

MONITORING THE EVOLUTION OF DEFORESTATION IN THE NORTH-WEST ROMANIA AREA, MARAMUREȘ COUNTY, BORȘA VILLAGE

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Abstract

Considering the abusive exploitation of wood in the North-Western part of Romania, we proposed a study comparing the years 2011, 2015 and 2017, in which to obtain data on: area of grubbed-up land, quantity of wood felled, but also number of coniferous trees needed for the reforestation of the area chosen in the study.

For a more elaborate analysis of the area of interest we realized a DTM, in order to determine the slopes, the mountainsides, the exposure to the sun and some areas of a certain elevation to determine which area is most exposed to deforestation as well as the area most protected from exploitation. For this purpose, the deforested areas were classified depending on the nearest access road, namely the county road DJ 18.

The data we used to achieve our goal consists of images and coordinates taken from the Google Earth application, and then using the TransDatRo application we converted the geographical coordinates (B, L, H) into Stereo coordinates 1970 (X, Y, Z).

The data processing and analysis was made in the ArcMap application. Finally, the resulting data gives us an overview of the deforestation problem that Romania currently has, but also the negative impact it has on the soil.

Key words: Analyzes, ARCGIS, Deforestation, DTM, GIS.

INTRODUCTION

Remote sensing and GIS are complementary technologies that, when combined, enable improved monitoring, mapping, and management of forest resources.

The information that supports forest management is stored primarily in the form of forest inventory databases within a GIS environment. A forest inventory is a survey of the location, composition, and distribution of forest resources. Historically, forest management inventories were primarily for timber management and focused on capturing area and volume by species. The types of attributes attached to individual mapping units, or polygons, might include stand species composition, density, height, age, and more recently, new attributes such as leaf area index. Other remote sensing sources such as satellite digital imagery have been valuable in updating forest attributes such as disturbance, habitat, and biodiversity.

Applications of remote sensing and GIS to forestry the use of remote sensing by forest managers has steadily increased, promoted in large part by better integration of imagery with GIS technology and databases, as well as implementations of the technology that better suit the information needs of forest managers.

Detailed forest inventory, data forest inventory databases are based primarily on stand boundaries derived from the manual interpretation of aerial photographs. These stand polygons are described by a set of attributes that typically includes species composition, stand height, stand age, and crown closure.

Through this symposium work we want to highlight the evolution of illegal wood felled, near the town of Borsa, to make known the impact of deforestation on the existing flora and fauna in the area, but also the physical effort and the time necessary for a reforestation of the deforested area.

MATERIALS AND METHODS

The programs used to make this scientific work are: Google Earth, TransDatRo, ArcMap, Microsoft Office Excel.

Google Earth was used to take images with the area of interest for years 2011, 2015 and 2017. Google Earth has also been used for inserting and taking geographical coordinates (B, L, h).

Program TransDatRo was used to the transformation of geographical coordinates (B, L, H) into stereographic coordinates 1970 (X, Y, Z).

With the help of ArcMap Program we created the database, we georeferenced the images with the help of control points taken from Google Earth, after we determined surface of the studied area, the digital information was used to vectorize forest, pasture and grassland areas, for a more elaborate analysis of the area of interest we realized a DTM (digital terrain model), in order to determine the slopes, the mountainsides, the exposure to the sun and some areas of a certain elevation to determine which area is most exposed to deforestation.

To perform calculation related to: areas cover with forest, pasture and grassland, quantity of wood felled, but also number of coniferous trees needed for the reforestation, we used Microsoft Office Excel Program.

RESULTS AND DISCUSSIONS

The first stage consisted in taking the images and control points with the help of Google Earth application, the satellite images of the area of interest weresaved and later downloaded from the application at a resolution of 3840x2160 (4K UHD), for the years 2011, 2015, 2017, the control points were inserted as placemark, then the coordinates of the points were inserted into an excel file.

