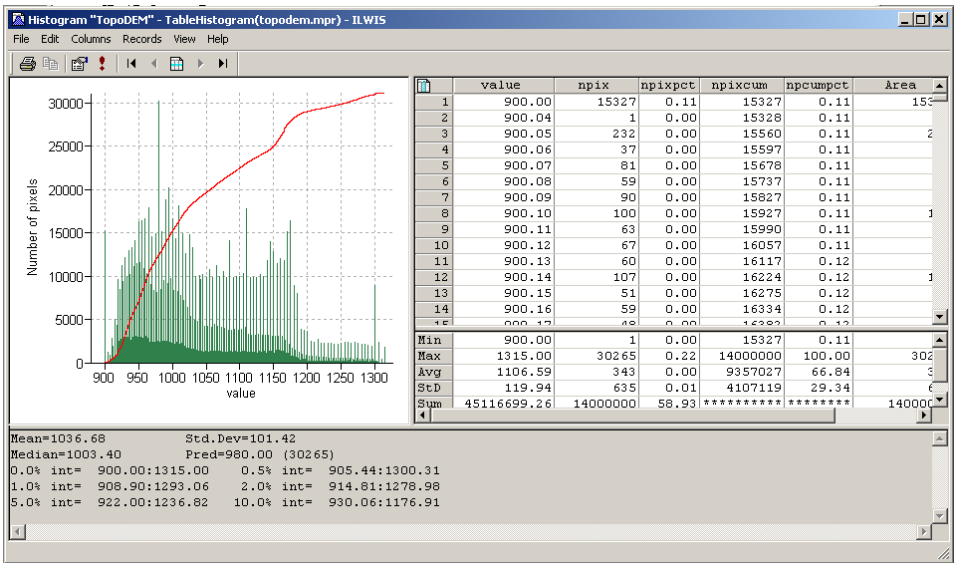
Exercise 1: Introduction to ILWIS and the dataset

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

Altitude data



	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

Below is shown the difference visualizations due to the different stretch options, of the Lidar image. In the right image you can appreciate the buildings much more clearly than in the left image with the default stretch. This is due to the fact that using a stretch from 900 to 950, you are applying the black colour to pixels with a value 900m of lower, and white to pixels with a value of 950 or higher. The pixels with values into the range 900-950 are displaye4d with 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)

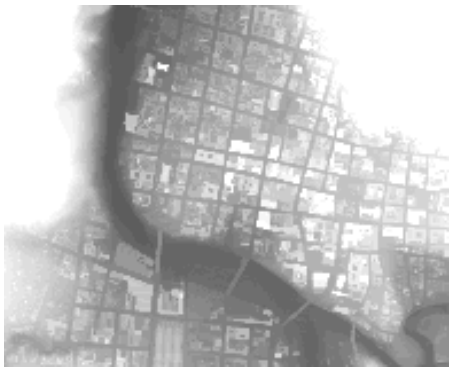
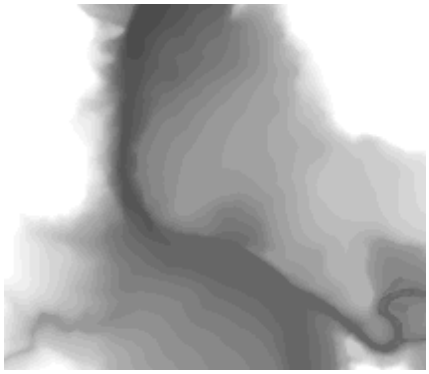
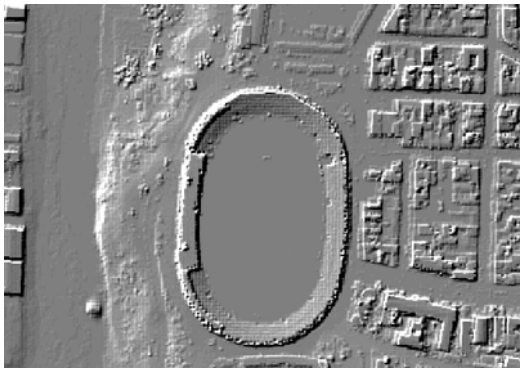


Image Lidar-Stretch 900-950



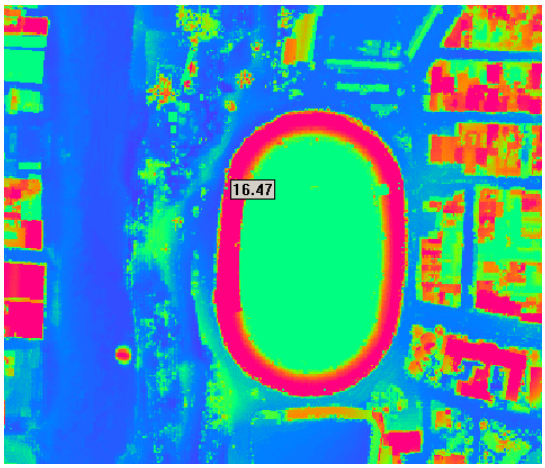
Below are shown the Hillshade image from the Lidar image, and the High resolution image.



