Urban forest patches in Bloomington, IN - Analyzing sustainability over time

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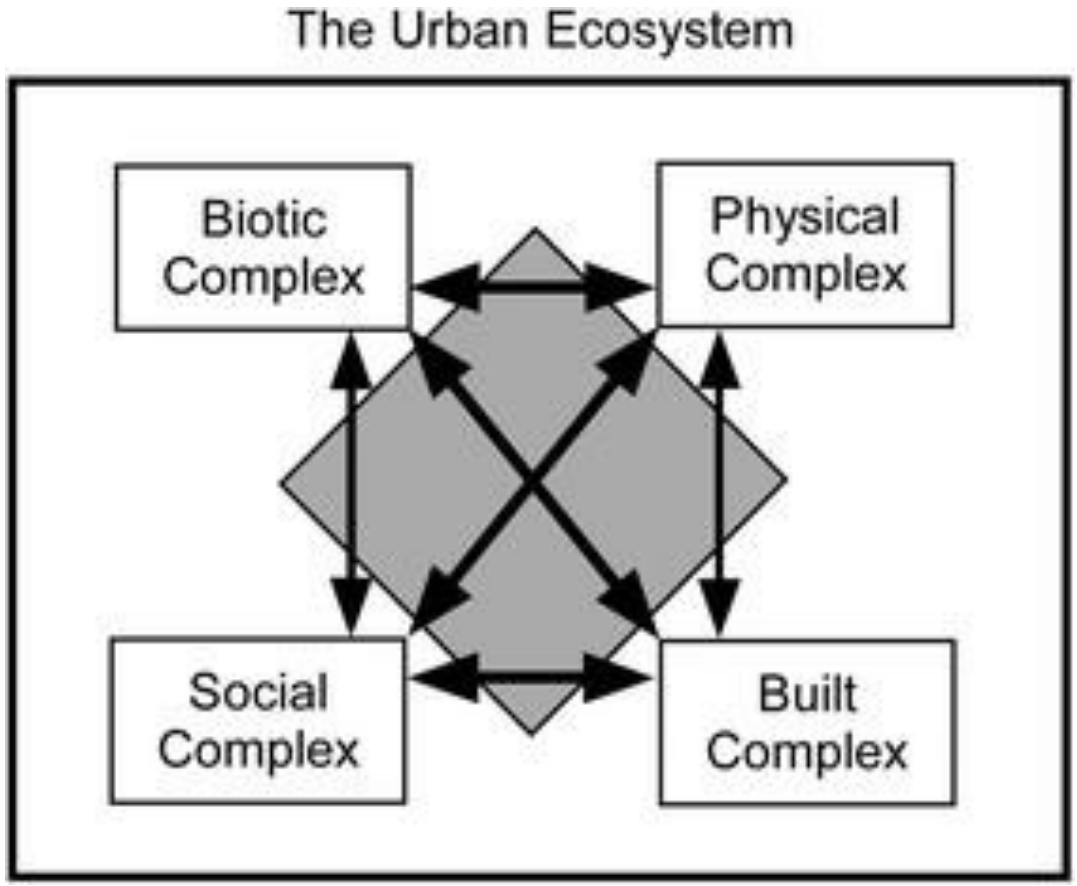
Urban forested patches- tree stands within a city

- Urban forest- the collection of trees in an urban setting
  - Trees planted along streets and in parks (public, “city” trees)
  - Trees in resident yards, business property (privately owned)
- Urban Forest (UF) patches as opposed to street trees
  - Ecological benefits- larger trees with understory, wildlife habitat
  - Ecosystem services
  - Include private (yards, etc.) and public trees (parks, etc.)
- Research on patches is emerging
  - Johnson et al. (2021)
  - Freeman-Day and Fischer (in press)

Urban patch ecology

- Baltimore School of Urban Ecology
  (Grove et al. 2015)
- Built, biophysical, social, ecological interactions
- Interactions at multiple scales through space and time