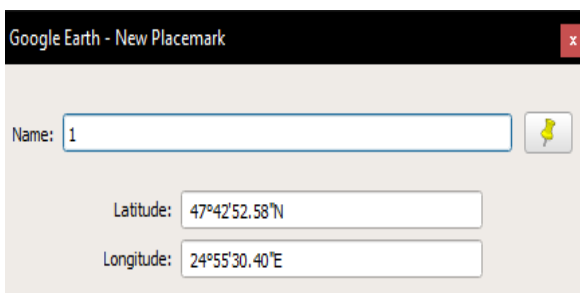


Figure 1. Taking checkpoint from Google Earth

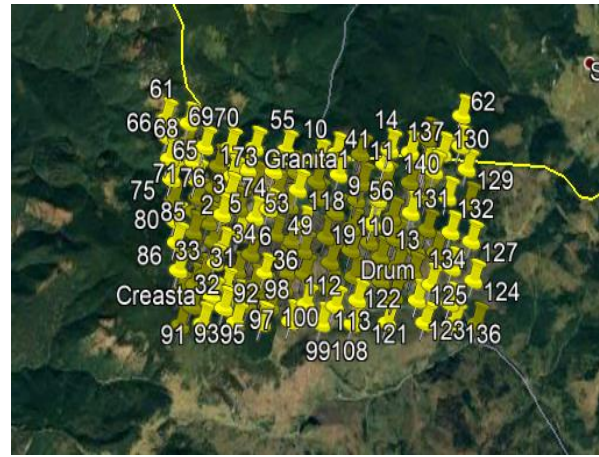


Figure 2. Insertion placemark in Google Earth

The control points from Google Earth are taken as geographical coordinates, being necessary later their transformation into stereographic coordinates 1970 with the help of the TransDatRo application.

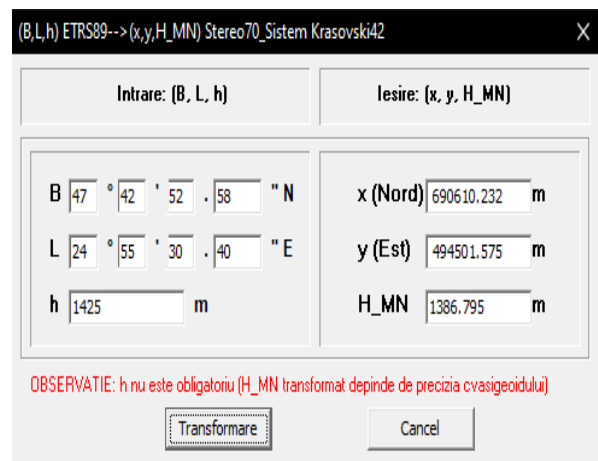


Figure 3. Transformation of geographical coordinates into stereographic coordinates 1970

Using the ArcCatalog program we have created three databases for each year, after we establish the Stereo 70 projection system and the Black Sea altitude system. We open the ArcMap program and upload the images one by one and insert them in the corresponding database, we also attach the excel file that contains the control points.

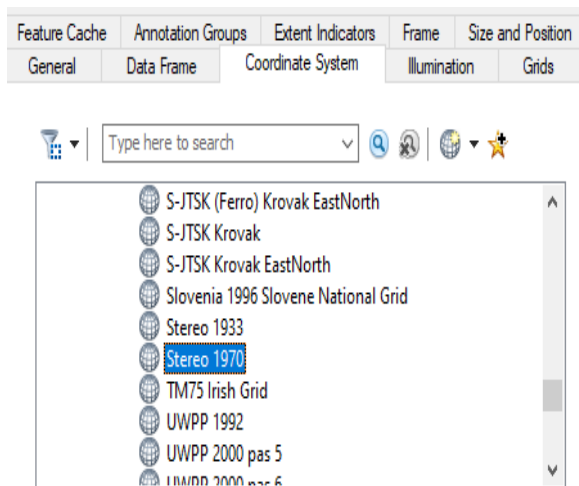


Figure 4. Selection of the projection system Stereo 1970

Next we georeferenced the satellite images using the previously transformed coordinates. Georeferencing tools are used to align the imagery to a coordinate system. When you georeference imagery, you define the image location using map coordinates allowing the imagery to be viewed, queried, and analyzed with other geographic data.

