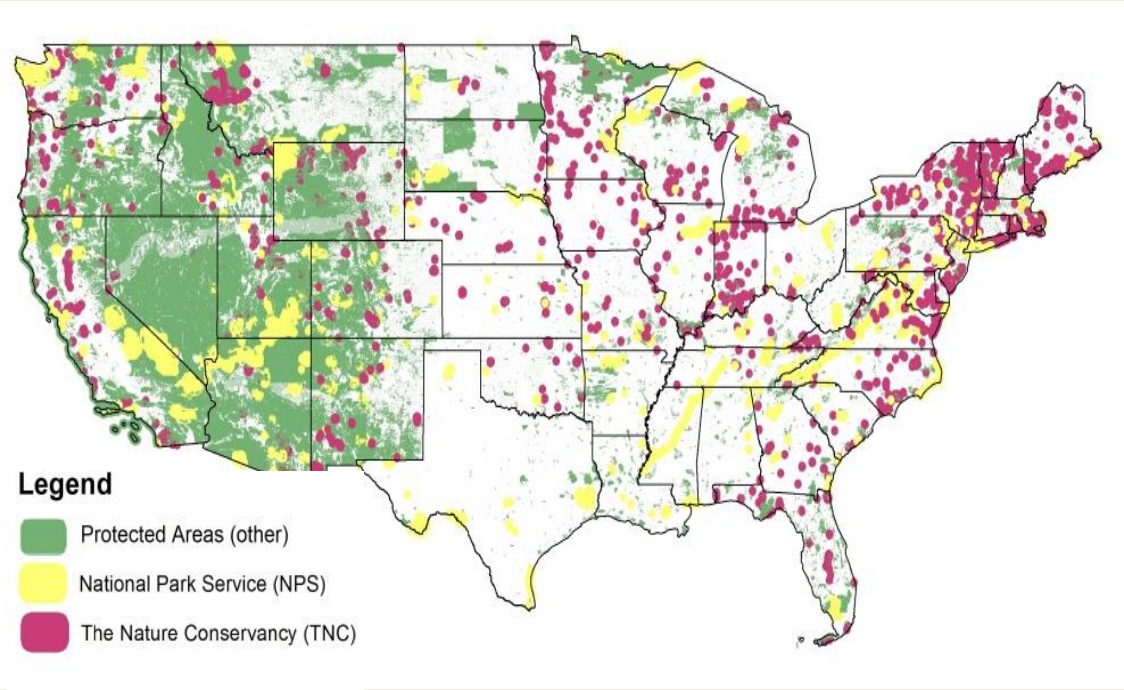
ACCURATE ACQUISITION COST PREDICTION FOR OPTIMAL RESERVE PLANNING

And more specifically today:

Purchase price, Reserve selection and Bargain Sales

Protected Areas

Conservation costs in the U.S.



- Lack of data

(use of proxies)

