Project for Luxemburg Fieldwork 2012

1. Digitizing Features

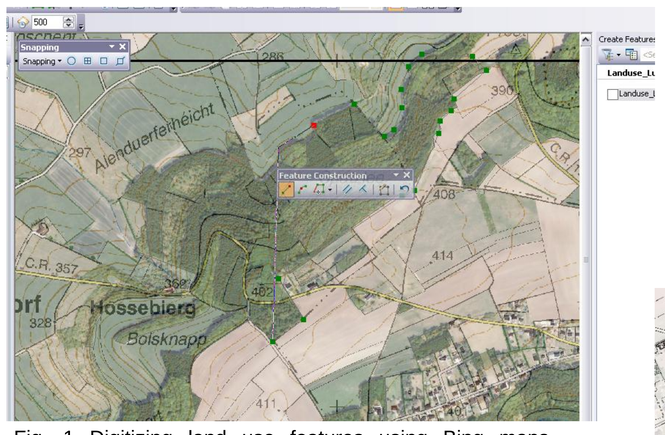

Fig. 1 Digitizing land use features using Bing maps overlayed by the 1:20000 map, at 50% transparency

Also, the (intermittent) rivers, springs and water reservoirs were digitized as line and point vector data.

To get started, a geodatabase was made in which all created rasters and feature classes were subsequently stored. 'Henk Jan's study area' was clipped from the file showing all subset areas, and this was used to clip the topographic maps.

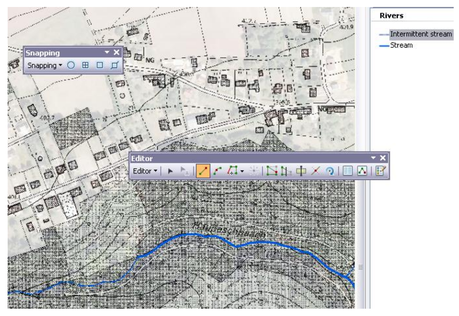

Fig. 2 Digitizing stream features using the Bing maps overlayed by the 1:5000 map, at 25% transparency

Using the available topographic maps (1:5000, 1:20000) and a background satellite image (Bing areal), the land use features were digitized as polygon features in 3 categories:

- Deciduous forest
- Coniferous forest
- Other

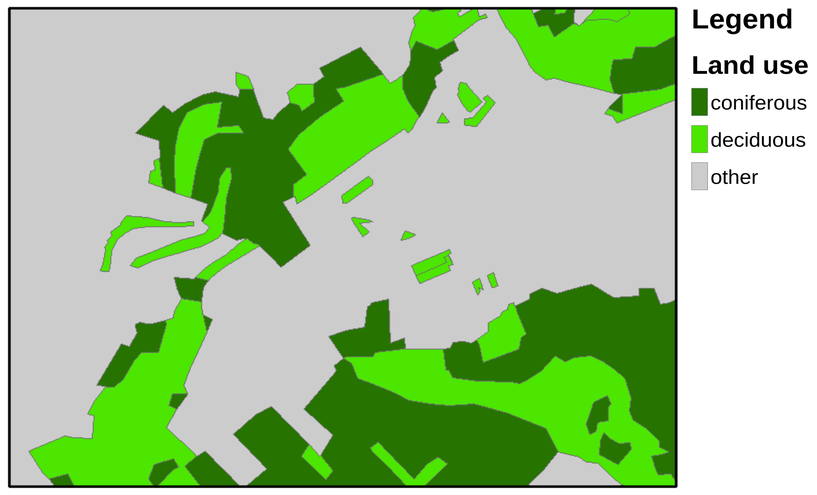

Fig. 3 The result: a land use shape file with hydrological line and point features.

2. Preparing 3D maps from contour map

Step 1: create a buffer around the study area outline

Step 2: clip the contour map to the buffer's extent

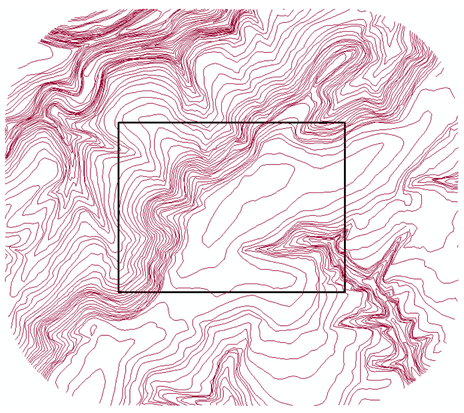

Fig. 4 The clipped contour features

Step 3: create a DEM using the Topo to Raster tool. This proved easier and more accurate than first creating a TIN and then converting that to a raster.