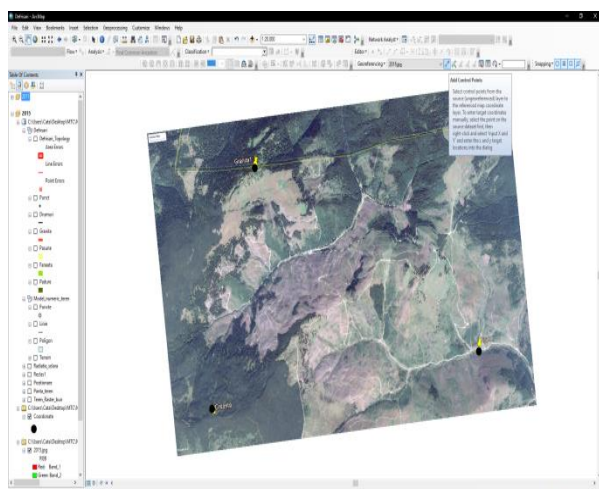


Figure 5. The georeferencing process

The vectorization of the surfaces on the georeferenced images was done using the editor tools bar. The vectorized elements were those of point, line and polygon type. The forest, pasture and grassland areas were vectorized as a polygon, the forest roads were vectorized as a line.

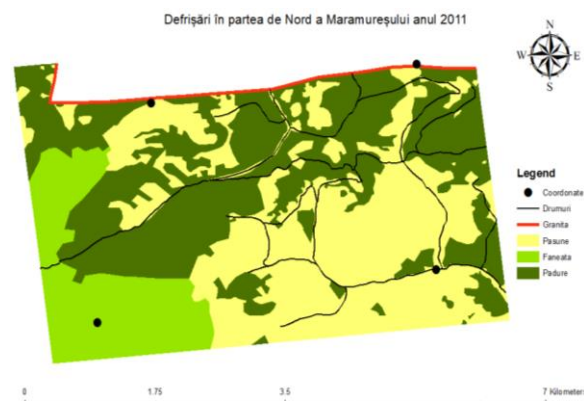


Figure 6. Vectorization of the area for 2011

Statistics of Pasune		Statistics of Padure		Statistics of Pajiste	
Field	SHAPE_Area	Field	SHAPE_Area	Field	SHAPE_Area
Statistics:		Statistics:		Statistics:	
Count:	35	Count:	44	Count:	1
Minimum:	1529.318046	Minimum:	9.656119	Minimum:	3077492.21634
Maximum:	2504328.378209	Maximum:	1763573.526388	Maximum:	3077492.21634
Sum:	8374781.367503	Sum:	8510432.508068	Sum:	3077492.21634
Mean:	239279.467643	Mean:	193418.920638		
Standard Deviation:	496681.89085	Standard Deviation:	326167.562161		

Figure 7. Statistics of the area for 2011

Using the attribute table of the forest layer from the created database, the statistical data related to the areas with forest, pastures and hayfields were determined in order to highlight the total area, the average area, the standard deviations and others. With the help of this information, a study was carried out on the distribution of the total area in the 3 categories.

