Adapting to future climate through land use

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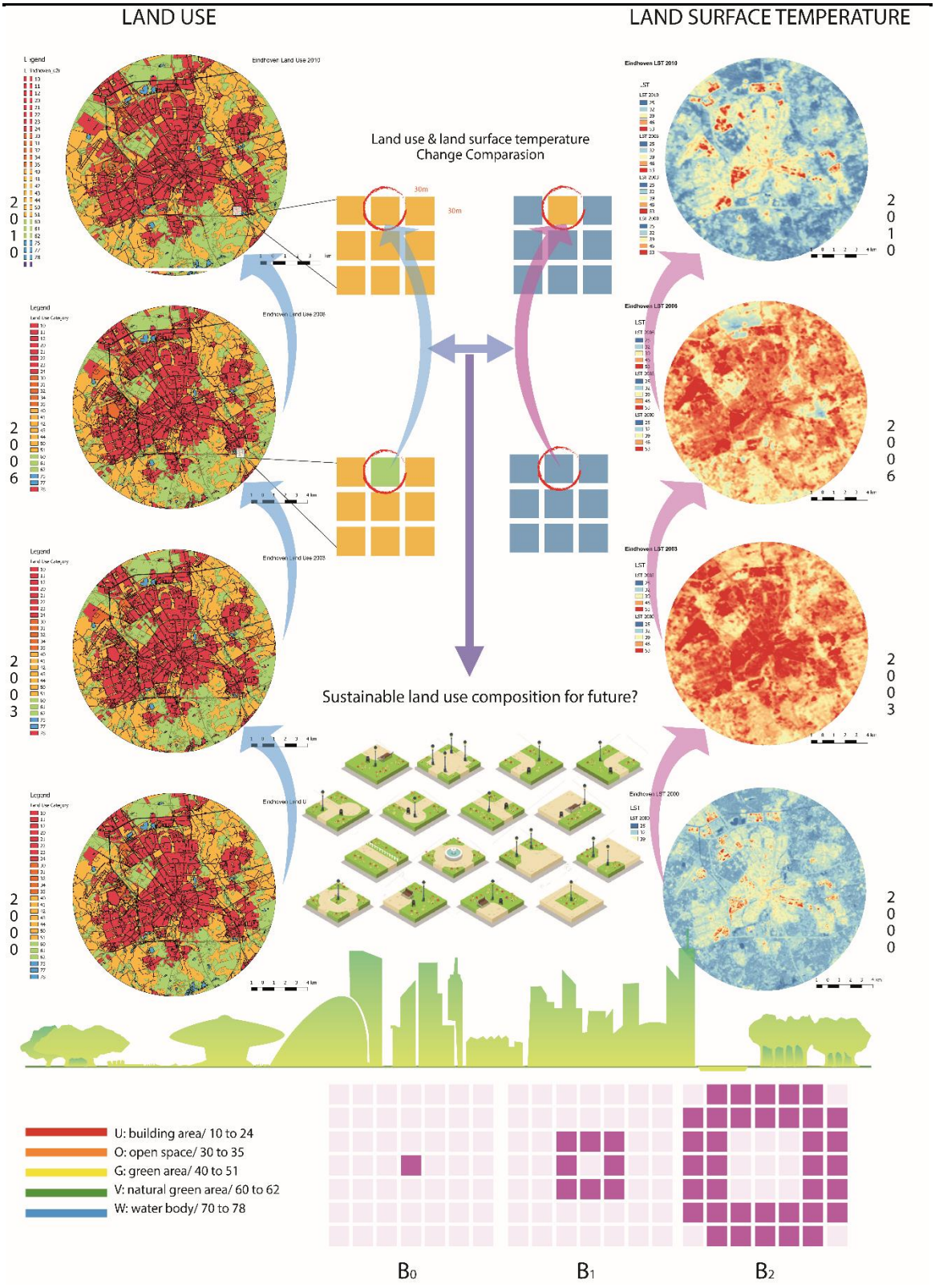

To adapt the urban area to the future climate and react to the global warming phenomenon, this project analyzed the dependency of land use and land surface temperature (LST) in Eindhoven area through 2000 to 2010. The goal is to achieve the Dutch government's target of COP22 and also reduce the two degrees increase mentioned in KNMI climate report. To help the local government plan the city in a more sustainable way, the land use data from DANS and LST data from USGS in the selected year 2000, 2006, 2006, and 2010 have been used. The dependency model investigate the land use and LST change in the same geolocation through the time. In the end, the best suggestion for future land use composition will be achieved.

