



Faculty of Design

2021

When a Tree is also a Multispecies Collective, a Photosynthesis Process, and a Carbon Cycle

Veselova, Emīlija and Gaziulusoy, İdil

Suggested citation:

Veselova, Emīlija and Gaziulusoy, İdil (2021) When a Tree is also a Multispecies Collective, a Photosynthesis Process, and a Carbon Cycle. In: Proceedings of Relating Systems Thinking and Design (RSD10) 2021 Symposium, 2-6 Nov 2021, Delft, The Netherlands. Available at <https://openresearch.ocadu.ca/id/eprint/3885/>

Open Research is a publicly accessible, curated repository for the preservation and dissemination of scholarly and creative output of the OCAD University community. Material in Open Research is open access and made available via the consent of the author and/or rights holder on a non-exclusive basis.

The OCAD University Library is committed to accessibility as outlined in the [Ontario Human Rights Code](#) and the [Accessibility for Ontarians with Disabilities Act \(AODA\)](#) and is working to improve accessibility of the Open Research Repository collection. If you require an accessible version of a repository item contact us at repository@ocadu.ca.

Emīlija Veselova & İdil Gaziulusoy

When a tree is also a multispecies collective, a photosynthesis process and a carbon cycle

A systemic typology of natural nonhuman stakeholders when designing for sustainability

Emīlija Veselova

Doctoral Candidate

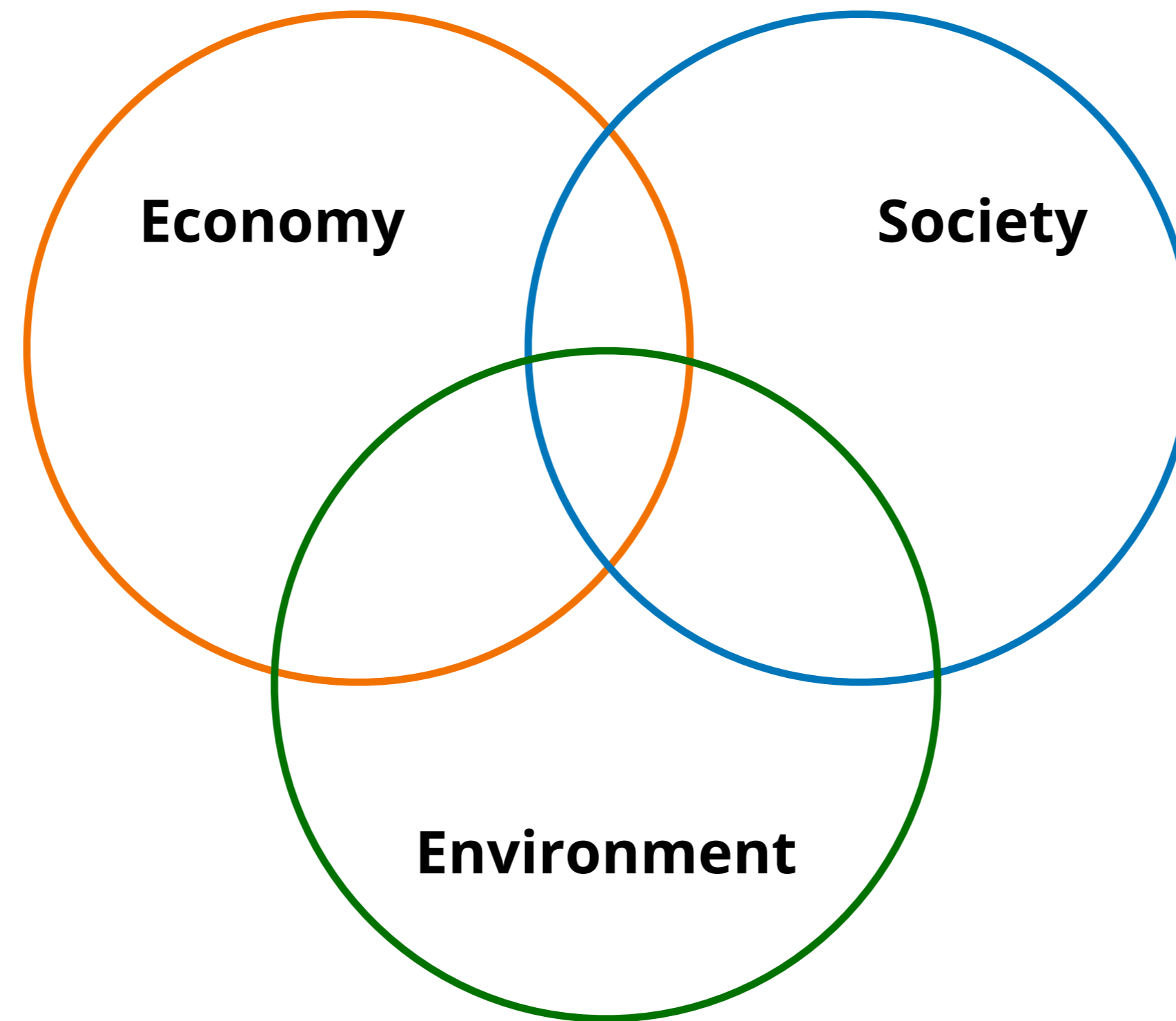
NODUS Sustainable Design Research Group,
Department of Design, Aalto University

emilija.veselova@aalto.fi // @emveselova



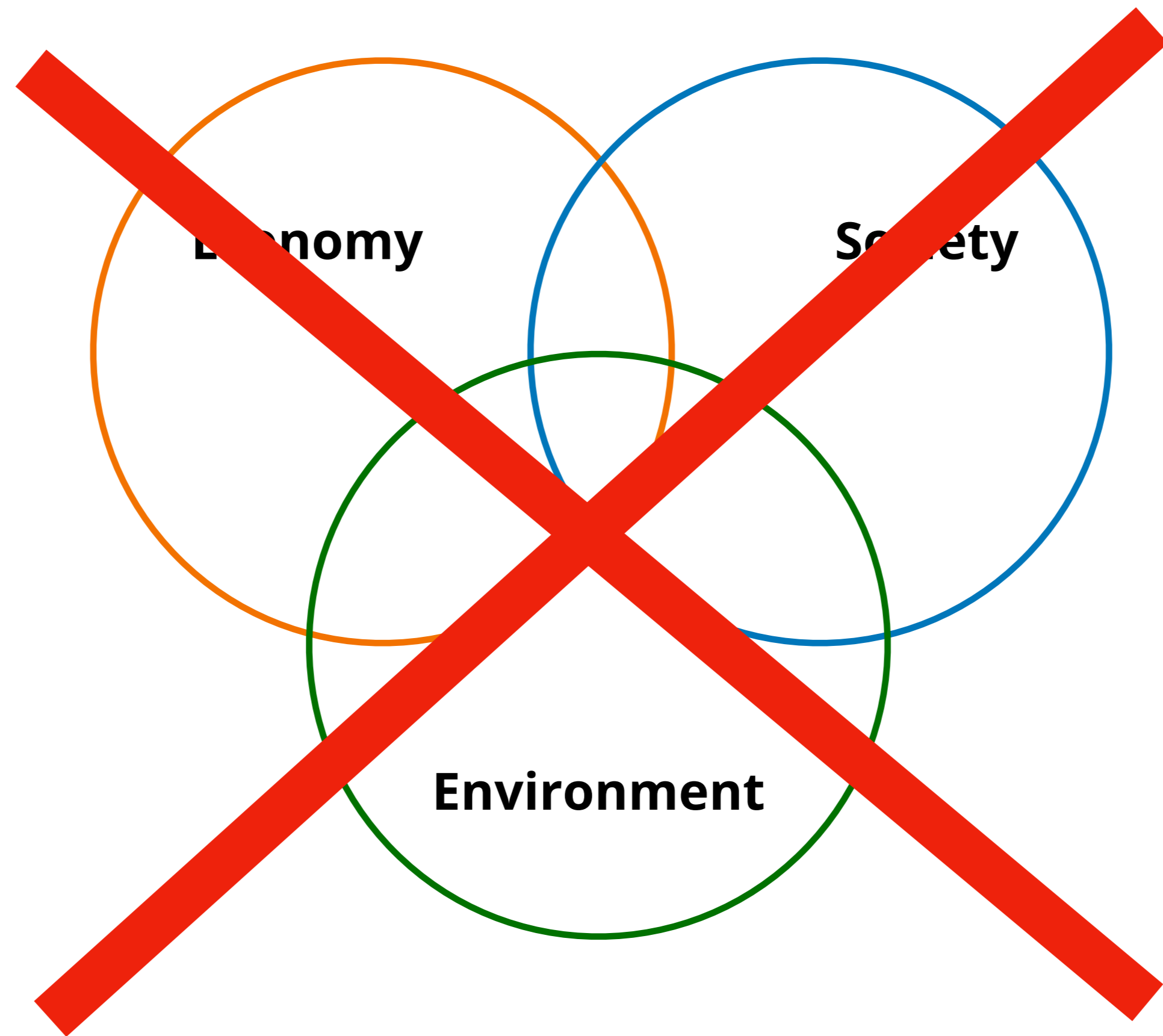
Sustainability
is a property of the whole system,
NOT of its individual elements or sub-systems !

Gaziulusoy, A. İ. (2015). A critical review of approaches available for design and innovation teams through the perspective of sustainability science and system innovation theories. Journal of Cleaner Production, 107, 366-377.



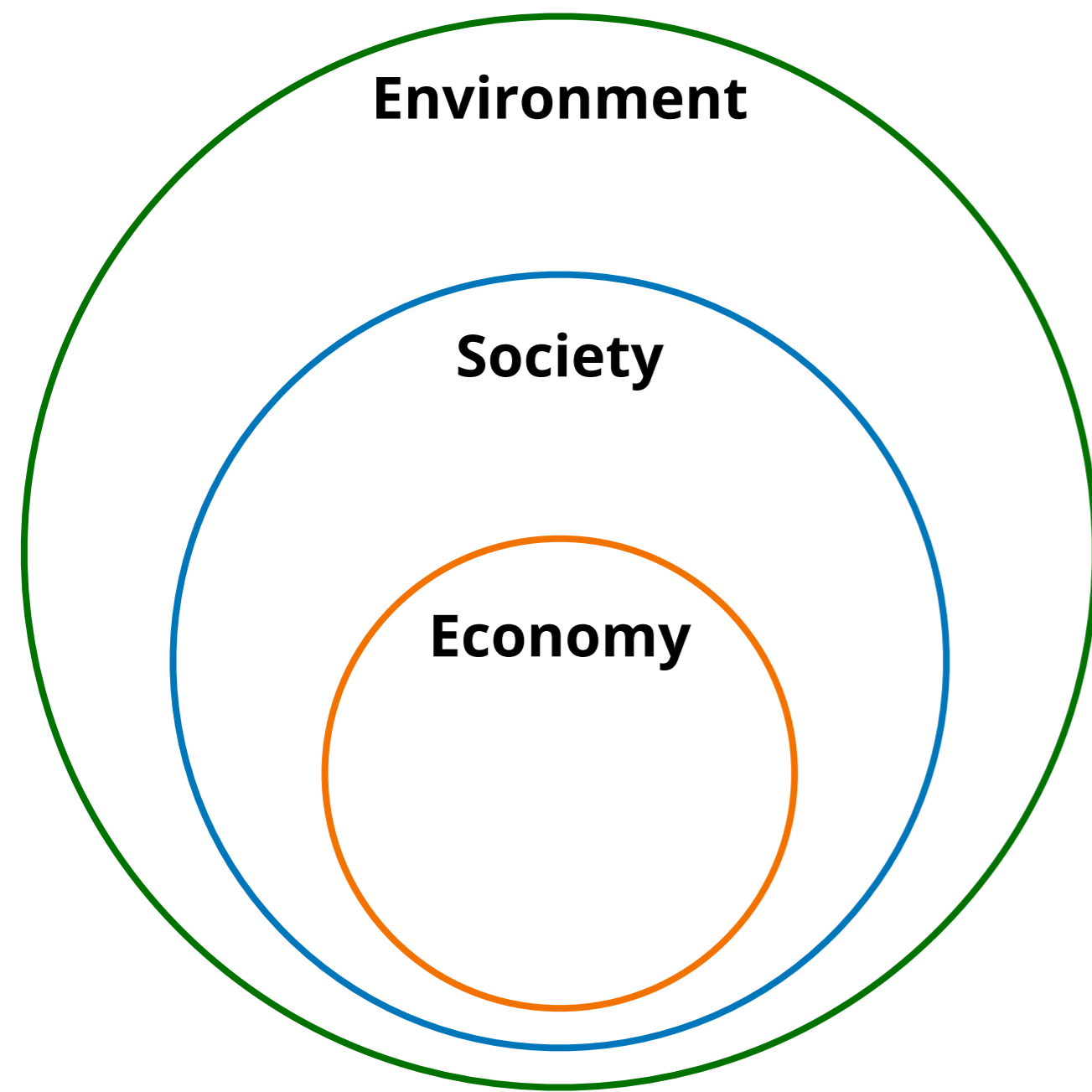
Weak Sustainability Model

Neumayer, E. (2003). Weak versus strong sustainability: Exploring the limits of two opposing paradigms. Edward Elgar Publishing.