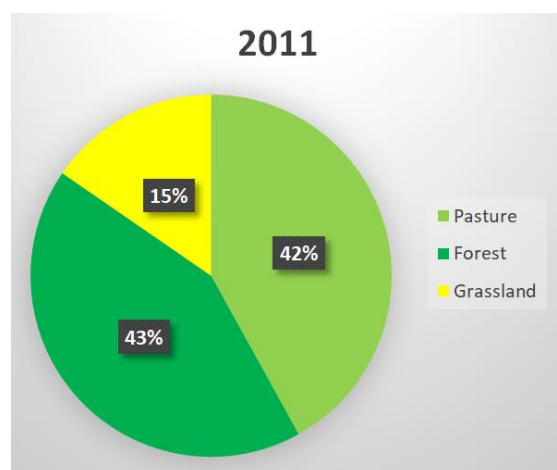


Figure 8. Pie with surface representation for year 2011

According to the graph we can see that the area covered by forest represents 43% of the area under study, the area covered with pastures

42%, and the area covered with hay represents 15%.

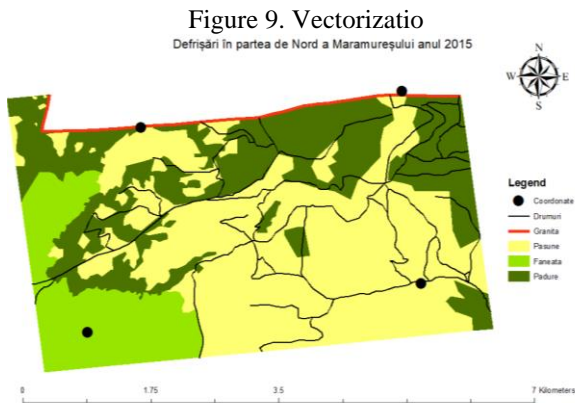


Figure 9. Vectorizatio

Defrișări în partea de Nord a Maramureșului anul 2015

of the area for 2015

Statistics of Padure	Statistics of Pasune	Statistics of Pajiste																																																
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Figure 10. Statistics of the area for 2015

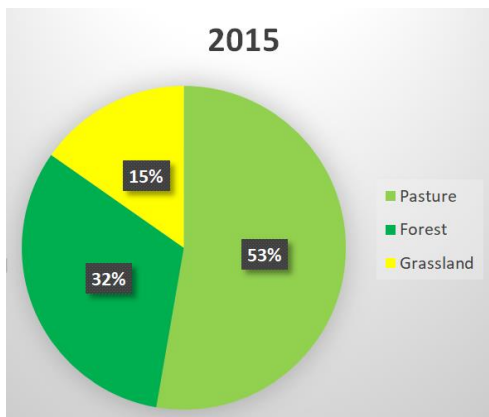


Figure 11. Pie with surface representation for year 2015

Can be seen from the graph that in 2015, the area covered by forest decreased by 10%, while the area covered by pastures increased by 11%, and the area covered with grass remained at 15%.

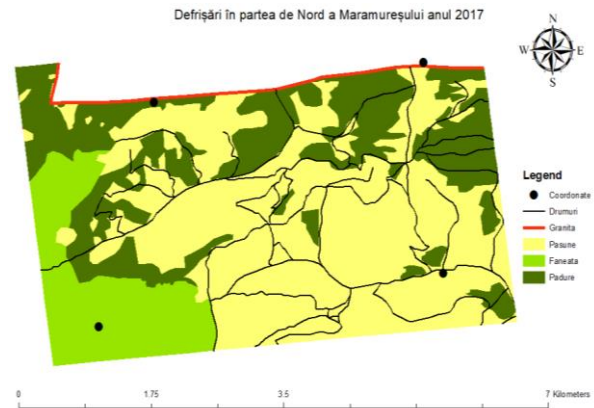


Figure 12. Vectorization of the area for 2017

Statistics of Pajiste	Statistics of Padure_Volum\$	Statistics of Pasune																																																
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Figure 13. Statistics of the area for 2017