Hillshade (“Shadow” in this exercise).

High resolution image.

In the map **altitude_dif** you are able to read the height of the buildings, 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 wards 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 no buildings, so there is an high hazard of landslides, but low risk. However, there are many sqautter areas on the steeper slopes that are located on old landslides that apprantly have a high 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 highest risk levels.

For experienced ILWIS users:

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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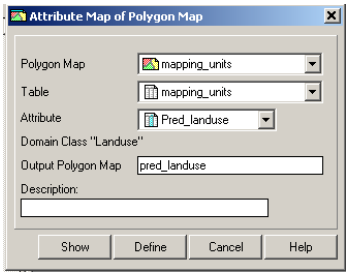
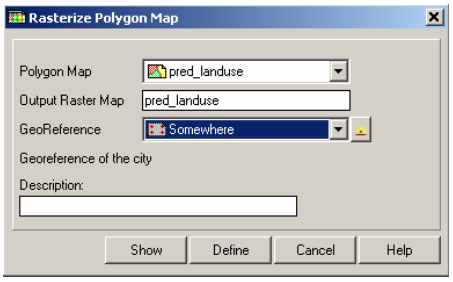
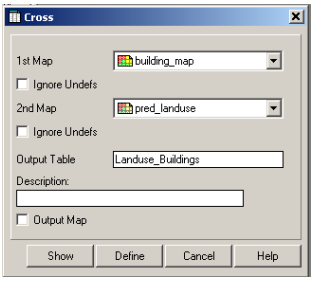
- Go in the catalog and right click on the polygon map **Mapping_Units** and then *vector operations, attribute map*. Select **Pred_landuse** as attribute and name the output **Pred_landuse**. See the image below.
- Convert the polygon map to raster map. In the main window of ilwis, go to *operations, 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.
- Open the raster map **Pred_landuse** and check the results. Close the map.
- 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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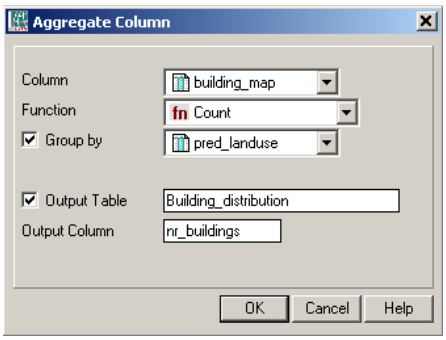
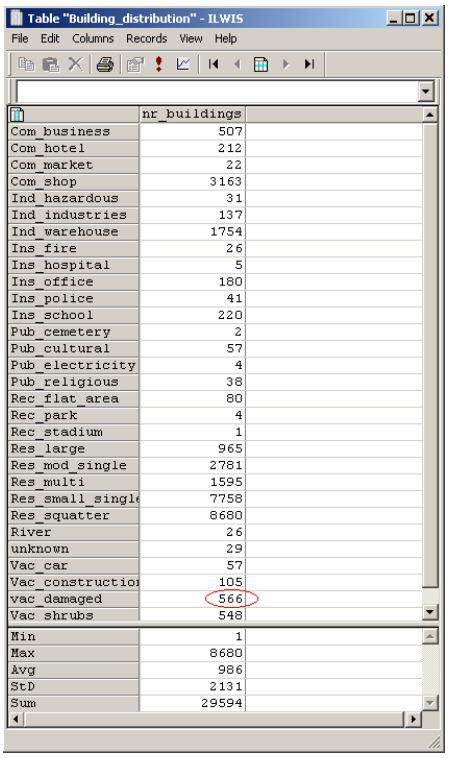
- Open the table **Landuse_Buildings**.
- In the menu of table, go to *column, aggregations* and select the column **Building_map**, use the **count** function and group by the **Pred_landuse**. Create an attribute table called **Building_distribution** and call the output column **Nr_buildings**.
- 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.

