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A Framework for Urban Forests as Social-Ecological Systems

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A Comprehensive Framework for Understanding Urban Forests as Social-Ecological Systems

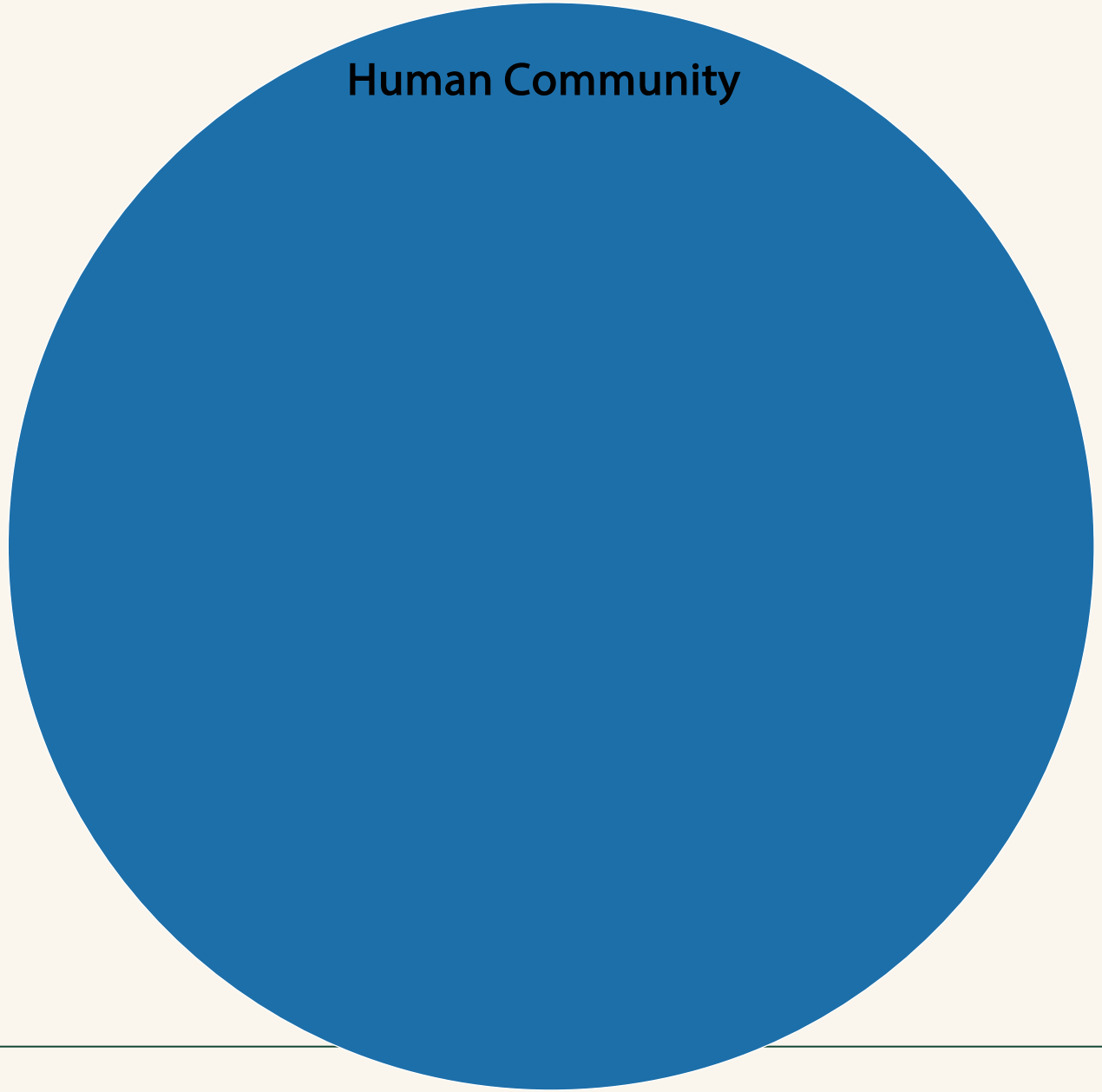
By Jess Vogt

Abstract. Urban forest management is a multistakeholder, multi-objective situation whereby a surfeit of synergistic or competing goals may exist. Greater research and applied guidance for what works in which urban forest contexts could help improve urban tree and forest outcomes. The challenge in conducting research of this nature is systematic definitions of "what works" and "which contexts" across multidimensional, polycentric urban forest social-ecological systems. This paper presents a comprehensive framework for studying the complexities in urban forest

