Uncertainty in the difference between maps of future land change scenarios

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Major Points

1. We compare two approaches to account for the uncertainty in land change scenario maps.
2. One approach places simple bounds on the possible spatial allocation, given the quantity of each transition.
3. The second approach uses validation to estimate uncertainty.
4. We prefer the first simpler approach for practical and theoretical reasons.

Plum Island Ecosystems (PIE) in northeastern Massachusetts

Land Change in the Ipswich River Watershed

Plum Island Ecosystems - Anderson Landcover 1971

0 5 10
Kilometers

Plum Island Ecosystems - Anderson Landcover 1985

— Watershed Boundary

Urban

Agriculture

Range

Forest

Water

Wetland

Barren

0 5 10 Kilometers

Plum Island Ecosystems - Anderson Landcover 1991

— Watershed Boundary

Urban

Agriculture

Range

Forest

Water

Wetland

Barren

0 5 10 Kilometers

Plum Island Ecosystems - Anderson Landcover 1999

— Watershed Boundary

Urban

Agriculture

Range

Forest

Water

Wetland

Barren

0 5 10 Kilometers

Logic of Analysis

Logic of Analysis

Storyline's Quantity of Transitions

Business As Usual

Alternative

Raw Scenario Maps

Difference Between Raw Scenario Maps

Raw Scenario Maps

How much difference can the spatial allocation make, given the storyline's constraint on the quantity of each transition?

Bounds on Difference Between Scenario Maps

Accuracy Estimated by Validation

Raw versus Estimated Maps

Estimated Difference Between Scenario Maps

Conclusions and Future Directions

1. The method of estimation of uncertainty by validation has severe practical and theoretical problems.
2. It makes little sense to calibrate and validate a business as usual scenario when past and future business is not usual.
3. We recommend the simpler method that separates the variation due to the scenario storylines from the variation due to the simulation model.

Plugs & References

Send us your stellar undergraduates for a summer research experience.

Visit www.clarku.edu/~rpontius or write to Gil at rpontius@clarku.edu to obtain the following:

1. Pontius and Neeti. In press. Uncertainty in the difference between maps of future land change scenarios. Sustainability Science.
2. Pontius, Versluis and Malizia. 2006. Visualizing certainty of extrapolations from models of land change. Landscape Ecology 21(7): 1151-1166.
3. Pontius, Boersma, Castella, Clarke, de Nijs, Dietzel, Duan, Fotsing, Goldstein, Kok, Koomen, Lippitt, McConnell, Mohd Sood, Pijanowski, Pithadia, Sweeney, Trung, Veldkamp, and Verburg. 2008. Comparing the input, output, and validation maps for several models of land change. Annals of Regional Science, 42(1): 11-47.

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