

System Requirements

Supported Operating Systems:

Windows 10, Windows 8.x, Windows 7 Service Pack 1, Windows Vista Service Pack 2

Microsoft .NET Framework 4.5 (available for download:

<http://www.microsoft.com/enus/download/details.aspx?id=30653>)

Required runtime components:

Visual C++ Redistributable for Visual Studio 2012 (available for

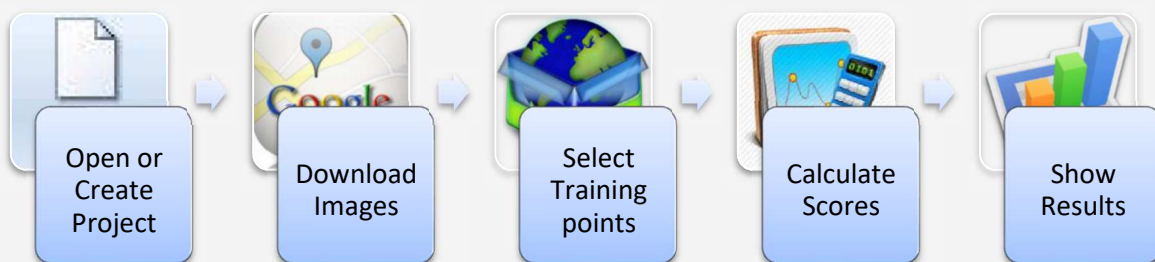
download: <http://www.microsoft.com/en-sg/download/details.aspx?id=30679>)

Hardware Requirements:

- **Processor:** 1GHz or faster processor
- **RAM:** 512 MB of RAM (Minimum)
- **Hard Disk:** up to 1 GB of available space may be required
- **Display:** 1024 x 768 high colour, 32-bit (Minimum)

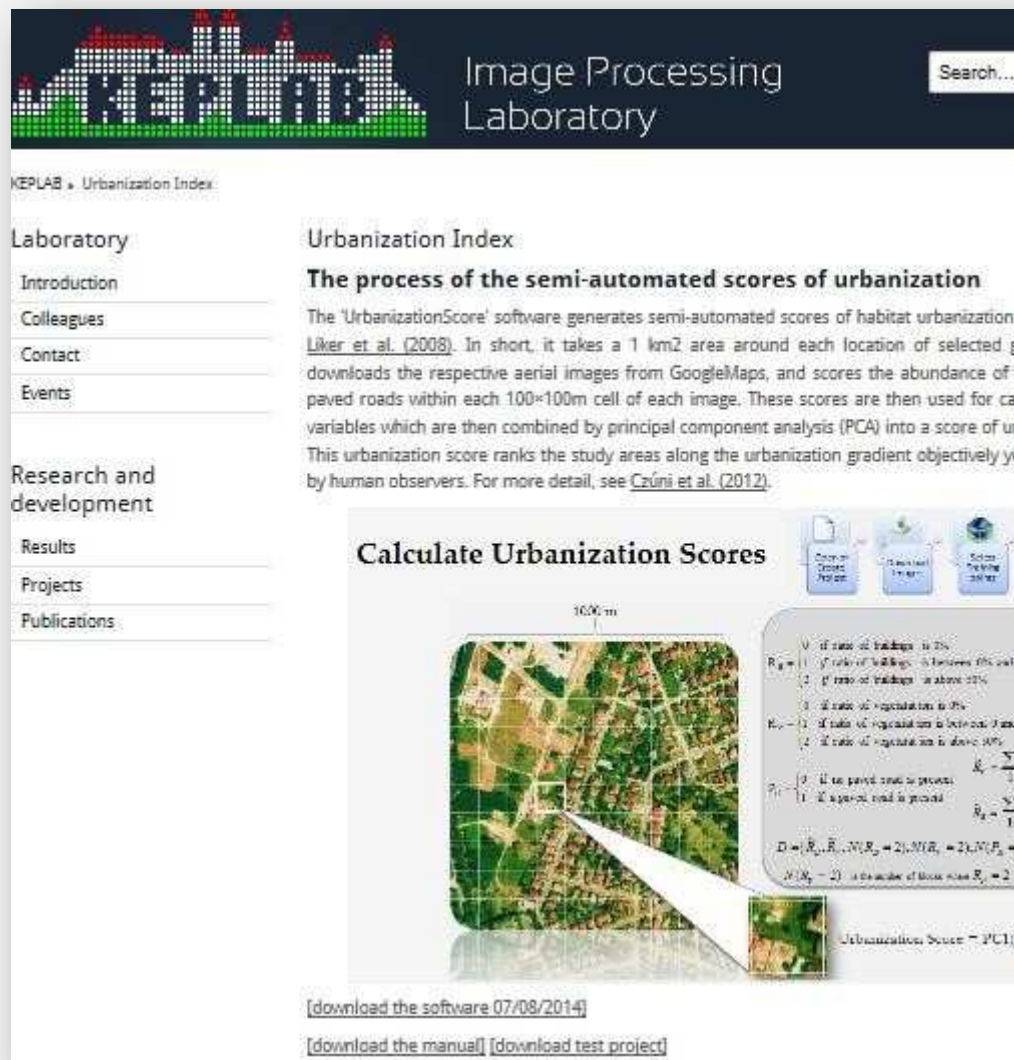
The process of the semi-automated scores of urbanization