Weak Sustainability Model

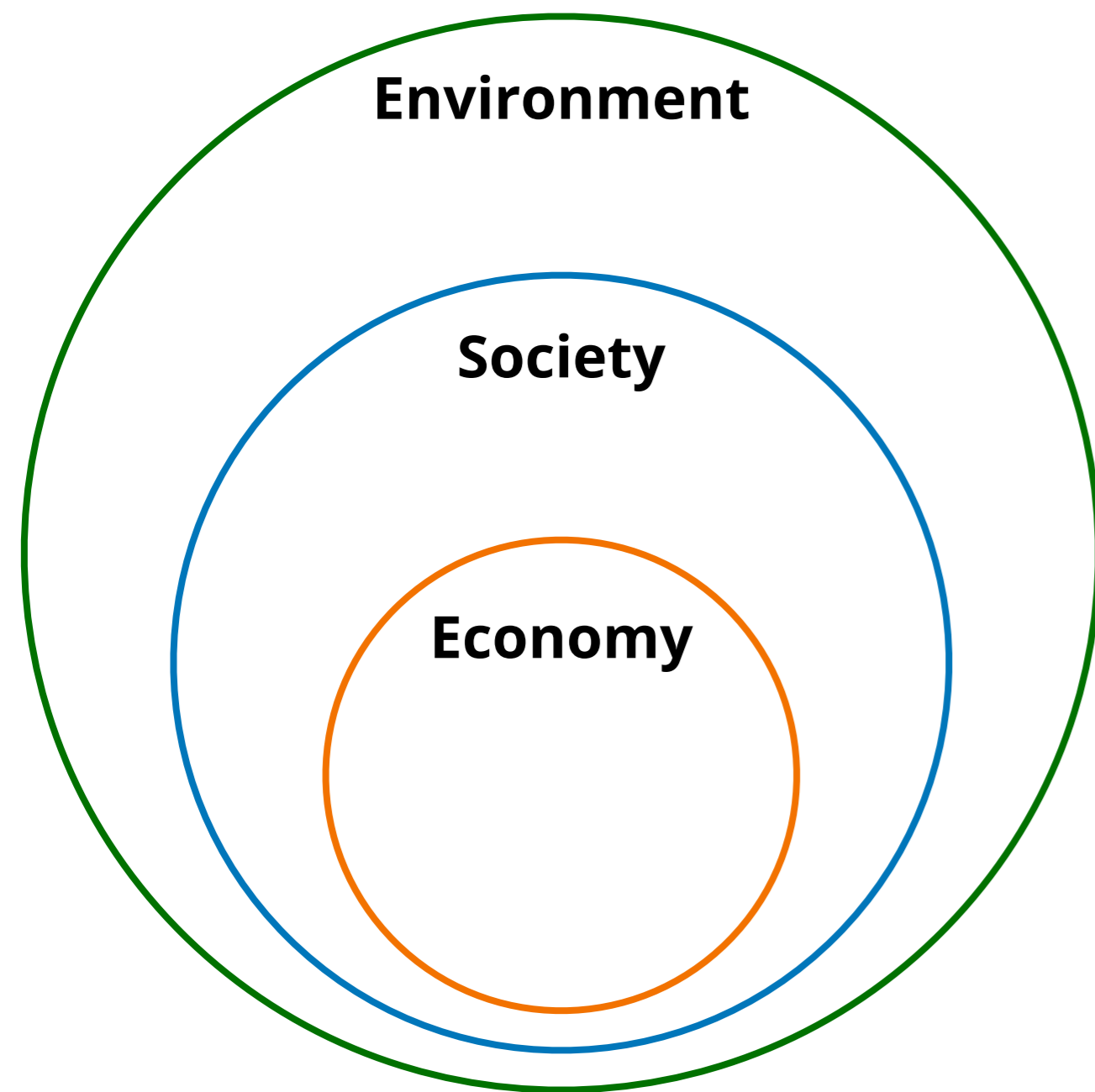
Neumayer, E. (2003). Weak versus strong sustainability: Exploring the limits of two opposing paradigms. Edward Elgar Publishing.



A. Strong Sustainability Model

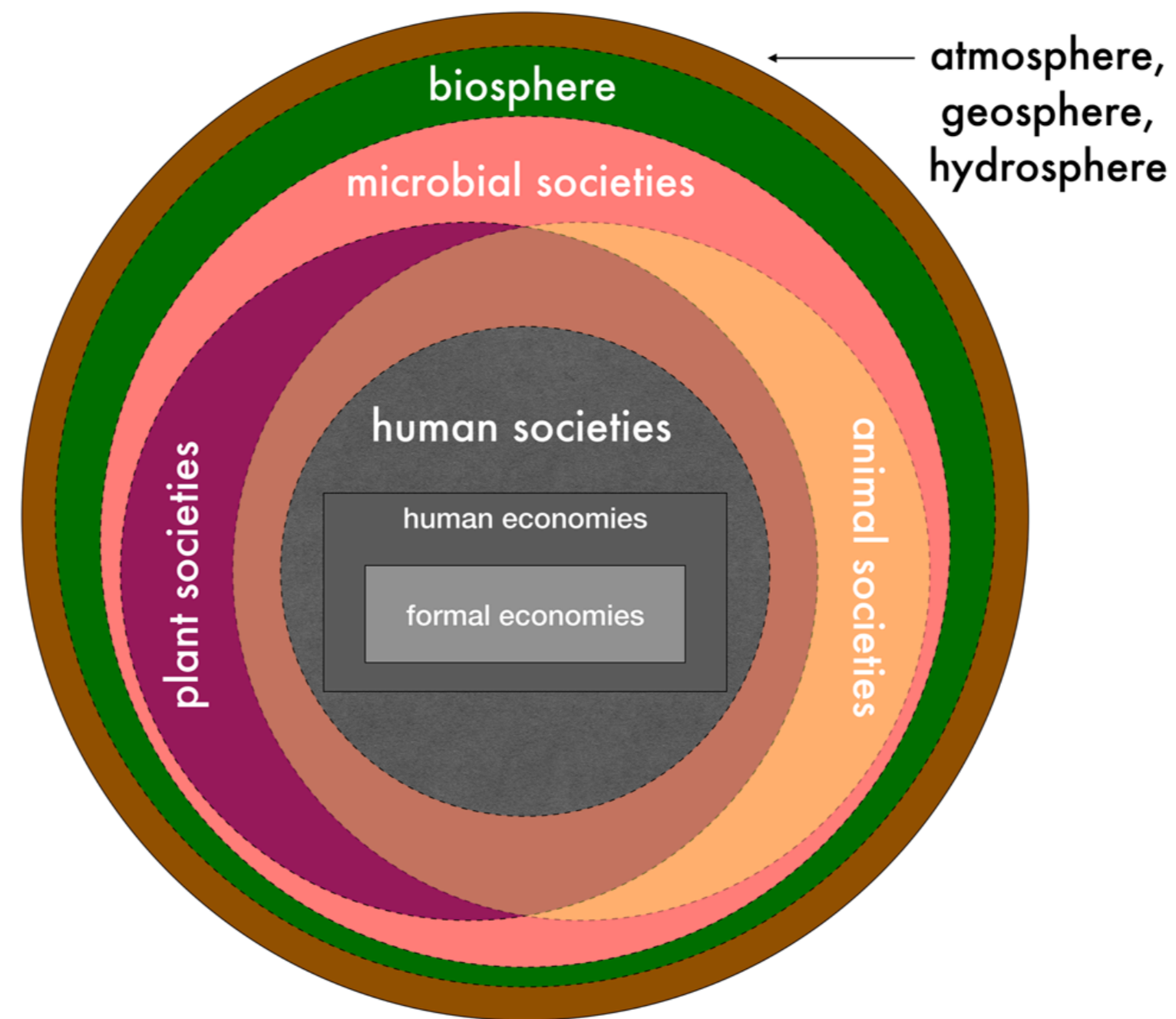
Neumayer, E. (2003). Weak versus strong sustainability: Exploring the limits of two opposing paradigms. Edward Elgar Publishing.

**! nested in =
dependent on**



A. Strong Sustainability Model

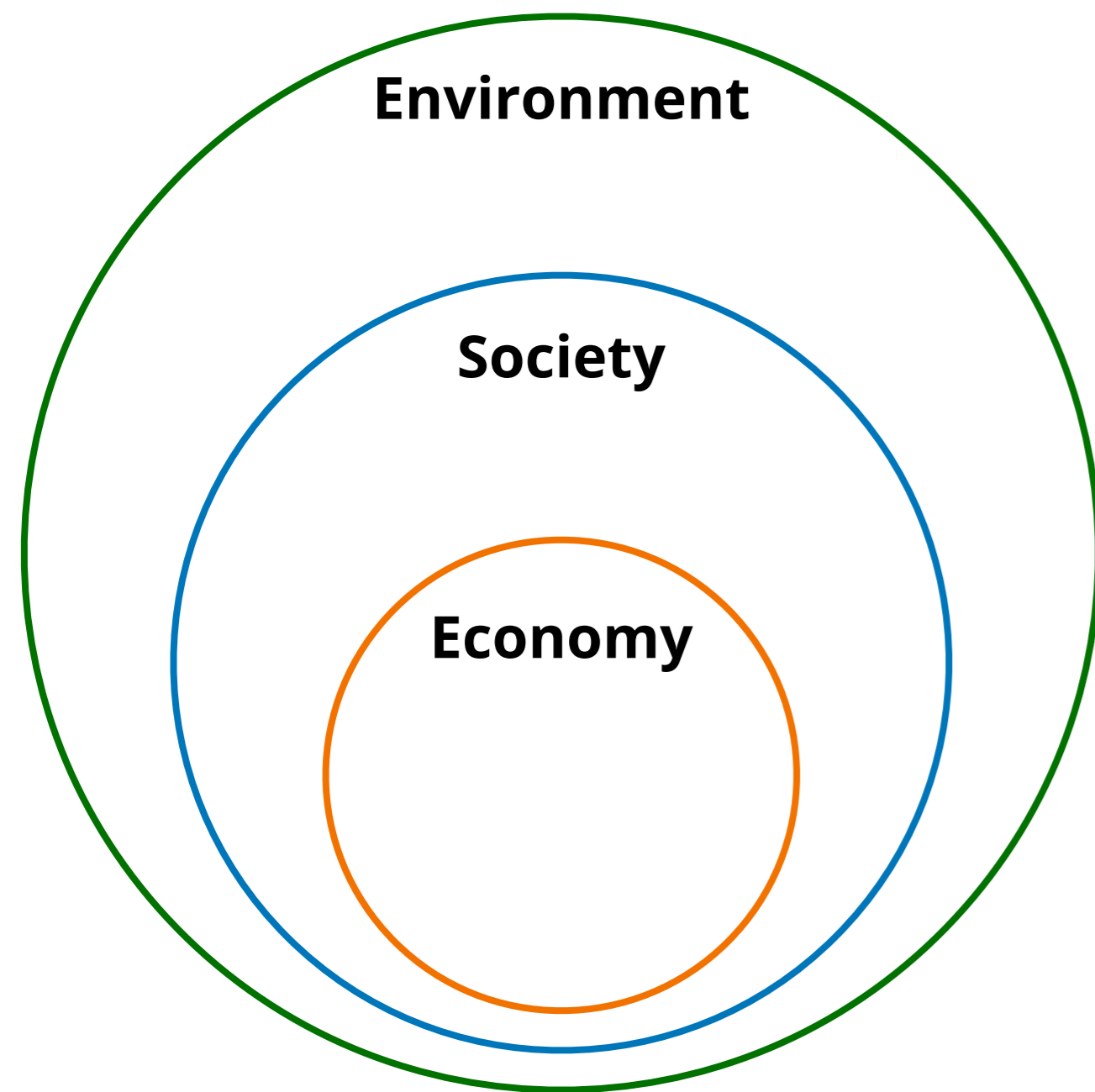
Neumayer, E. (2003). Weak versus strong sustainability: Exploring the limits of two opposing paradigms. Edward Elgar Publishing.



B. Multispecies Sustainability Concept

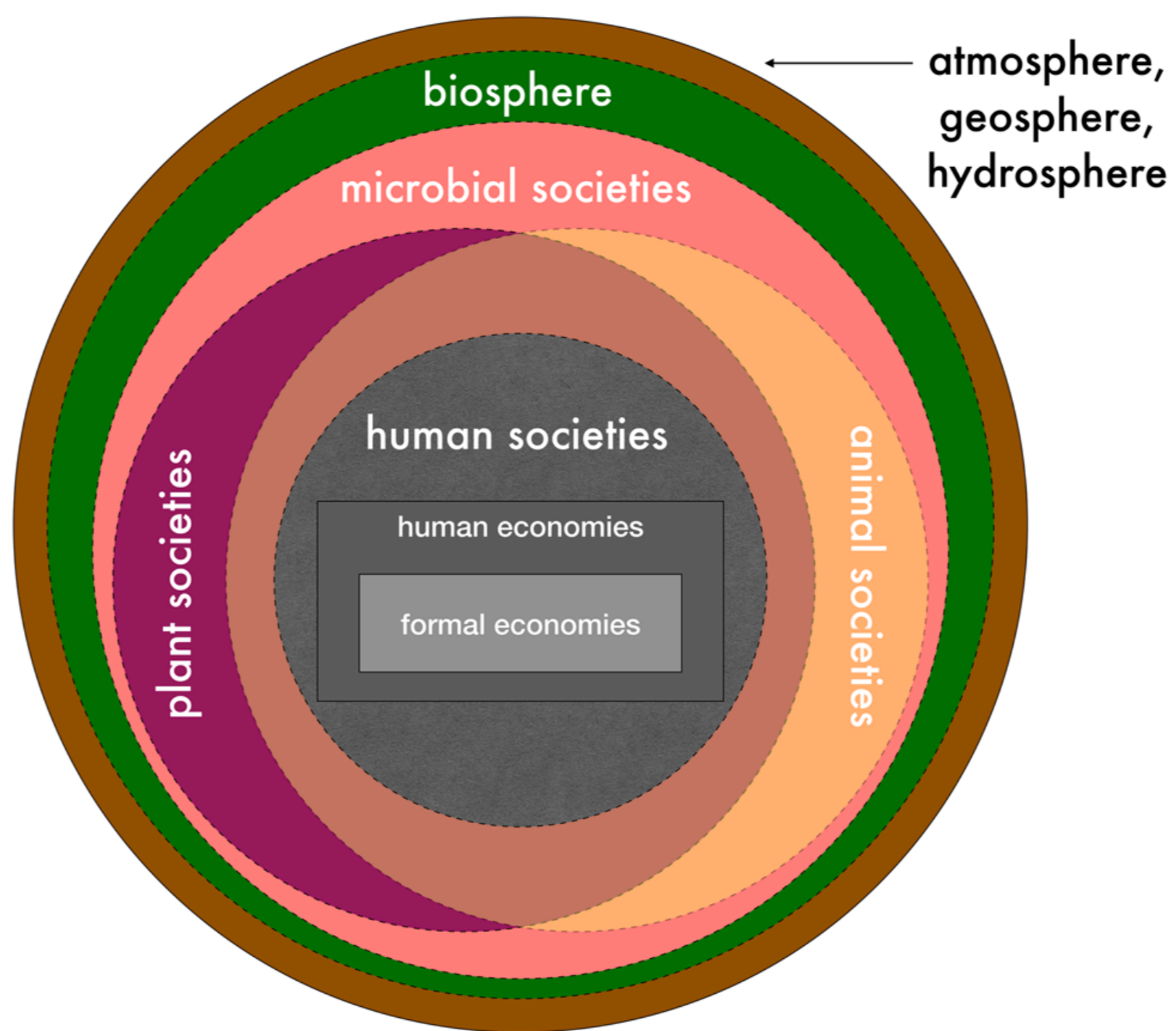
Rupprecht, C. D., Vervoort, J., Berthelsen, C., Mangnus, A., Osborne, N., Thompson, K., ... & Kawai, A. (2020). Multispecies sustainability. Global Sustainability, 3.