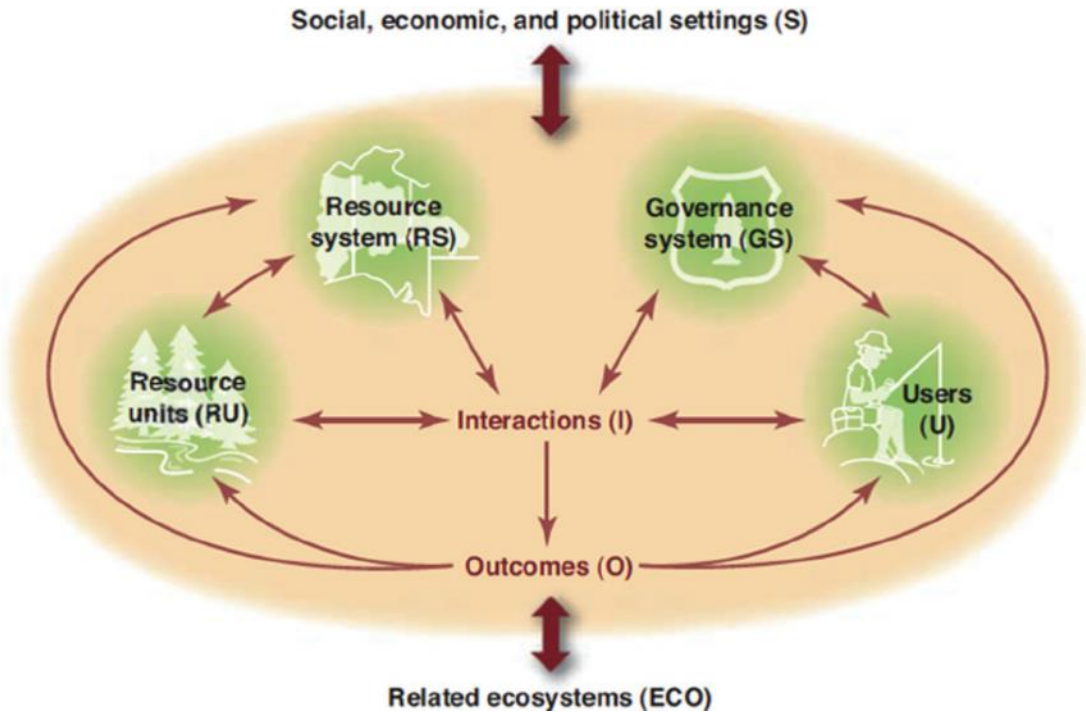
Pickett et al. (2017)

Social-ecological systems

- Resource factors
  - Location, system boundaries, spatial/temporal distribution
- Social factors
  - Property rights, operational rules, monitoring, historic use

  (Ostrom, 2009)
- Additional ecological factors
  - Community/species composition, fragmentation, disturbances

  (Vogt et al., 2015)



Ostrom (2009)

Patches as commons resources

- Street trees as commons resource
  - Provide ecosystem services for the community (*potential* low excludability, but rivalry in usage of planting spaces)

    (Fischer and Steed 2008)
- Governance for patch sustainability, perseverance
  - Formal/informal norms and rules, especially mixed ownership patches

	Subtractability of resource use		
Excludability of people from enjoying resource		Low	High
	High	Toll/club goods (gym membership, cable television)	Private goods (clothing, food)
	Low	Public goods (Common knowledge, sunsets)	Common pool resources (fisheries, irrigation systems, etc.)