Human Community

Urban forests are complex, polycentric **social-ecological systems.**

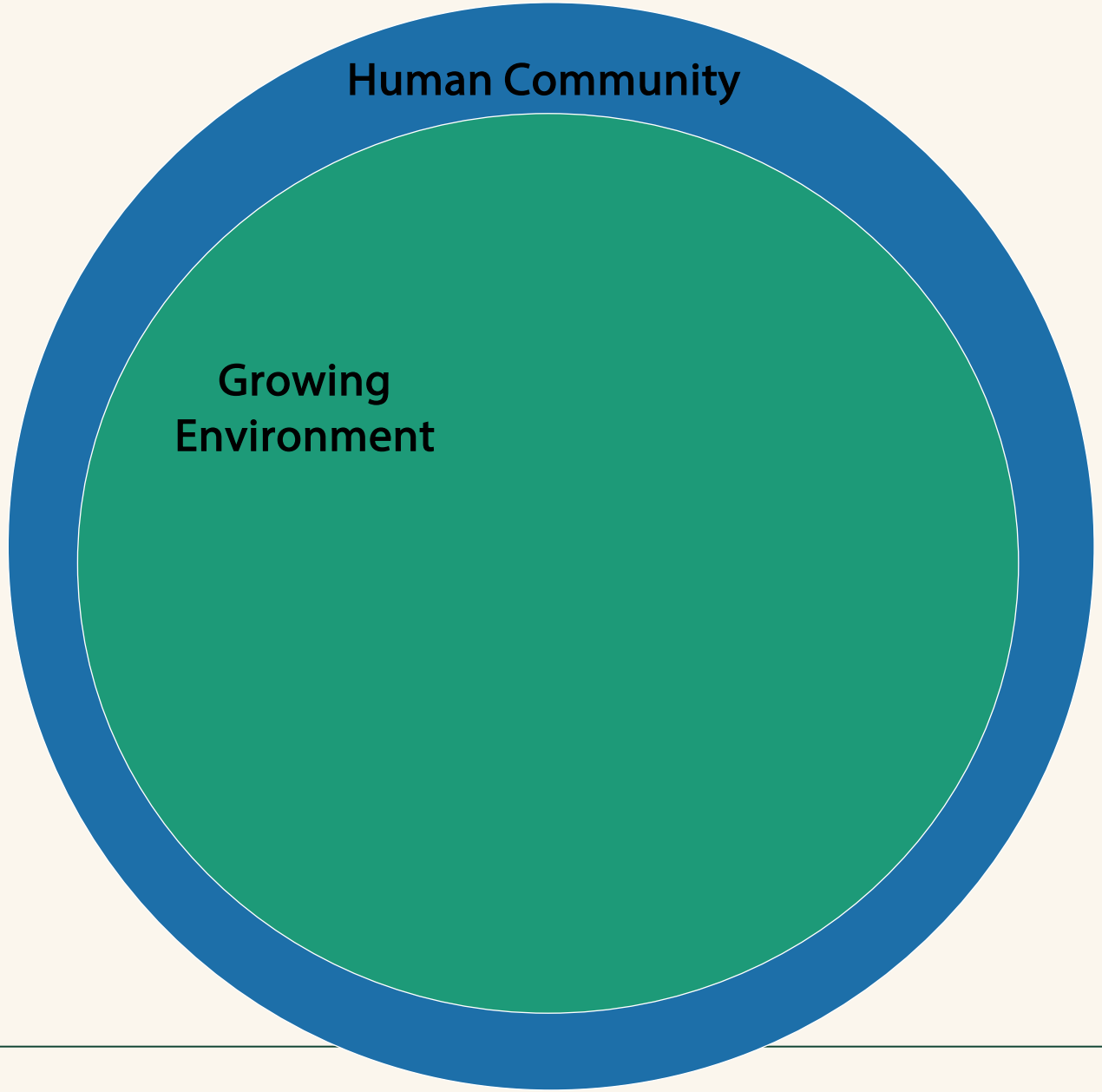
What is a social-ecological system?



Urban forests are **social-ecological systems.**

Human communities are diverse and heterogeneous:

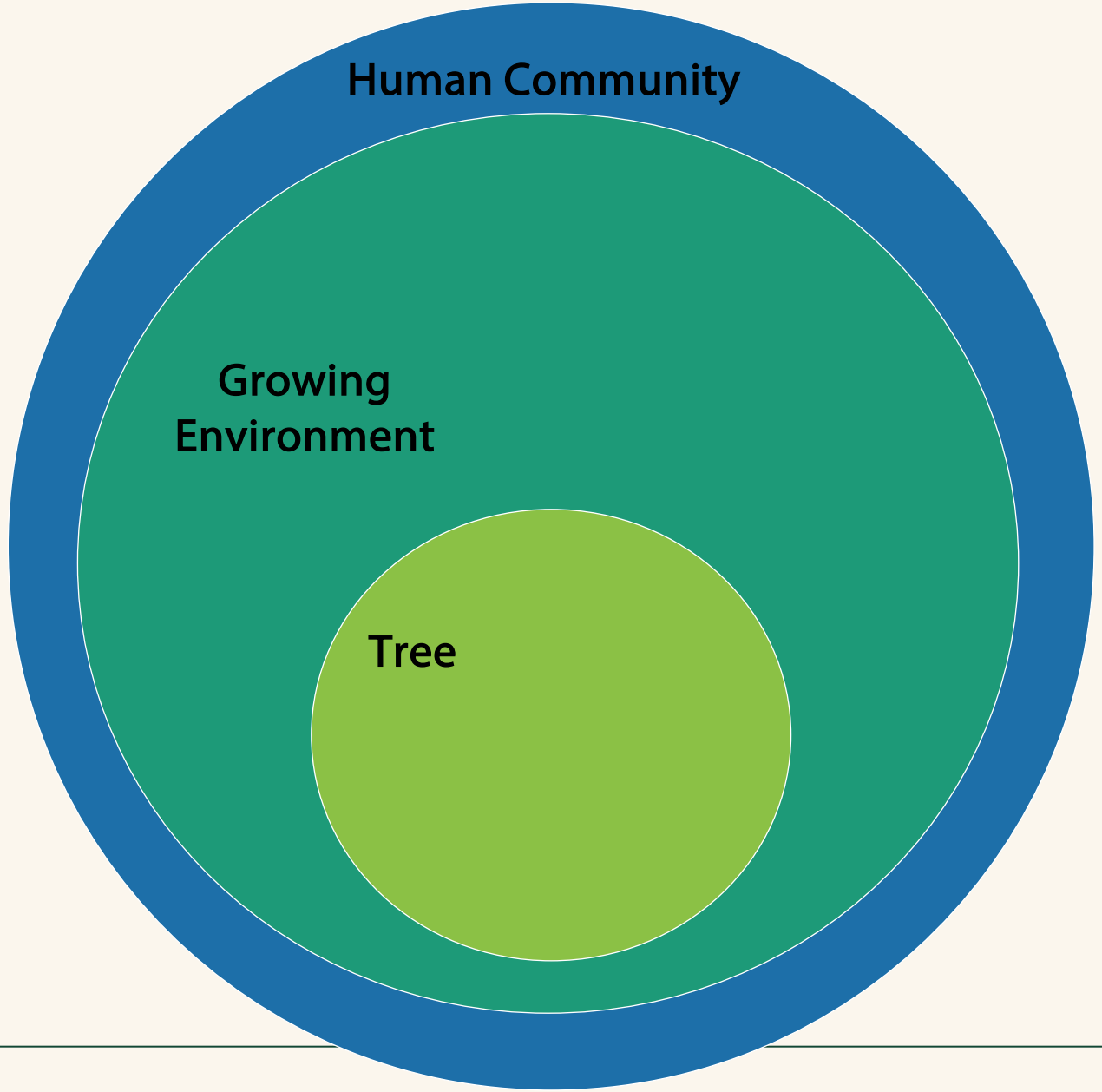
- ✓ Small towns to large megacities
- ✓ Diverse in people, urban form, and economy
- ✓ In ecology, geography, and landscape
- ✓ In legacies of history, geology, and hydrology



