the area using the proportional method. From this, it was found that the different types of trees differ in their presence on the site and the reason is attributed to the difference in height, direction and the different organic matter in which these types were grown and the environmental conditions appropriate to the species and that these factors have an effective role in the distribution of species and their densities in the different sites of the study area. We also noticed that the highest presence in terms of number was of edible oaks, followed by tannins oak in second place, at a rate ranging from (29.84%, 6.35%).

Keyword: Tree species, Remote sensing, Mapping, Geographic Systems.

1. Introduction

Forests are a renewable natural resource that plays a major role in preserving the environment. In addition to its role in producing many of the goods and services, which it provides to society, it is a producer of wood and fodder for many domestic wildlife, and a shelter for wild animals. From that, we see that the forest department undertakes many basic natural products within the areas that are spread over by the forest. Therefore, the management of forest resources today has changed a lot from before and has become more complex to increase the demand for its natural products and services that it provides to societies. Therefore, the preparation of sustainable plans for forest natural resources requires us to rely on a database of the site with high accuracy. This requires us to conduct an inventory of the forest and to know what it contains the various natural resources available on the site. Whereas the traditional inventory process requires a lot of time, high costs, and expertise to implement the inventory process and to bypass these obstacles and obtain information for administrative decision-making that is based on sound scientific foundations, remote sensing techniques RS and Geographic Information Systems (GIS) have been used in mapping and managing renewable natural resources and this corresponds to With what he mentioned [1]. It is also consistent with what [2], indicated that the geographic information system (GIS) is a data collection technique that has been used in drawing environmental decision-making policies and forest planning in the past two decades.

The forest inventory requires the collection of broader data from the growing stock and its woody products, but also for non-wood products and related characteristics such as forest composition, plant biodiversity, and forest hydrology. That is, focusing on the composition of the forest from the woody content of the various species included in an ecological site. This means that the forest inventory is a survey of the site, its composition, the nature of the resource it contains, and the method of its distribution on the site. And one of the basic information about the forest is its size, species and distribution, age of trees, growing storage, and the amount of biomass it contains. All this information that is obtained using modern technologies
such as a statement of remote sensitivity, a geographic information system, and a global location system has increased its use in the field of forest management because of the information it provides, it is considered the main database in making many administrative decisions towards forest sustainability and this is consistent with what has been mentioned. By [3] And [4] explained that the use of remote sensing techniques, geographic information system, and land sites, whether used alone or in combination, have a wide range of applications from simple to complex, so the simple application includes the identification of different sites, and maps of different pieces for use in the field or the distributions of different types of soils and their correlation with the productive capacity of the species. Therefore, the basis of the forest inventory is to work on fixing the outer limits of the forest and the boundaries between the forests, which give us a clear picture of the homogeneous units of the characteristics of the forest. Therefore, this study aims to achieve the objectives through the use of R.S and Geographic Information Systems (GIS). In determining the species of forest trees, their distribution, density, and areas Amadiyah Province.

2. Materials and Methods

This study was conducted in mixed natural forests scattered in Amadiya district / northern Iraq. These mixed natural forests are located on longitudes (43 ° 25'24.309 " - 43 ° 11'6.839 " ) to the east and two latitudes (37 ° 12'36.359 " - 37 7'25.484 " ) north, and an altitude of between (600-2025 m) and an area of (2775.2) km2. The site is characterized by mountainous topography with many vegetation covers, foremost of which are natural mixed forests, agricultural and rocky lands, in addition to naturally occurring water bodies. In this study, remote sensing techniques, geographic information systems, as well as a ground inventory were used to obtain data from all sides and the Amadiyah center of the study site in Amadiya district, northern Iraq. The integration between these means gives a clear picture to the forest administrator about the vegetation cover, its areas occupied by it, and the distribution of these species. In addition to the fact that the cost of this information is low and can be obtained easily and helps to shorten the time to obtain information and reach areas difficult to reach by the survey as mentioned [5]. The space indication captured by the ETM + (Enhanced Thematic Mapper plus) from the sentinel-2 satellite on 9/9/2019 was used, if this indication was used to measure the reflectivity of the forest cover and other ground targets and the spatial resolution of the clarity of the space indication was (10 meters) It was reduced to a spatial resolution (5 m), field data were collected for the period 12/18/2019 - 5/7/2020, represented by selecting the Amadiya district with an area of (2775.2131 ) km².