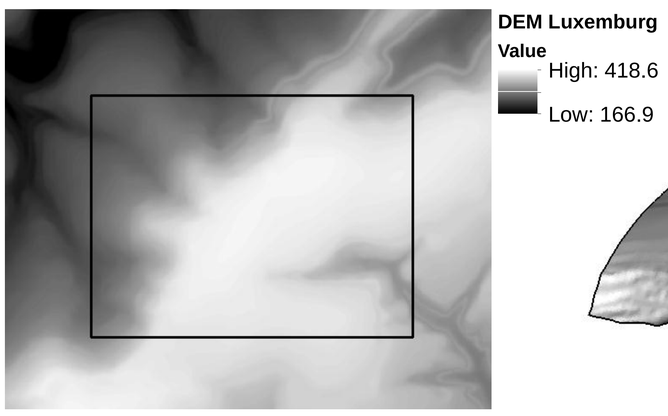

Fig. 5: the Digital Elevation Map (DEM) of Henk Jan's study area, Luxemburg

Step 4: create Hillshade, Slope and Aspect maps using the corresponding tools from the ArcToolbox '3D Analyst tools'

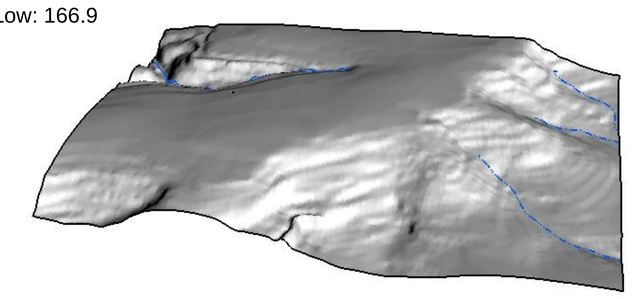

Fig. 6 Hillshade map (made 3D in ArcScene)

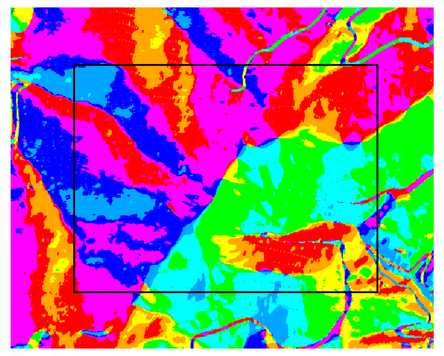

Fig. 7 Aspect map

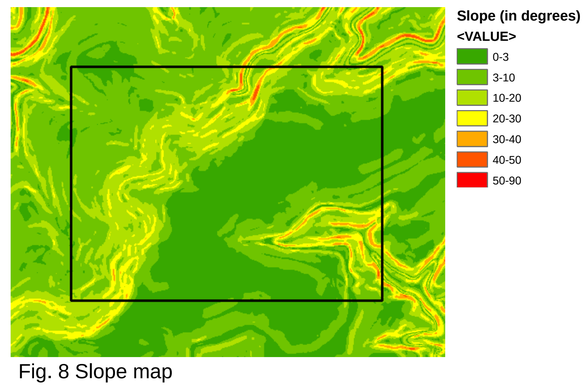

Fig. 8 Slope map

3. GIS questions

1. How much area of each land cover type is found in the area, and what geological substratum is found below each type?

The area of each class was found by selecting 'statistics' of the 'area' tab. To find the distribution of each land class over the different geological units, a union was created between the landuse and veldgeologie' feature classes.

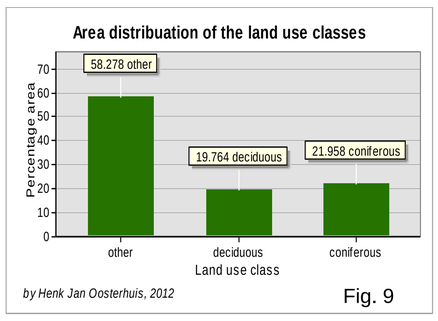

Fig. 9

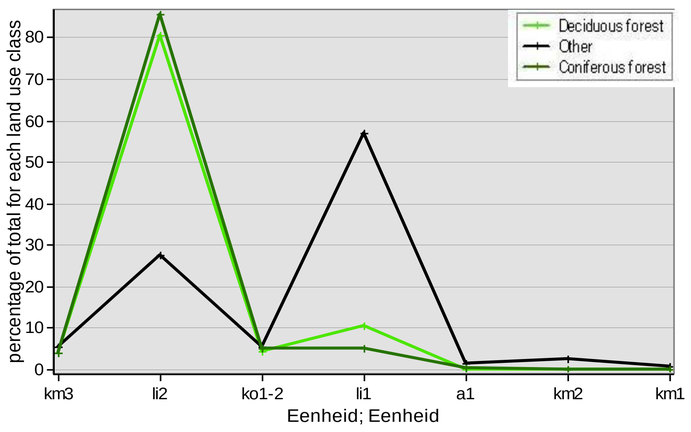

Fig. 10 Percentage area underlayed by each geological unit for the three land use classes