Urban forests are **social-ecological systems.**

Trees grow a huge variety of places:

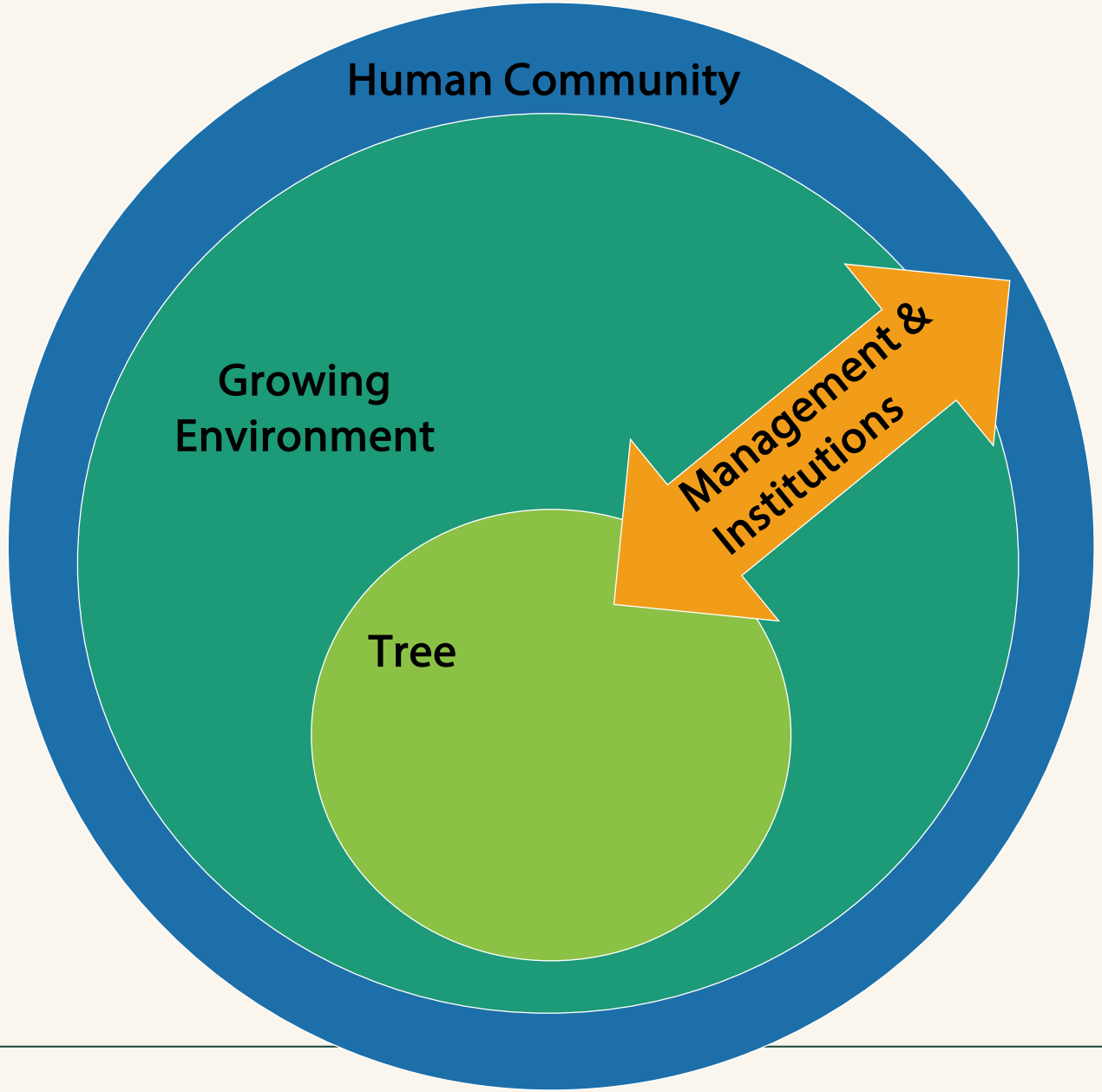
- ✓ Tree pits, parkways, boulevards, yards
- ✓ Manicured parks, golf courses, residential estates
- ✓ Vacant lots, restored prairie patches
- ✓ Along highway shoulders
- ✓ On raised rail trails, green roofs
- ✓ …and so many more places



Urban forests are **social-ecological systems.**

There are so many kinds of trees:

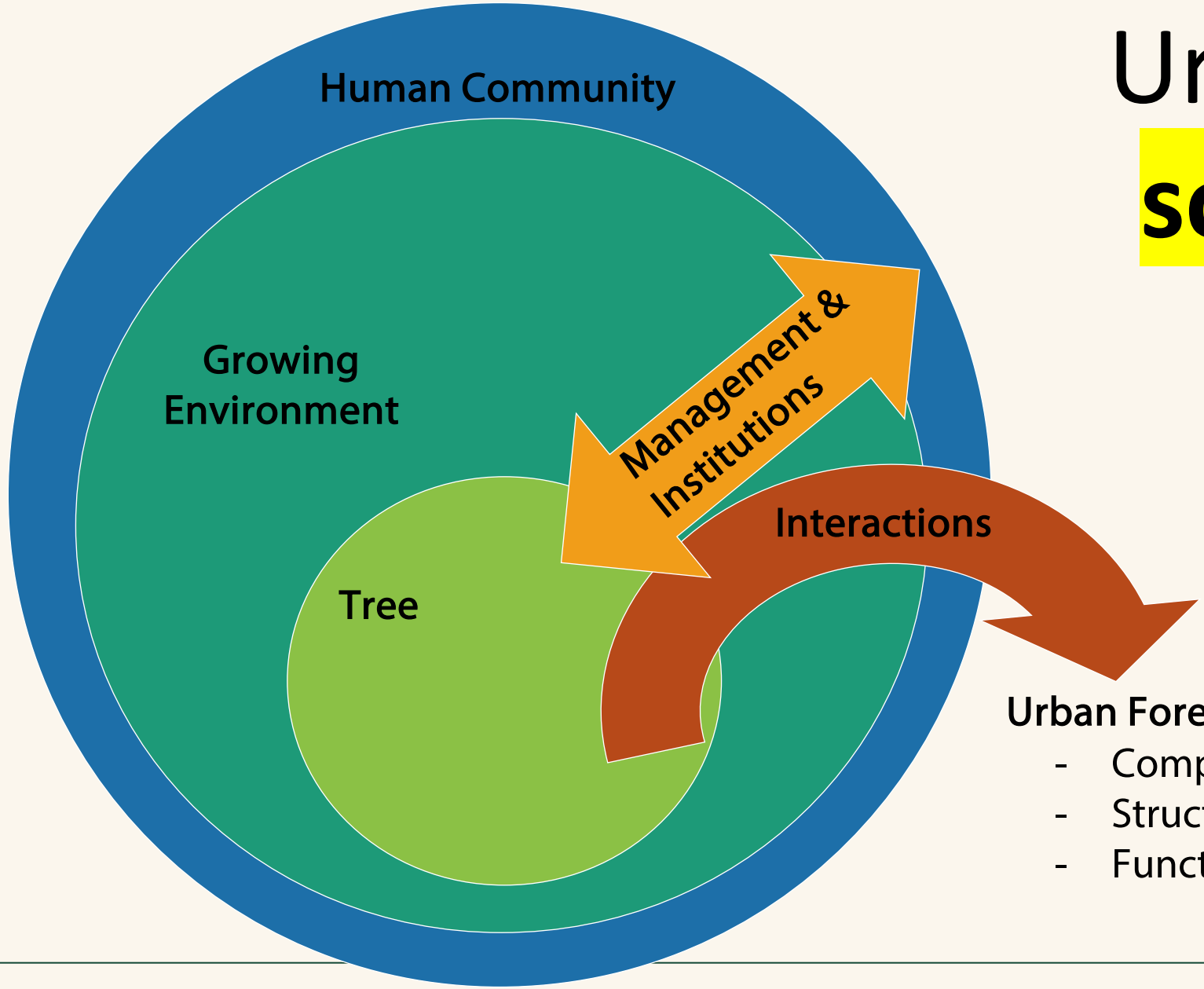
- ✓ Shade trees, ornamental trees, fruit-bearing trees
- ✓ Old trees, new trees, tall trees, small trees
- ✓ Meticulously cared for trees, scrappy alley trees
- ✓ …and more



Urban forests are **social-ecological systems.**

There are many management scenarios:

- ✓ City depts pruning street trees
- ✓ Parks districts mulching park trees
- ✓ Homeowners watering yard trees
- ✓ Nonprofits planting & caring for trees
- ✓ Volunteers removing invasive spp in forest patches
- ✓ …and more



Urban forests are **social-ecological systems.**

Urban Forest Outcomes

- Composition
- Structure
- Function
- Benefits/Disservices
- Sustainability/Persistence
- etc. …

Figure after Vogt and Fischer, 2014, *Cities and the Environment*

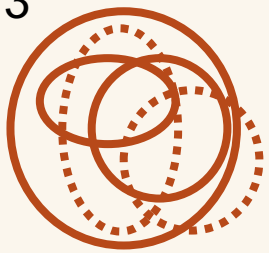
Urban forests are **complex**, polycentric social-ecological systems.

This is complexity.

This is complexity.

Fall 2021 >>

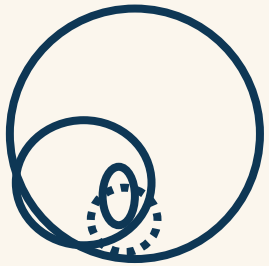
<< Summer 2024



Multiple, overlapping centers of decision-making

Urban forests are complex, **polycentric** social-ecological systems.

Nested, yet decentralized



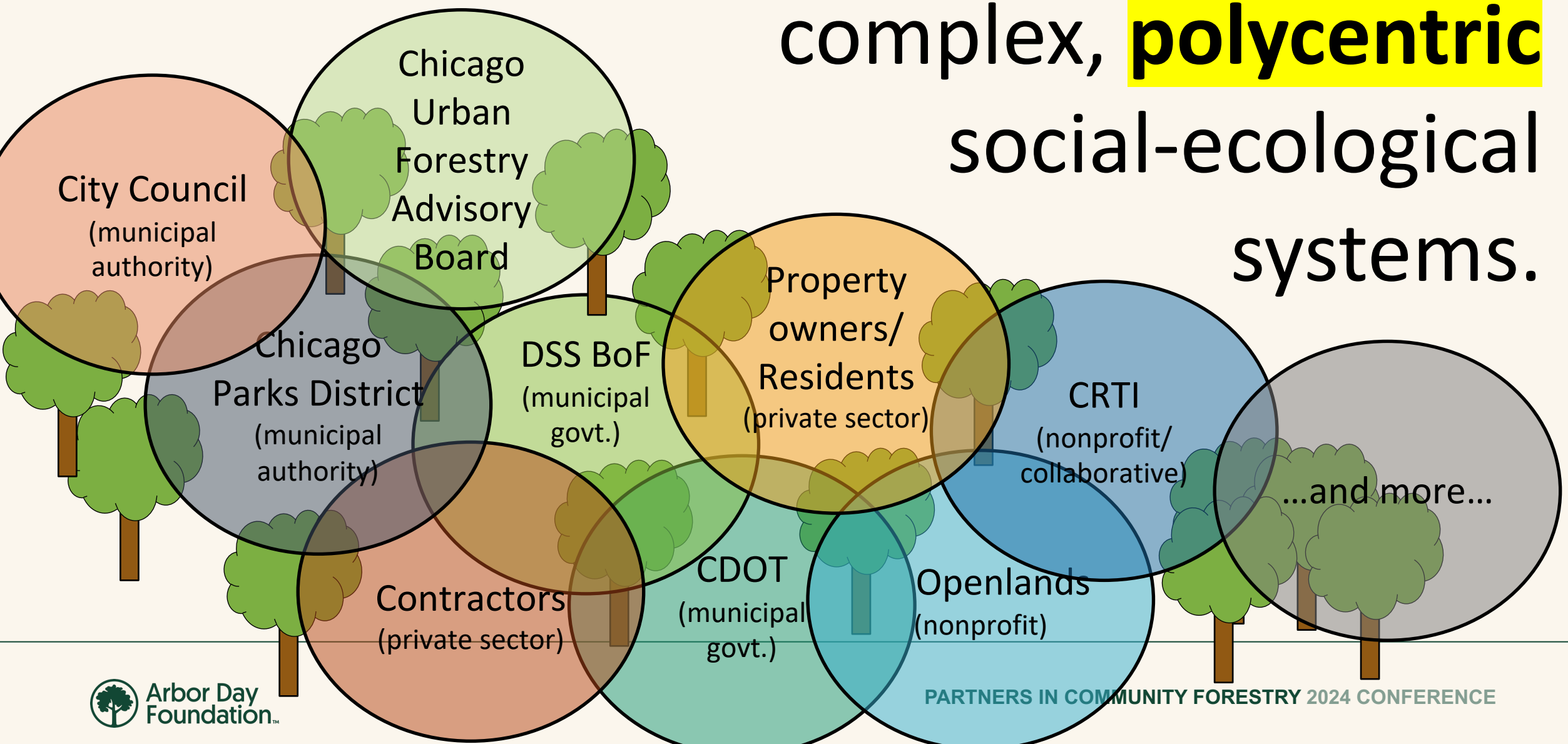
Layering of individuals, organizations, decision-making venues, and narratives…