To get acquainted with the various ground targets deployed at the study site, we used GPS to take the coordinates of the various non-plant ground targets deployed at the study site, and it became clear to us that there are many of these targets deployed at the site. The density of forests was estimated through a group of circles with a radius of 30 m and randomly to estimate the density of the forest. The ground inventory used the Multiple Stage Inventory. In the first phase, the space indication was used to classify the ground targets and through it, the tree vegetation was determined. In the second phase, the ground inventory was used to classify mixed forests into three different categories in terms of density, as mentioned by each of [6] and [7] and I have three high, medium, and low densities, and from each of them, ten random samples were taken so that the total of random samples (30) samples distributed randomly on the study site to include all types of trees for mixed forests, with a single sample area (30 * 30) m, and [8] mentioned, and also the species present in the sample. Several measurements were taken for the trees inside the sample (the diameter of the tree at breast height, total tree height, crown center height, crown area) To obtain the density of the sample and the percentage of coverage for each type of tree in the sample and its percentage in one sample. Also, the geographical coordinates of each type of tree spread in the study site were taken with three replications for each type of tree by the GPS device, the Global Positioning System, as well as the nearest point of the location of the leaves taken from these trees to measure the reflectivity and determine the type.

2.1 Volume different trees for high-density samples (m³)

The average coverage area of all field-taken samples that contain a species, we can extract with the average coverage of this species multiplied by the average size of one tree, to estimate the size of a type of high-density sample in different trees growing in intentional forests, so the relationship was used in Guess it is as follows:

Volume for a species in high-density samples = average coverage area for all samples that contain a specific type * average size for one tree * average coverage area for one tree for the same type.
Table 1. Sample Volume estimation of edible oaks in high-density samples.

| Sample number | Tree type             | Total coverage area for high-density samples (30 * 30m) | Coverage area of *Quercus aegilops* in the sample (m²) | The number of trees | Type average coverage area (m²) | Species coverage percentage in the sample % | Volume of sample (m³) | Average volume of sample (m³) |
|---------------|-----------------------|--------------------------------------------------------|-------------------------------------------------------|---------------------|--------------------------------|---------------------------------------------|----------------------|-----------------------------|
| 2             | *Quercus aegilops*    | 656.18                                                 | 202.80                                                | 15.00               | 13.52                          | 22.53                                        | 0.64                 | 0.04                        |
| 3             | *Quercus aegilops*    | 737.92                                                 | 339.07                                                | 42.00               | 8.07                           | 37.67                                        | 0.77                 | 0.02                        |
| 5             | *Quercus aegilops*    | 679.34                                                 | 76.97                                                 | 2.00                | 38.48                          | 8.55                                         | 0.70                 | 0.35                        |
| 7             | *Quercus aegilops*    | 805.02                                                 | 96.41                                                 | 7.00                | 13.77                          | 10.71                                        | 0.25                 | 0.04                        |
| 8             | *Quercus aegilops*    | 761.63                                                 | 590.64                                                | 56.00               | 10.55                          | 65.63                                        | 1.36                 | 0.02                        |
| 10            | *Quercus aegilops*    | 639.41                                                 | 12.57                                                 | 1.00                | 12.57                          | 1.40                                         | 0.05                 | 0.05                        |
| sum           |                       | 4279.49                                                | 1318.46                                               |                     |                                |                                              |                      |                             |
| Average       |                       | 713.25                                                 | 219.74                                                |                     |                                |                                              |                      |                             |

From Table (1) shows after determining the thirty samples with an area of (30 * 30 m) at the site of the study. The size was estimated for each type of tree present in the samples spread in the study area and for each of the three densities separately.