! nested in = dependent on



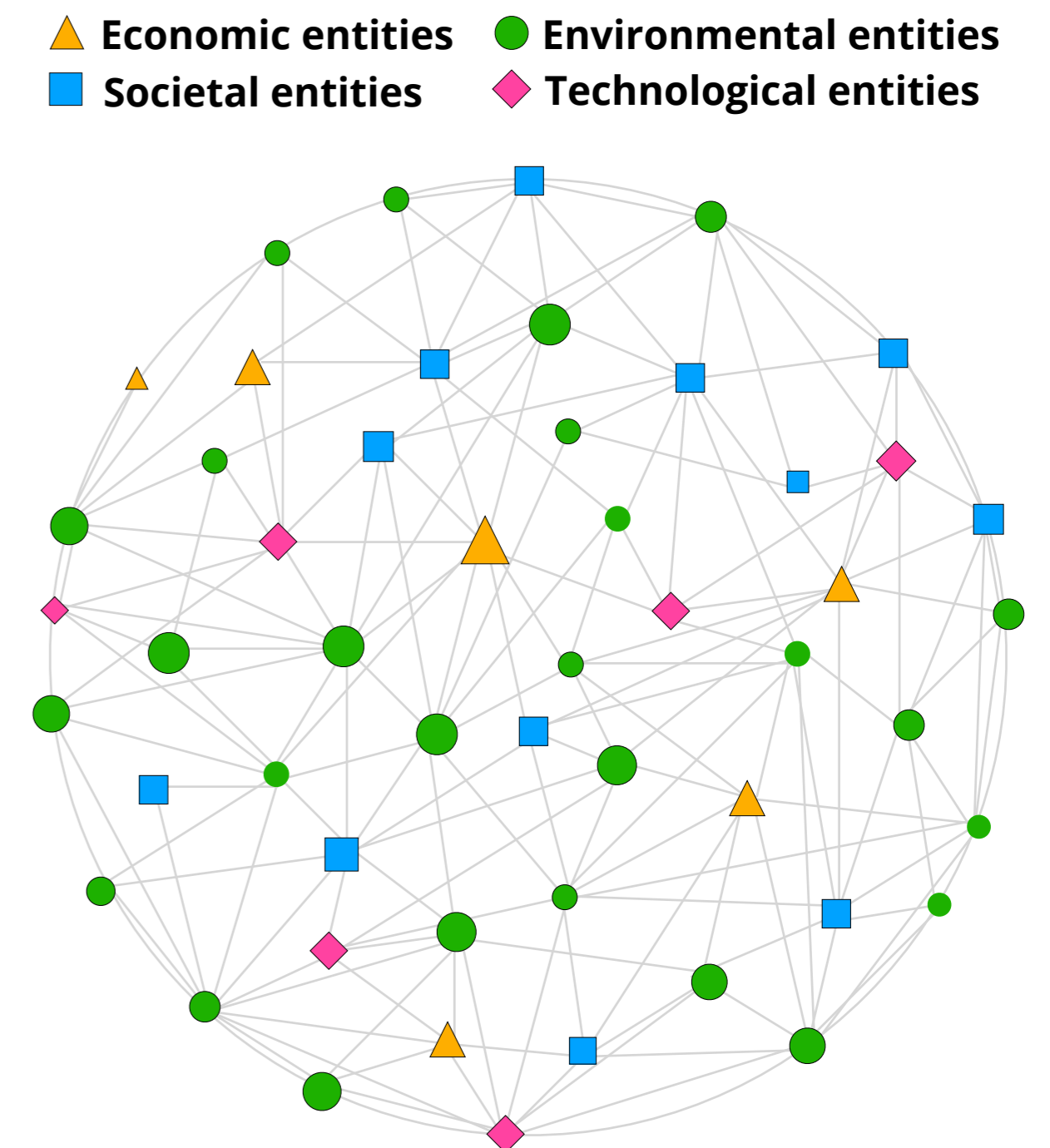
A. Strong Sustainability Model

Neumayer, E. (2003). Weak versus strong sustainability: Exploring the limits of two opposing paradigms. Edward Elgar Publishing.



B. Multispecies Sustainability Concept

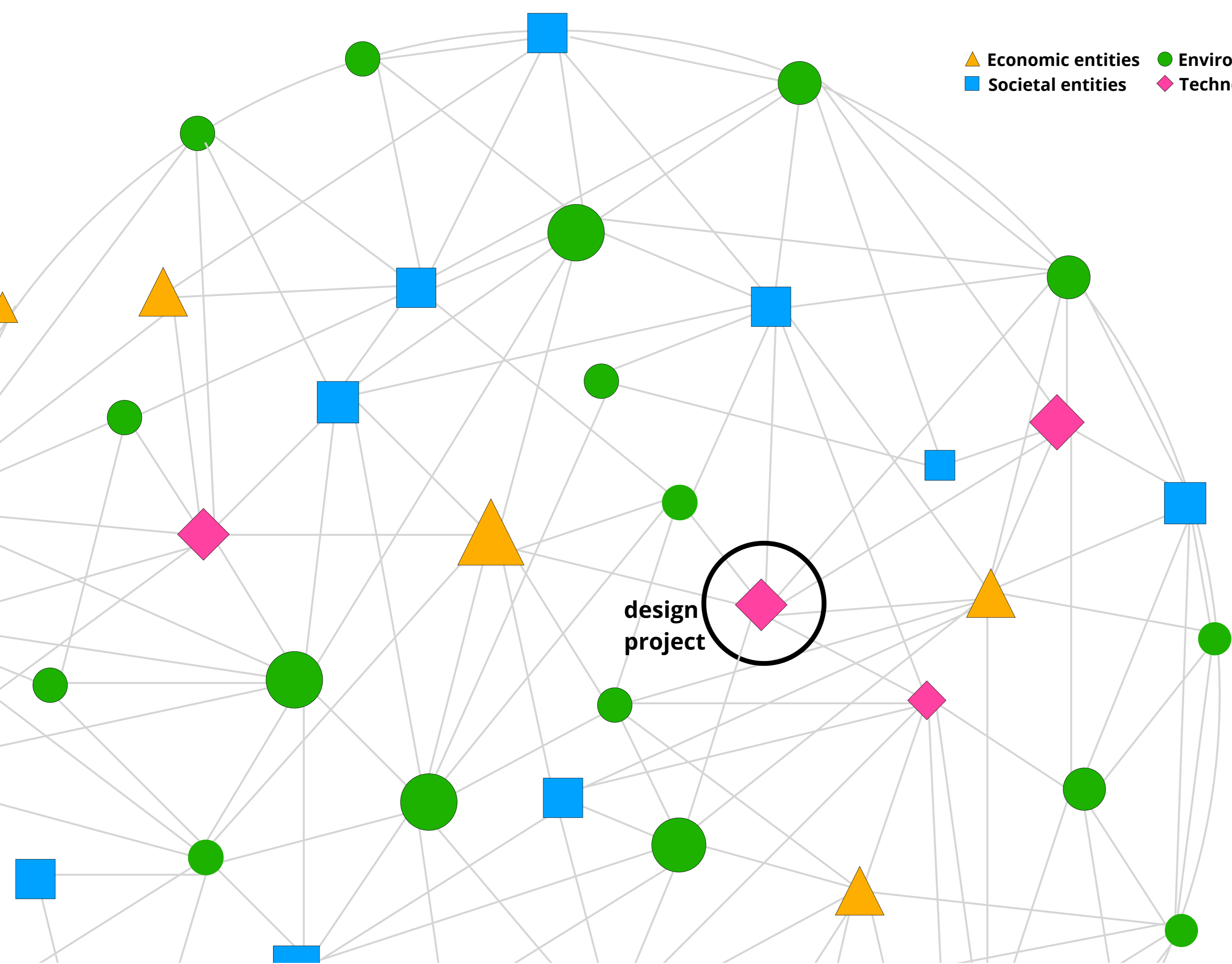
Rupprecht, C. D., Vervoort, J., Berthelsen, C., Mangnus, A., Osborne, N., Thompson, K., ... & Kawai, A. (2020). Multispecies sustainability. Global Sustainability, 3.



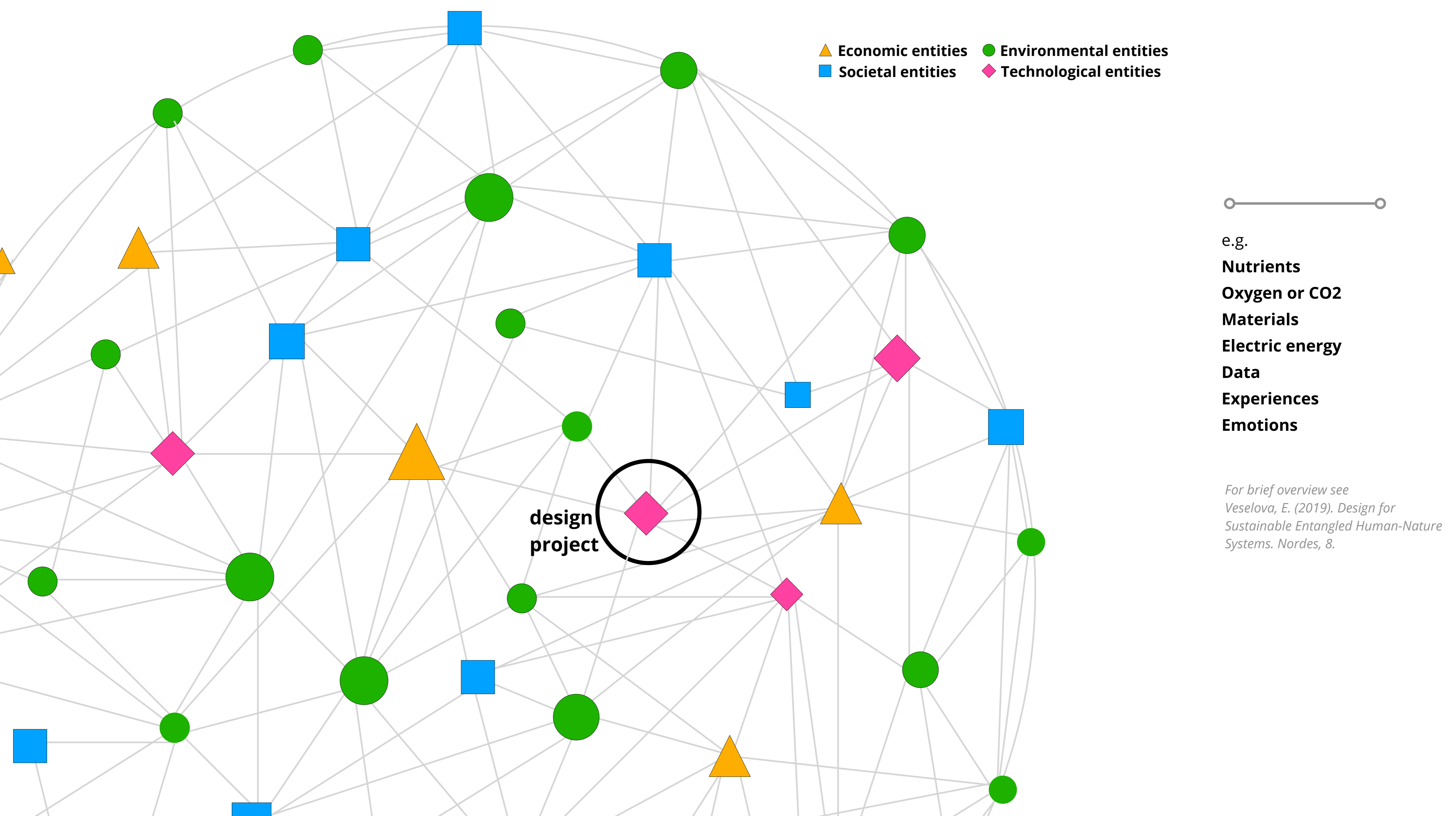
C. Interconnected view on Sustainability

! nested in = dependent on

- ▲ Economic entities
- Environmental entities
- Societal entities
- ◆ Technological entities



design project



▲ Economic entities ● Environmental entities
 ■ Societal entities ◆ Technological entities



e.g.
Nutrients
Oxygen or CO2
Materials
Electric energy
Data
Experiences
Emotions

*For brief overview see
 Veselova, E. (2019). Design for
 Sustainable Entangled Human-Nature
 Systems. Nordes, 8.*