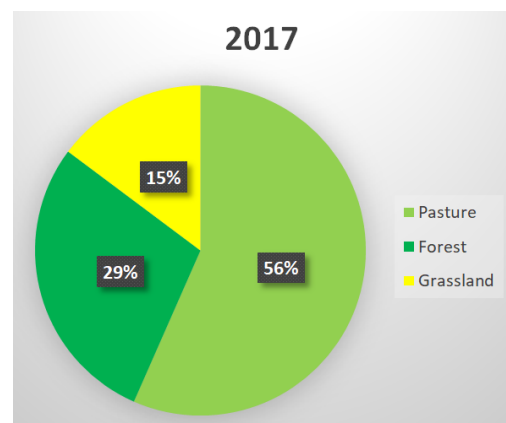


Figure 14. Pie with surface representation for year 2017

In the graph for 2017 we can see a new decrease in the area covered by forest vegetation, ie a decrease of 3% of the area covered by forest, an increase of 3% of the area covered by pastures, while the area covered by grassland remains at a constant percentage of 15%.

Below we have attached the column type graph in which you can see more obviously the annual

decrease of the area covered by forest and the increase of the area covered by pastures.

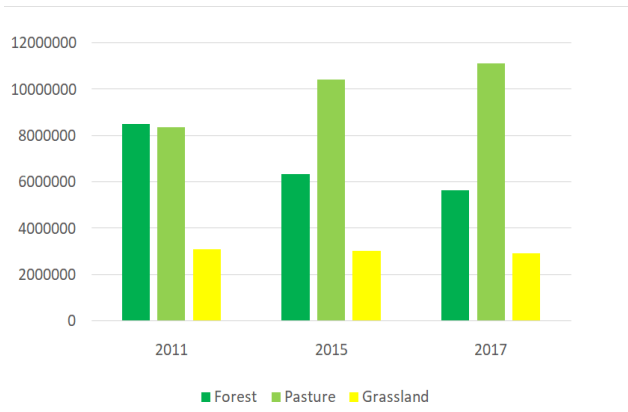


Figure 15. The evolution of the vegetation in the studied area

Next we made a classification on vectorized areas, highlighting the average volume of forest species that grow in this area.

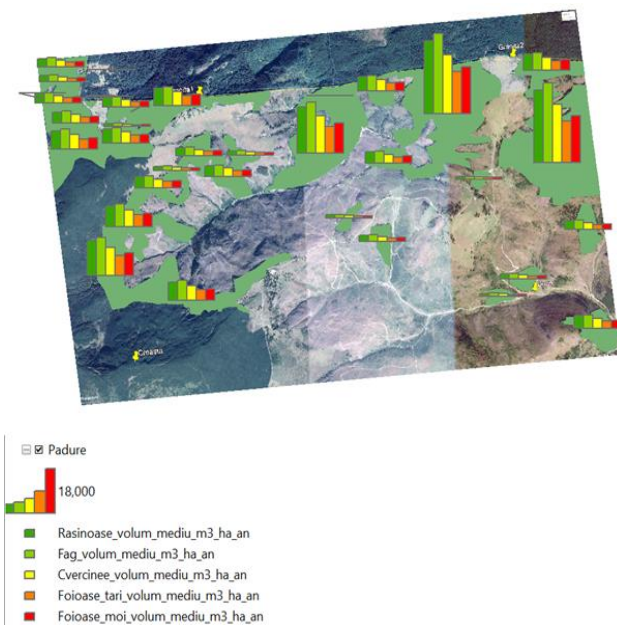


Figure 16. The average volume of tree species in the area

Depending on the vectorized forest areas we can estimate based on the data taken from the National Forest Inventory website, the annual growth depending on the tree species, from the image posted above we can see that softwoods have a higher growth compared to deciduous trees from the area.