For example, the size of edible oak was estimated in dense samples. At first, the number of dense samples containing edible oak was determined, which was 6 samples out of 10 dense samples containing edible oak (2-3-5-7-8-10). The total coverage area of the six samples containing *Quercus aegilops*, each sample separately. Then the average coverage area of all samples containing *Quercus aegilops* was extracted. Then the coverage area of the *Quercus aegilops* was extracted in the sample and divided by the number of *Quercus aegilops* trees in the sample containing the *Quercus aegilops*.

On the average coverage area of *Quercus aegilops* acorns in one sample and repeated over the remaining six samples containing *Quercus aegilops* edible acorns, then these averages were combined for the six samples and divided by the number of samples. We obtained the average coverage area for one tree. As for the coverage percentage of *Quercus aegilops* in the sample, it was estimated as previously mentioned by multiplying (total coverage area * 900/100) which is the area of one sample (30 * 30 m). The volume of one sample from the six samples containing *Quercus aegilops* was previously calculated. As for the average size of each sample obtained by collecting the size of all trees and dividing them by the number of trees, the average size of one tree was obtained by collecting the size of all six samples and dividing it by the number of samples, and so on for other types of trees. After that, the total size of *Quercus aegilops* was extracted in the previously mentioned dense samples. By multiplying (the average size of one tree (*Quercus aegilops*) by the average coverage area of all specimens that contain the type (*Quercus aegilops*), then dividing by the average coverage area of one tree (*Quercus aegilops*) and so on for the rest of the species in the three densities. [9]. In the use of ratios in an estimation of the variables studied with area coverage.

2.2 Calculate the total area of each species at the three densities

The total area of each tree type in the Amadiyah district was estimated during the space declaration classification. A guided classification based on dropping the coordinates of each tree type in the study site, which were taken to measure the reflectivity of each type. We obtained the number of pixels for each type of tree. Some types of trees were common or mixed with other types within a single pixel area, and some were pure or single within a single pixel area. Below is an example of estimating the total area of an oak tree eating at high density.
- The number of pixels that contain the single type and the common type at high densities: was obtained through the classification of the space declaration of Amadiyah district, a classification directed according to the coordinates of each type of trees located at the study site.

- The ratio of the type in the single-pixel: was obtained using the proportions for each type in the samples that contain common or mixed species, i.e. adding up the number of each type of species present in the sample and then dividing the total of each species on the sum of all the types present in the sample.

- number of pixels of one type at high density = number of pixels containing the common type in samples of high-density * ratio of type per pixel

- Type area in high-density m² = number of pixels of one type in high density * area of pixels m²

**Table 2.** Model for estimating the total area of the species (*Quercus aegilops*) in high-density m².

| No. | Type area is at high density (m²) | Pixel area (m²) | Number of pixels of a single type at high density | Ratio of type in a single pixel | Number of pixels containing the single and the common type of high density. | Tree type |
|-----|----------------------------------|----------------|-----------------------------------------------|--------------------------------|-----------------------------------------------------------------------|----------|
| 1   | 8717734                          | 25             | 348709                                        | 0.58                           | 601223                                                                | *Quercus aegilops* |

Thus, for the rest of the tree types in the three densities, the area of each tree type in the study site for Amadiyah district in northern Iraq was estimated.

### 3. Results and Discussion

#### 3.1 Tree classification

What we are interested in in this study is the tree area cover and shrubs distribution in the study site for Amadiya. Therefore, the tree area cover class was separated from other non-tree varieties in special maps and tables. The area of each type of tree and shrub, and its percentage per pixel, were extracted from the study site.

![Figure 1](image-url)  
**Figure 1.** A map of the distribution of the types of trees spread in the Amadiyah district in northern Iraq.

The process of classifying the space indication for the study site was done. A directed classification based on the projection of the coordinates of the 44 types of trees on the space indication of the study site, and by using the Arc GIS program, 23 colors were shown for the trees only instead of 44 colors. Because the forests in the study site are mixed forests, not immaculate.

