Three threads to applied research in ecological economics:

•What is the effect of the Vilas County Lake Classification scheme (VLC) on lakeshore property values?

•What factors explain differential rates of development on Vilas County lakes?

•Is there a "Tragedy of the Partially-Regulated Commons" on private lakes?

Research Issue 1: Applying Economic Analysis to the Vilas County Lake Classification (VLC): Is the overall effect of the VLC positive or negative?*

VLC took effect in June 1999:

- Develops several bundles of zoning restrictions; restrictions vary according to existing development and the lake's ecological sensitivity;

- Restrictions can be relaxed for a property if the property owner accumulates sufficient mitigation points

- More restrictive town ordinances remain in effect

Theory underpinning the work:

- A negative development effect

- A positive amenity effect

Matrix of lake classes:

	Low Sensitivity	Medium Sensitivity	High Sensitivity
Low Density			
Medium Density			
High Density			

Analysis strategy: obtain data on lakefront properties sold from 1997-2001, and use this data in a statistical analysis of the sale price of properties.

Using property and neighborhood characteristics to "explain" property prices is a standard technique of analysis called "Hedonic Valuation"…it is essentially a rigorous version of what assessors do all the time.

Estimation Challenges:

• Obtaining data on improvements to properties

• Determining the "correct" measure of development

• Omitted variable bias associated with development

• Correctly interpreting estimation results (the "no effect" paradox in empirical hedonic studies of zoning)

From the Wisconsin Department of Revenue we obtained the sale price of 1088 lakefront properties sold in Vilas County during the period 1997-2001. The factors we used to explain the sale price included the following:

Factors used to explain property prices:

Assessed value of structural improvements, indexed by assessor

Year of Sale

Lot acreage

Lot frontage

Distance to the nearest major town (Minocqua-Woodruff or Eagle River)

Lake area
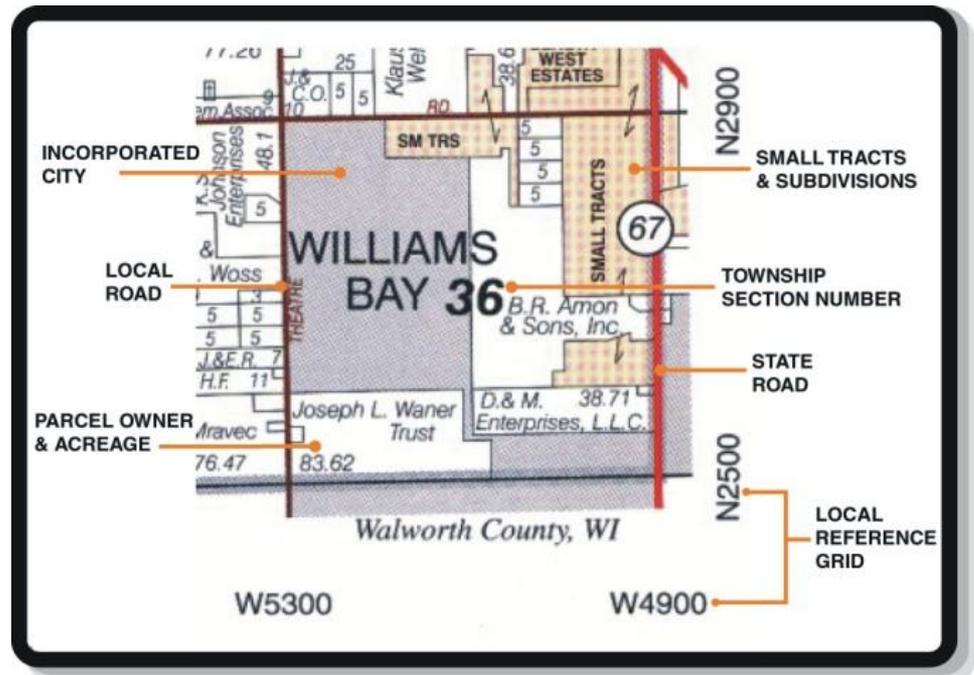
Secchi depth

Mercury warning

Ecological Sensitivity Index

Public access to lake

Factors used to explain property prices, con't:

Factors indexing the current state of development on the lake, in particular, the proportion of the lake in each of the following categories, as defined by commercial plat maps developed by Rockford Map Publishing, Inc.:

• Public

• Tribal

• Private large tracts

• Private small tracts

INCORPORATED CITY

SMALL TRACTS & SUBDIVISIONS

LOCAL ROAD

TOWNSHIP SECTION NUMBER

PARCEL OWNER & ACREAGE

STATE ROAD

LOCAL REFERENCE GRID

WILLIAMS BAY **36**

WEST ESTATES

SM TRS

SMALL TRACTS

67

B.R. Amon & Sons, Inc.

