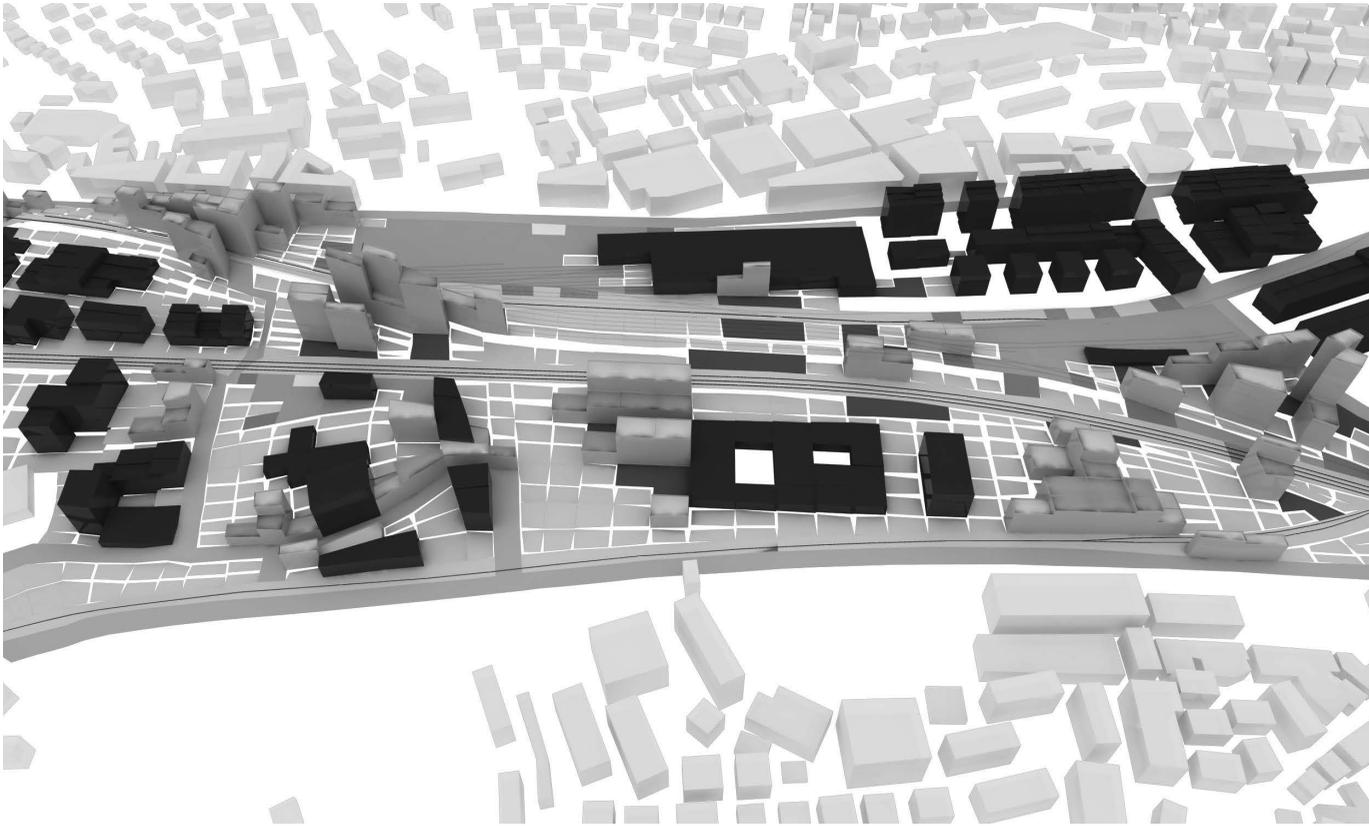


FOOD URBANISM: SCENARIO MODELING

Trevor Patt
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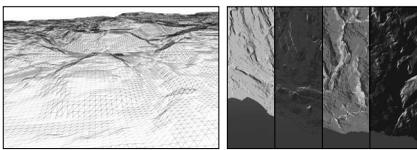
1 Rendered perspective of an urban scenario combining productive agricultural land with densification on the site of a former railway storage spur (Patt 2013)