Therefore, more than one type of tree appeared in a single-pixel with an area (5 * 5) m. Therefore, the types present in a single-pixel appear in one color. Therefore, when classifying these types through the Arc GIS wave classification program, some species shared a single-pixel because they are located close to each other and grow in small areas within the area of a
single pixel, so the pixel gave one color to all the mixed types present in the single pixel. But for all trees in a single pixel in a pure form that has a specific color that distinguishes it from the other type according to the reflectivity, because each type of tree has a different reflectivity from the other. As for the common types in the area of a single pixel, their colors and reflections overlap with each other and appear in one color. Determining the ratio of each species in a single pixel is determined by the relative density of that type and by depending on the density of the type divided by the total density per pixel, and this is consistent with what was mentioned [9], Divided by the total area of the species.

When classifying these 44 types of trees, a guided classification using the Arc GIS program, some types appeared pure in one pixel that gave one color to the pixels of a certain area and proportion to it, or in common with a target other than trees, such as the presence of roads, rocks, stagnant water, running water, in addition to residential areas such as a building Or a part of a building that entered within a single pixel area during the projection of these coordinates to the space indication, such as Quercus infectoria with water in one pixel and horizontal cypress with rivers running also in one pixel. Also, more than one type, for example, two, three, or even four types of trees, shared with some in one pixel and some of these common types in one pixel shared with other non-tree targets such as Morus nigra and Corylus with residential areas, so the areas and proportions of them are in common. As in Table(3).

Table 3. Types of trees and the number of pixels in which these types appeared, along with the areas and percentages of each type according to the pixel area.

| No. | Area (m²) | No. of pixel | Percentage | Tree Species |
|-----|-----------|--------------|------------|--------------|
| 1   | 84.25     | 3370112      | 3.0        | Olea europaea |
| 2   | 79.05     | 3161948      | 2.8        | Juniperus oxycedrus. |
| 3   | 78.83     | 3153136      | 2.8        | Pistacia eurycarpa |
| 4   | 78.56     | 3142488      | 2.8        | Morus nigra – Corylus – Residential areas |
| 5   | 76.81     | 3072324      | 2.8        | Eucalyptus L. |
| 6   | 76.63     | 3065252      | 2.8        | Craategus azarola - Cupressus Sempervirens var. Pyramidalis- Pistacia khinjuk stocksk |
| 7   | 75.15     | 3006116      | 2.7        | Quercus aegilops - Juglans regia |
| 8   | 73.40     | 2935844      | 2.6        | Cercis siliquastrum - Morus rubra - Ficus nigra |
| 9   | 71.64     | 2865572      | 2.6        | Prunus argentea - Ficus carica |
| 10  | 71.53     | 2861332      | 2.6        | Populus euphratica - Salix babylonica - Pyrus Syriaca |
| 11  | 71.01     | 2840248      | 2.6        | Prunus microcarp |
| 12  | 66.46     | 2658548      | 2.4        | Acer monspessulanu - Thuja(Biota) orientalis - Celtis tournefortii |
| 13  | 64.83     | 2593140      | 2.3        | Salix alba - Populus eupamericana |
| 14  | 63.29     | 2531732      | 2.3        | Pinus brutia - Pinus pinea - Fraxinus rotundifolia - Cedrus Libani |
| 15  | 60.57     | 2422948      | 2.2        | Quercus libani - Thuja occidentalis |
| 16  | 49.01     | 1960568      | 1.8        | Platanus orientalis – Pistacia vera |
| 17  | 44.82     | 1792744      | 1.6        | Morus alba |
| 18  | 42.56     | 1702352      | 1.5        | Pistacia khinjuk - Salix acmophylla - Tamarix - Populus nigra |
| 19  | 42.01     | 1680372      | 1.5        | Cupressus Sempervirens var. horizontalis – Underway collapsed Robinia pseudoacacia - Cupressus macrocarpa Hartweg – Rhus carria – Tiled roads |
| 20  | 38.55     | 1541820      | 1.4        | Quercus infectoria – Basins for water |
| 21  | 33.97     | 1358976      | 1.2        | Prunus cerasus |
| 22  | 32.13     | 1285108      | 1.2        | |
| 23  | 19.57     | 782828       | 0.7        | |