**design
 project**

Every design project has natural nonhuman stakeholders

Every design project has natural nonhuman **stakeholders**

Actors without formal design training who can

inform,

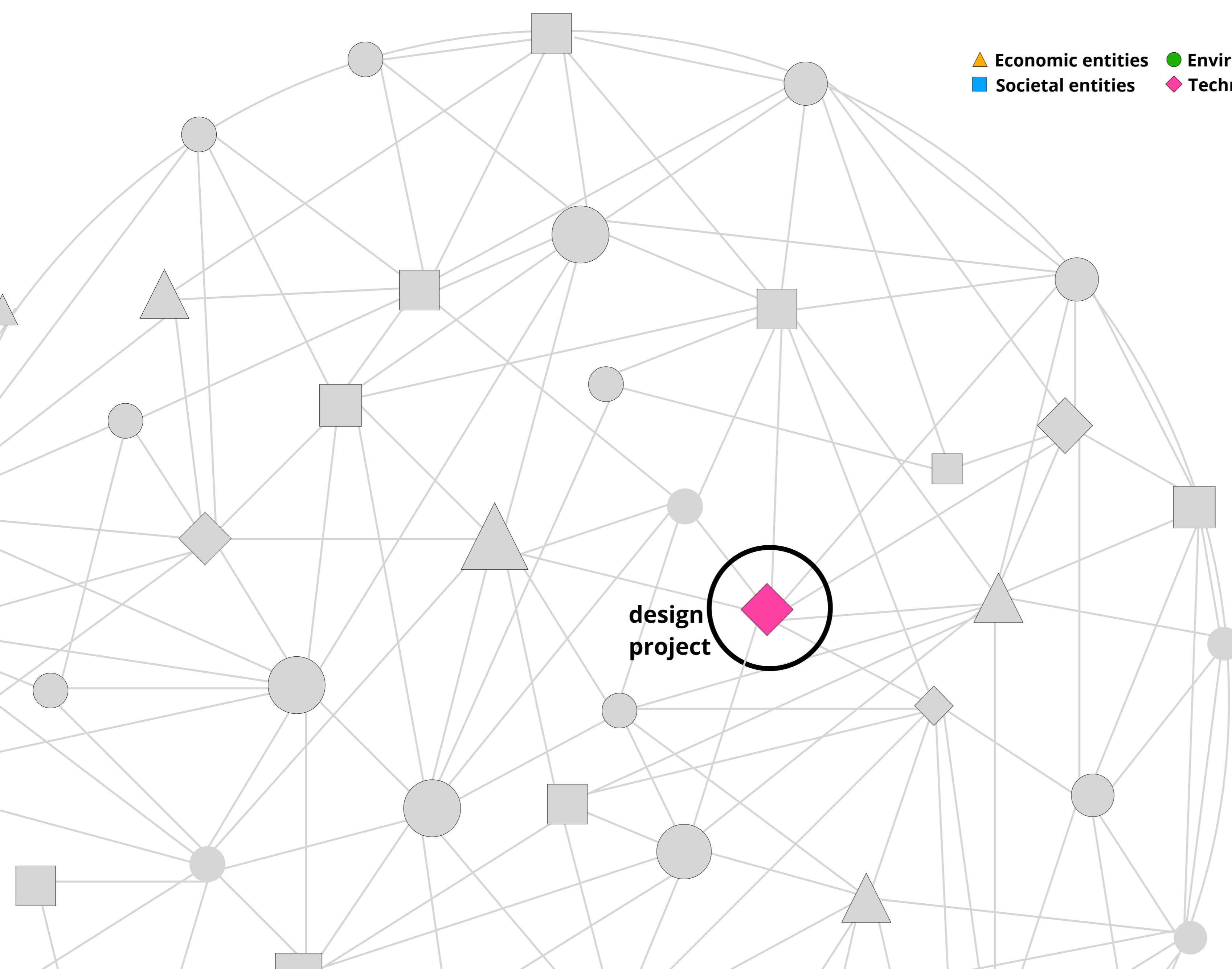
are **involved** in or

affected by

the design process and its outcomes

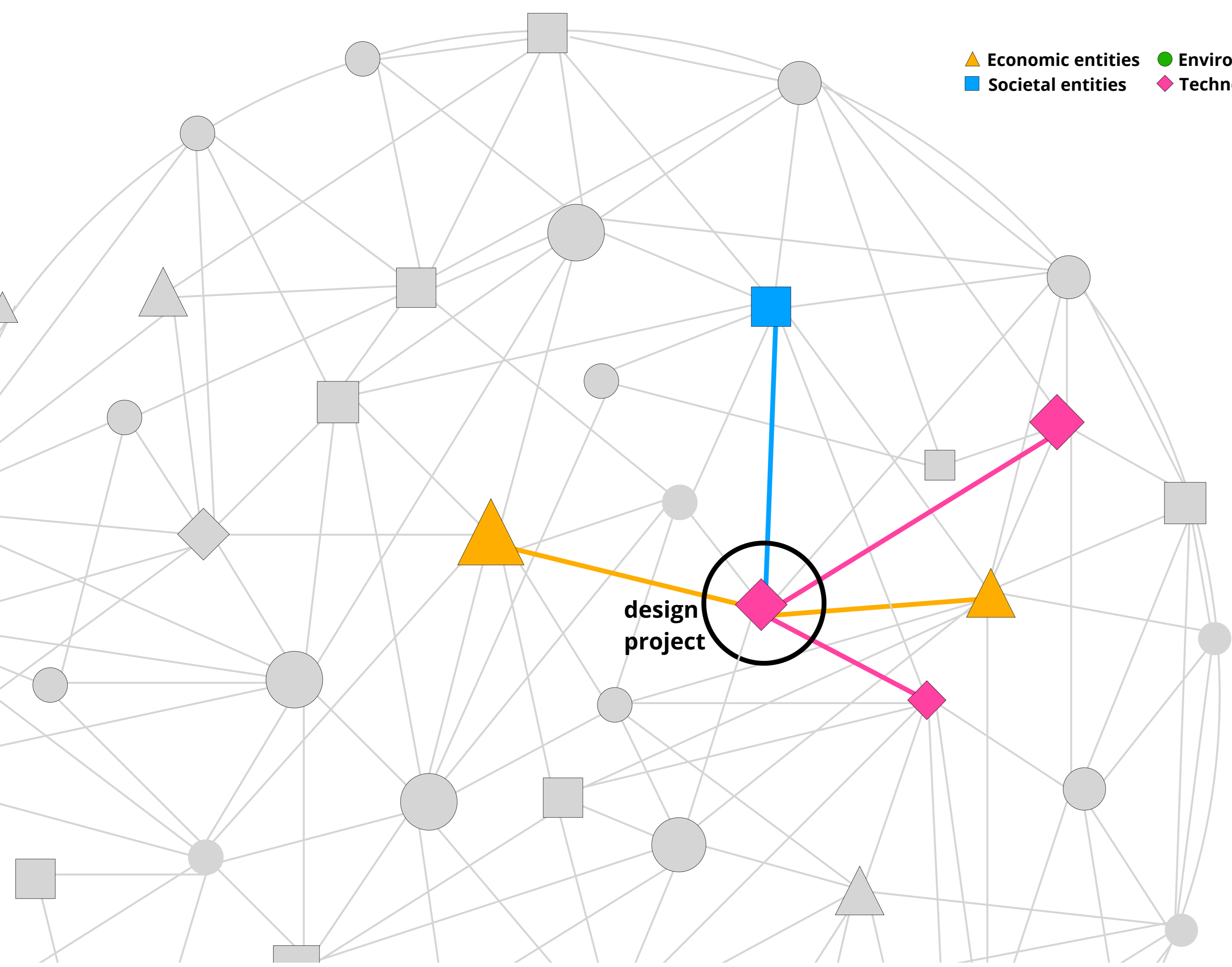
Veselova, E., & Gaziulusoy, A. İ. (2019). Implications of the Bioinclusive Ethic on Collaborative and Participatory Design. The Design Journal.

- ▲ Economic entities
- Environmental entities
- Societal entities
- ◆ Technological entities