Conclusion: There are significant correlations between land use, geological substratum, and landscape features. The two forest classes grow for over 80% on unit li2, the Luxemburg Sandstein, compared to less than 30% for the other class. Unit ko 1-2, the black marls and red sandstones, shows the opposite pattern. Possibly, the former rock type has soils which are unproductive for farming, so these the forests have been left to grow. The latter rock type may have more productive soils.

2. What are the mean and standard deviations of the slope angles for the deciduous and coniferous forest?

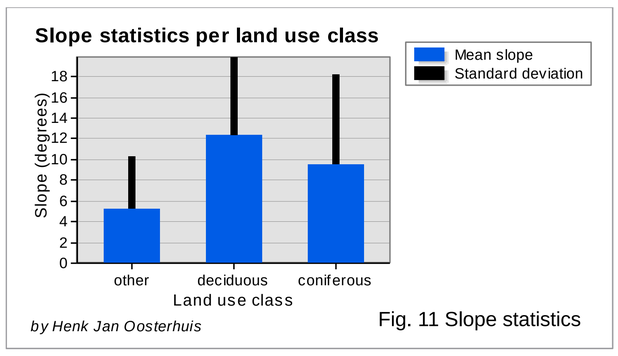

Fig. 11 Slope statistics

These stats were calculated using the 'zonal statistics as table' tool. This yielded a table with the slope statistics for each polygon; by merging all the polygons of each land use class, the overal stats were found.

From figure 11 it can be seen that deciduous and coniferous forests have higher mean slope angles; this is probably due to the fact that steeper grounds are harder to cultivate and so the forests there have been left standing.

3. Is there a correlation betwee the geological substratum, and the angle of slope and aspect?

As can be seen from the 3D hillshade map above, it appears that the landscape in this study area is structure-controlled: there is a clear dipslope dipping to the left, and a face slope on the right. To test this hypothesis, the slope and aspect statistics for each geological unit were calculated in ArcGis using the 'zonal statistics as table' tool.

Eenhei	GEOLOGY_LEGEND_NAAM	Period	Mean slope angle	Std slope angle	Mean aspect angle	Std aspect angle	Percentage
km1	Pseudomorphosenkeuper	Trias - middel	5.744062	2.62697	243.34674	42.156761	3.1
km3	Steinmergelkeuper	Trias - laat	9.040942	5.200913	240.84886	114.81107	17.8
km2	Rote Gipsmergel	Trias - middel	6.098498	3.07615	274.95801	49.711517	3.3
li2	Luxemburger Sandstein	Jura - middel	6.455666	7.285964	183.59764	108.3976	68
ko1-2	Schw arze Blättermergel, Rhätsandstein	Trias - laat	14.996722	6.388659	270.85477	90.495728	2.8
li1	Psilonotenschichten	Jura - vroeg	14.996634	5.503908	280.0611	81.42572	4.6
a1	Hellingafzettingen van de Luxemburger Sandstein	Holoceen	20.637648	11.155169	258.73471	62.536858	0.5

Fig. 12. Geological legend with mean and standard deviation stats for slope angel and aspect angle (degrees), and percentage area cover of each geological unit.

From figure 12, some tentative conclusions can be drawn about the correlation between geological unit, slope and aspect. A number of geological units have a significantly higher mean slope angle; aside from the Holoceen colluvium, these are probably weaker rock types which erode easily once the harder overlying rocks are removed. The mean aspect angle for all units is similar (between 240 and 280), except that of the Luxemburger Sandstein (184 degrees). This is a major unit in this area with 68% cover, and it is important in determing the landscape form – the blue/green area on the aspect map is the south/southwest facing dipslope of this geological layer. Thus there is a significant correlation between geological substratum, slope and aspect. Of course, must still be checked in the field.

Ref. 1: Geology information from Lucius, 1948, 1950

Ref. 2: Topographical maps from GIS studio, provided by A. C. Seijmonsbergen.

By Henk Jan Oosterhuis, January-Febuary 2012, Amsterdam