The 'UrbanizationScore' software generates semi-automated scores of habitat urbanization based on the method by Liker et al. (2008). In short, it takes a 1 km² area around each location of selected geographical coordinates, downloads the respective aerial images from GoogleMaps, and scores the abundance of vegetation, buildings and paved roads within each 100×100m cell of each image. These scores are then used for calculating landscape-cover variables which are then combined by principal component analysis (PCA) into an 'urbanization score' for each area. This urbanization score ranks the study areas along the urbanization gradient objectively yet similarly to the ranking by human observers. For more details, see Czúni et al. (2012) and Seress et al. (2014).



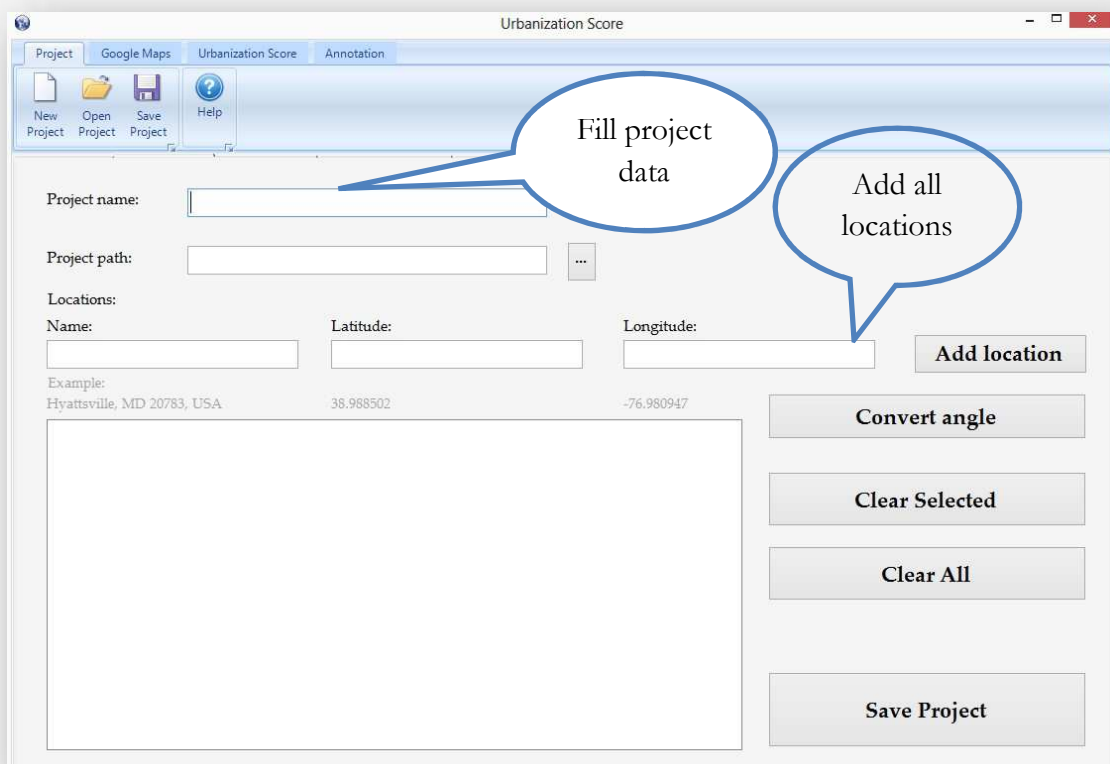
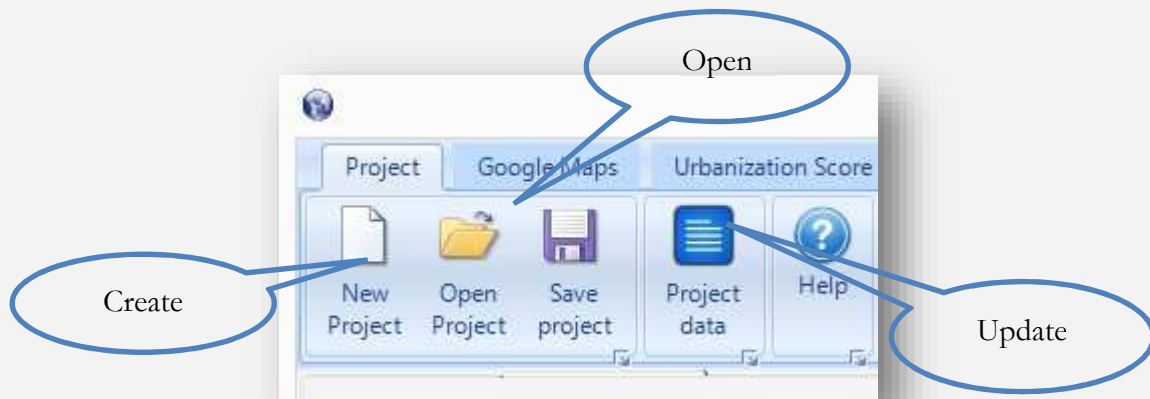
Step by Step Instructions