TOTAL 1394.6 55785508

from the table (3) the total number of pixels for the types of trees only and the targets in common with them are (55785508) pixels, which were slightly more than half the total number of pixels for all trees with the total targets that appeared when a first classification of the space statement was (111008524) pixels, and it was also More than the number of pixels for all trees in the final classification of the three densities before segmentation according to the coordinates was (52075863) pixels, which is higher than the number of real pixels that include these tree species, because in this classification the single trees that are in overlap with residential areas, on roadsides were for trees.

So the total number of pixels of the tree cover appeared more than the real one at the study site, which was (52075863) pixels for the three densities (high density 10251763 - medium density 21871863 - low density 19788828). Also, the percentage of forest trees that reached (50.3%) is higher than the percentages of all other goals combined, and the olive tree appeared first and was counting.
The pixels in which the olive tree appeared (3370112) pixels, and this does not mean that it is the dominant one and the most present in the study area because the olive tree is planted at spaced distances apart from each other (6 * 6) m or (5 * 5) m depending on the variety, so it may be in one pixel. Only one tree, no more, unlike other species that are located close to each other, such as Quercus, Pistacia eurycarpa, Prunus microcarp., and other species that grow naturally in mixed with each other in the site. It may reach from 5 to 10 trees per pixel. It may be the pre-dominant according to the coverage area of the species that is It will be extracted, so the higher the coverage area is about the species, the greater its area at the site of the study, so that the area of olives, which is to (84.25 km2) and by (3.0%), is very inaccurate. Identify the area of olives more accurately, as are other types that are mixed in a single-pixel such as (Crataegus azarola - Cupressus sempervirens var. Pyramidalis- and Pistacia khinjuk stocksk,). The proportions of each tree type must be extracted and multiplied by the number of pixels to obtain the true number of pixels the type contains on the site.

3.2 Accurate classification of trees

The accuracy of the classification of trees in the Amadiyah district was assessed to determine the extent of the classification conformity with these trees, and the possibility of relying on the prepared map and its future use by taking (249) ground control points for the various trees to determine this accuracy. And that these points are separated from each other by not less than (5 km) and randomly selected at the site of the study as confirmed by [9]. Therefore, the accuracy was calculated for the space indication classified for trees, and we got an accuracy (83.12%), and this indicates that the accuracy of the overall classification for a good and acceptable classification can be relied upon. High percentages appeared for all the items in the study site, reaching (90%) for Ficus nigra. And the least (75%) is for Juniperus oxycedrus and Prunus microcarp, and this is acceptable as indicated by [10]. Through this accuracy, we can determine the extent to which the classification matches these trees and the possibility of reliance on the prepared map and its future use.

Table 4. Represents the accuracy of the classification map for trees only prepared from the sentinel-2 satellite statement for the year 2019.

| Objectives | Quercus infectoria – Basins for water | Juniperus oxycedrus - Underway collapsed | Cupressus sempervirens var. horizontals – Residential areas | Morus nigra – Corylus | Salix alba | Populus euraméricana - Pyrus carica | Prunus cerasus | Eucalyptus | Cupressus Sempervirens var. Pyramidalis | Quercus libani – Angiosperms | Pissacia vera | Pistacia microcarp | Prunus microcarp | Acer monspessulanus – Celtis tenuifolium | Total |
|------------|--------------------------------------|-----------------------------------------|-------------------------------------------------|----------------------|-------------|---------------------------------|----------------|-----------|----------------------------------|-------------------------|------------------------|-------------------------|------------------------|---------------------------------|-------|
|            | 11  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  1  0  0  0  0  13 | 0  3  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  3 | 1  0  7  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  1  0  1  0  1  0  0  0  0  0  8 | 0  0  0  6  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  23 |
It is also possible to rely on the Kappa statistical scale to calculate the accuracy of the classification as this scale measures the degree of difference between the ground control points of the trees that have been taken and the changes that have been classified in the classification map prepared for the study site itself and compare it, and this is what he referred to [11]. The

