Hierarchical Investigation of Socioeconomic Drivers of Decadal Scale Land-Cover Changes in the Upper Midwest

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Introduction

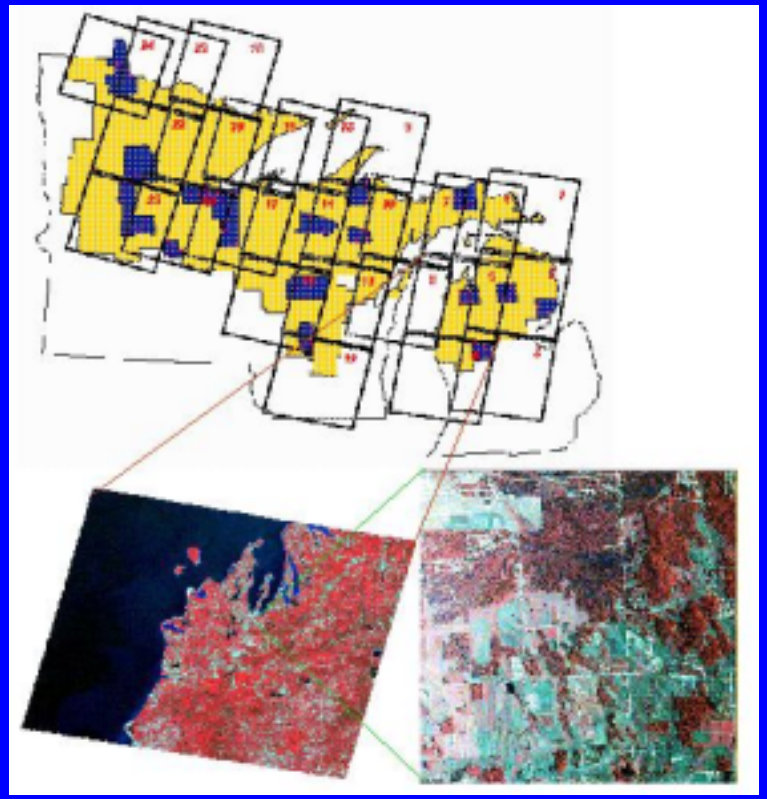
RESEARCH QUESTIONS

- How can we observe and model changes in land use and land cover and their spatial patterns on a regional scale?
- What regional and local factors are driving spatial pattern of land use change?
- How is land use change affecting the amount and quality of forest cover in the region?
  - has implications for ecosystem health, forest resource production, carbon sequestration

APPROACH

- A combination of satellite imagery & aerial photography for observation and GIS-based spatial and statistical modeling.

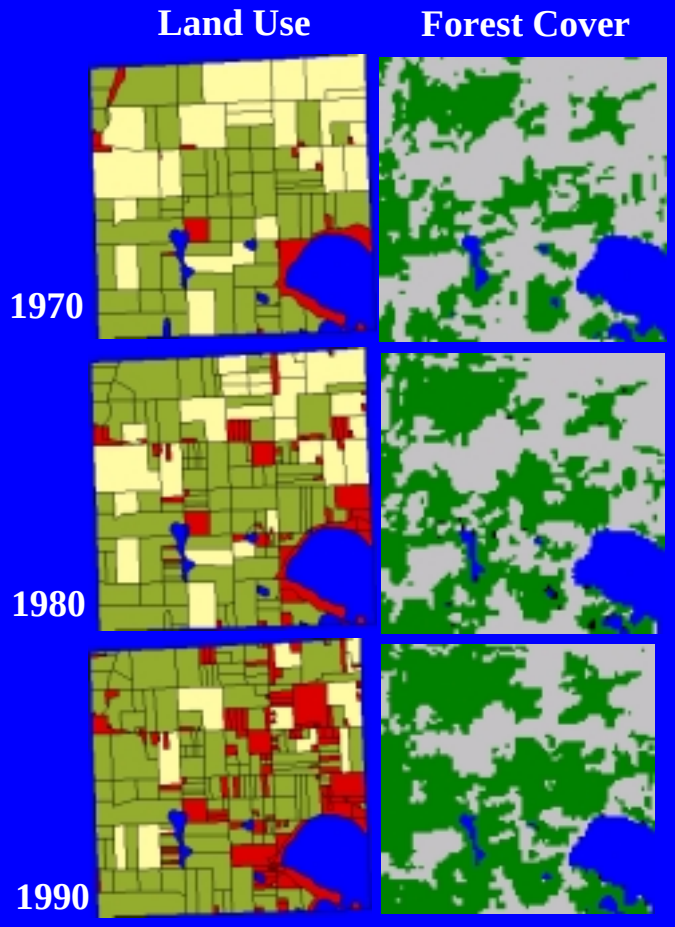
ILLUSTRATION OF THE DATA. Our project created three-date maps of forest cover regionally, using the NALC data set, and land use within 136 sample sites (2500 ha), using aerial photography and digitized parcel maps.



Results

- Average increase in forest cover for our 136 sample sites was 17 % per decade, driven by ag. abandonment at an average rate of about 10 % by area per decade. Development, affecting an average of 30 % by area per decade, tended to increase forest clearing and dampen regrowth.
- We developed methods to estimate uncertainty in metrics of changing forest amount and pattern; global metrics tend to be more uncertain.
- We developed a two-step modeling process: (1) land use change as a function of exogenous drivers & (2) forest cover change as a stochastic simulation conditioned on land use change.
- Future steps include adding temporal depth to our data base, to improve our description of process, and incrementally refining the models.

CHANGE OCCURRING AT ONE SAMPLE SITE. Three land use classes: developed (red), undeveloped (green), and agriculture (yellow). Two cover classes: forest (green), not forest (gray).



Conclusions

- Forest cover increase in the Upper Midwest was real and should result in increased carbon sequestration, because it was replacing, mostly, pastures and croplands.
- The increase in forest cover was due, largely, to the abandonment of marginal agricultural lands as the farm economy has declined, a decline that could slow as marginal farmlands are removed from production and agriculture becomes more specialized. A significant lag effect was observed between abandonment and regrowth.
- A countervailing trend was extensive dispersed rural development in the region. This development was driven by demand for recreation and retirement destinations as well as for seasonal homes.
- To effectively map and model land use and land cover change in this region we required an approach that treated land use change, at the parcel level, and cover change, at the pixel level, as separate but linked processes.

PRESENTATIONS

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- Brown, D.G., Pijanowski, B.C., Savage, S.E. In Preparation. Effects of land-use change on forest-cover in the Upper Midwest at the parcel scale.