Exercise 1: Introduction to ILWIS and the dataset

Some example of disaster's evidence:

Which signs can you see of a recent disaster in the area?	X	Y
LANDSLIDE	477696	1560928
LANDSLIDE	477656	1560822
LANDSLIDE	477512	1560663
LANDSLIDE	476554	1559358
FLOODING	477187	1560248

For experienced ILWIS users:

See result files: number of destroyed buildings (for_experienced)

Cross operations: performs an overlay of two raster maps. Pixels on the same positions in both maps are compared. These combinations give an output cross map and a cross table. The cross table includes the combinations of input values, classes or IDs, the number of pixels that occur for each combination and the area for each combination.

Calculating the number of destroyed buildings.

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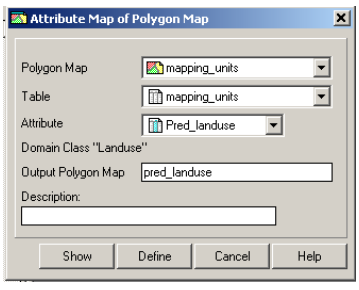
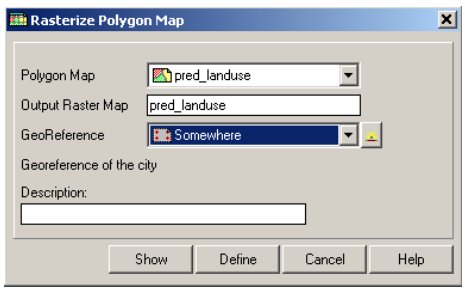
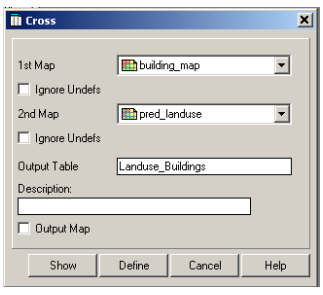
- Go in the catalog and right click on the polygon map **Mapping_Units** and then *vector operations, attribute map*. Select **Pred_landuse** as attribute and name the output **Pred_landuse**. See the image below.
- Open the raster map **Pred_landuse** and check the results. Close the map.
- Convert the polygon map to raster map. In the main window of ilwis, go to *operations, rasterize, polygon to raster*. Select the polygon map **Pred_landuse**. Name the output raster map in the same way and use the **Somewhere** GeoReference. See the image below. Click on the Show button to start the rasterizing operations.
- Go to *operations, raster operations, cross* and select the **Building_Map** and the **Pred_Landuse**. Call the output table **Landuse_Buildings**. Do not ignore the indefinite value. See the image below.







Now we need to know which buildings are damaged after the disaster. You can do that aggregating the building pertaining to the vacant damaged area in the landuse type.

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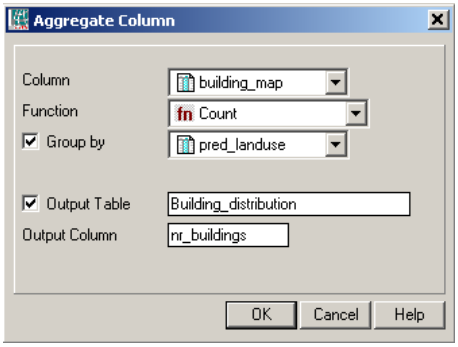
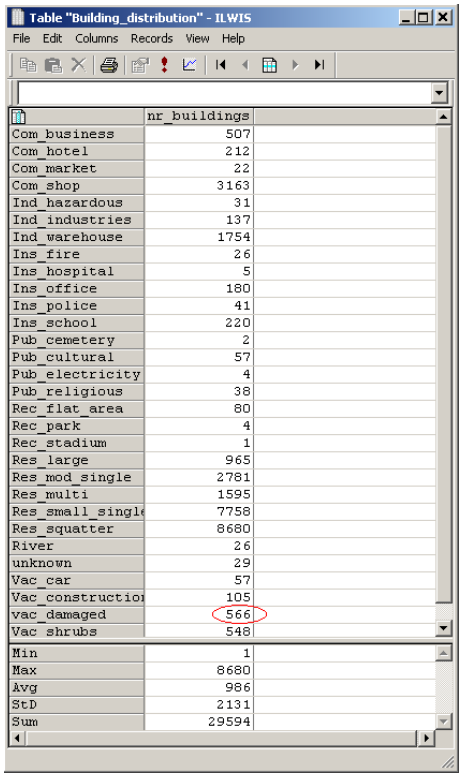
- Open the table **Landuse_Buildings**.
- In the menu of table, go to *column, aggregations* and select the column **Building_map**, use the **count** function and group by the **Pred_landuse**. Create an attribute table called **Building_distribution** and call the output column **Nr_buildings**.
- Open the table **Building_distribution** and check the result. The number of buildings damaged is the value that you can read in correspondence to the class **Vac_damaged**. See the image below.