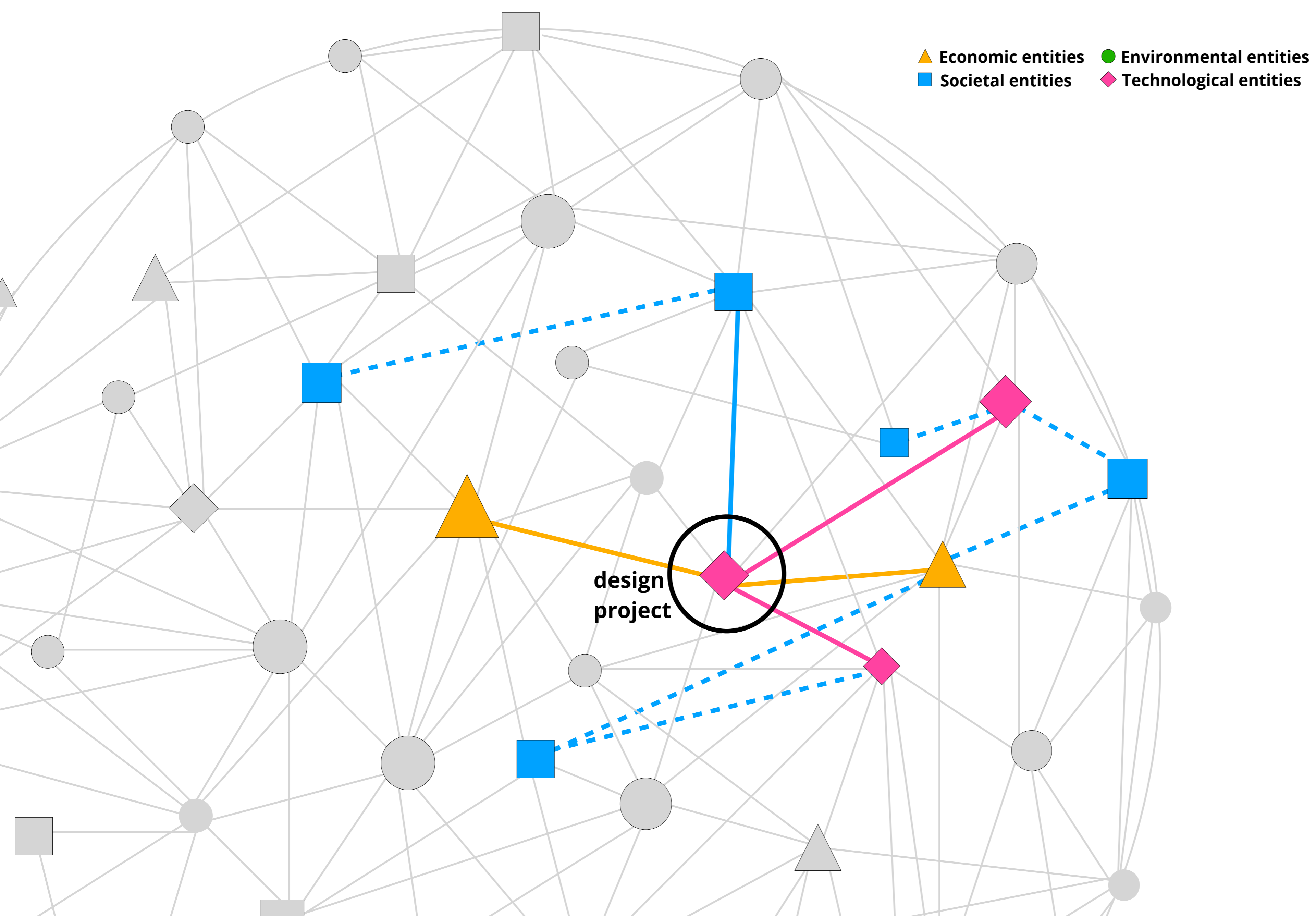


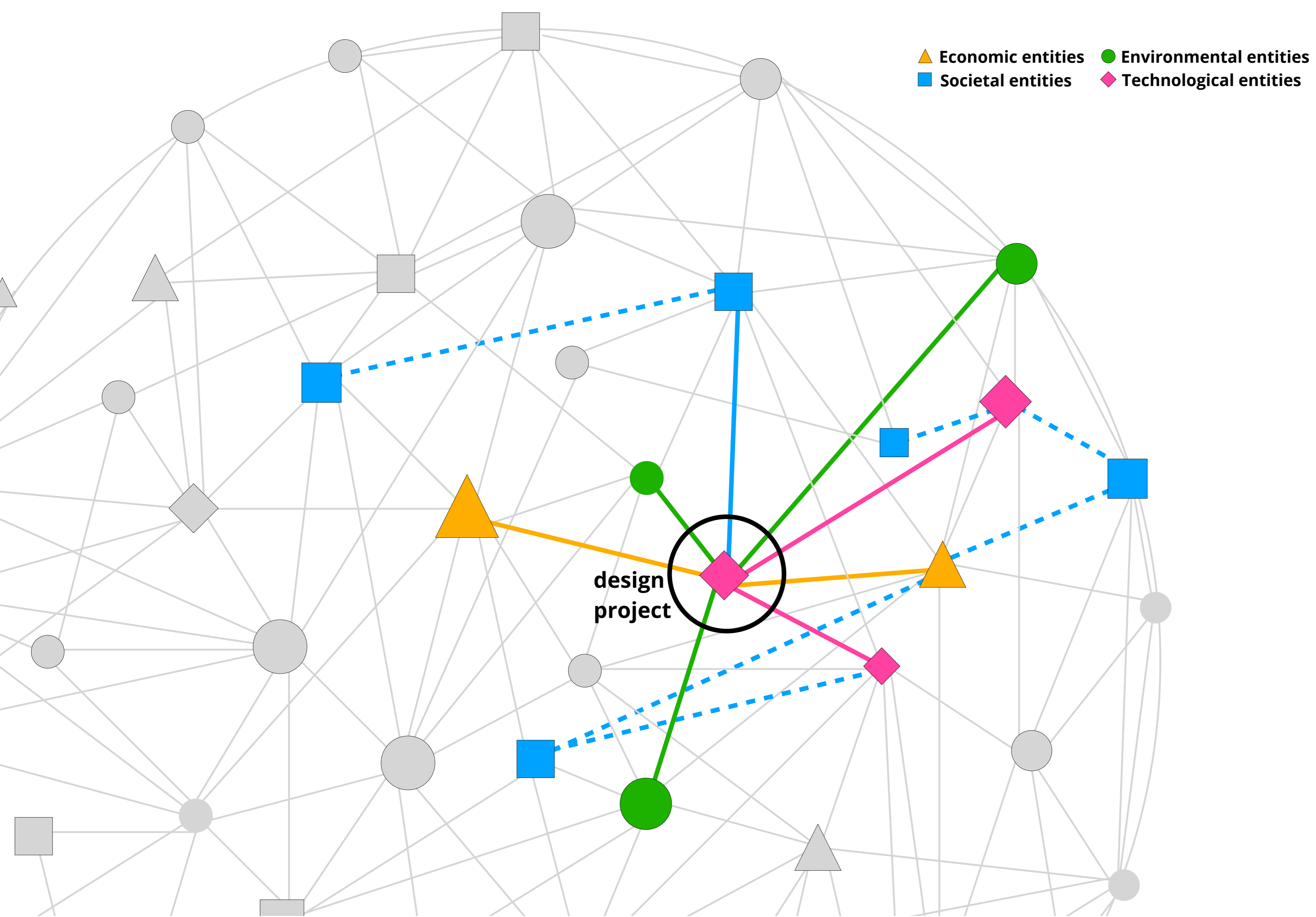
design project

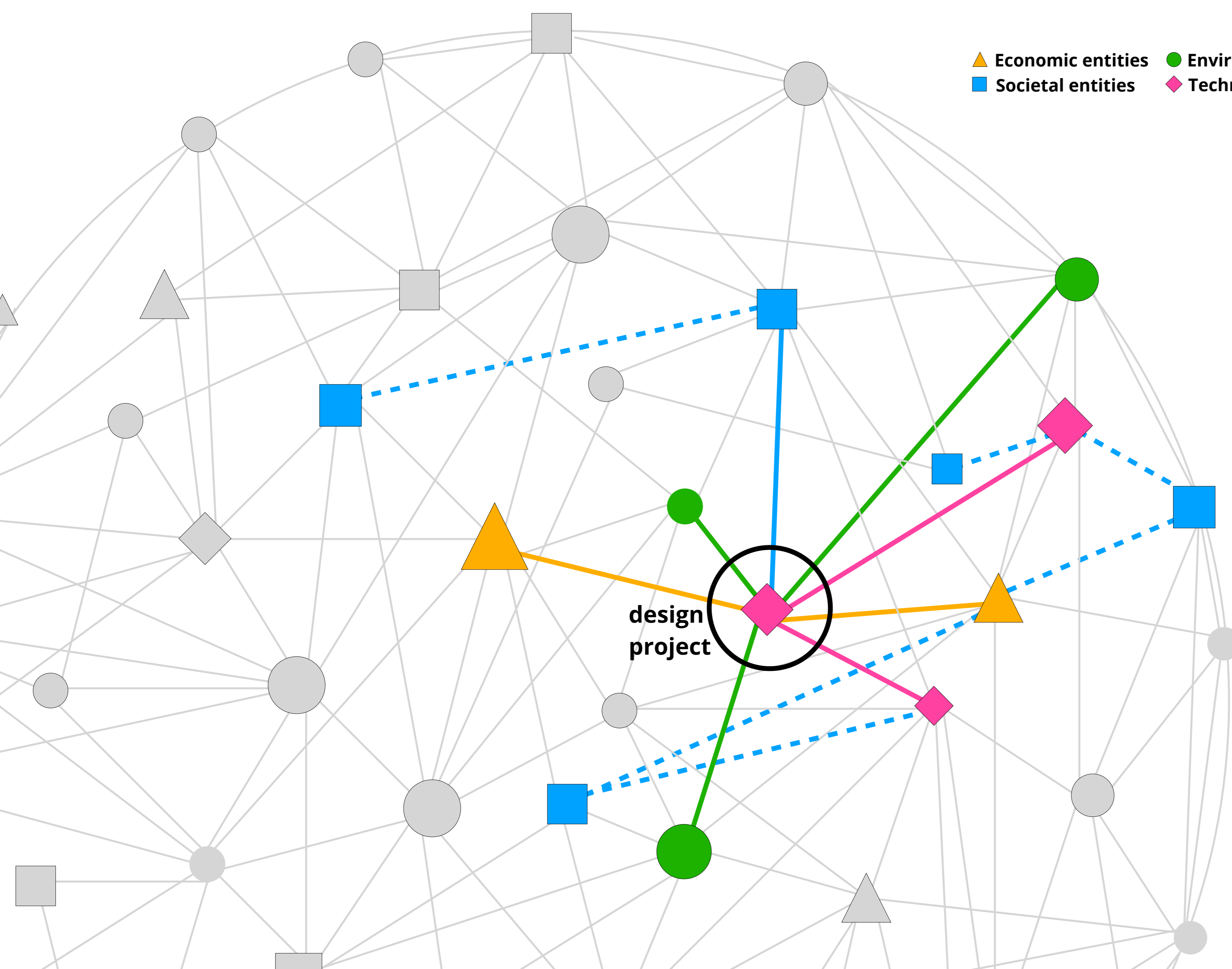
- ▲ Economic entities
- Environmental entities
- Societal entities
- ◆ Technological entities



design project







▲ Economic entities ● Environmental entities
 ■ Societal entities ◆ Technological entities

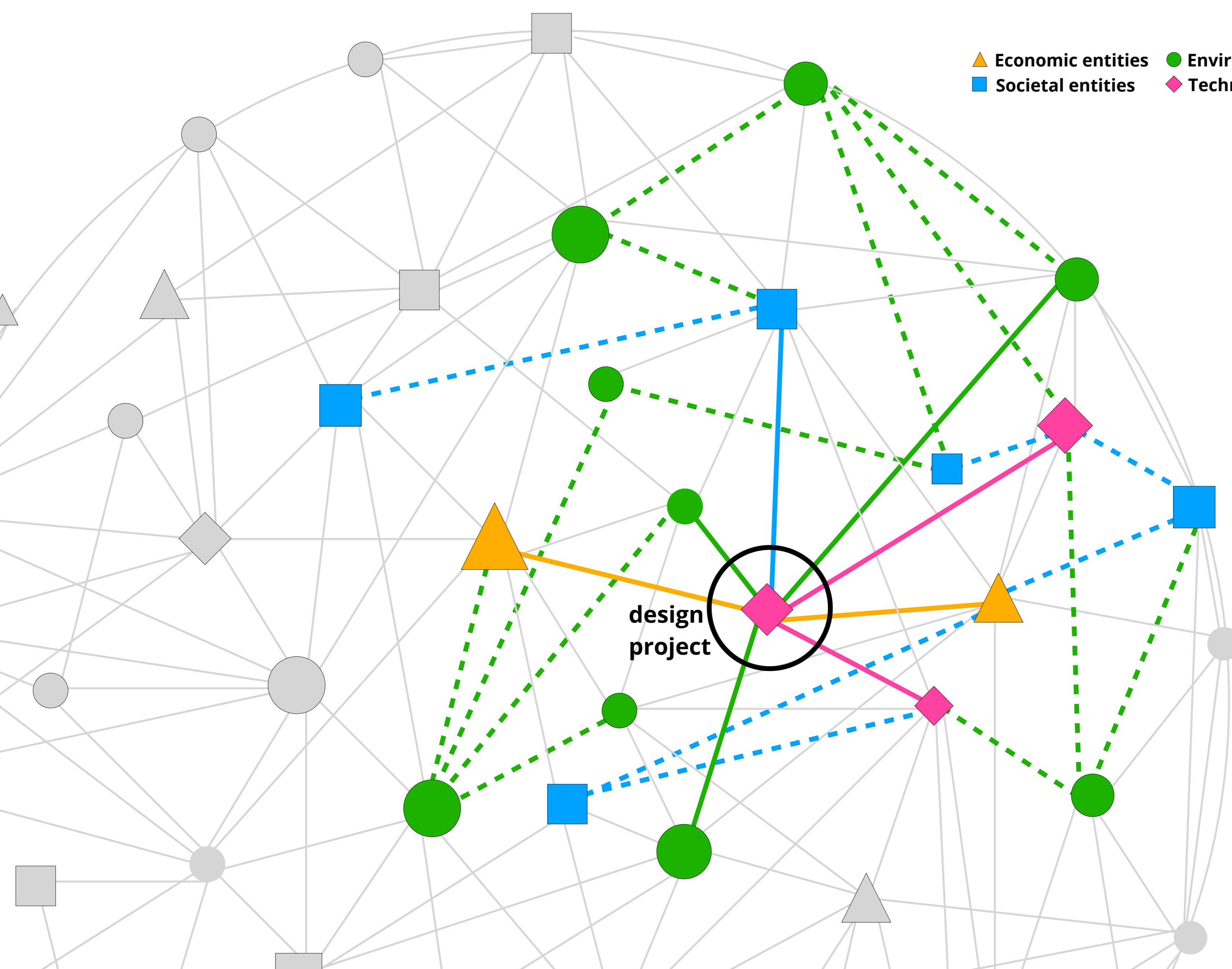
Seeing nonhuman stakeholders requires shifting between:

Timeframes (short-, mid-, long- term)

Proximity (local, regional, global)

Number of steps (one, two.... ten)

design project



Seeing nonhuman stakeholders requires shifting between:

Timeframes (short-, mid-, long- term)

Proximity (local, regional, global)

Number of steps (one, two.... ten)

design project

Who and what are these nonhuman stakeholders?

Methodology

- Empirical data collected through a multispecies ethnography study*
- Data analysed using the DSRP theoretical structures of systems thinking**
 - Four interrelated and interdependent systems thinking structures
 - Meta-level view on what happens when one does systems thinking

*Kirksey, S. E., & Helmreich, S. (2010). *The Emergence of Multispecies Ethnography*. *Cultural Anthropology*, 25(4), 545–576.

**Cabrera, D., Cabrera, L., & Powers, E. (2015). *A Unifying Theory of Systems Thinking with Psychosocial Applications*. *Syst. Res.*, 13.

**Cabrera, D., & Colosi, L. (2008). *Distinctions, svstems, relationships, and perspectives (DSRP): A theory of thinking and of things*. *Evaluation and Program Planning*, 31(3), 311–317.

Methodology

- Empirical data collected through a multispecies ethnography study*
- Data analysed using the DSRP theoretical structures of systems thinking**
 - Four interrelated and interdependent systems thinking structures
 - Meta-level view on what happens when one does systems thinking
 - **Distinctions:** observing a boundary between an element and 'the other' thus defining or distinguishing what the element is and what it is not
 - **Systems:** seeing the larger whole of 'element' and 'other' as a system of 'two or more related parts'
 - **Relationships:** recognising causal, correlation, direct, indirect and other relationships between the elements in the system
 - **Perspectives:** recognising that any distinctions, interpretation, relationship-making and meaning-making is done from a certain perspective or point of view

*Kirksey, S. E., & Helmreich, S. (2010). *The Emergence of Multispecies Ethnography*. *Cultural Anthropology*, 25(4), 545–576.

**Cabrerá, D., Cabrerá, L., & Powers, E. (2015). *A Unifying Theory of Systems Thinking with Psychosocial Applications*. *Syst. Res.*, 13.

**Cabrerá, D., & Colosi, L. (2008). *Distinctions, svstems, relationships, and perspectives (DSRP): A theory of thinking and of things*. *Evaluation and Program Planning*, 31(3), 311–317.

Systemic typology of natural nonhuman stakeholders

i	Single Organism
ii	Single species collective
iii	Multispecies collective
iv	Life Process
v	Living system
vi	Biogeochemical Cycle
vii	Process of the atmosphere



Single Organism:

- An organism typically seen as a independent living entity
 - Plants
 - animals, incl. mammals, birds, reptiles, insects, amphibians, crustaceans, molluscs



Single Species Collectives:

- A collective of organisms from a single species that live together and might have a special organisation of their life
 - Social insect colonies
 - Bryophytes, incl. mosses and hornworts
 - Algae
 - Fungi



Multispecies Collectives:

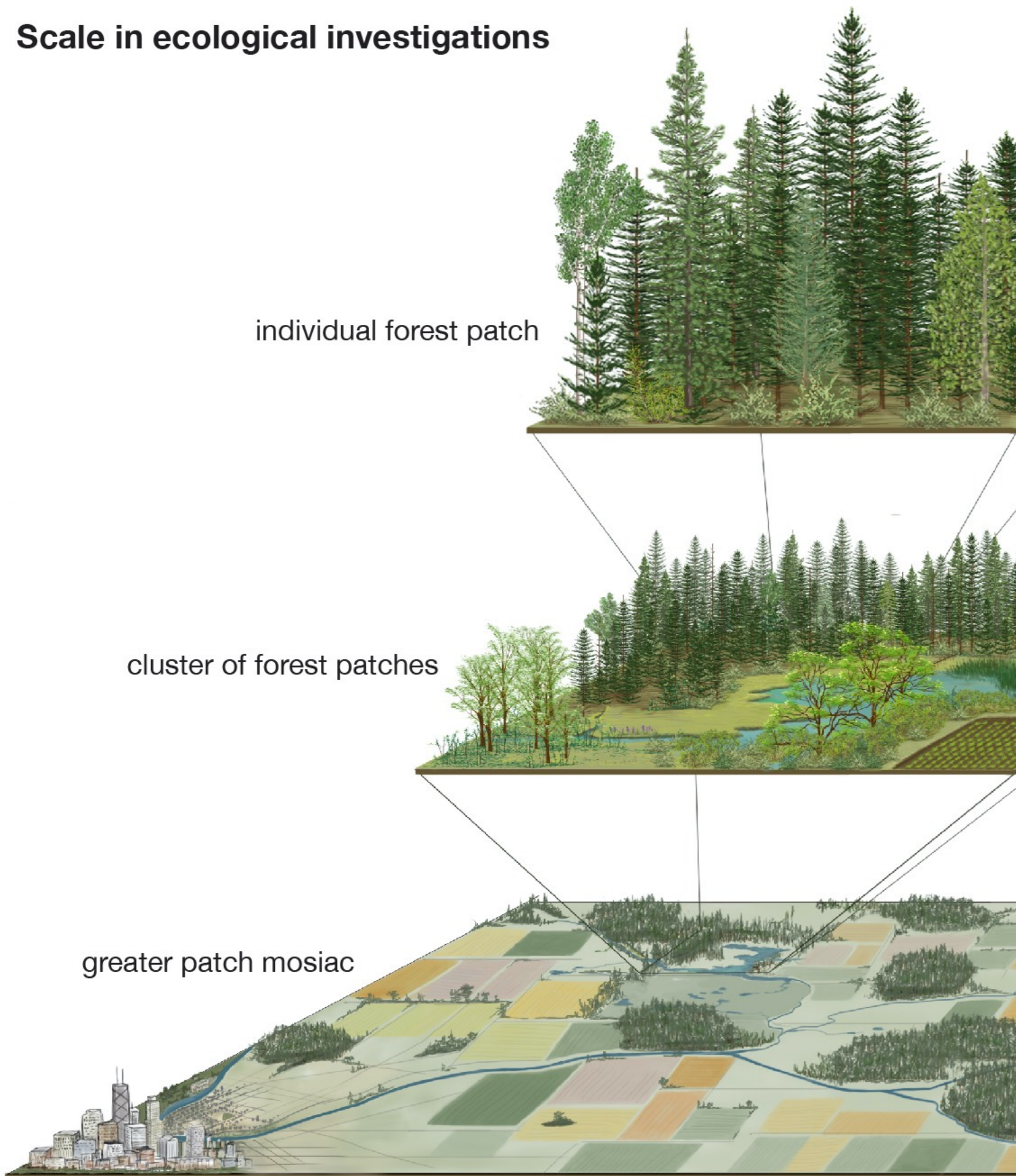
- A collective of living organisms, such as microorganisms, insects, worms that jointly partake in life processes
 - Bacterial collectives
 - Lichens
 - Soil
 - Compost
 - Animal manure



Life Process

- A flows of elements between living and nonliving parts of the biosphere
 - Photosynthesis
 - Decomposition of organic matter
 - Respiration
 - Nitrogen Fixation