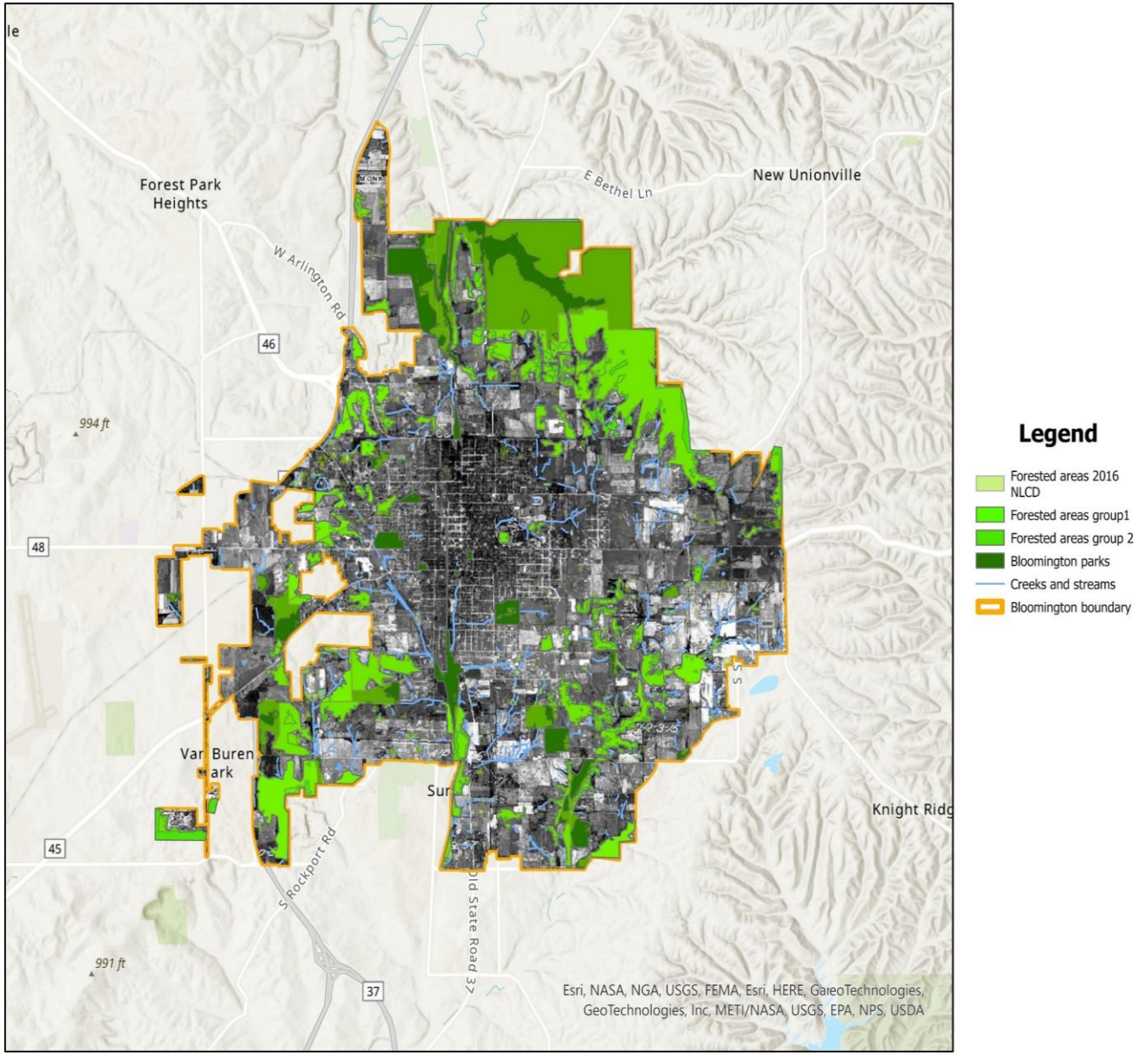
Adapted from Ostrom, 1994

Research questions

1. What social and ecological drivers are associated with urban forest patch perseverance, or sustainability over time?
2. Which governance strategies are associated with success in sustainability?
3. In what conditions might urban forested patches be considered commons?

Study area

- Urban forest within 2021 Bloomington boundaries
- Patches an acre + and > 120’ wide (Urban Forest Inventory and Analysis)
- City-designated parks and informal areas with > 20% canopy cover (National Land Cover Database)
- Before windshield tour- 118 urban forested patches

