Understanding the Effect of Political History on Urban Growth: Cellular Automata Modeling Approach

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Abstract

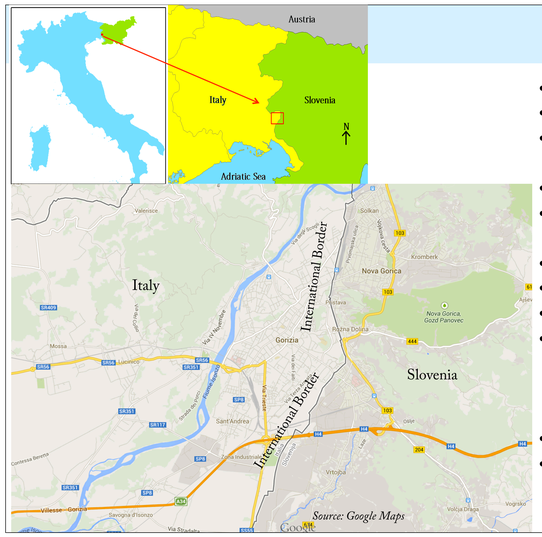
This study examines the impact of land use policy variations on urban growth in a transborder region. Analysis was conducted using multi-temporal maps and satellite imagery for the adjacent cities of Gorizia, Italy, and Nova Gorica, Slovenia, twin towns historically trapped on a political border, a line that has changed in its degree of separation from extreme during the Cold War to minimal today. The SLEUTH land use change model is calibrated and used for forecasting land use change from 2005 to 2040. The model is run under three different scenarios, once for the whole area and twice independently for the two sides of the border, allowing a comparison of the resulting differences. The validation of the results shows that both the cities are growing independently and that territorial cohesion has no impact on change in land use pattern of the region. To plan for a sustainable future, it is invaluable to be able to successfully demonstrate policy impacts via computer modeling, simulation, and visualization and to use the forecasts within decision and planning support systems.

Introduction

- Simulate policy effects on urban growth via CA model
- Border represents a transitional zone, a region of flow and connection between two socio-economic systems
- Policy is broadly defined as the combination of the political decisions, political history and situations which have directly affected the land use and socio-economic activities on the both sides of the border
- Policy makers are the land managers and political leaders who affect how land is used at this very local level (Reid et al. 2006)

Objective

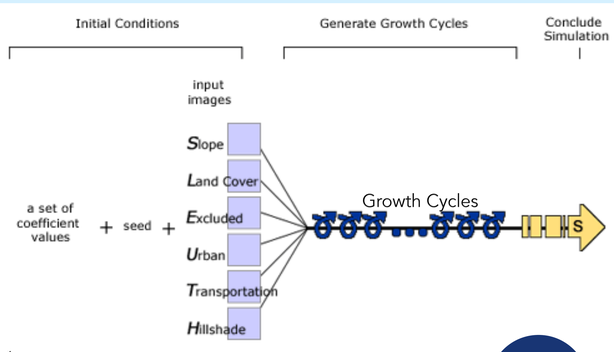
Evaluate impact of political history on the pattern of urban growth

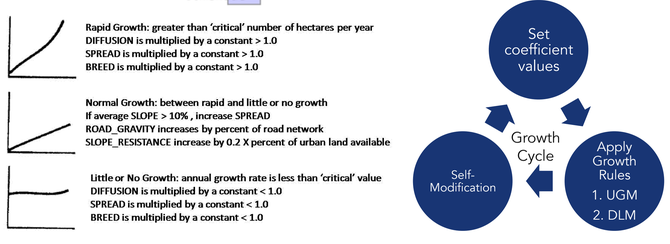


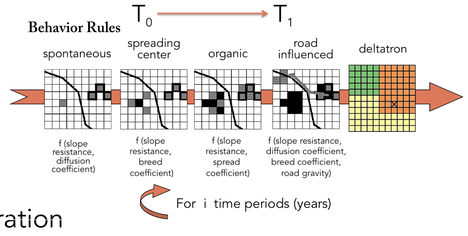
Study Area

- Initially under the Austro-Hungarian empire
- 1915 – Taken over by Italy
- 1943 – 1945 – Taken over by Germany. Completely destroyed and rebuilt during World War II
- 1945 – 1947 – Acquired by Yugoslavia
- 1947 – Old city of Gorizia was divided and western part of the city went back to Italy and eastern portion remained in Yugoslavia (Nova Gorica)
- 1992 - Became part of Slovenia after partition of Yugoslavia
- 2004 - Slovenia became part of EU
- 2007 – Slovenia became part of Eurozone
- Number of local and regional EU border integration policies were implemented to foster agglomerated urban growth in the region
  - INTERREG III (European Inter-regional Territorial Cohesion Policy)
  - Spatial Developmental Strategy of Slovenia (CEMAT Report, 2010)
- Border regions pose different characteristics compared with the parent nation.
- It represents a transitional zone, a region of flow and connection between two socio-economic systems