Scale in ecological investigations



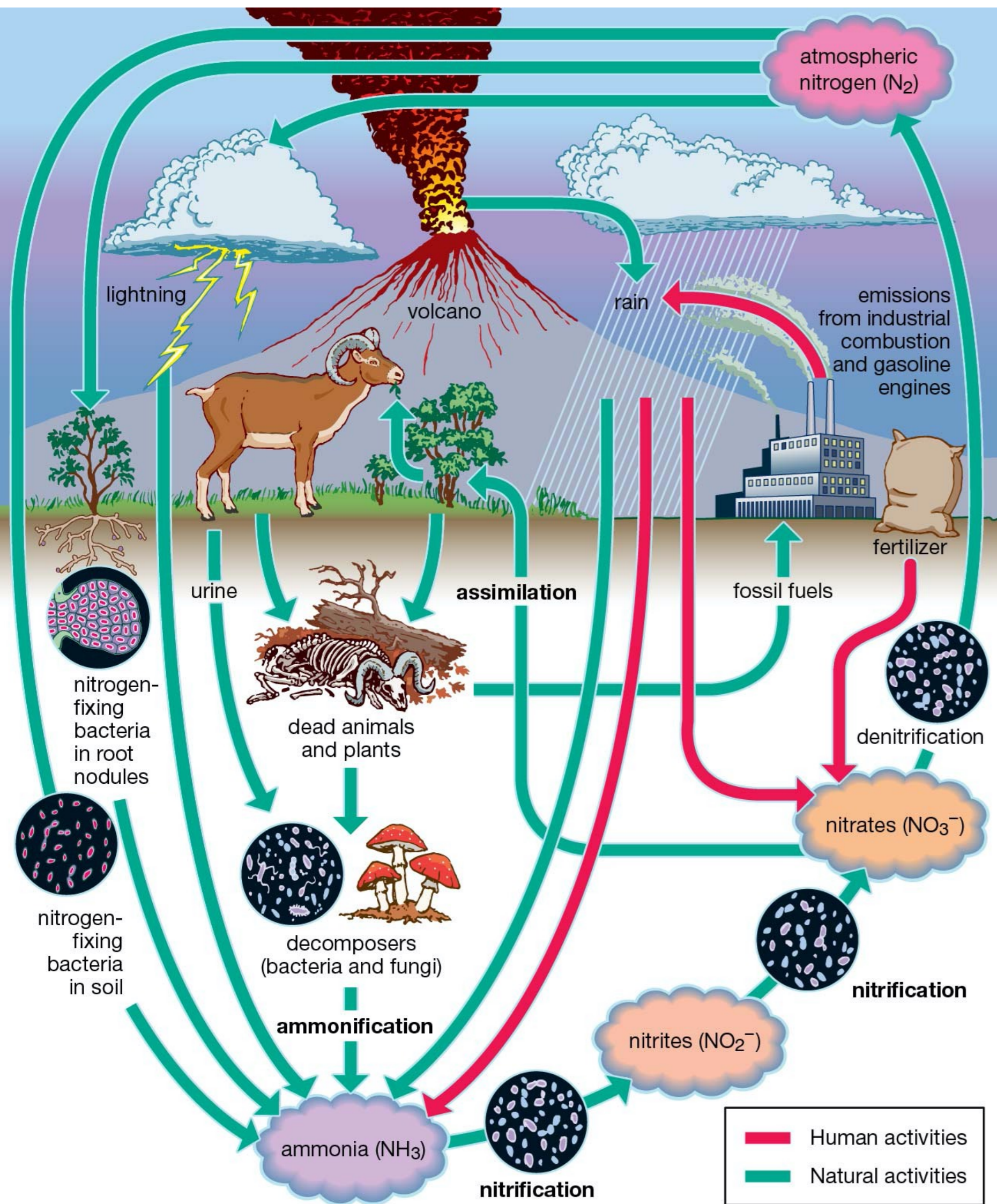
© 2013 Encyclopædia Britannica, Inc.

Living System

- A location-tied system of living organisms, collectives and the organic and inorganic matter and gasses that jointly partake in life processes

Ecosystem. (2020). In *Encyclopedia Britannica*. <https://www.britannica.com/science/ecosystem>

- Garden
 - Lawn
 - Greenhouse
 - Forest
 - River
-
- Different levels of observation provide a different 'system'



© 2011 Encyclopædia Britannica, Inc.

Biogeochemical Cycle

- A cyclical flow of an elements between the living and nonliving parts of the biosphere
 - Carbon cycle
 - Nitrogen cycle
 - Phosphorus cycle
 - Water cycle
- “In order for the living components of a major ecosystem (e.g., a lake or a forest) to survive, all the chemical elements that make up living cells must be recycled continuously.”



Processes of the atmosphere

- A short-, mid-, or long-term processes in the atmosphere that determines presence of elements and energetic resources for life processes

Waggoner, P. E. (2020). Climate. In Encyclopedia Britannica. <https://www.britannica.com/science/climate-meteorology>

- Weather (short-term)
- Season (mid-term)
- Climate (long-term)

Systemic typology of natural nonhuman stakeholders

i	Single Organism
ii	Single species collective
iii	Multispecies collective
iv	Life Process
v	Living system
vi	Biogeochemical Cycle
vii	Process of the atmosphere

Systemic typology of natural nonhuman stakeholders

i	Single Organism
ii	Single species collective
iii	Multispecies collective
iv	Life Process
v	Living system
vi	Biogeochemical Cycle
vii	Process of the atmosphere

- Key distinct variations rather than precise, definite, mutually exclusive or universal categories
- A mental model for making sense of the complexity when working with natural nonhuman stakeholders

Systemic typology of natural nonhuman stakeholders

i	Single Organism
ii	Single species collective
iii	Multispecies collective
iv	Life Process
v	Living system
vi	Biogeochemical Cycle
vii	Process of the atmosphere
	Type Y ?

- Key distinct variations rather than precise, definite, mutually exclusive or universal categories
- A mental model for making sense of the complexity when working with natural nonhuman stakeholders
- Leaves room for other categories

Systemic typology of natural nonhuman stakeholders

i	Single Organism
ii	Single species collective
iii	Multispecies collective
iv	Life Process
v	Living system
vi	Biogeochemical Cycle
vii	Process of the atmosphere
	Type Y ?