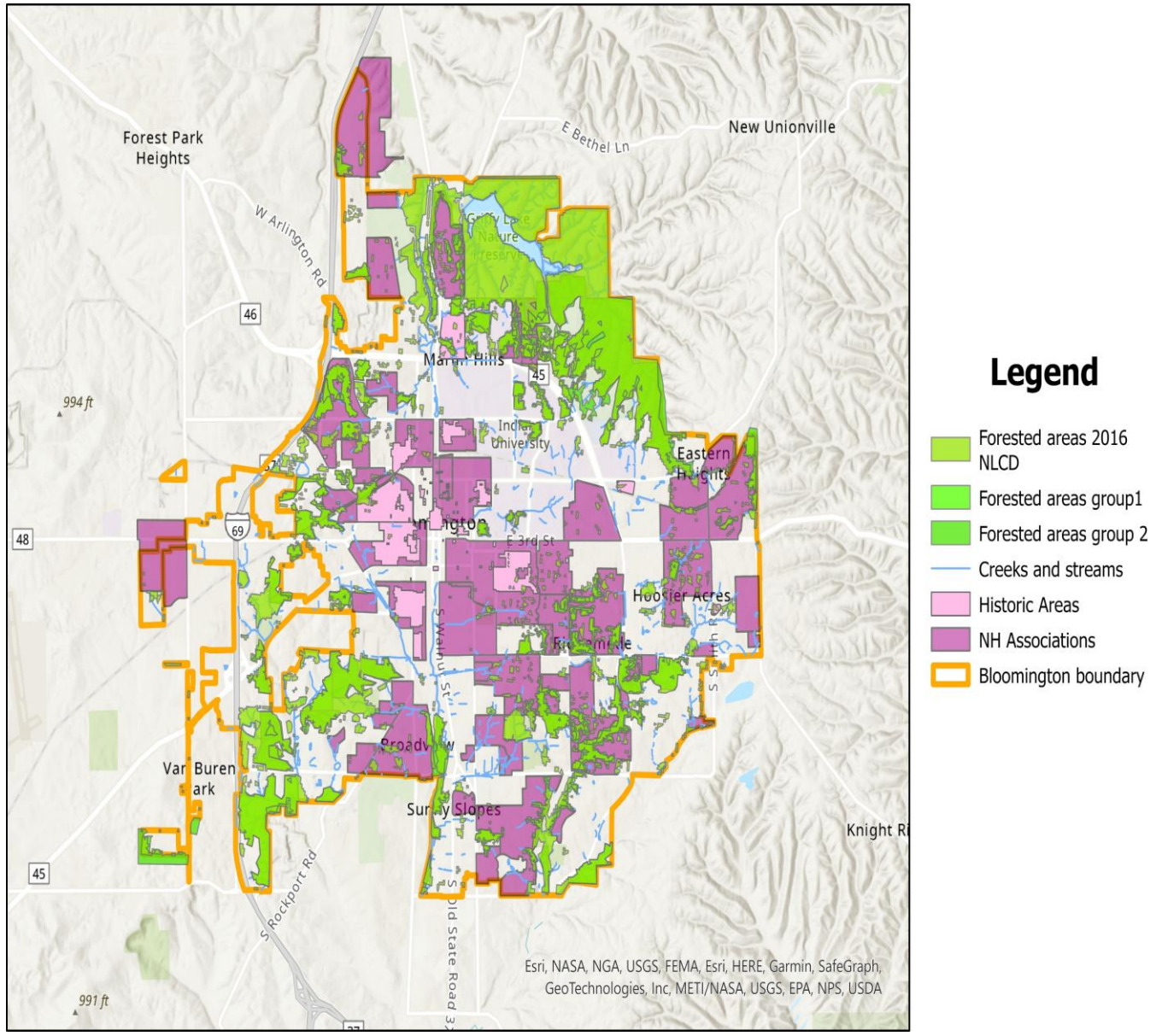


Methods- data collection

- Social data
  - Interviews- outreach to interest groups and referrals
  - Parcel search for ownership- private vs. public
  - Archives search for records- protected areas, patches cleared for development
- Ecological data
  - Windshield tour (patch size, canopy cover, dominant tree species)
  - Sample inventories, more in-depth ecological assessments
  - Baseline data for future comparison