Climate is changing our city and influencing our daily life significantly. The area of the built environment accounts for more than forty percent of the Eindhoven area, which is believed to have substantial contribution for the urban climate. Thus we consider it as an urgent and necessary task for us to deal with the climate change on the urban level. The relation between urban climate and land use is however not analyzed so far. This project is targeting to achieve the Dutch government's promise on COP22 as well as retard global warming and UHI effect in the Eindhoven city, the Netherlands. To investigate the relation of urban climate and urban morphology, a lot of parameters need to be probed in this spatial model, for instance land use category, land surface temperature (LST), air temperature, normalized difference vegetation index (NDVI), built-up ratio, population density, gross floor area, etc.

For the first stage of the project, the land use and land surface temperature (LST) has been applied to analyze the change in difference years. We acquired land use data from DANS and land surface temperature data from Landsat 5, Landsat 7, and Landsat 8. The geometric resolution of the image is 30 X 30 m, which has be assigned as the cell size in this project. The selected area is a circle of radius 9 km from the central point, Eindhoven train station. The study area covers around 250 km^2 which contains 278,607 cells.

The land use shapefile from DANS dataset originally contains twenty-six kinds of land use type. In this project, we categorized twenty-six into five kinds of land use type. The land use code "U" represents the built up area which contains the old code 10, 11, 12, 20, 21, 22, 23, and 24. The land use code "O" represents the open space area which contains the old code 30, 31, 32, 33, 34, and 35. The land use code "G" represents the artificial green area which contains the old code 40, 41, 42, 43, 44, 50, and 51. The land use code "V" represents the natural green area which contains the old code 60, 61, and 62. The land use code "W" represents the water area which contains the old code 70, 71, 72, 73, 74, 75, 76, 77, and 78. Among the study area, there are 40% of U (112229 cells), 36% of G (99731 cells), and following by 20% of V (56024 cells). The W and O cells only accounts for 1.6% (4490 cells) and 2,2% (6133 cells). The method of modifying data is clipping the study area from ArcGIS and the rasterized the shape file into the tiff file. The rule to determine how the cell has be assigned a value when mix land use falls within a cell is based on the maximum value of the attributes of the points within the cell. In other words, the land use category which occupies the largest area is dominant. Afterwards the rasterized map has been exported into csv file, and saved then modify inside excel based on its

specific GIS location. The same step has been taken for the LST data.

The LST and land use data from 2000, 2003, 2006, and 2010 have been provided for the temporal comparison. The dependency of LST on land use is the objective of analysis through the changes over time at the same GIS location. The cell which changes its land use type has be compared with the cells that remain the same. Moreover, this project provide a comprehensive analysis of influence between the central cell and the neighboring land use type. Both distance and different type of land use act as parameters. The above image illustrates the central cell (B_0), first ring of 8 neighboring cell (B_1), and second ring of the 36 neighboring cell (B_2). The LST is the dependent variable and land use is the independent variable. The analysis methodology we applied is the regression model from SPSS.

To conclude, the result shows that different kinds of land use types have different average LST within the year. Furthermore, the surrounding land use has positive impact on the central area´s LST. The correlation of land use and LST (r square) has increased while the amount of surrounding increasing. For the next step, we will use the findings here to conduct the exhaustive analysis between the years. Also the seasonal comparison between summer and winter will be interesting. In the future, the urban land use can be planned in the sustainable way by using the result from this research and hopefully the urban environment can be redesigned such that it can adapt the climate change.

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