| Libani | Salix alba - | Populus euramerican | 0 0 0 0 0 10 0 0 0 0 1 1 0 0 0 12 |
|--------|--------------|---------------------|-----------------------------------|
|        | Morus alba   | Cercis silquastrum  | 0 0 1 0 0 0 5 0 0 0 0 0 0 0 6     |
|        | - Monspessula | - Morus rubra      |                                    |
|        | Prunus       | - Ficus carica     | 0 0 0 0 1 0 0 5 0 0 0 0 0 0 0 7   |
|        | argentea     | Prunus cerasus.    | 0 0 0 0 0 0 0 0 5 0 0 0 0 0 5     |
|        | - Salix      | - Eucalyptus -     |                                    |
|        | babylonica   | - Cupressus -      |                                    |
|        | - Pyrus      | - Crataegus -      |                                    |
|        | - Pistacia   | - Cercis -         |                                    |
|        | - Thuja      | - Acacia -         |                                    |
|        | - Populus    | - Olea -           |                                    |
|        | - Ficus      | - Prunus -         |                                    |
|        | - Quercus    | - Microcarp -      |                                    |
|        | - Quercus    | - Monspesuana -    |                                    |
|        | - Tamarix -  | - Thajal (Biot) -  |                                    |
|        | - Stocksk.   | - Celtis -         |                                    |
|        | - Khinjuk    | - tournefortii     |                                    |
|        | - acmophylla | - orientalis -     |                                    |
|        | - stocksk.   | - orientalis -     |                                    |
|        | - ovari.     | - orientalis -     |                                    |
|        | - orientalis | - orientalis -     |                                    |
|        | - orientalis | - orientalis -     |                                    |
| Total  | Average %   | Total              | 13 4 8 7 25 12 6 9 6 6 15 6 9 13 9 12 15 19 10 18 8 4 15 24 9 83 1 |
value of the overall Kappa rating scale appeared (0.822), which is limited between (0.8 - 0.99) and this is considered very
good, meaning that the classification is acceptable and can be relied upon and recommended in the classification. As in the
following equation below. The overall accuracy of the rating is (83.1%) and the Kappa coefficient (0.82) indicates the quality
and accuracy of the classification, and this is in agreement with [12].

Table 5. The types of trees, the number of pixels for each type of tree after segmentation, along with the areas and
proportions of each type according to the area of the pixels.