1. Download the software and a test project from <http://keplab.mik.uni-pannon.hu/en/urbanization-index>

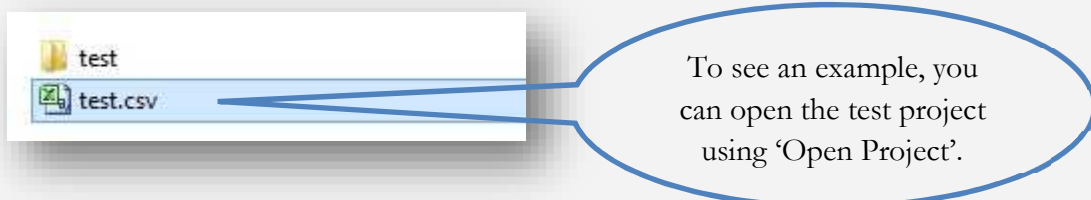


2. Unzip the files and launch 'UrbanizationScore.exe' file by double-clicking on it.
3. Create or Open a Project.

When creating a new project, give it a name and choose where you want to save it on your computer. Then provide the geographical coordinates (latitude and longitude) for each of the locations you wish to score. The coordinates are represented as positive or negative decimal values (e.g. 47.620975, 16.446075); you can access these coordinates for example from GoogleMaps by right-clicking on a location. If you have coordinates in the degrees-minutes-seconds format, use the 'Convert angle' button. After adding all coordinates, click on the 'Save project' button.

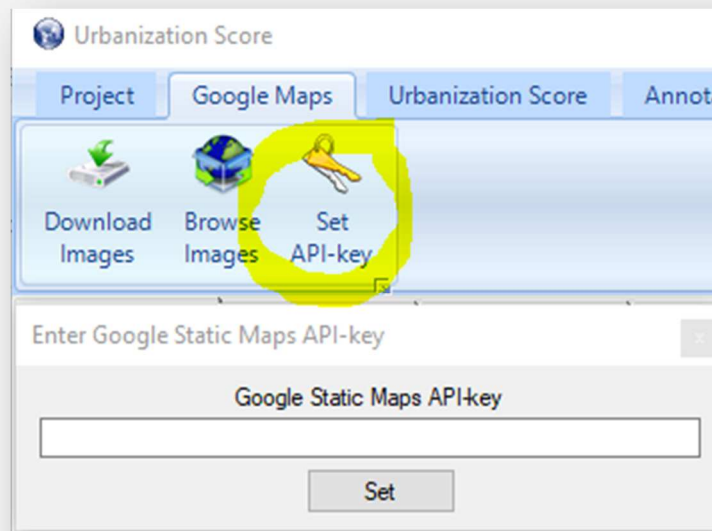


To open a previously created project, choose 'Open Project' and click on the 'name.csv' file where 'name' stands for the name of the project you wish to open. By doing this you can add new locations at any time to an already existing list of areas.