… with heterogeneous biophysical and social realities

Because of complexity, polycentricity arises.

Ex.: overlapping urban forestry decision-making in the City of Chicago

Urban forests are complex, **polycentric** social-ecological systems.



Key terms:

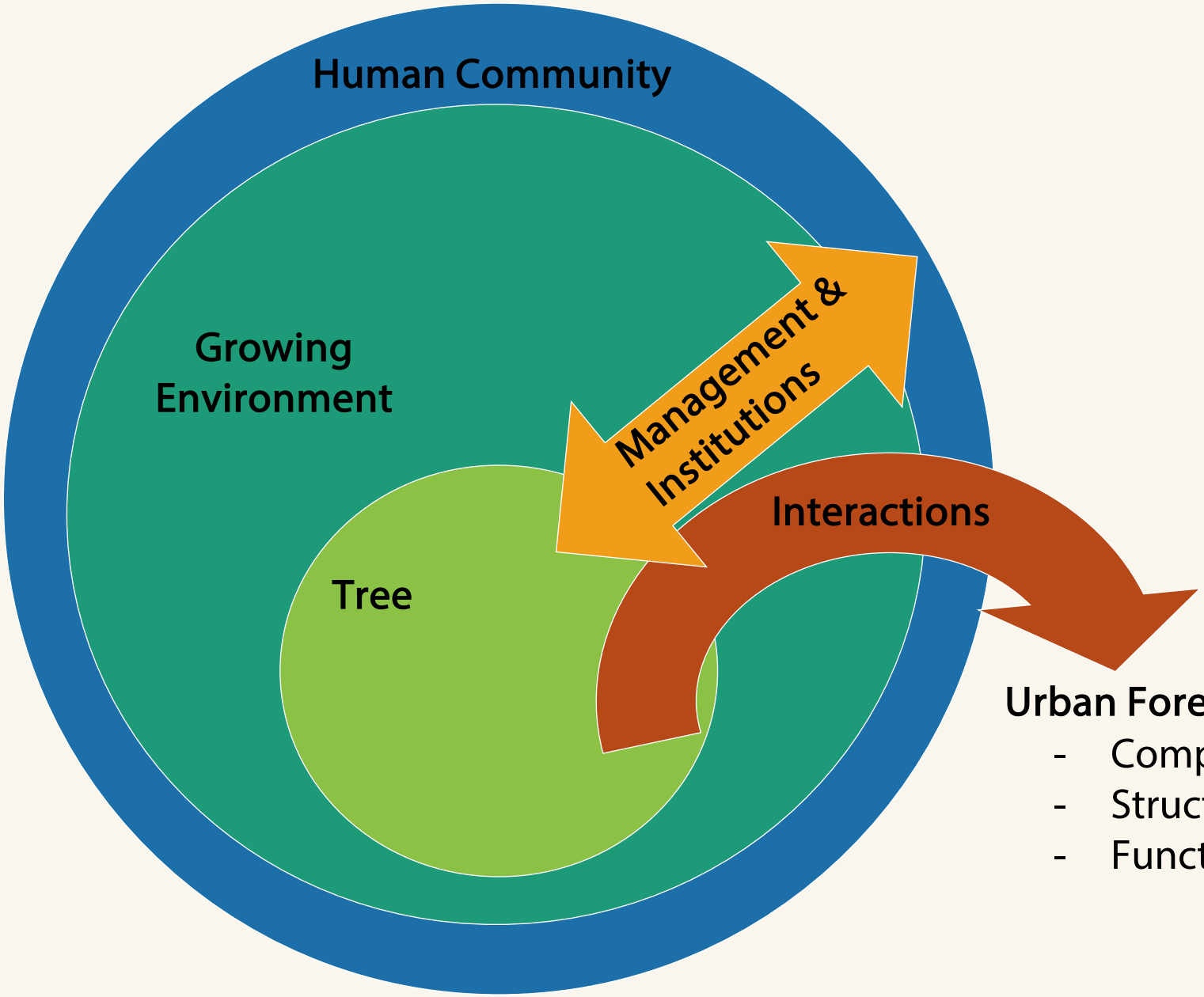
- [x] Social-ecological system
- [x] Complexity
- [x] Polycentricity

Organized, nested set of variables

- [x] Case study
- [x] Transferability

What works, which contexts

- [ ] Framework



This is a visual description of urban forests as social ecological systems.

