State Land changes and biodiversity

**Background:** The population growth and human habitation expanding increased pressures on the Florida ecosystem in the past several decades (Pearlstine et al., 2002). Biodiversity conservation efforts often face challenges due to discrepancies between priority areas for species richness and land ownership patterns or economic valuation (Jenkins et al., 2015). Biodiversity conservation became more and more important, the funding for conservation program from the U.S. Farm Bill increased from $500 million in 2002 to $3.5 billion in 2022 (Li & Zhang,2024). The Kunming-Montreal Global Biodiversity Framework proposes an expansion of areabased conservation measures to at least 30% of the earth’s surface by 2030 (Palmer et al., 2025). The US National Gap Analysis Program (Gap) is aim to mitigate wildlife conservation problems by providing an assessment of the essential biotic elements (plant communities and native animal species) and to facilitate the application of this information to land management activities (Pearlstine et al., 2002). To make better informed land-use decisions, policy makers demand information about socio-economic and ecosystem properties of land-use systems and how they respond to changes in external stimuli and shocks (Castro & Lechthaler, 2022). The paper try to access the correlation between biodiversity richness and land use type/value, and examine the spillover effects of different land type. This project will contribute to the understanding of conservation-economic trade-offs and give insight of land management strategy in different lands.to optimize biodiversity protection efforts in Florida (Pearlstine et al., 2002; Smith & Swanson, n.d.).

**Research question:**

How do biodiversity priority areas align with land ownership (cross exdogeneity), land use, and land value distribution in Florida? If biodiversity scheme aliment with need in the area (externality and spillover effects)?

**GIS Methodology:**

This study relies on maps of Florida land cover types as the fundamental spatial component of the analysis for biodiversity richness. Our theoretical of land types based on National Vegetation Classification Scheme (NVCS). The NVCS is an ecologically based, hierarchical classification that treats all existing terrestrial vegetation types in one system (Pearlstine et al., 2002).

Overlay biodiversity richness with land value and land ownership layers to visualize spatial patterns. Extract species richness values to parcels via zonal statistics (Jenkins et al., 2013; Pearlstine et al., 2002). Overlay biodiversity data with land value, land ownership, and land use layers to visualize mismatches. The land value is estimated through Florida residence property tax data. Histogram to show distribution of biodiversity richness across land ownership and land values.

**Econometric method:**

Assumption: The ecosystem services (biodiversity) value have heterogeneous preferences across different land ownership, and ecosystem service damages within and across border also be spatially heterogeneous. (Atallah, 2024). Externality and spillover effects occur through spatial connectivity of different conservation area and ownership lands.

Regress Biodiversity richness or protection status (hydrography index) (Y) on Land value, ownership, category, distance between private and public land, and conservation area (dummy) (X).

Cluster Analysis: To group parcels by biodiversity-land value profiles and identify clusters of high biodiversity-low protection mismatches.

Predict biodiversity indices using land value, ownership, and land-use variables.

**Paper review:** Castro & Lechthaler, (2022) described bio-economic models applied to land-use decisions, with a particular focus on the provision of ecosystem services, and forward in bio-economic modelling enables it to incorporate multiple time and spatial scales. Atallah, (2024) found the social cost of the externality is greatest when a bio-invasion starts on the recreation land property, and the optimal subsidy is non-uniform, targeting the landowner who acts as the weaker link, regardless of where a bio-invasion starts.

The hierarchical and extensible schema that incorporated classifications currently used by the Florida Fish and Wildlife Conservation Commission (FWC), Florida Natural Areas Inventory (FNAI), and Florida’s water management districts (WMD) is the most feasible and produce the most usable land cover dataset (Kawula & Redner, n.d.).

Liang et al., (2020) provide large-scale evidence that air pollution, specifically ozone, is associated with declines in bird abundance in the United States.

Landowner will maximize the utility of representative household or revenue from land property. Studying the management of land spatial dynamic externalities in the context of landownership patterns requires research frameworks that account for the decentralized management of cross-boundary public bads affecting properties managed by landowners with heterogeneous preferences (Atallah, 2024). Land management will become more important if preference heterogeneity drives which landowners act as the weaker links and contribute to the production of the spatial-dynamic externalities through their management decisions (Atallah, 2024).

Florida panhandle region need a priority on trees, fish, and reptiles. Almost none of the region is within IUCN ranked protected areas. Most of the region is privately owned, but with some federal and state lands. Florida Keys region’s priority on trees. A moderate amount of the Keys is within IUCN ranked protected areas and other public lands (Jenkins et al., 2015).

The development of a statewide dataset using the land cover classification system is likely the highest priority for future work as many of the goals and priorities of the Strategy rely on these data (Kawula & Redner, 2018).

**Appendix**:

[Mapping the Diversity of Trees in the USA](https://biodiversitymapping.org/index.php/usa-trees/)

[biodiversitymapping.org](https://biodiversitymapping.org/); [GBIF](https://www.gbif.org/zh/)

[Florida Revenue Department](https://floridarevenue.com/property/Pages/DataPortal_RequestAssessmentRollGISData.aspx)

Parcel data: [Data | Multi-Resolution Land Characteristics (MRLC) Consortium](https://www.mrlc.gov/data?f%5B0%5D=category%3ALand%20Cover&f%5B1%5D=project_tax_term_term_parents_tax_term_name%3AAnnual%20NLCD)

[GIS Data Source Links – University of Florida GeoPlan Center](https://www.geoplan.ufl.edu/gis-data-source-links-2/)

[Statewide Land Use Land Cover | Florida Department of Environmental Protection Geospatial Open Data](https://geodata.dep.state.fl.us/datasets/2f0e5f9a180a412fbd77dc5628f28de3/explore)

USA land cover and land use:<https://www.lcluc.umd.edu/content/data-lcluc-research>

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