One entity

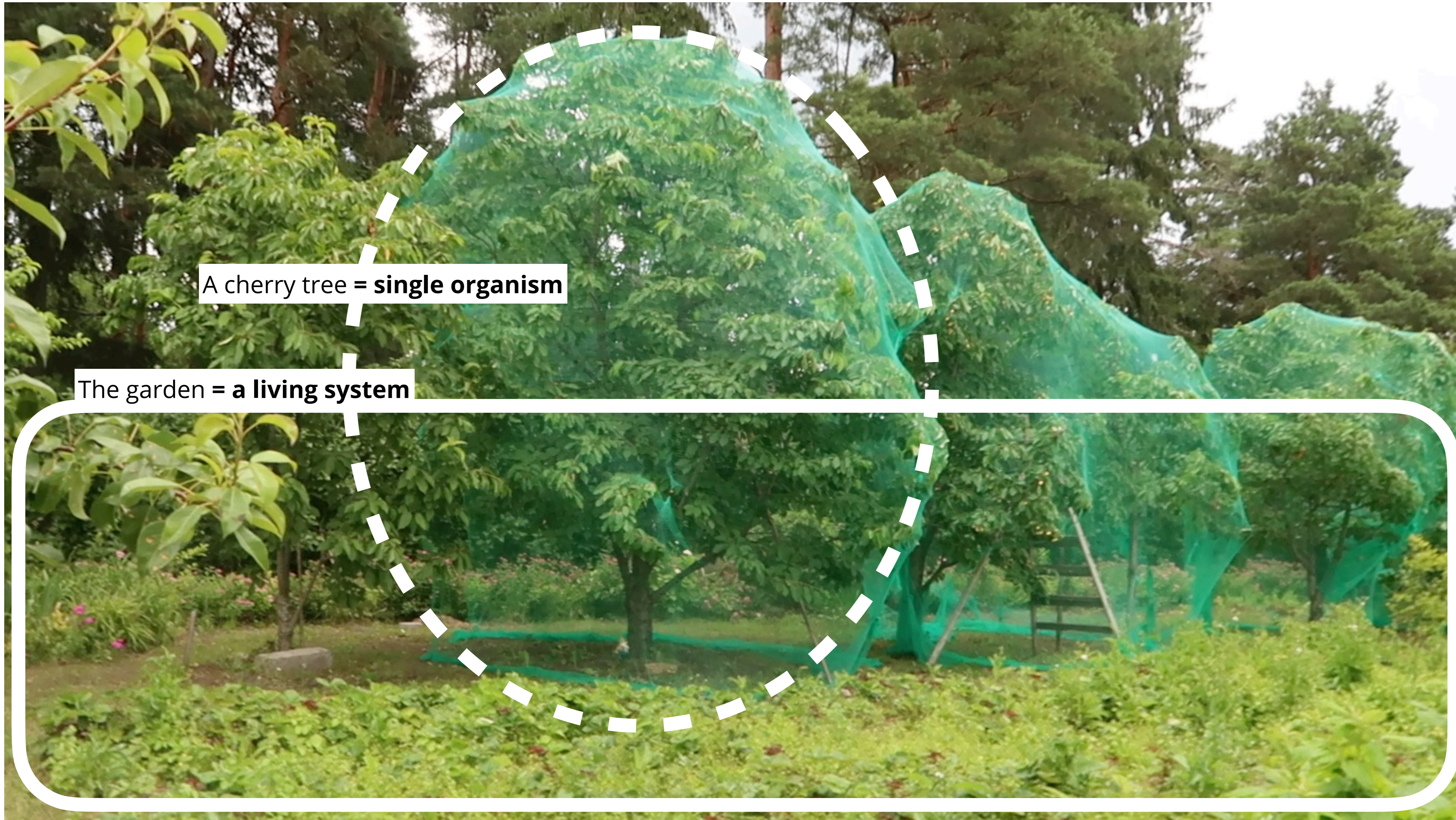
=

**Several
systemic stakeholder
types**





A cherry tree = **single organism**



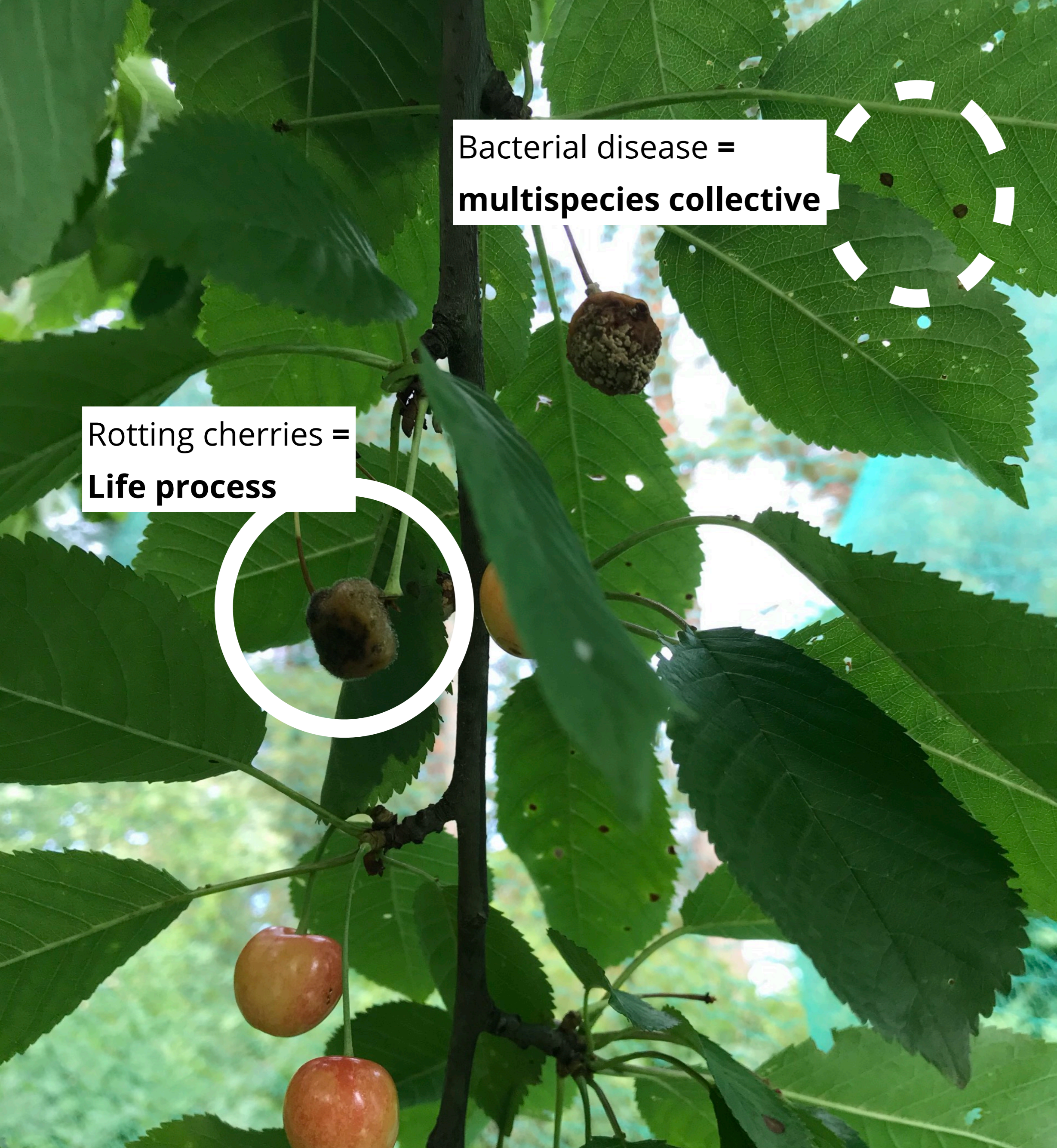
A cherry tree = **single organism**

The garden = **a living system**



Bacterial disease =
multispecies collective

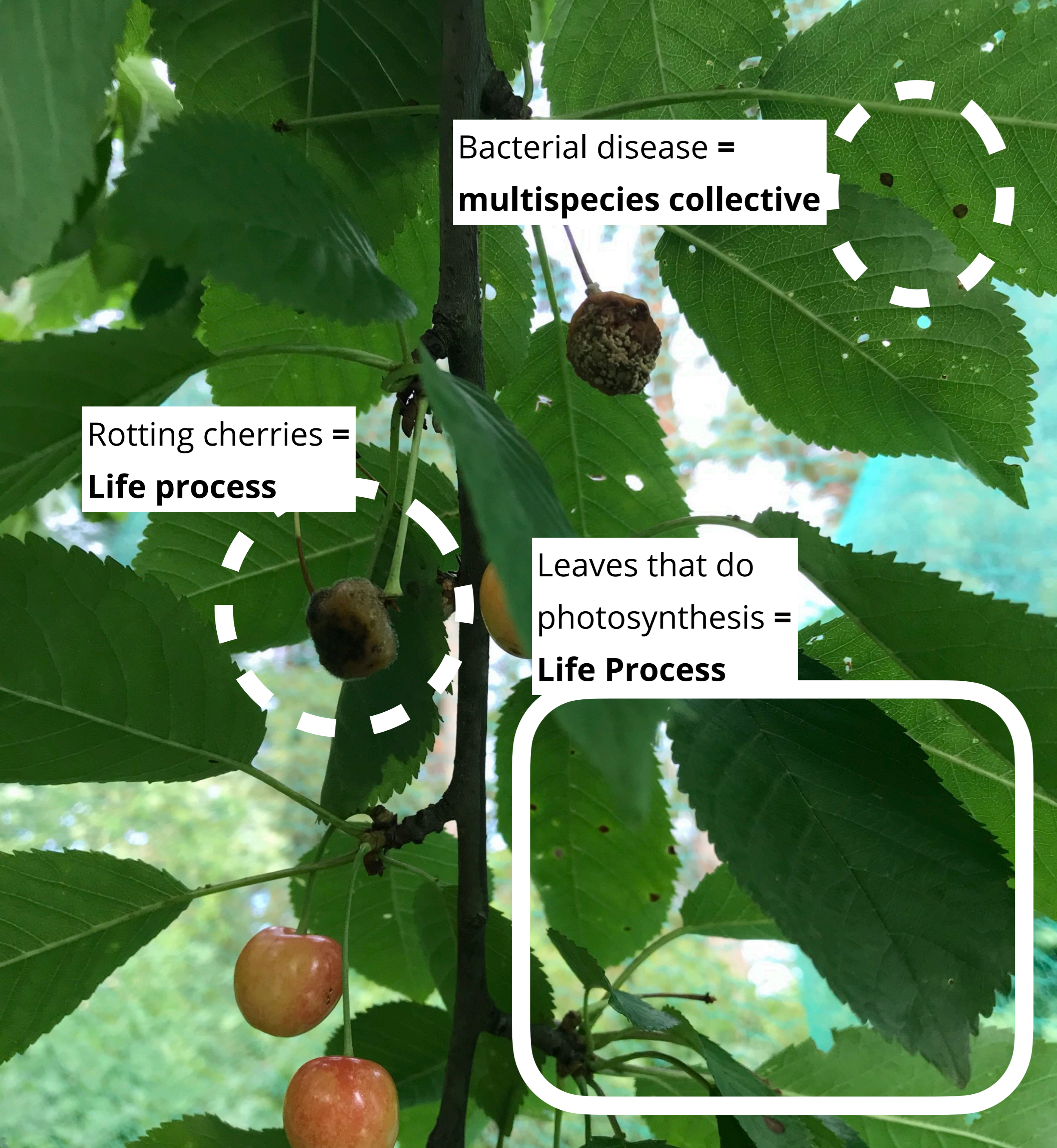




Rotting cherries =
Life process

Bacterial disease =
multispecies collective



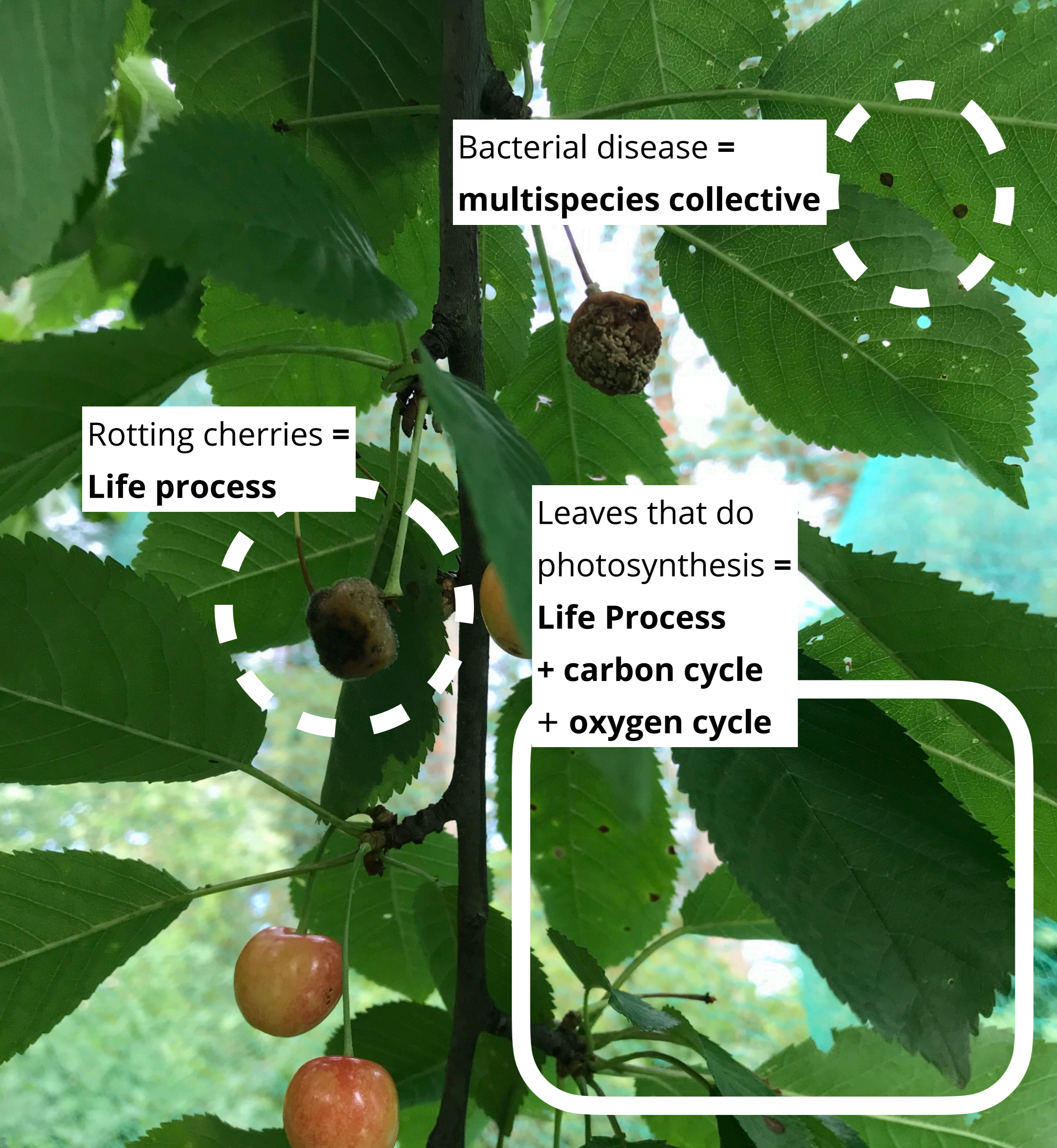


Bacterial disease =
multispecies collective

Rotting cherries =
Life process

Leaves that do
photosynthesis =
Life Process



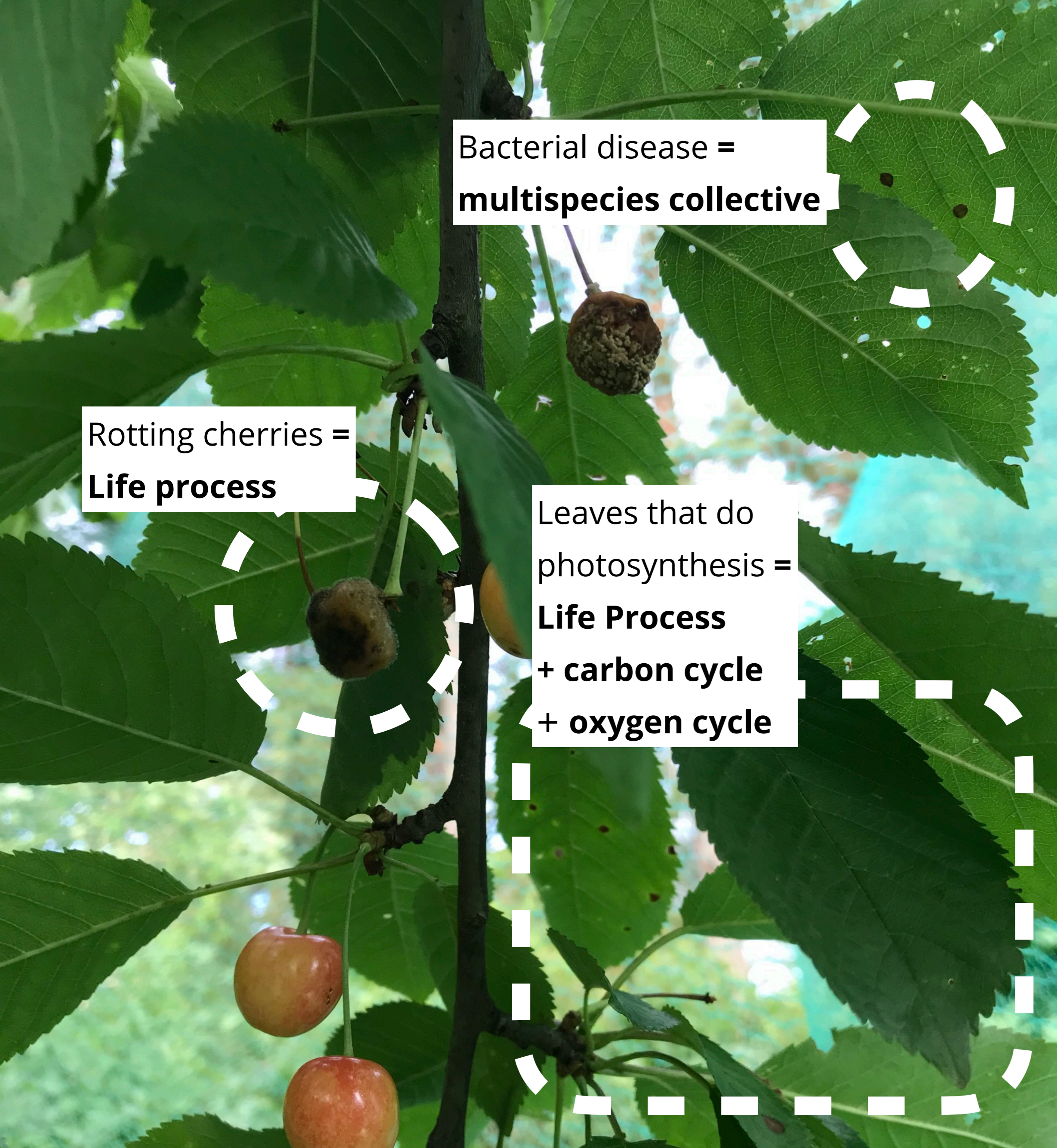


Bacterial disease =
multispecies collective

Rotting cherries =
Life process

Leaves that do
photosynthesis =
Life Process
+ **carbon cycle**
+ **oxygen cycle**





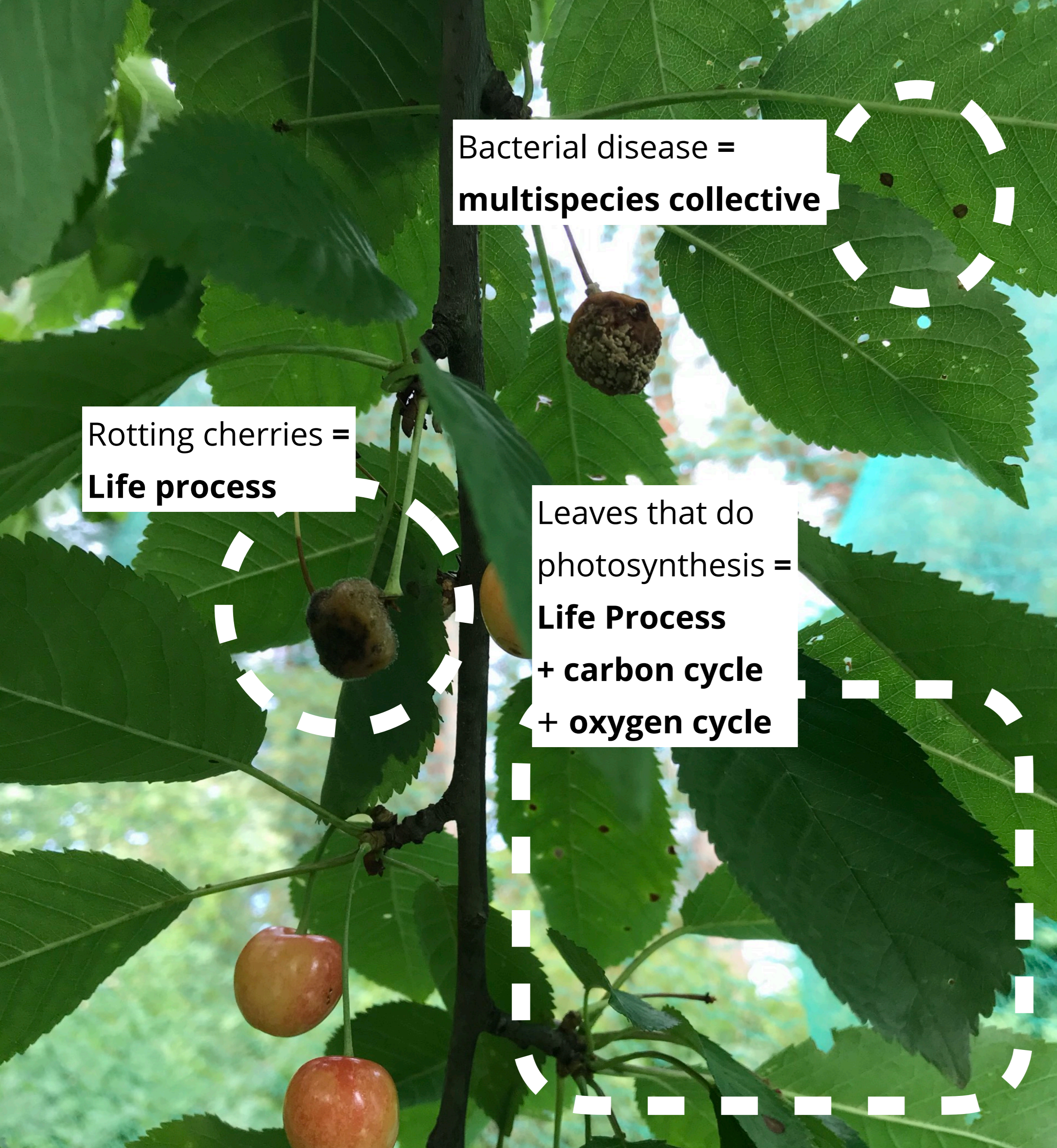
Bacterial disease =
multispecies collective

Rotting cherries =
Life process

Leaves that do
photosynthesis =
Life Process
+ **carbon cycle**
+ **oxygen cycle**