Urban Forest Outcomes

- Composition
- Structure
- Function
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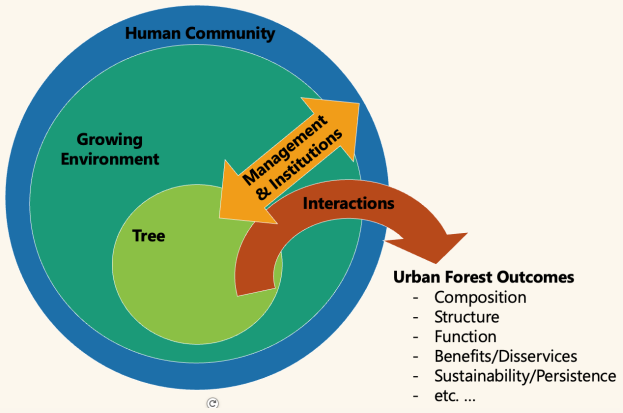
Figure after Vogt and Fischer, 2014, *Cities and the Environment*



Re-organize into a formal framework

Broader Environmental Context and Dynamics

Ecological Disturbances ⟷ Ecological Rules

Boundaries for system of interest

Characteristics of Trees in the Urban Forest (T) ⟷ Biophysical Subsystem ⟷ Surrounding Growing Environment (E)

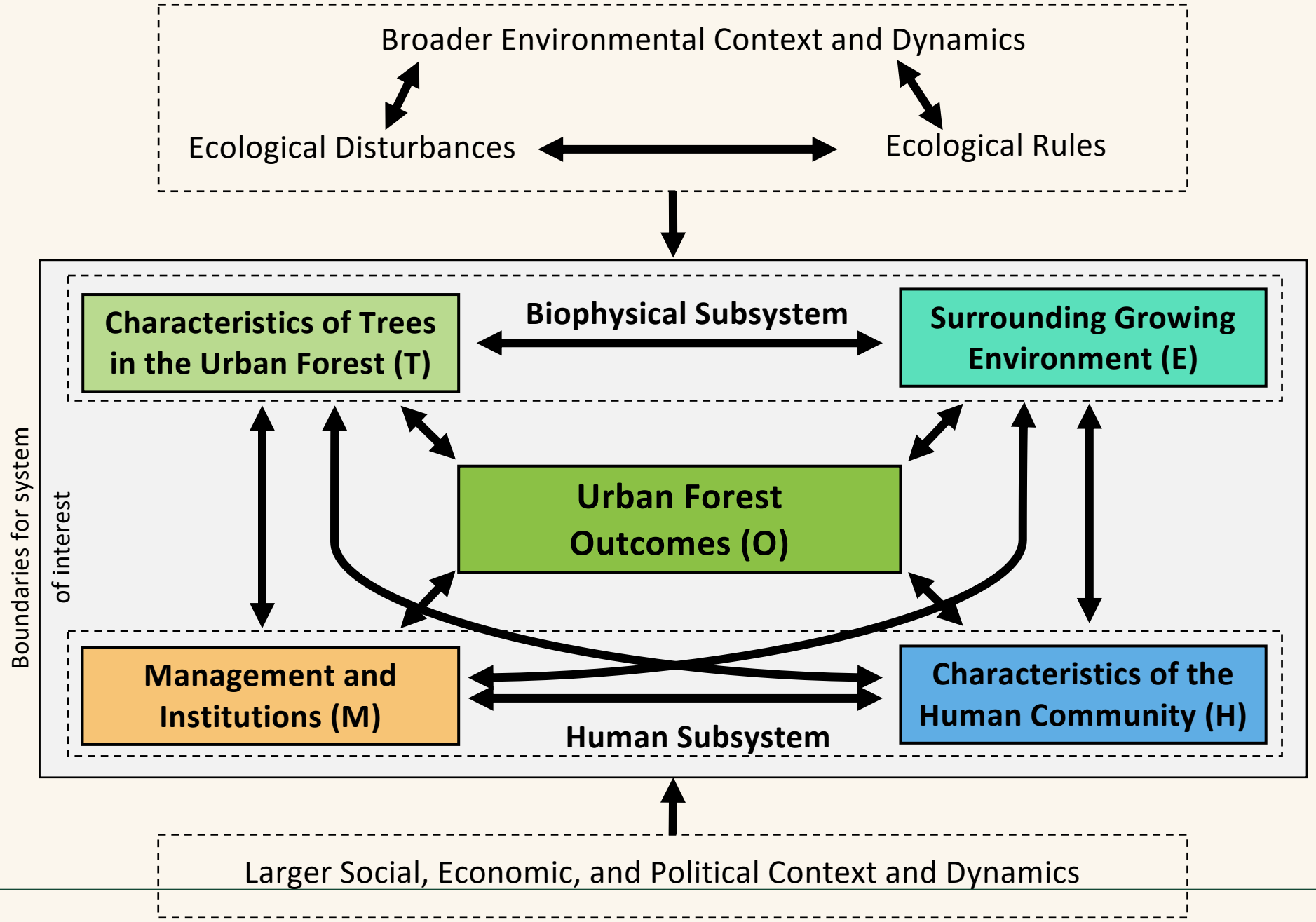
Urban Forest Outcomes (O)