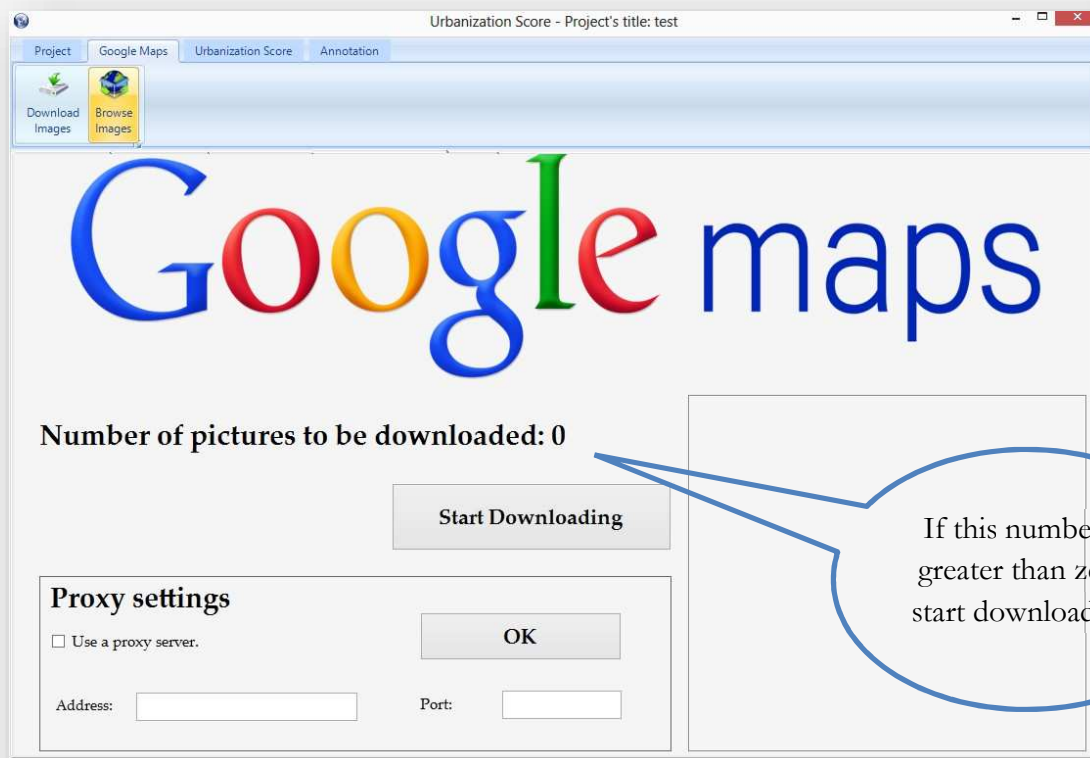


4. Download missing images

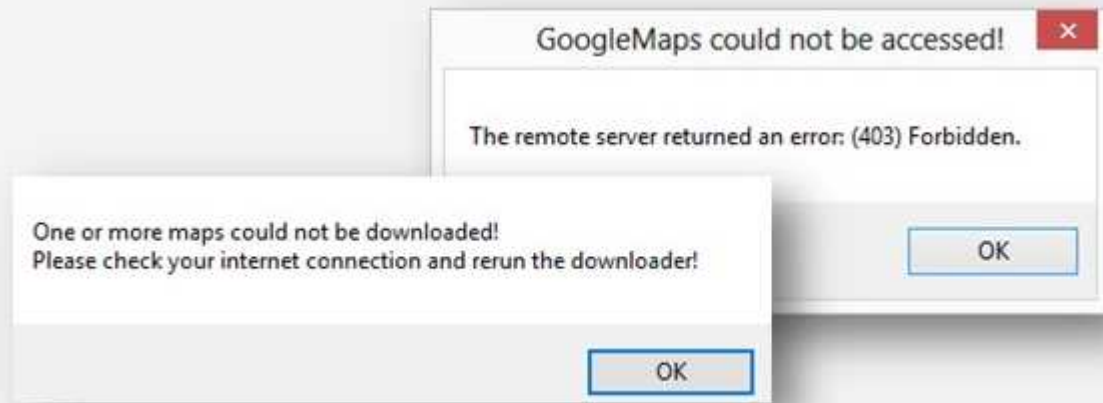
Request an API key from <https://developers.google.com/maps/documentation/maps-static/usage-and-billing> and copy it to the software. Approx. 200 habitat downloads per month are free.



You need live internet connection for downloading the images to be scored. Click the 'Start downloading' button and wait until the 'All pictures have been downloaded' message is displayed. This process may take a few minutes depending on the number of images.



If one of the following error messages appears, try downloading again later.