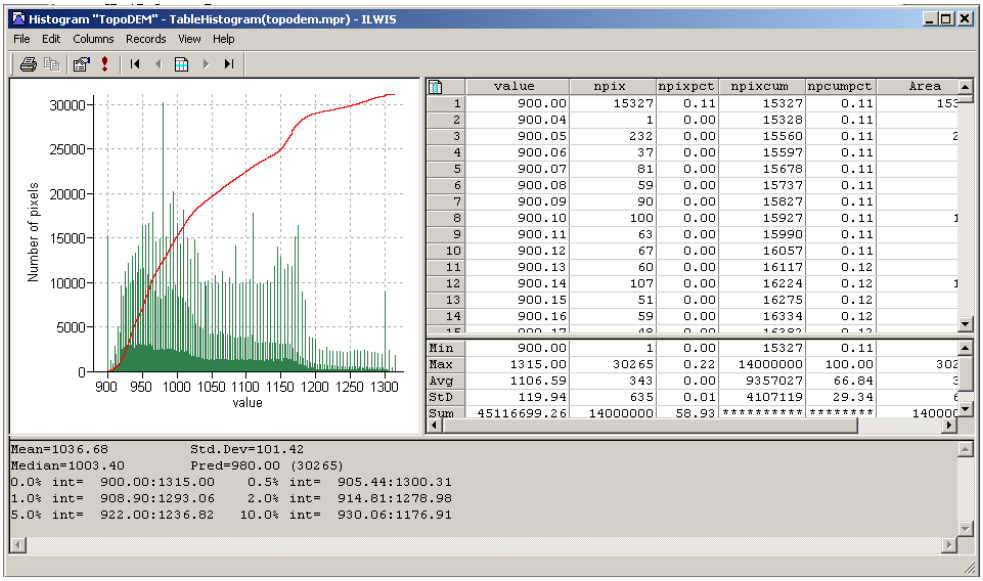
Aggregate functions: Is a very important and useful potentiality of ilwis. You can get one aggregate value, for instance the average or the sum, of a whole column, or one value per group of class names. You can read further explanation about the aggregate functions in the ILWIS guide.





Altitude data

See result files: Lidar dem



	value	npix	npixpct	npixcum	npcumpct	Area
1	900.00	15327	0.11	15327	0.11	153
2	900.04	1	0.00	15328	0.11	
3	900.05	232	0.00	15560	0.11	2
4	900.06	37	0.00	15597	0.11	
5	900.07	81	0.00	15678	0.11	
6	900.08	59	0.00	15737	0.11	
7	900.09	90	0.00	15827	0.11	
8	900.10	100	0.00	15927	0.11	1
9	900.11	63	0.00	15990	0.11	
10	900.12	67	0.00	16057	0.11	
11	900.13	60	0.00	16117	0.12	
12	900.14	107	0.00	16224	0.12	1
13	900.15	51	0.00	16275	0.12	
14	900.16	59	0.00	16334	0.12	
Min	900.00	1	0.00	15327	0.11	
Max	1315.00	30265	0.22	14000000	100.00	302
Avg	1106.59	343	0.00	9357027	66.84	3
StD	119.94	635	0.01	4107119	29.34	6
Sum	45116699.26	14000000	58.93	**********	********	140000

As you can read in the histogram, the most common value of altitude is 980 m.
The average is 1106.59 m

Below is shown the difference visualization due to the different stretch, of the Lidar image. In the image right you can appreciate the building much more clearly than in the image with the default stretch. This is due to the fact that using a stretch 900-950, you are applyng the black colour to the pixel with value 900m, and white to the pixel with value 950. The pixel with value into this range will have different gray level, according with the value in meter. In this way you are increased the contrast between the object in this range and is more easy distinguish them.

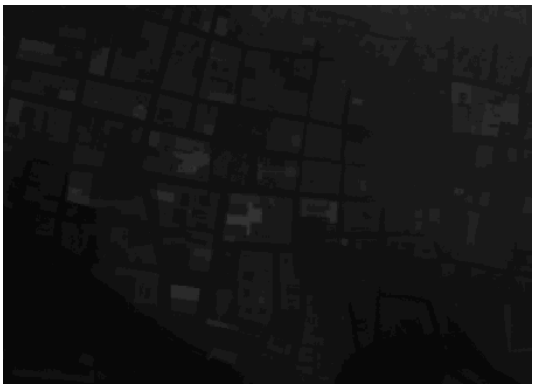


Image Lidar-Default stretch (min-max)