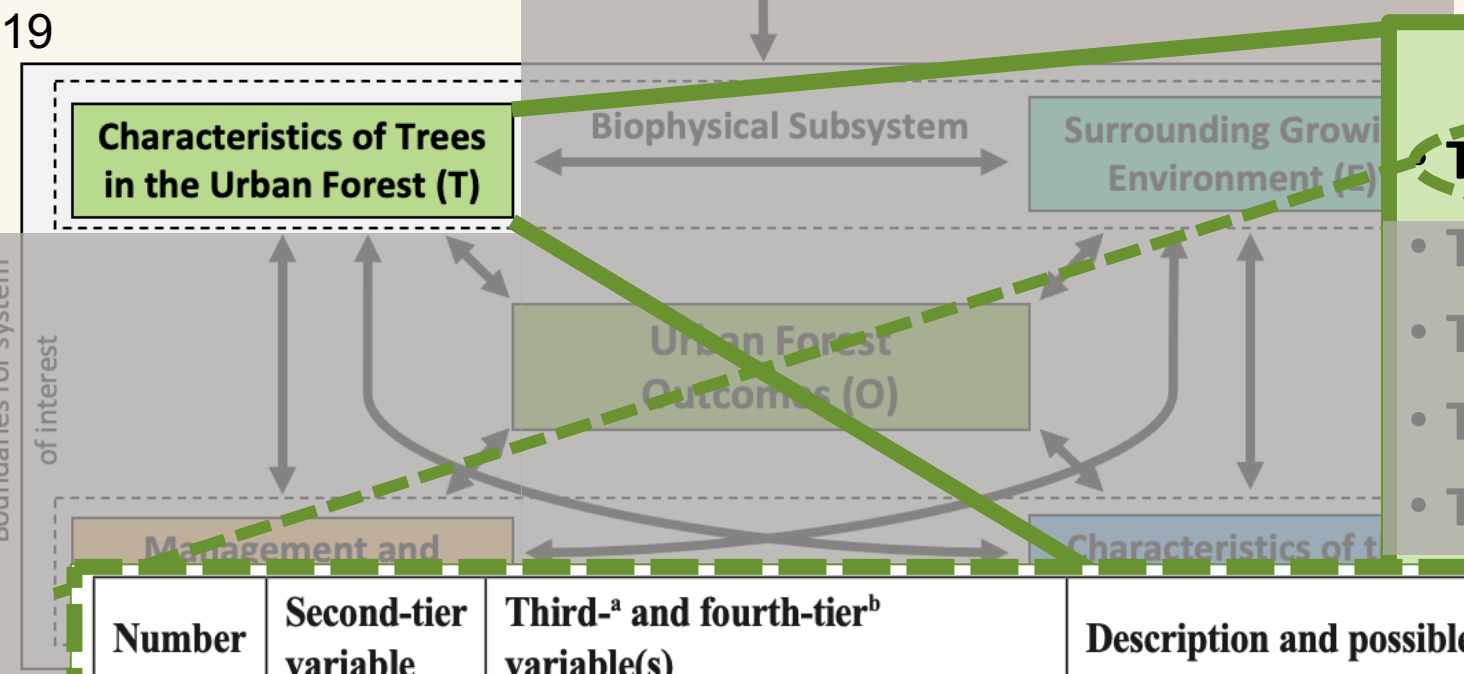
Management and Institutions (M) ⟷ Characteristics of the Human Community (H)

Human Subsystem

Larger Social, Economic, and Political Context and Dynamics

Urban Forest Social-Ecological Systems (UFSES) Framework

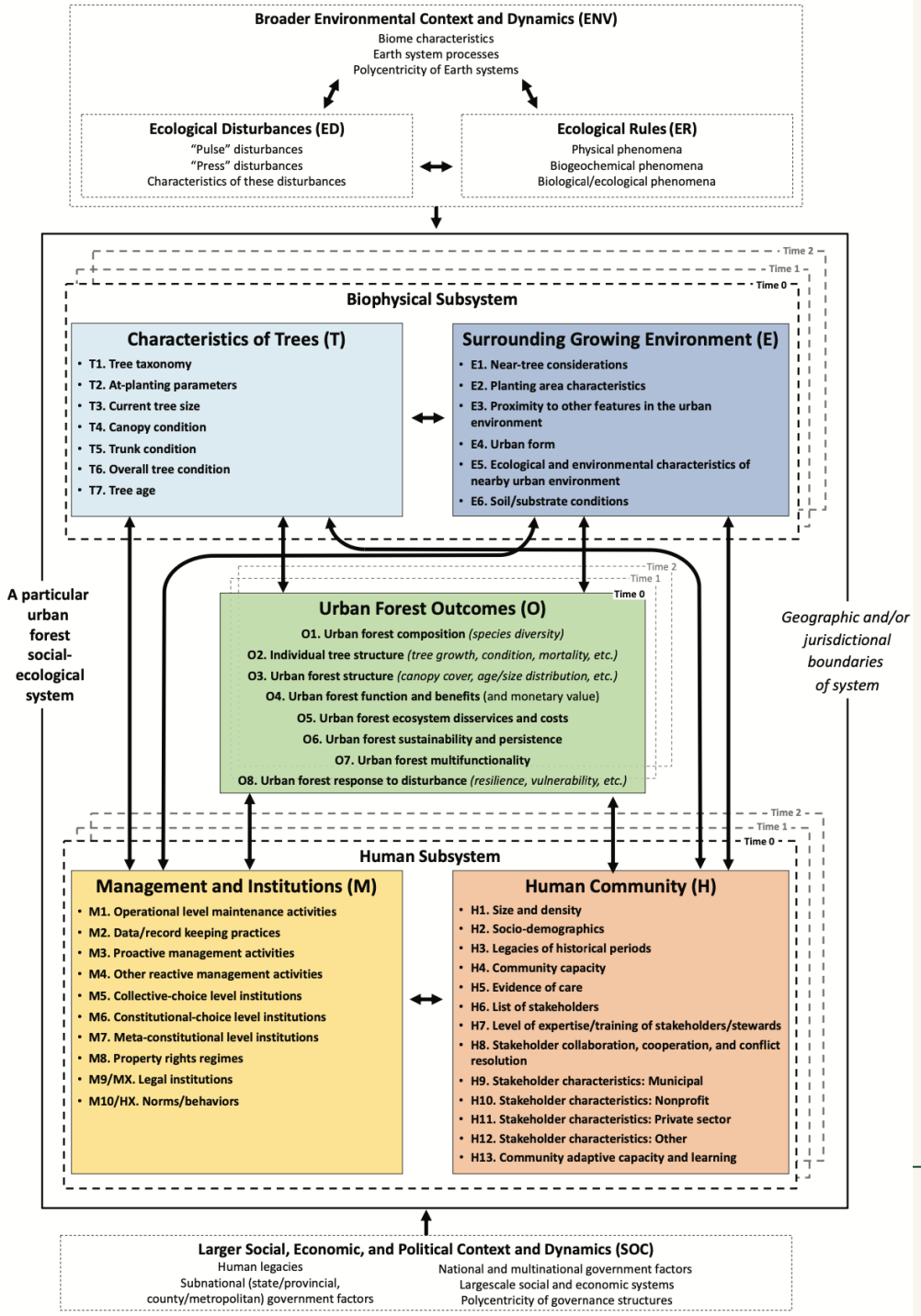




Characteristics of Trees (T)