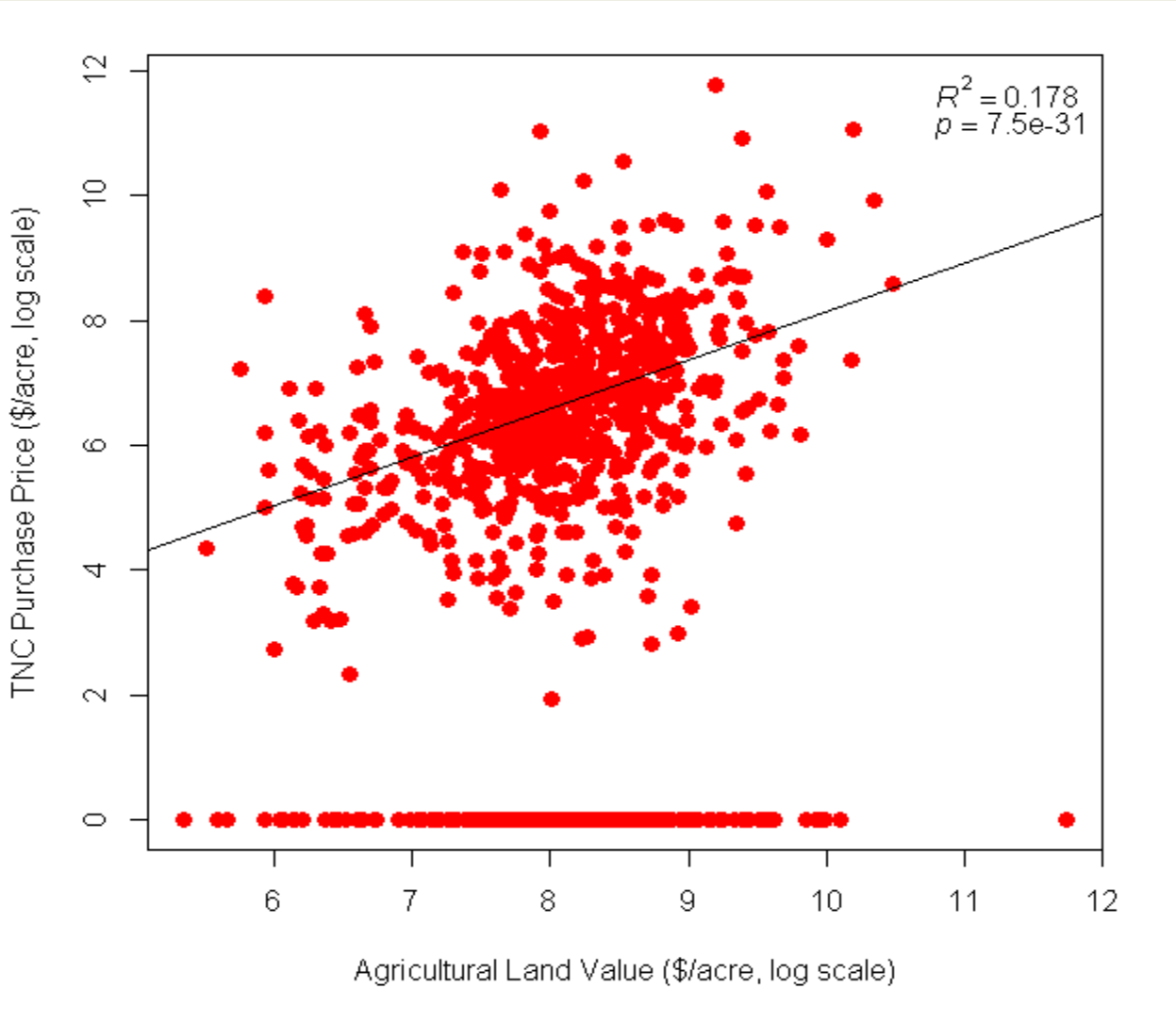
- Spatial aggregation

(and grain discrepancy)

Protected Areas

Agricultural land value

How wrong could we be?



Actual purchase price of areas acquired by TNC against average agricultural land value in their county (USDA NASS data)

How wrong could we be?