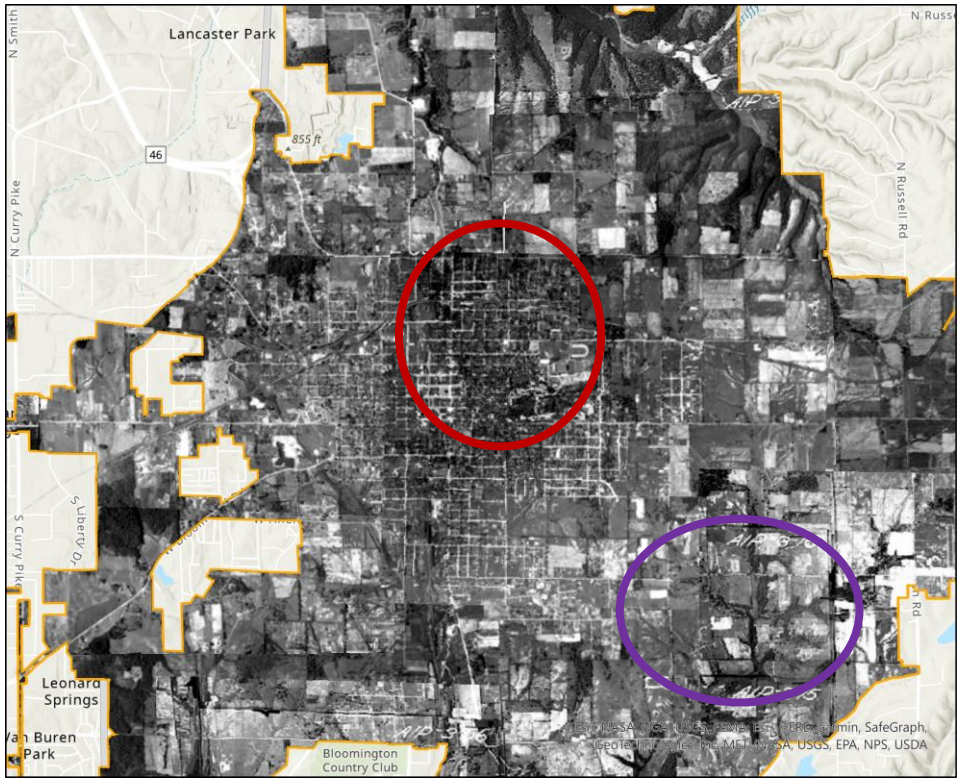
Methods- GIS

- GIS analysis
  - Historical aerial imagery- locations of “lost” patches and of land that has reforested
  - Current imagery
  - Current NLCD land classification data (three forest types)
  - Watershed/proximity to stream
  - Neighborhood associations
  - City boundary changes

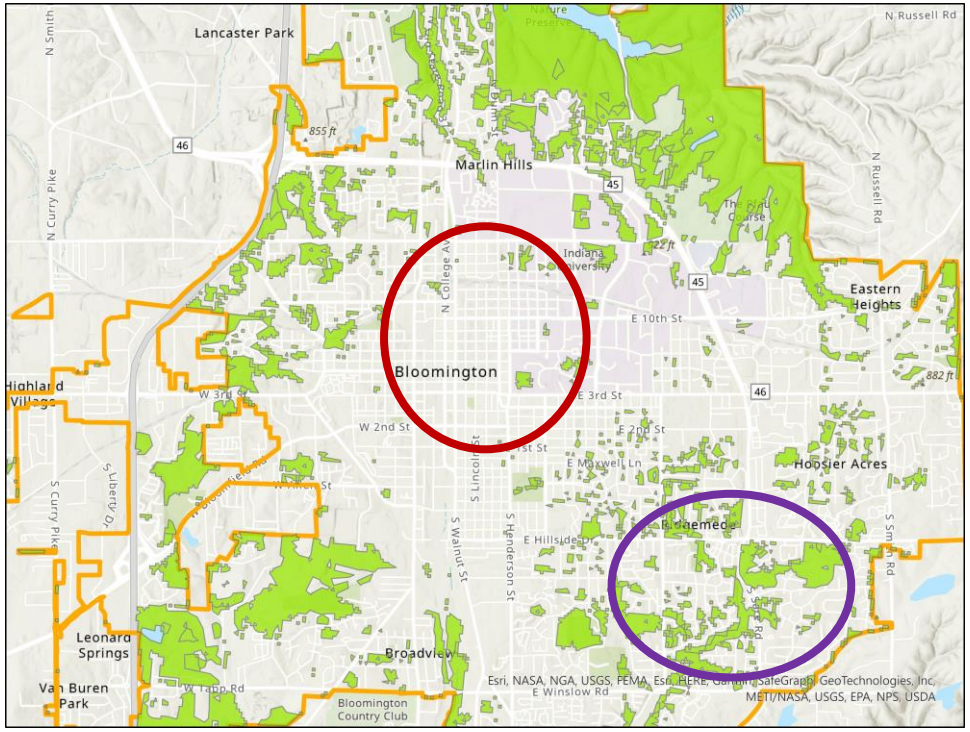


Preliminary results- downtown patch loss, forest regrowth in former farmland

1939 map- forested areas, some fragmented downtown



2016 NLCD data- downtown area largely developed, more forested areas outlying



Future research

- Use of historic and social data- we know what happened with UF patches over time in Bloomington and can learn more about processes linked with outcomes
- Expansion to Indianapolis-
  - more variability in ecological and demographic variables
  - richer statistical analysis
  - larger patches
- Template for other cities and settings
- Resource for sustainable governance of urban forested patches

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