Method



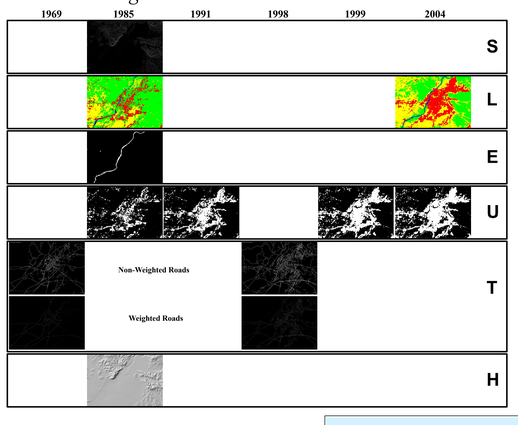




Calibration

- Most essential element to ensures realism
- 'Brute force calibration' - Phased exploration of parameter space using Monte Carlo method
- Start with coarse parameter steps and coarsened spatial data
- Step to finer and finer data as calibration proceeds
- Tests sensitivity and generate 'best-fit' parameters

- Tightly coupled Clarke's Urban Growth Model and Deltatron Land Use Change model
- "Train" the model to simulate historic patterns of development using historical data
- Generate 'best-fit' parameters (dispersion; breed; spread; slope; road gravity), which closely capture the past trend
- Forecast future urban growth



Scenario Development

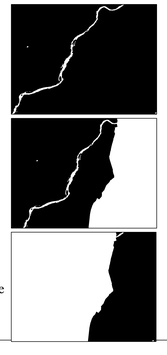
Scenario 1: Whole area available for development excluding water bodies = Situation after border eradication

If predicted maps closely matches Scenario 1, EU integration policies are successful

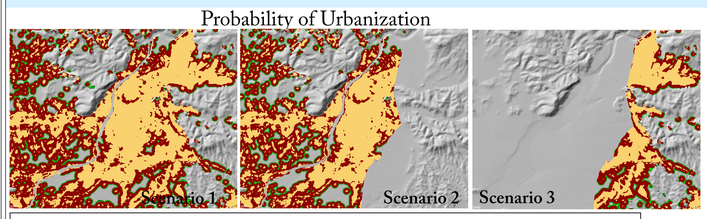
Scenario 2: Only Gorizia available for development excluding water bodies = Situation before border eradication

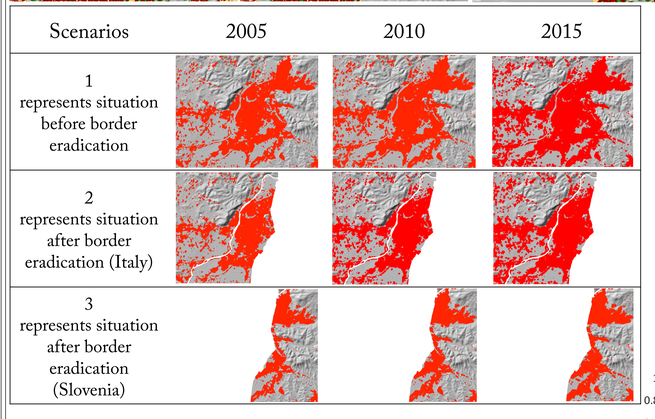
If predicted maps closely matches Scenario 1 and 2, EU integration policies are unsuccessful

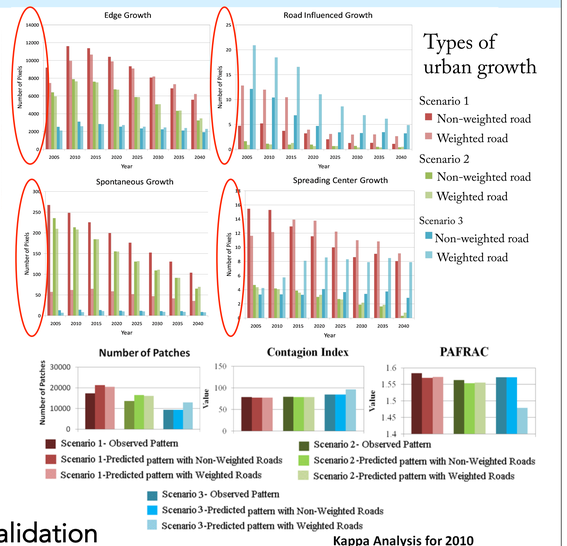
Scenario 3: Only Nova Gorizia is available to development excluding water bodies = Situation before border eradication



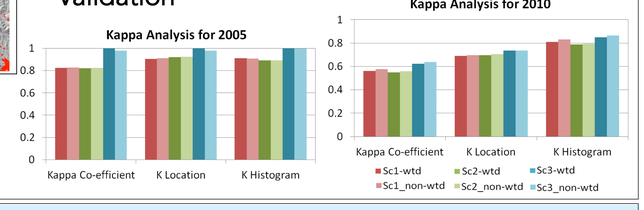
Result







Validation



Conclusion

- At the local level there are no significant differences between urban growth with weighted roads and non-weighted roads
- Scenario 3 is more accurate than Scenario 2 and 1 → Urban growth in Nova Gorica hasn't been affected by eradication of the border, it still retains its dispersed pattern of growth
- Scenario 2 and 1 have almost same level of accuracy → Border eradication is not going to affect urban growth in Gorizia
- EU and local territorial cohesion integration policies haven't been successful in fostering an integrated regional urban growth in the region
- Change on both the sides of the border are not identical

Selected References

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- *INTERREG (http://www.interreg3c.net/sixcms/detail.php?id=310)*
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