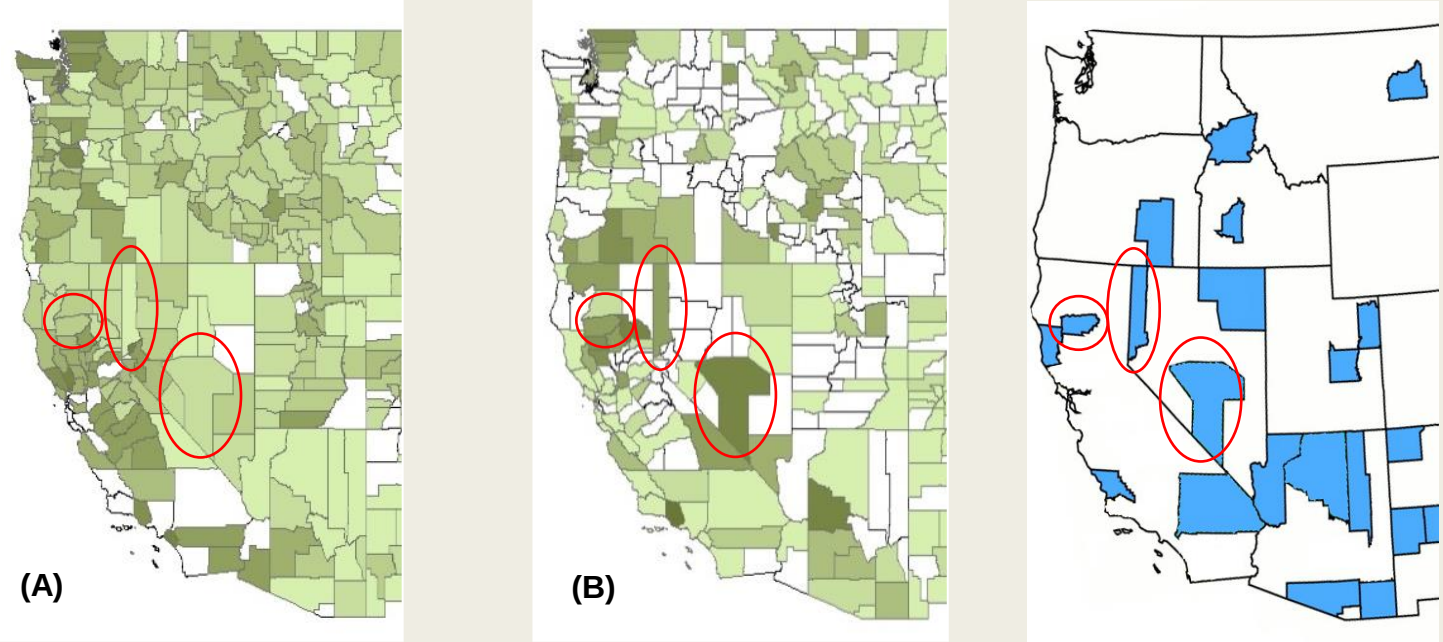
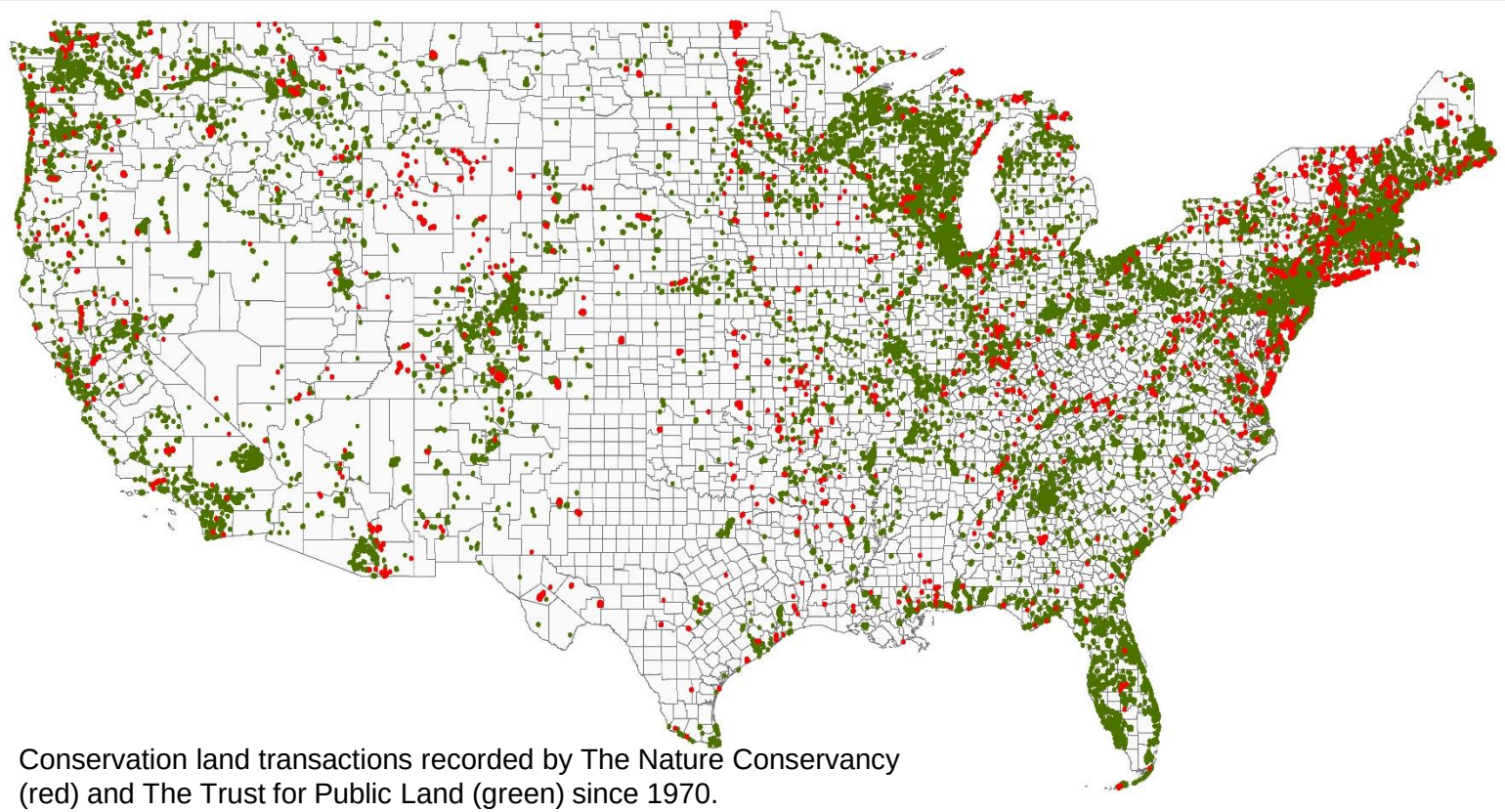


Figure 3: (A) Agricultural land value at county level, as per USDA census data. (B) Actual acquisition cost paid by TNC at county level and over the last 40 years. (C) From Ando et al. 1998. Selected sites for coverage of 453 ESA-protected species in the US while minimizing total acquisition costs.