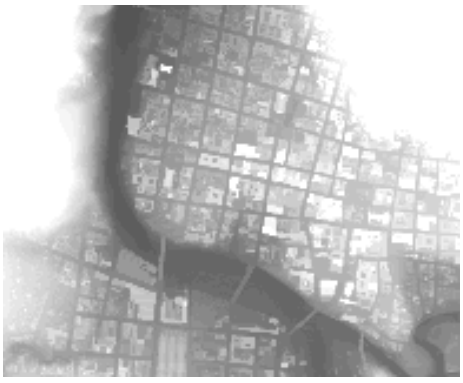
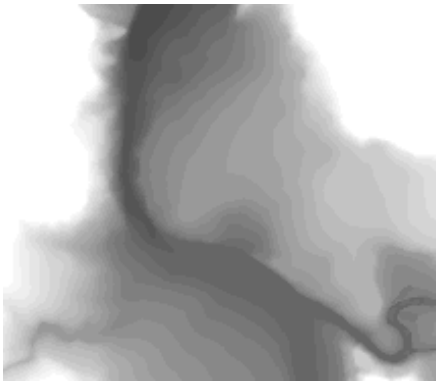
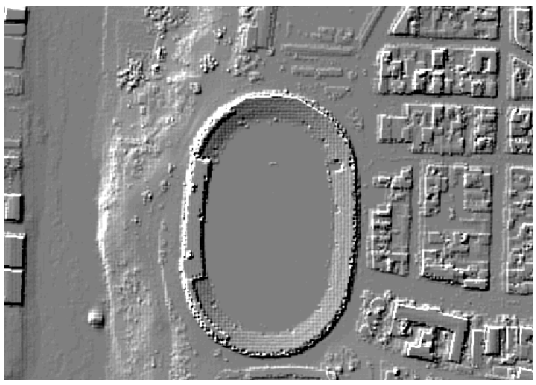


Image Lidar-Stretch 900-950



The image on the left is a stretch 900-950, of the TopoDem of the same area. According to the definition of DTM (Digital Terrain Model), here you cannot see the buildings

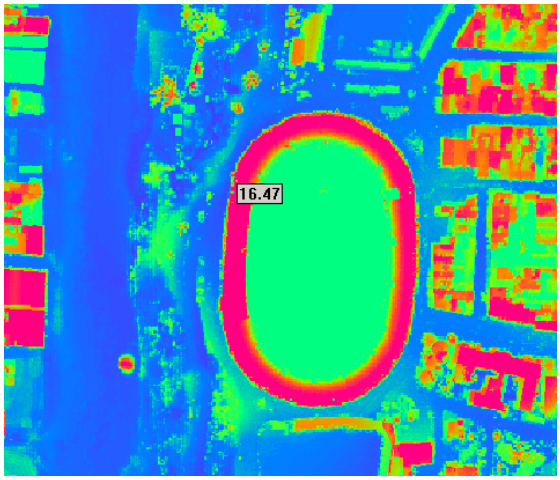
Below are shown the Hillshade image from the Lidar image, and the High resolution image.



Hillshade ("Shadow" in this exercise).

High resolution image.

In the image altitude_dif you are able to read the height of the building, pixel by pixel. In the exemple is shown the height a a point in the stadium.



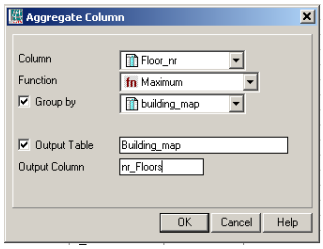
Altitude_dif-Zoom in the stadium and visualization of the height.

Wich ward do you think have the highiest landslide risk?

It is difficult dermine only with a qualitative approach wich ward have the highest landslide risk. You can see that the area more affected by landslides is classified as "open_space", but in this area there are not buildings, so there is an high hazard of landslides, but low risk.
We need to now the vulnerabilty for the quantitative evaluation of the risk, but in the same time we can imagine that the ward "Nairobi" is one with the higher

For experienced ILWIS users:

See result files: Number_of_floors(experienced)



☞ **Calculating the number of floors per building**

- In the command line of ILWIS type the formula:

Floor_nr:=altitude_dif/3

Use a precision of 1.

- Go to *operations, raster operations, cross*, and select the **Building_map** and the **Floor_nr**. Do not ignore the indefinites value for the **Building_Map**. Call the output table **Building_Floor_nr**.
- Open the table **Building_Floor**_and go to *column, aggregation*, and select the column **Floor_nr**, the **maximum** function, and group by **Building_map**. Store the data in the output table **Building_map** and call the output column **nr_Floors**. See the image on the left.