This project comprises one facet of a cooperative research study, the Food Urbanism Initiative, which addresses the potential for productive urban landscape to play a generative role in the densification of the contemporary city, in Switzerland and elsewhere. The aspect of the project specifically presented here seeks to distill and synthesize design and logistical intelligence produced by partner teams into a computational workflow that automates the analysis of a complexly interrelated set of parameters to project scenarios for urban design that integrate increased residential density, professional and amateur agricultural land, and production space for secondary industries related to agriculture.

Because the partner teams are continually refining or producing new information in parallel with the development of this design engine, adaptability and flexibility are essential to the definition of the project.

Finally, generative urban modeling activates this information through the interrelationships of spatial and programmatic requirements of urbanity.

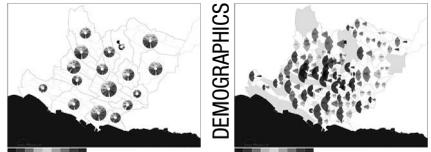
GEOGRAPHIC INFORMATION



Geographic maps focused on the very urban topography of the city of Lausanne revealed an elevation of 1000 meters was increased to 600 in order to reduce relatively shallow land from slopes too steep for efficient agricultural production (the left).

The topographic model was also used to calculate accurate solar exposure throughout the year. Shown here are heat measurements at 7:30, 11:30, and 1:30 on the 21st of June (see left).

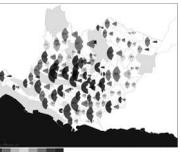
SURVEY



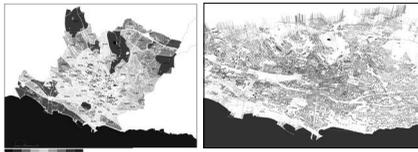
A public survey was conducted which asked a number of questions about the citizens' relationship to agriculture, produce, and their perception of the city and neighborhood. The responses were mapped geographically and as a composite value (representing attributes were related to the city quarters for accuracy). Shown here for left is a value which represents "Local Agriculture Ability", a hybrid value compiled from a number of variables. The result of each wedge represents the percent of respondents at each value from strongly opposed (blue) to strongly in favor (red).

Demographic data was available for each sector (in addition to the quartering from previous). The map represented here (see left) depicts age groups. At each sector the left wedge shows the percent of the population below 20 years of age, the right wedge those older than 65 years—the survey results showed a high correlation between age and attitudes toward urban agriculture.

DEMOGRAPHICS



BUILT ENVIRONMENT



Various aspects of the built environment were mapped about the morphology of the city that the urban design team could use to inform their design. The map shown here (see left) depicts the height of buildings. The left wedge shows the percent of the ground surface which is "tall", defined from under 20% in the center to over 50% at the height of the city perimeter (see left).

Another map showed the actual distance between the network nodes (see left) and revealed areas of high density (see left).

FOOD URBANISM SCENARIO MODELING

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PROJECT SUMMARY:
This project is one facet of a comprehensive research study, the Food Urbanism Initiative (FUI), addressing the potential for productive urban landscapes to play a generative role in the diversification of the contemporary city in Switzerland and elsewhere. The project specifically presented here seeks to distill and synthesize design and regional intelligence produced by partner teams into a computational workflow that automates the analysis of a complex interrelated set of parameters:

- geographic information
- solar exposure
- demographic data
- population density
- the layout and condition of the existing built context
- green
- public green space
- existing urban infrastructure
- new urban typologies

→ project scenarios for urban design which integrate increased residential density, professional and amateur agricultural land, and production space for secondary industries related to agriculture.