| NO. | Area (m²) | No. of pixel | Percentage% | Tree Species               |
|-----|-----------|--------------|-------------|---------------------------|
| 1   | 78.828    | 3153136      | 8.0         | Pistacia eurycarpa        |
| 2   | 71.639    | 2865572      | 7.3         | Ficus nigra               |
| 3   | 67.402    | 2696090      | 6.8         | Olea europaea             |
| 4   | 66.464    | 2658548      | 6.7         | Prunus microcarp.         |
| 5   | 61.446    | 2457859      | 6.2         | Quercus infectoria        |
| 6   | 46.670    | 1866798      | 4.7         | Quercus aegilops          |
| 7   | 45.848    | 1833930      | 4.6         | Juniperus oxycedrus       |
| 8   | 36.511    | 1460456      | 3.7         | Acer monspessulanu        |
| 9   | 34.216    | 1368635      | 3.5         | Crataegus azarola         |
| 10  | 33.020    | 1320791      | 3.3         | Prunus argentea.          |
| 11  | 28.516    | 1140644      | 2.9         | Juglans regia             |
| 12  | 28.483    | 1139318      | 2.9         | Pyrus Syric               |
| 13  | 26.386    | 1055458      | 2.7         | Morus alba                |
| 14  | 25.175    | 1006997      | 2.5         | Cupressus sempervirens var. Pyramidalis |
| 15  | 23.956    | 958260       | 2.4         | Morus rubra               |
| 16  | 23.563    | 942523       | 2.4         | Ficus carica              |
| 17  | 21.733    | 869316       | 2.2         | Salix babylonica          |
| 18  | 18.873    | 754938       | 1.9         | Quercus libani            |
| 19  | 18.630    | 745186       | 1.9         | Populus euphratica        |
| 20  | 17.237    | 689498       | 1.7         | Rhus cararia              |
| 21  | 15.657    | 626262       | 1.6         | Pistacia khinjuk stocks   |
| 22  | 13.356    | 534244       | 1.4         | Thujia(Biotia) orientalis |
| 23  | 11.378    | 455126       | 1.2         | Thujia occidentalis       |
| 24  | 10.685    | 427408       | 1.1         | Pinus pinea               |
| 25  | 8.989     | 359566       | 0.9         | Tamarix                    |
| 26  | 8.587     | 343468       | 0.9         | Pinus brutia              |
| 27  | 8.418     | 336720       | 0.9         | Populus euramericanus     |
| 28  | 8.116     | 324648       | 0.8         | Robinia pseudoacacia      |
| 29  | 7.687     | 307476       | 0.8         | Populus nigra             |
| 30  | 6.615     | 264866       | 0.7         | Fraxinus rotundifolia     |
| 31  | 6.155     | 224810       | 0.7         | Cedrus Libani             |
| 32  | 5.602     | 224093       | 0.6         | Pistacia vera             |
| 33  | 4.682     | 187267       | 0.5         | Cupressus macrocarpa Hartweg |
| 34  | 2.999     | 119978       | 0.3         | Eucalyptus                |
| 35  | 2.516     | 100630       | 0.3         | Salix acmophylla Boiss    |
| 36  | 2.462     | 98470        | 0.2         | Pistacia khinjuk          |
| 37  | 2.355     | 94204        | 0.2         | Salix alba                |
| 38  | 0.210     | 8392         | 0.02        | Cupressus sempervirens var. horizontalis |
| Total | 987.852 | 39514092     | 100         |                           |

In the table above, the species of trees that were mixed, such as water basins, running rivers, residential areas, and tiled roads
within the area of a single-pixel were separated by the method of proportions, i.e. the ratio of each mixed species in one pixel.
Mixed and overlapping trees were also separated into one pixel, for example (Crataegus azarola - Cupressus sempervirens var. Pyramidalis).
var. Pyramidalis- and Pistacia khinjuk stocksk) were separated from each other, so that each pixel contains one type according to its ratio in the pixel, so the total pixels for all types of trees were only without any other goal It has a shared area of pixels (39514092) pixels, and the area of all trees in pixels is (987.852 km²) if we assume that trees cover the entire pixel area, but some types do not cover the entire pixel area but rather cover part of the pixel area, but appeared in the pixel depending on the reflectivity And the ground coordinates that were taken to the trees and projected to the spatial indication, each group of pixels appeared containing a specific type of trees, of course after separating the mixed types of trees that appeared in the single pixel in one color when classifying the statement Space using the Arc GIS program. We noticed that the palm tree came first in terms of the number of pixels it contains after performing the separation process for the overlapping types with each other in the pixel because it was present in all three densities (high, medium, and low), so it surpassed olive after Separation, as the olive tree is only present in medium and low densities because it is planted at separate distances from each other, unlike the sap, which is naturally present in distances close to each other or far from each other, i.e. it grows in various densities, after estimating the number of pixels for each type of tree by regeneration. That is, the ratio of each type of tree in the pixels of the three densities, after it is easy to estimate the area of the type in each of the three densities and the study area only we need the pixel area (5 * 5 m) i.e. multiplying the number of pixels of the type * the area of one pixel is 25 m. We get The coverage area of the species in any density and the overall size of the study easily, and from it is possible to know the number of trees in each density and each site through proportions as well.

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