Ando, 1998 (Science)

Data



Conservation land transactions recorded by The Nature Conservancy (red) and The Trust for Public Land (green) since 1970.

- The Nature Conservancy
- The conservation Almanac (Trust for Public Land)

= 42,000 transactions

Generalized Linear Model

- GLM of the form $g(cos\,ts) = \alpha + \beta * X + \lambda\varepsilon + \nu$

g a suitable link function
X a vector of covariates including variables described above
β a vector of coefficients to be estimated
accounts for a variety of spatially lagged error structures ($\lambda\varepsilon + \nu$)

- Topology, ecology at site level:
  - *site area*
  - *rugosity*
  - *habitat type*
  - *density of other protected areas*

- Socio-economic data at county level
  - *agricultural land value*
  - *county income and poverty estimates*
  - *education*

Maximum Coverage Problem

GOAL : selecting a subset of areas A'

- *among all possible areas* $\mathcal{A} = \{A_1; A_2; \dots A_m\}$
- *which have associated costs* $\{c_i\}_{i=1}^{m}$
- *are defined over a domain of elements* $\mathcal{E} = \{e_1; e_2; \dots e_n\}$ *(target species)*

The contribution of a site i *to the regional persistence of a species* j *is* $\{p_{i,j}\}_{i \in [1,m]; j \in [1,n]}$

(generalized MCP)

The overall budget available is $\mathcal{C}$

Writing the MCP : $\max_{x_j} \sum_{j=0}^{n} \sum_{i=0}^{m} (p_{i,j} * x_{i,j})$ with $x_{i,j} \in \{0; 1\}$

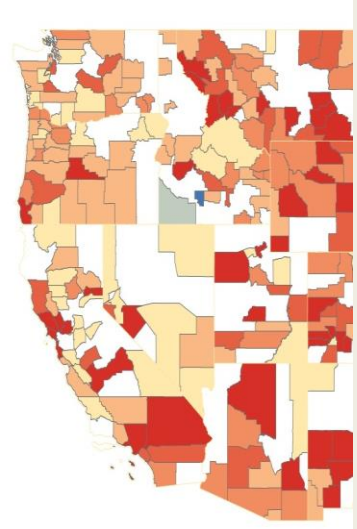
($x_{i,j}$=*1* if attribute e_j is covered by the selection of are A_i)

Subject to: $\sum_{i=0}^{m} (c_i * y_i) \leq \mathcal{C}$ budget constraint, with $y_i \in \{0; 1\}$

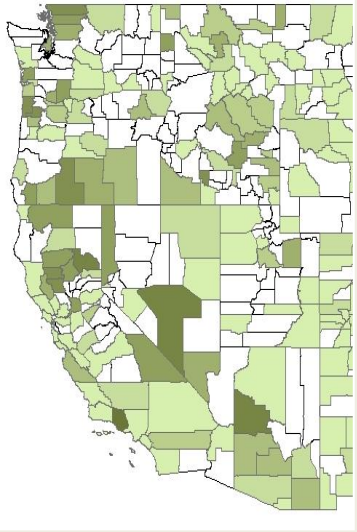
(y_i=*1 if area* A_i *is selected)*

$\sum_{i:\, e_j \in A_i} y_i \geq x_{i,j}$ coverage constraint

What are bargain sales?



Bargain Sales



Actual acquisition costs
TNC Database

Conservation dollars in the form of land donation or land sold at a bargain price for conservation

Donated fraction:

$$DF = \frac{FMV - Purchase.Price}{FMV}$$

Generalized Linear Model

In addition to the variables used in predicting actual conservation costs, additional variables such as

- *county income*
- *number of dependents*
- *population density (rurality)*
- *education level*
- *political alignment*

➢ Predicting the occurrence of a bargain sale and predicting the magnitude of the bargain

Questions

Opportunity concept:

- How do bargain sales, philanthropic donations and democracy investments covary?
- What would be an optimal blend of strategies for an organization such as TNC when starting a fundraising campaign in order to acquire a particular area?

Thanks!

CONTACT:
Diane Le Bouille
PhD Candidate
dlebouille@utk.edu

With the help of the Nature Conservancy

Head office staff:
Melissa Clark Joe Fargione Thomas Minney

State chapter land managers:

Chuck Byrd	Corey Giles
Malcolm Hodges	Kristen Austin
Chris Minor	Marek Smith
Deborah Barber	Sam Lindblom
Megan Sutton	Braven Beaty
Elizabeth Johnson	Mike Powell

Armsworth Lab
https://www.armsworthlab.com

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