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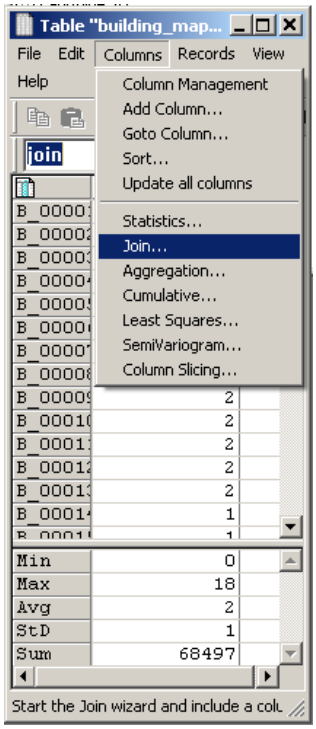
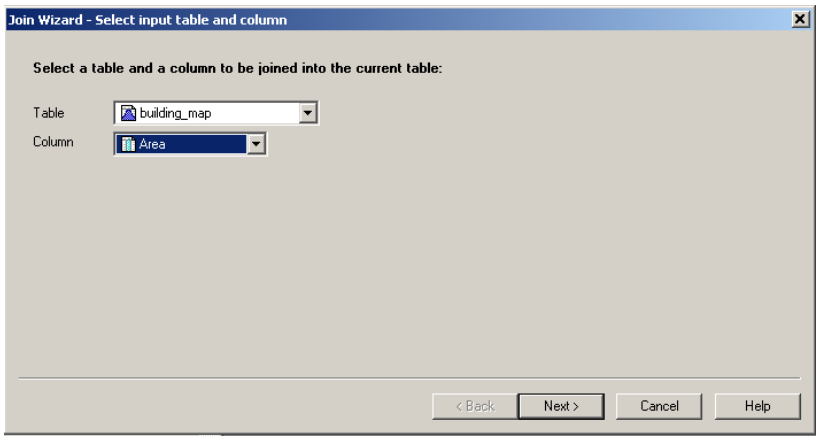
- Create an attribute map of the **Nr_Floors**. Right click on the **Building map** in the catalog, then *raster operations, attribute map*. Select the **Building_map** table and name the output map **Building_Floors**. Show the map and check the results, than close it.
- Evaluate the floorspace per building: Right click on the icon of the raster **Building_map** on the catalog, and select *statistics, histogram, show*.
- Now we need to link the area of every building to the **Building_map**. Open the table **Building_map** and go to *columns, join* and select the histogram of the **building_map** in the field "table". In the field "column" select **Area**, and then click on the *next* button. Use the default name (**Area**) for the output column. See the image below and on the left.
- Type the following formula in the **Building_map** table:

Floorspace:=nr_Floors*Area





Now we want to know the number of Buildings per mapping units.
See result files: estimation buildings in mapping units(experienced)

Calculating the number of buildings per mapping unit.

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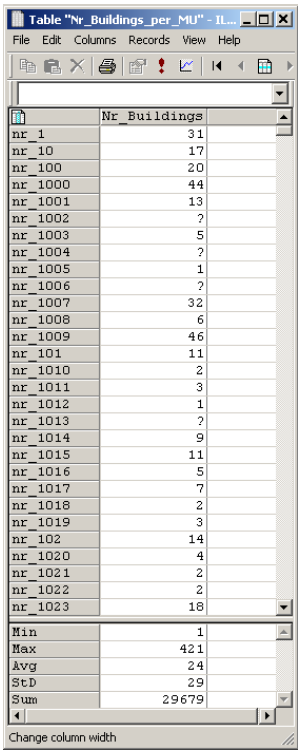
- In the main window of ILWIS go to *operations, raster operations, cross*, and select the **Mapping_units** and the **Building_map**. Do not ignore the indefinites value and call the output table **mapping_units_buildings**.
- Open the table mapping_units_buildings and go to *columns, aggregations*, and select the column **Building_map**, the **Count** function and group by **mapping_units**. Create an output table called **Nr_Buildings_per_MU** and call the new column **Nr_Buildings**. See the image below.
- Open the table **Nr_Buildings_per_MU** and check the value.



	Nr_Buildings
nr_1	31
nr_10	17
nr_100	20
nr_1000	44
nr_1001	13
nr_1002	?
nr_1003	5
nr_1004	?
nr_1005	1
nr_1006	?
nr_1007	32
nr_1008	6
nr_1009	46
nr_101	11
nr_1010	2
nr_1011	3
nr_1012	1
nr_1013	?
nr_1014	9
nr_1015	11
nr_1016	5
nr_1017	7
nr_1018	2
nr_1019	3
nr_102	14
nr_1020	4
nr_1021	2
nr_1022	2
nr_1023	18
Min	1
Max	421
Avg	24
StD	29
Sum	29679

Table: Nr_Building_perMU.