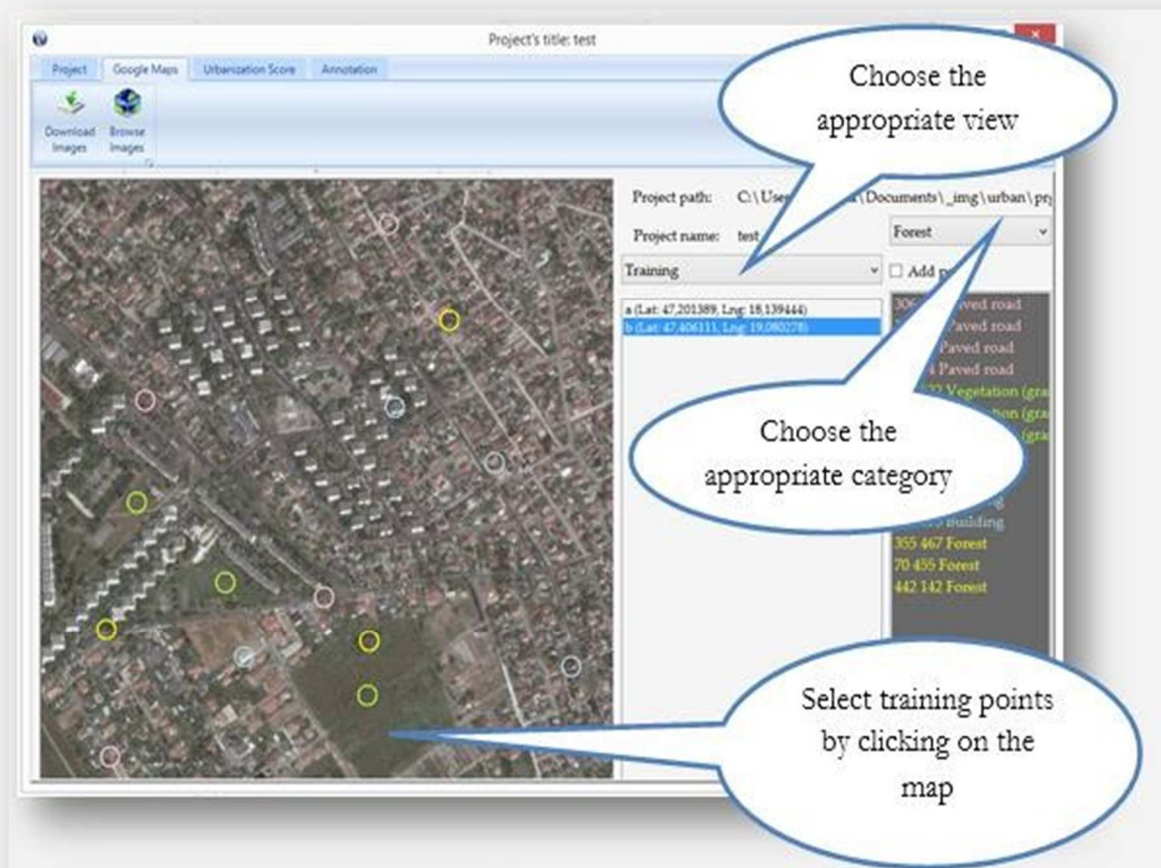


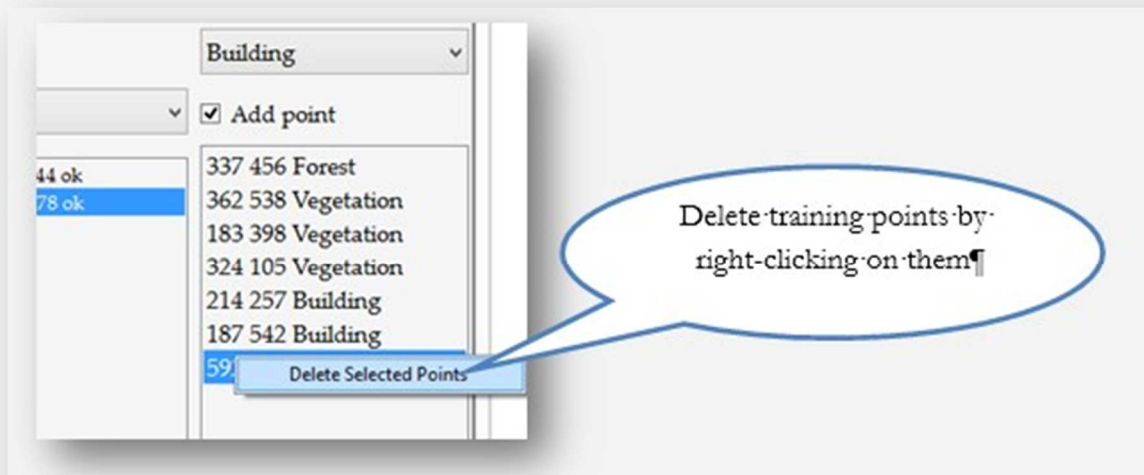
Change the proxy settings if necessary.

Once the images are downloaded, you can use the 'Browse Images' tab to display the satellite view ('Satellite') or the road network map ('Map') for each location.