Joseph L. Waner Trust

D. & M. Enterprises, L.L.C.

Walworth County, WI

N2900

N2500

W5300

W4900

76.47

83.62

38.71

Factors used to explain property prices, con't:

Zoning factors**:**

Interaction term 1: Involves the Minimum Frontage Above the State Minimum (MFASM) and the proportion of private land in large tracts;

Interaction term 2: Involves Interaction term 1 and a dummy variable for properties sold post-VLC;

Interaction term 3: Involves Interaction term 2 and the DNR's sensitivity index;

Interaction term 4: Involves MFASM and a dummy variable indicating that the property is undeveloped

Analysis Results:

The analysis explains roughly 75% of the variation in property prices; 25% remains attributable to "unobserved" factors

Results indicate that in general, lakefront zoning raises the value of lakefront property, including the value of unimproved property.

Research Issue 2: What factors explain differential rates of development on Vilas County lakes? To what extent is this a matter of heterogeneity in lake physical/ecological attributes, heterogeneity in the effects of these attributes, and/or unobserved state dependence (Heckaman, Keane)?

Related work:

Obert Master's thesis (2002) constructs a statistical model of the proportion of private shoreline in small tracts (vs. large tracts). Explanatory factors include the size of the lake, distance from the nearest town, distance from the southernmost point of highway 51, proportion of the lakeshore in public land, proportion of the lake in tribal land, presence of public access, water color, zoning restrictions, and other variables.

Data collected for 150 lakes, 1959-2001.

Let **z** denote a vector of time-specific variables, let **x** denote a vector of lake-specific variables. The proportion of a lake's private shoreline in small tracts at time t:

$$p_{kt} = p_{k,t-1} \cdot h\left(\mathbf{z}_t;\delta_t\right) + \left(1 - p_{k,t-1}\right) \cdot \left(\frac{\exp\left(f\left(\mathbf{x}_{kt},\mathbf{z}_t;\beta_t\right) + \varepsilon_{kt}\right)}{1 + \exp\left(f\left(\mathbf{x}_{kt},\mathbf{z}_t;\beta_t\right) + \varepsilon_{kt}\right)} \right)$$

Issues with this past work:

•Form of the model is highly reduced;

•Presumes no heterogeneity across lakes and no heterogeneity within a lake;

•Agglomeration vs. repellent effects of development

•Using the model to address long-run vs. short-run effects of policies that constrain development;

•From the analyst's perspective conversion of a parcel on a lake is independent over time and across parcels

•Statistical issue: serially correlated errors are correlated with lagged dependent variables in likelihood function, suggesting coefficient estimates are biased. How to circumvent this problem (what instrument should be used)?

Building heterogeneity into the model of lakeshore development:

•Latent class analysis in which the parameters explaining the conversion of shoreline to small tracts presumably are drawn from distinct groups, each group defining a different type of lake…"Development regimes". Group membership is probabilistic, and dependent on observable characteristics

•State dependence in which we hypothesize the existence of an unobserved state variable affecting shoreline conversion and use the data to estimate initial state values and state transitions (e.g. Heckman, Keane).

•Combining these two approaches…

•How to account for heterogeneity on a given lake?

Research Issue 3: Is there a "Tragedy of the Partially Regulated Commons" on private, shared lakes?

- Are lake associations an effective instrument for avoiding environmental degradation?

- Are private lakes in better ecological condition than public, regulated open access lakes?

- What factors affect deterioration on public vs. private lakes?

- Are shoreline owners on private lakes fundamentally different from those on public lakes?

Broad policy relevance of the questions…

Immediate policy relevance of the questions…

Study design:

Develop pairs of lakes (one private, one public) with similar physical features, e.g. size, amount of shoreline, landscape position, ecological sensitivity.

Public lakes in each pair are drawn from those for which we already have good ecological data;

Obtain access to a number of private lakes to gather ecological data –**what ecological data can/should be obtained?**

Study design, con't

Obtain socioeconomic data for the lakes: survey of lake associations, survey of residents

important information to be obtained from surveys of lake associations: activities and genesis

important information to be obtained from surveys of residents: permanent vs. seasonal resident, motivations for ownership, days per season the property is rented out, tenure length, interaction with other shoreline owners.

Statistical analysis to jointly explain (a) ecological degradation as an outcome of lake characteristics, current level of development, development policies, type of lake (public vs. private), etc. (b) development level as a function of lake characteristics, type of lake (public vs. private), ecological degradation, etc.

$$E_{1n} = f_1(x, Z, D) + \varepsilon_1$$

$$E_{2n} = f_2(x, Z, D) + \varepsilon_2$$

$$D = g(E_{1n}, E_{2n}, x, Z, y) + \gamma$$

$$Z = ?$$

Questions to be addressed:

Conceptual question of the degree of open access;

Practical question: how many public and private lakes in the sample?

Practical question: getting access to private lakes;

Practical question: public lakes for which we have good data;

Practical question about the ecological data to collect: water quality and shoreline buffers seem cheap to get (can be obtained remotely) …but what about lake data? Can we obtain the data from surveys of residents?