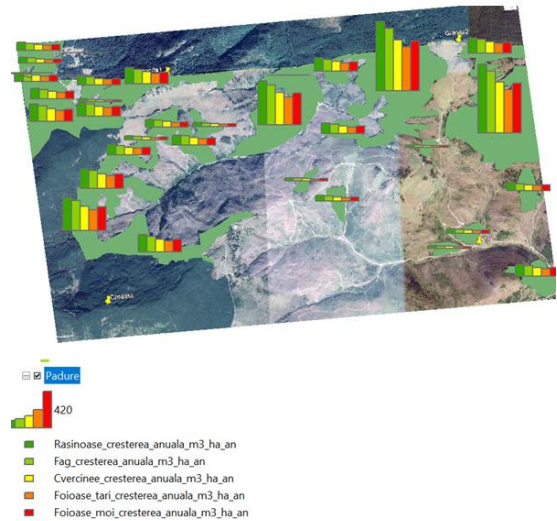


Figure 17. Annual growth of tree species in the study area

With the help of the 140 points taken from Google Earth and inserted in ArcMap, we created the DTM (digital terrain model) and the raster image.

Digital terrain models are representations of land surface point elevations. They are used as input for the generation of surface models and contours or the orthorectification process of aerial photography.

The Terrain to Raster function is used to render multipoint data managed using a terrain stored in a geodatabase. The function will be used when you add multipoint data to a mosaic dataset using the Terrain raster type.

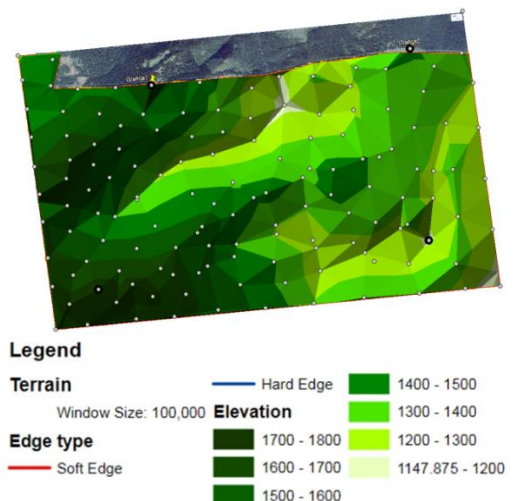


Figure 18. Digital terrain model

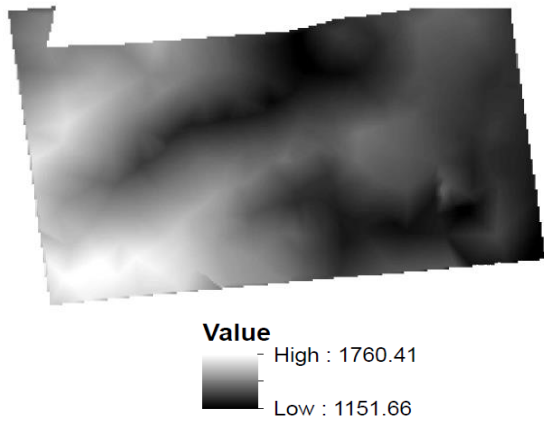


Figure 19. Raster image

In the raster image we can see with dark tones (gray, black) is represented the area with lower elevation, and with light tones (white) are represented the areas with high elevation. With the help of raster images we were able to perform various analyzes on the area studied. The main analyzes performed had as object of study: the positioning of the mountainside, the solar radiation and the slope of the land.

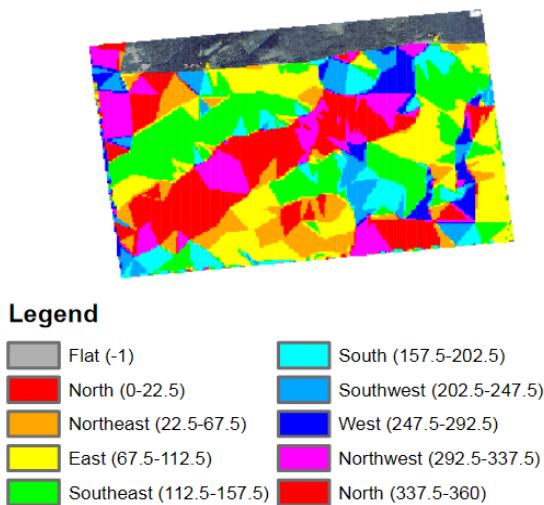


Figure 20. Mountainside positioning

Mountainside represent an area inclined to the horizontal of the place, developed between the level of peaks or ridges at the top and an almost horizontal base represented by terraces, meadows, the hearth of a depression, plain. Knowing the inclination and positioning of the mountainside helps us to assess the degree of soil erosion caused by rainfall, water runoff creating a washing effect of the slopes, this effect can be reduced by reforestation of