5. Add training points

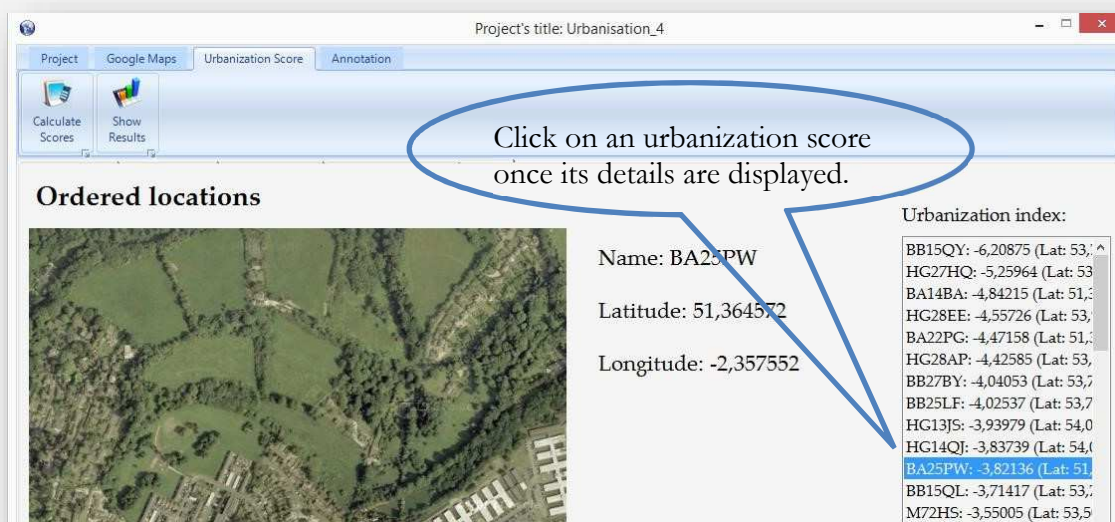
Before starting the scoring process, you need to select a few (typically 3-6) training points for each landscape category (vegetation, buildings, paved surfaces) within each image. To do this, click 'Browse images', select an image from the right-hand list on the screen, and select the 'Training' view. Tick the 'Add point' box, choose a landscape category from the drop down list, and choose your training points by clicking on the image. A small circle will appear, the centre of which is the pixel you marked as a training point for the selected landscape category. The more heterogeneous the image looks for a given category (i.e. vegetation or buildings), the more training points are ideal. E.g. when a given picture contains many buildings with different appearances, try to represent each type with at least one training point. You can (but do not need to) mark other types of landscape cover such as railroads or water using the 'Other' category.





6. Calculate Scores

After adding all training points, start the calculation process of the urbanization scores by clicking the 'Calculate Scores' button on the 'Urbanization Score' tab. This will calculate the landscape-variables for each area, which is then followed by PCA. The process may take a few minutes depending on the number of study sites (c.a. 10 seconds per image). Note: as the 'UrbanizationScore' software ranks the downloaded images according to their urbanization scores (PCA values), at least two images are needed in your project in order to run PCA properly. You should run vcrcdist_x86.exe if you get error message.



You can access the resulting urbanization scores and the landscape variables used for calculation by opening the 'pcaResult.csv' file in Excel from your project's library (following the project path). The landscape variables are as follows:

- number of cells with high building density (>50% cover; range: 0-100),
- number of cells with high vegetation density (>50% cover; range: 0-100),
- number of cells with paved surface (range: 0-100),
- mean building density score (range: 0-2),
- mean vegetation density score (range: 0-2).

The last but one column contains the urbanization scores.

Picture_name	Cells_where_building_label=2	Cells_where_vegetation_label=2	Cells_where_road_label=1	Avg_building_labels	Avg_vegetation_labels	PCA_value
C:\Users\lipovitsa\Documents\img\urban\test\uproba79\1\01.bmp	76	5	99	1.75	1.05	-2.96169
C:\Users\lipovitsa\Documents\img\urban\test\uproba79\2\01.bmp	37	36	85	1.3	1.36	-1.04409
C:\Users\lipovitsa\Documents\img\urban\test\uproba79\3\01.bmp	0	95	2	0.02	1.94	2.93511
C:\Users\lipovitsa\Documents\img\urban\test\uproba79\4\01.bmp	25	71	38	0.64	1.71	1.07067

Locations are listed in the order you supplied them.

7. Check results

Using the 'Annotation' tab, click on the 'Show Labels' button to check the results in full detail. For each study area, the calculated scores for the abundance of vegetation, buildings and paved surfaces are displayed for each 100×100m cell along with the satellite image and the road network map. The study areas in the drop-down list are ordered according to their urbanization scores, from negative to positive values (i.e. by increasing degree of urbanization).



You can also access the table of cell scores by opening the 'svmResult.csv' file in Excel from your project's library (following the project path). Cells within each image are listed row by row, i.e. the first 10 cells are at the top of the image from left to right, and so forth down.

