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Game Theory and Computational Economics in the Environment

Applications and Research

About Me

- ❖ Background
- ❖ Research Interests

Useful Frameworks for Studying Behavior

- ❖ Game Theory
- ❖ Computational Economics / Evolutionary Game Theory

Thinking In Games

- ❖ What is a game?
 - ❖ Players, Information + Actions, Payoffs
- ❖ What is Game Theory?
- ❖ How is it useful to recognize and evaluate interactions as games?

My Work in Game Theory

- ❖ Addressing the Traveler's Dilemma Paradox
- ❖ Understanding Rural Opposition to the Reintroduction of Wolves

Background

- ❖ Eastern Red Wolves
 - ❖ Indigenous to the southeast
 - ❖ Federally Protected Species
 - ❖ Reintroduction is Mandated by Federal Court
- ❖ Grey Wolves
 - ❖ Reintroduction Heavily Supported in Urban Communities / Heavily Opposed in Rural Communities
- ❖ Indigenous to the North and West
- ❖ Federally Protected Species
- ❖ Reintroduction Heavily Supported in Urban Communities / Heavily Opposed in Rural Communities

Understanding the Behavior

- ❖ Behavior
 - ❖ Sharp Rural / Urban Divide Regarding Wolf Reintroduction
- ❖ Can we explain this behavior using Game Theory?
 - ❖ Who are the players?
 - ❖ What actions / information is available?
 - ❖ What are the payoffs?

The Reintroduction Game

- ❖ Players
 - ❖ Rural Voters, Urban Voters, Nature
- ❖ Actions
 - ❖ Vote for Reintroduction, Vote against Reintroduction
- ❖ Payoffs
 - ❖ Deterministic small positive for reintroducing (urban and rural)
 - ❖ Deterministic medium negative for not reintroducing (urban and rural)
 - ❖ Stochastic large negative for reintroducing (rural)
- ❖ Interesting Notes
 - ❖ Asymmetric Game, Introspective Oneshot, Overestimation of negative payoff and probability

Muddying the Waters

- ❖ Behavior - Rural and Urban Communities Support the Reintroduction of Elk
 - ❖ The Game is Unchanged
- ❖ Players
 - ❖ Rural Voters, Urban Voters, Nature
- ❖ Actions
 - ❖ Vote for Reintroduction, Vote against Reintroduction
- ❖ Payoffs
 - ❖ Deterministic small positive for reintroducing (urban and rural)
 - ❖ Deterministic medium negative for not reintroducing (urban and rural)
 - ❖ Stochastic large negative for reintroducing (rural)

Future Work

- ❖ Reformulate the Reintroduction Game to explain discriminating between ungulates and predators.

Questions We can't Ask with Game Theory

- ❖ How did this behavior develop?
- ❖ How hard would it be to change the behavior? (stability)
- ❖ Is it accurate to assume the players are rational?

Computational Economics

- ❖ Multi-Agent Dynamic Model
- ❖ Each agent has some learning ability
- ❖ Learns to mimic the behaviors of other agents
- ❖ Will deviate from the best observed response probabilistically
- ❖ Why is it useful to analyze games dynamically?
 - ❖ Observe the development of social norms and emergent behaviors
 - ❖ Analyze the stability of the behavior
 - ❖ Doesn't Expect Rational use of Information

Future Work

- ❖ Future Work
 - ❖ Should the Reintroduction Game be different for ungulates and predators or is the difference irrational?
 - ❖ If irrational, why does experience with coyotes not generalize to expectations of wolves?
 - ❖ How did the rural / urban dichotomy develop? (What computationally underlies the development of this emergent behavior)
 - ❖ How stable is the rural opposition?
 - ❖ Could it be replaced easily or nudged out of stability?
- ❖ Thinking Bigger
 - ❖ How might strong bipartisan divide develop as an emergent behavior?