CRITICAL CARTOGRAPHY
The scope of this study at the scale of the city of the entire city of Lausanne was limited with a three-dimensional parametric modeling software, which enabled efficient spatial analysis and cross-referencing of data within an integrated workflow (see below). The new data was processed for multiple file formats and platforms and linked spatial definition making it difficult for the research team to assess potential sites for their suitability to urban agriculture.

The validation of this data into a single parametric model allowed the quick production of dozens of alternative and analytical maps which were shared within the research team. Of particular interest was the identification of large open areas, which might be capable of supporting a professional-scale farm. Some of the city whose adjacent population viewed urban agriculture favorably and expressed an interest in participating in gardening initiatives. Locations which lacked nearby public green space, and locations of the city characterized by professional and retail infrastructure. The left is the selection of high-value agricultural sites, which is detailed on the next page.

Raw geographic data was imported from GeoServer and was converted from GIS to files using the MATLAB, vml, and custom written VMLNET tools.

A public opinion survey was conducted by the partner team at EPFL and the results were compared with demographic information from GeoServer to map attributes which shaped attitudes toward urban agriculture within the city and toward the formation and emergence of the city.

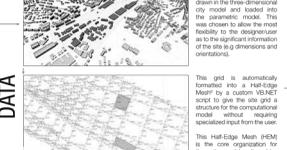
Further maps were produced through analysis of the spatial and morphological aspects of the city, especially relating to density, open space, and accessibility. Much of this data—such as street and rail networks, building footprints and heights—was also supplied by GeoServer, converted and imported to a similar manner to the geographic information.

FUI is supported by various Swiss Agencies (Government) and includes teams from Agroscope, Ag-Environmental Economics, Swiss, ETH-Zürich, Architecture, Urban Design, Media & Design Lab, EPFL, Lausanne, FUI is funded under National Research Priority Program by Swiss State Secretariat for Education, Research and Innovation. www.epfl.ch/research/fui/

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DATA

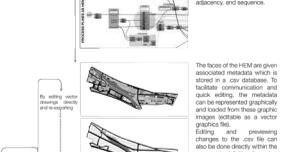


A grid of these as well as some significant points of access and terrain in the three-dimensional city model and loaded into the geographic model. This was chosen to allow the most flexible use of the geographic information in a 3D environment.

This grid is automatically formatted into a Half-Edge Mesh¹ by a custom VMLNET script to give the grid a structure for the computational model without requiring specialized input from the user.

This Half-Edge Mesh (HEM) is the core organization for the entire model as it enables quick querying of location, adjacency, and sequence.

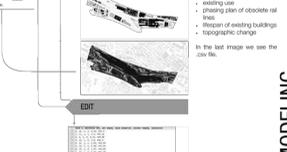
MODELING



The basis of this model are given associated metadata which is filtered in our database. To facilitate communication and search within the model, design parameters can be represented graphically and linked from their graphic images (visible as a vector graphic) to the model.

Editing and presenting changes to the city file can also be done directly within the parametric interface through a custom interface.

EDIT



Shown here from top to bottom are the metadata changes for new buildings, the placement of building footprints, the placement of building heights, and topographic change.

In the last stage we see the city file.

CONCLUSIONS AND FURTHER WORK

As a tool for integrating diverse research strands and representing them in a comprehensible, unified way, this tool has been quite successful. It has also proven extremely capable of generating multiple variations of design scenarios in the urban design process, the "New Urban Quality Matrix". Despite the subjective quality of a number of these criteria, it is deemed to incorporate this assessment tool within the computational model in a way that provided further insight to the differences between the many possible variations. As these assessments become more clear, further integration into the decision-making space would also be beneficial to limiting the search field for solutions which are "tuned" to particular situations—such as changes to planning policy, or the release of a new city planning document, for example.

Finally, developing the architectural and landscape quality with some particular details would strengthen the claim that an integrated, data-driven process is capable of sensitively addressing multiple scales simultaneously while also increasing the value of the model as a visualization tool for decreasing the number of alternatives which need to be explored to properly describe the result.

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