A	B	C	D	E	F	G
Picture_name	Cell_name	Building_label	Vegetation_label	Road_label		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	0	2	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	1	2	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	2	2	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	3	2	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	4	1	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	5	1	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	6	2	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	7	1	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	8	1	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	9	1	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	10	2	1	1		
C:\Users\lipovitsa\Documents_img\urban\test\ujproba79\1\01.bmp	11	2	1	1		

8. Improve results

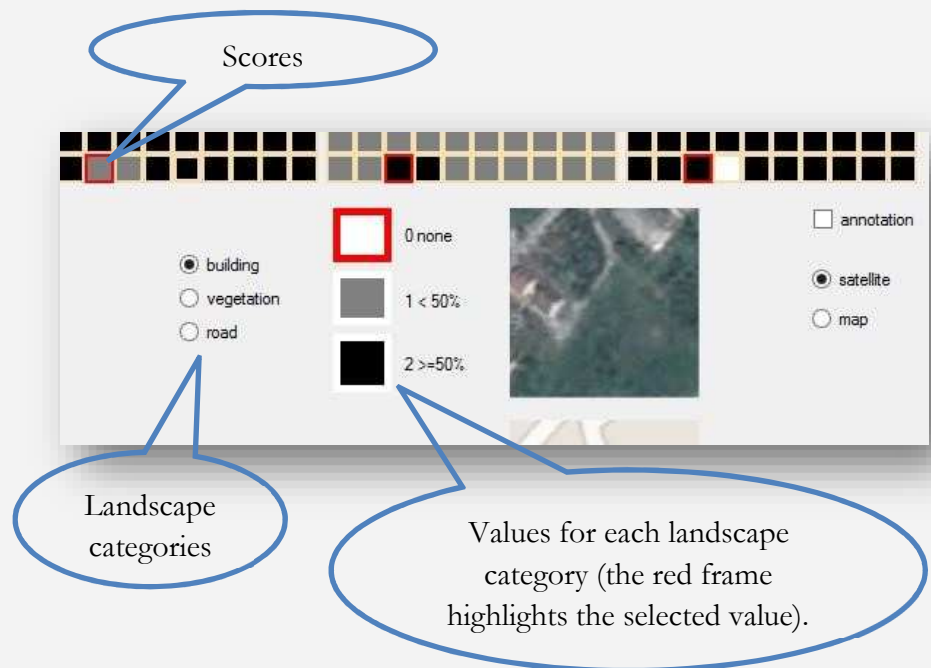
In the 'Annotation window' (see '7. Check results') you can manually overwrite the software generated cell scores in any image cell of your choice, for each landscape category. To do this you should first select a site from the drop-down list, then choose a landscape category (e.g. buildings) and set a new value (e.g. 0), then tick the 'annotation' checkbox and finally select the image cell the score of which you would like to change. Now the score of that image cell has changed (in the selected landscape category). Repeat these steps in every case when you judge it to be necessary; by doing this you can improve the final results.

Important note: the changes will be saved only if you switch to another image, e.g. by navigating to the next/previous picture!

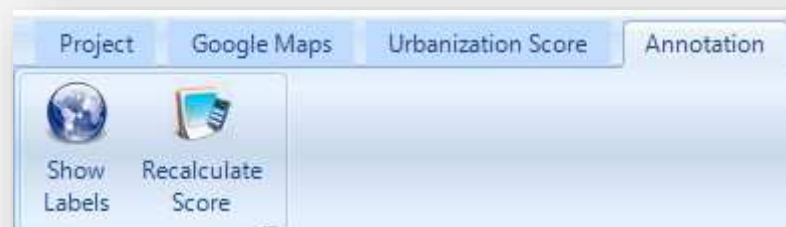
I

Hotkeys:

b: select building category
 v: select vegetation category
 r: select road category
 0: select white
 1: select grey
 2: select black
 s: select satellite
 m: select map
 a: check/uncheck annotation
 →: next picture
 ←: previous picture
 CTRL + →: next cell
 CTRL + ←: previous cell
 SPACE: change label



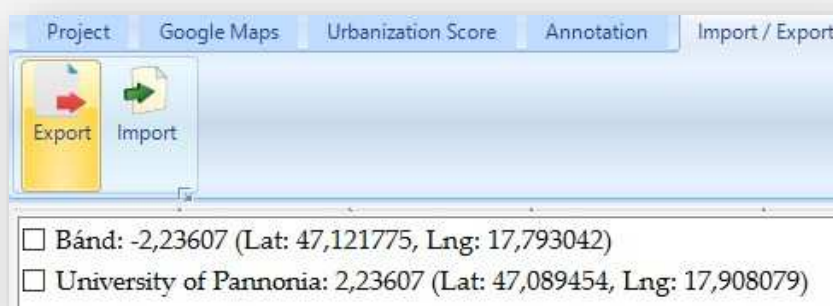
After manually correcting some of the image cell-scores (see '8. Improve results') now you can recalculate the urbanization scores by re-running the PCA. To do this just click on the 'Recalculate score' button in the 'Annotation' tab which will generate new urbanization scores for your images.