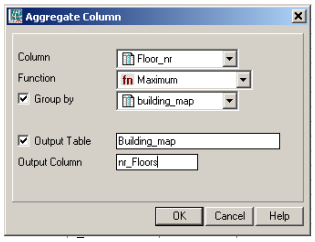
Aggregate functions: Is a very important and useful potentiality of ilwis. You can get one aggregate value, for instance the average or the sum, of a whole column, or one value per group of class names. You can read further explanation about the aggregate functions in the ILWIS guide.





	nr_buildings
Com_business	507
Com_hotel	212
Com_market	22
Com_shop	3163
Ind_hazardous	31
Ind_industries	137
Ind_warehouse	1754
Ins_fire	26
Ins_hospital	5
Ins_office	180
Ins_police	41
Ins_school	220
Pub_cemetery	2
Pub_cultural	57
Pub_electricity	4
Pub_religious	38
Rec_flat_area	80
Rec_park	4
Rec_stadium	1
Res_large	965
Res_mod_single	2781
Res_multi	1595
Res_small_singl	7758
Res_squatter	8680
River	26
unknown	29
Vac_car	57
Vac_constructio	105
vac_damaged	566
Vac_shrubs	548
Min	1
Max	8680
Avg	986
StD	2131
Sum	29594

For experienced ILWIS users:



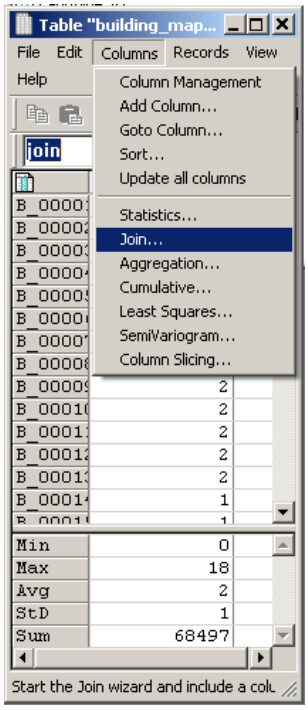
☞ **Calculating the number of floors per building**

- 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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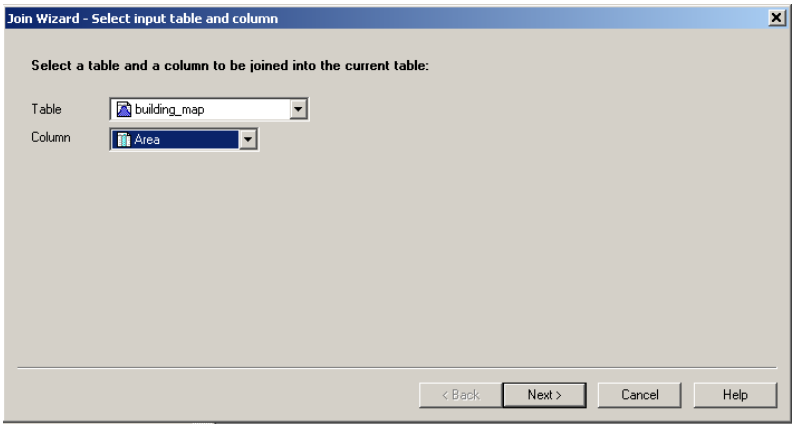
- Create an attribute map of the **Nr_Floors**. Right click on the **Building map** in the catalog, then *raster operations, attribute map*. Select the **Building_map** table and name the output map **Building_Floors**. Show the map and check the results, than close it.
- <u>Evaluate the floorspace per building</u>: 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.

Calculating the number of buildings per mapping unit.

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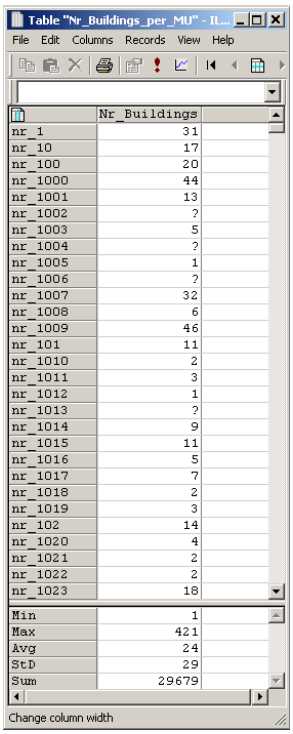
- In the main window of ILWIS go to *operations, raster operations, cross*, and select the **Mapping_units** and the **Building_map**. Do not ignore the indefinites value and call the output table **mapping_units_buildings**.
- Open the table mapping_units_buildings and go to *columns, aggregations*, 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

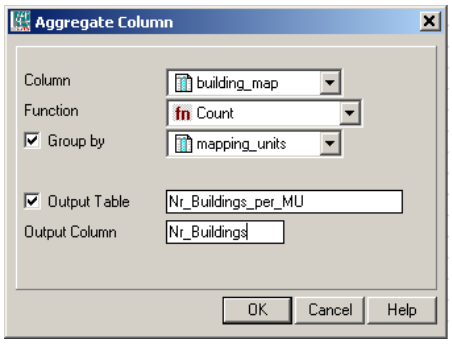


Table: Nr_Building_perMU.