deforested areas, and slopes are useful in determining the river basins.

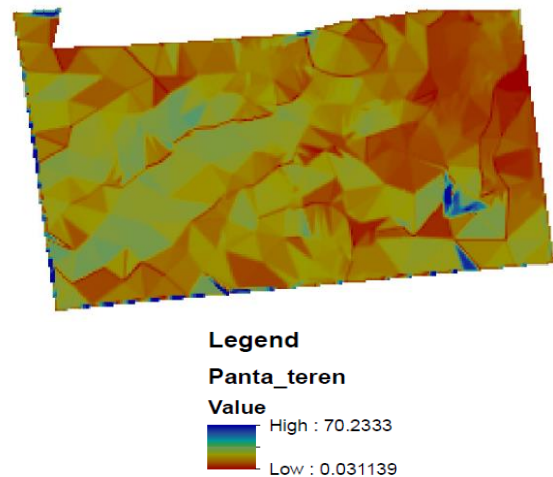


Figure 21. Terrain slope

From the image above, in which we have the representation of the slope depending on its inclination in degrees, the colors blue and green represent the areas with low slope, and the colors yellow and red represent the areas with high slope.

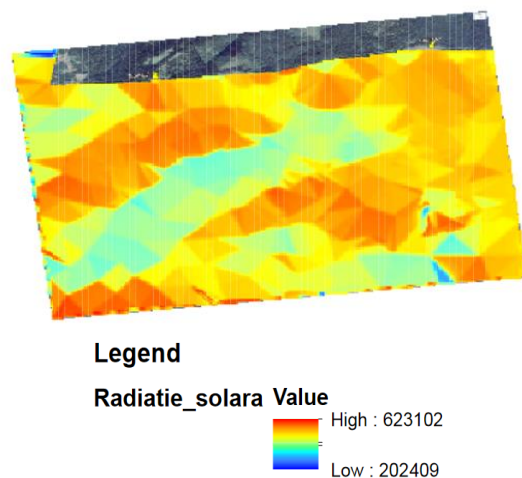


Figure 22. Solar radiation

The image with solar radiation shows that the colors red and yellow represent the areas that enjoy the most sunlight, and the areas with the colors green and blue, show us the areas where there is a deficit of light, so those areas have a higher humidity.

We made a spatial connection between the road layer from the Romania database and the forest layer from our database, thus wanting to find the distance between the studied area and the

nearest access road. As a result of the spatial connection, the nearest road is DN 18, located to 11 kilometers from our area of interest.

CONCLUSIONS

Following the calculations performed in Excel we were able to determine the total area taken into study, and later we determined the areas covered by forest, pastures and grassland. The total area is 1979,987 hectares, of which in 2011 the forest had 851,043 hectares, in 2015 there

was 632,291 hectares and in 2017 there was 563,564 hectares covered by forest.

A decrease of the area covered by forest can be observed in the period 2011-2017, when 287.480 hectares of forest being cut.

It is known that to reforest one hectare of softwoods, are needed 5000 seedlings, so for our area of 287 hectares are needed 1435000 seedlings.

REFERENCES

Course support

Practical work performed at GIS laboratories

<https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/25816.pdf>

<http://roifn.ro/site/rezultate-ifn-1/>

<https://www.google.com/earth/>

<https://www.proalpin.ro/blog/efecte-negative-defrisarea-despadurire/>