- **T1. Tree taxonomy**
- T2. At-planting parameters
- T3. Current tree size
- T4. Canopy condition
- T5. Trunk condition

Number	Second-tier variable	Third-[a] and fourth-tier[b] variable(s)	Description and possible values	Other UF frameworks
T1	**Tree taxonomy**	**Family, genus, species, cultivar; native/nonnative/invasive; seed source[b]**	Taxonomy influences tree form, size-at-maturity, average growth rate, drought/flood tolerance, nutrient requirements, pest vulnerabilities, climate change vulnerability, etc. (Note 18).	SUS, SES1, CC, VULN, MORT
T1-1		**Tree traits[a]**	Tree traits are nested within *T1. Tree taxonomy* as traits are directly connected to the species/cultivar of a tree.	
T1-1a		**Tree type[b]**	Deciduous, coniferous, evergreen, fruit trees, palms, etc.	
T1-1b		**Stature/expected size-at-maturity[b]**	Large, medium, small, ornamental, etc.	
T1-1c		**Tree form/growth habit[b]**	Excurrent, decurrent, columnar, etc.	
T1-1d		**Drought or flood tolerance[b]**	How well a tree is expected to be able to withstand periods of low or no rainfall/water or excessive moisture during periods of flooding; connected to tree species and cultivar.	



My *AUF* article expands each one of the boxes into a working list of **second-** and **third-tier variables.**

Go beyond case studies

Foster holistic systems thinking – systematic, yet flexible

Adaptable to existing and new research

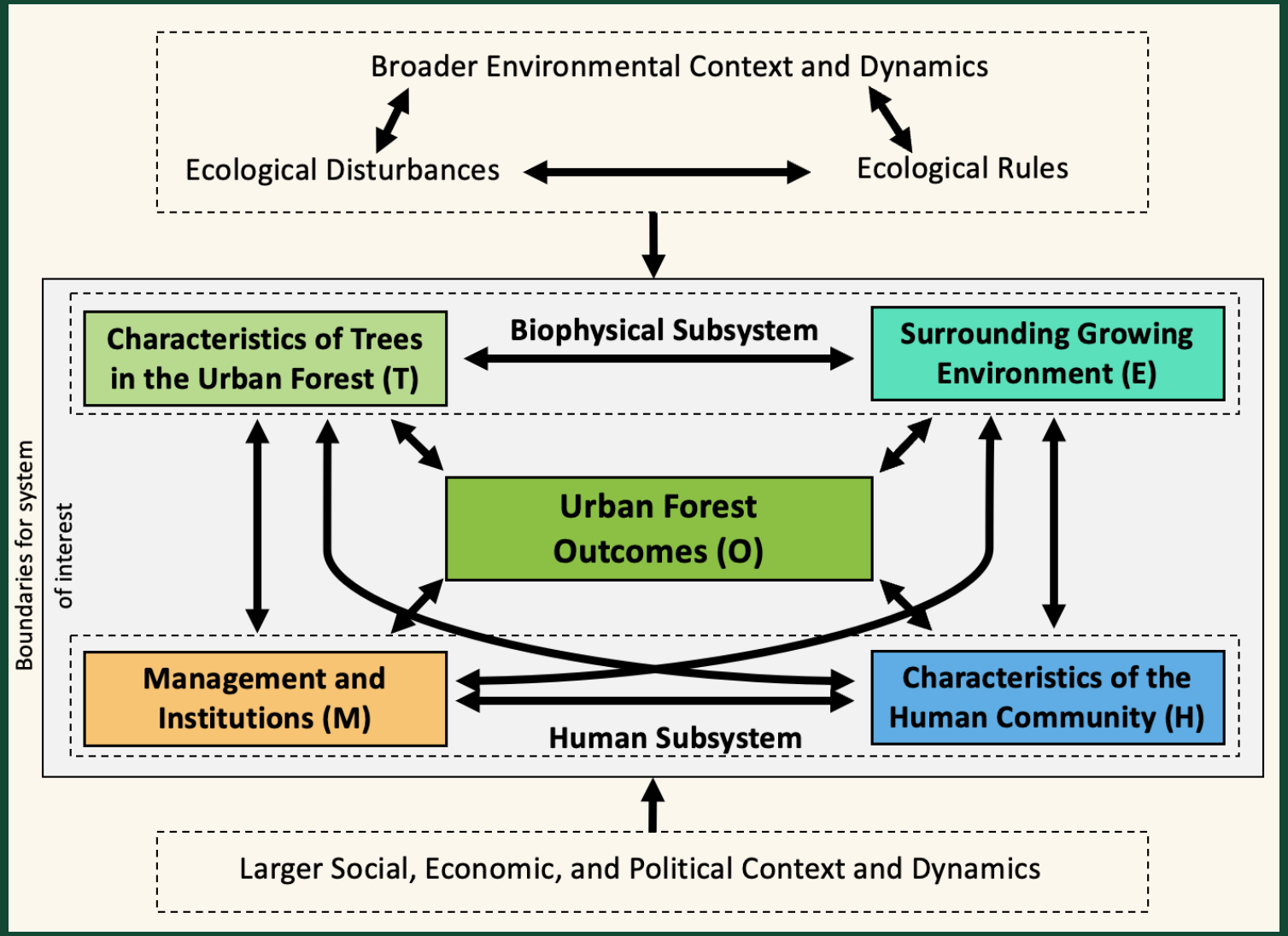
https://tinyurl.com/UFSES

Working draft of a common language

Virtues of a comprehensive UFSES framework

Enable comparative case research

Imagine a database...



Thank you.

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