9. Import/Export

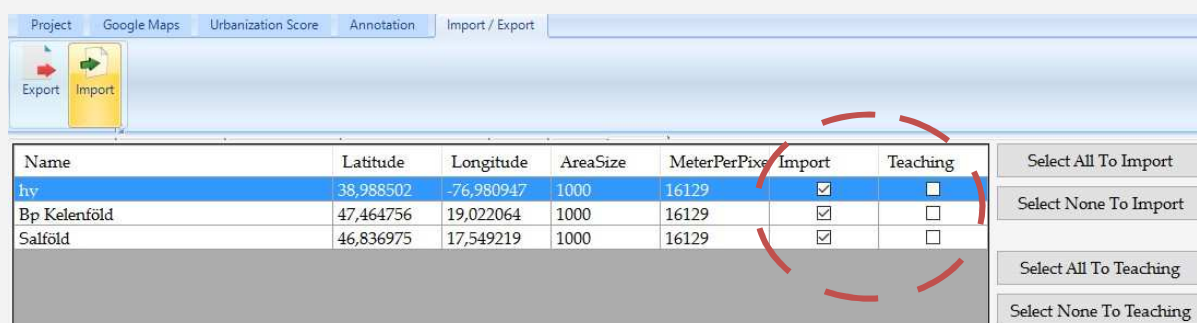
Export

After the program calculated the urbanization scores for your images, you can export these images into zip files, which makes it easy to use them in other projects and to share them with others. To do this, click on the 'Import/Export' tab and select 'Export'. Now you can see a list including all the images to which you have added training points and the software-generated cellscores. Use the checkbox to select the images you wish to export for later use or shearing, then click on 'Export selected locations', name your file (e.g. 'hungarian-urban-habitats.zip') and save it. This will create a zip file with all the exported images you have chosen; the 'Export succeeded' message will report you on the successful process.



Import

If you wish to use other images (e.g. from your former or shared project) in your current project or enhance the teaching dataset, you should go to the 'Import/Export' tab and select 'Import'. In the pop-up window browse and choose the zip file (containing the exported images you want to import to your project) and select 'Open'. Now you will see the list of the images (site names and coordinates) included in the zip file. By ticking the appropriate checkboxes you can either incorporate these images to your current project ('Import'), or just add them to your teaching dataset without using these images in your current project ('Teaching'), or both. When you are ready with this, click on the 'Import selected locations' button on the right bottom of the screen. If you have chosen to import at least one image, now it can be seen in your current project. You can use these images as any other images you added before.



Coming soon: up- and downloading, rating and browsing existing export files on our web page. On our web page, you can up- and download image sets, and share yours with other users. You can also rate or comment the available image sets and use them in your own projects.

10. Save image into the teaching set

You can add your own or shared by others, annotated images into the teaching dataset, hence improving future calculations. If there are special visual appearances of a land cover category in your images (e.g. unique building types), this step is particularly important.

References:

- Czúni, L., Lipovits, Á., & Seress, G. (2012). Estimation of urbanization using visual features of satellite images. Proceedings of the AGILE'2012 International Conference on Geographic Information Science, Avignon, April, 24-27, 2012, 233–238.
- Liker, A., Papp, Z., Bókony, V. & Lendvai, Á. Z. (2008). Lean birds in the city: body size and condition of house sparrows along the urbanization gradient. *Journal of Animal Ecology*, 77, 789–795.
- Seress, G., Lipovits, Á., Bókony, V. & Czúni, L. (2014). Quantifying the urban gradient: A practical method for broad measurements. *Landscape and Urban Planning*, 131, 42-50.
- For examples of case studies that applied the scoring method of Liker et al. (2008), see:**
- Bókony, V., Kulcsár A. & Liker, A. (2010). Does urbanization select for weak competitors in house sparrows? *Oikos*, 119, 437–444.
- Bókony, V., Seress, G., Nagy, Sz., Lendvai, Á., Z., & Liker, A. (2012). Multiple indices of body condition reveal no negative effect of urbanization in adult house sparrows. *Landscape and Urban Planning*, 104, 75–84.
- Bókony V., Kulcsár A., Tóth Z. and Liker A. (2012). Personality traits and behavioral syndromes in differently urbanized populations of house sparrows (*Passer domesticus*), *PLoS ONE*, 7, e36639. doi:10.1371/journal.pone.0036639.
- Zhang, S., Lei, F., Liu, S., Li, D., Chen, C., & Wang, P. (2011). Variation in baseline corticosterone levels of Tree Sparrow (*Passer montanus*) populations along an urban gradient in Beijing, China. *Journal of Ornithology*, 152, 801–806.
- Zhang, S., & Zheng, G. (2008). Effect of urbanization on the abundance and distribution of Tree Sparrows (*Passer montanus*) in Beijing. *Chinese Birds* 2010, 188–197.