Lichens on the trunk =
Multispecies collective



Bacterial disease =
multispecies collective

Rotting cherries =
Life process

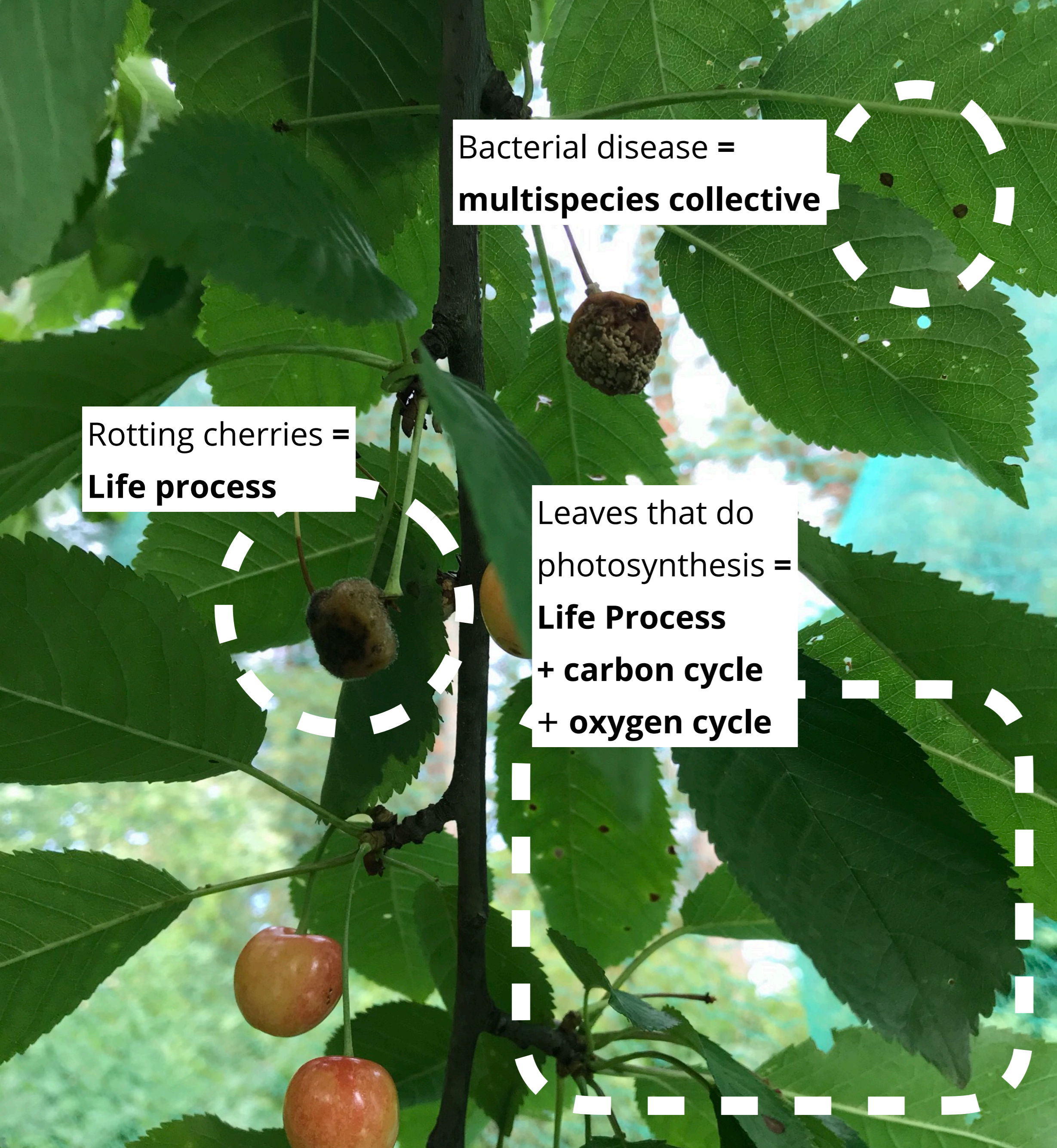
Leaves that do
photosynthesis =
Life Process
+ **carbon cycle**
+ **oxygen cycle**



Soil =
Multispecies collective



Lichens on the trunk =
Multispecies collective



Bacterial disease =
multispecies collective

Rotting cherries =
Life process

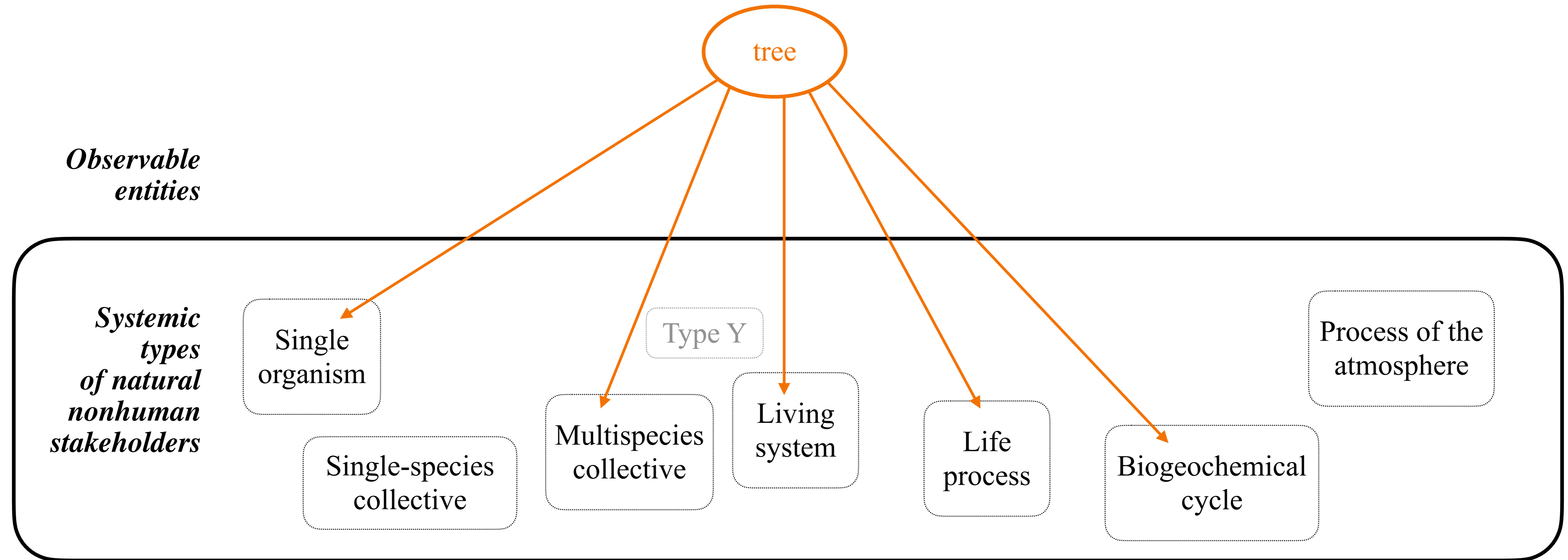
Leaves that do
photosynthesis =
Life Process
+ **carbon cycle**
+ **oxygen cycle**



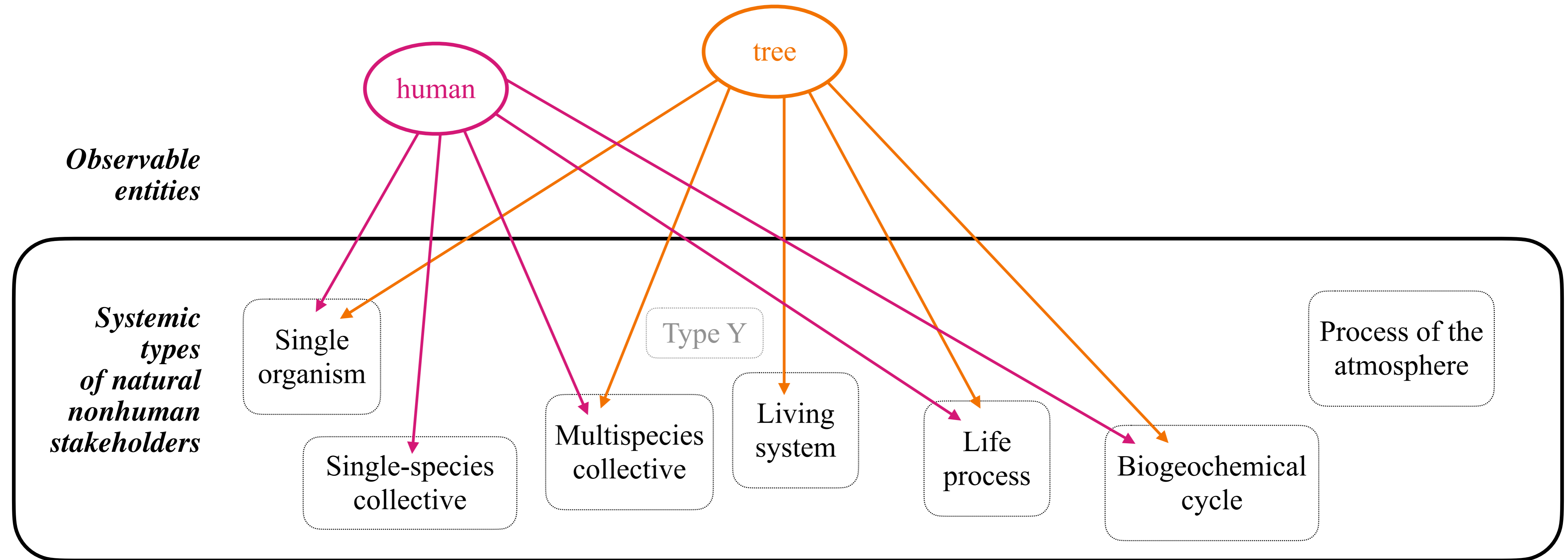
Soil =
Multispecies collective
+ **nitrogen fixation**
+ **Nitrogen cycle**

Lichens on the trunk =
Multispecies collective

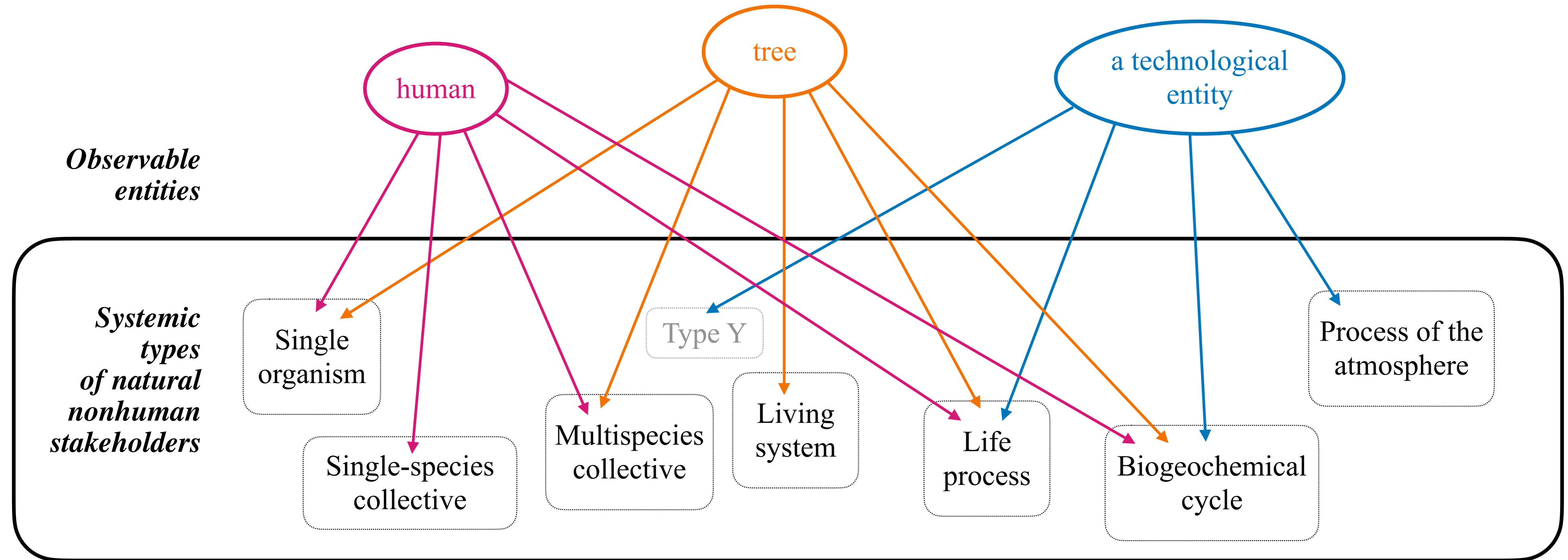
One entity = several systemic stakeholder types

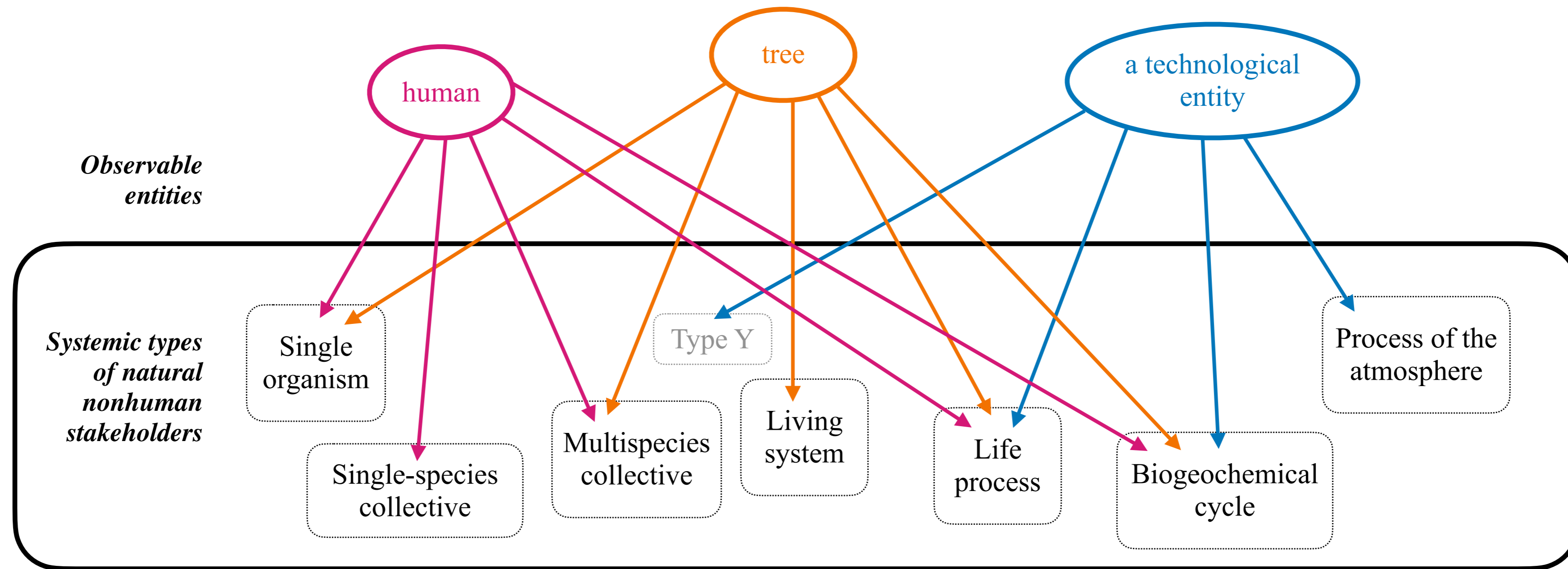


One entity = several systemic stakeholder types

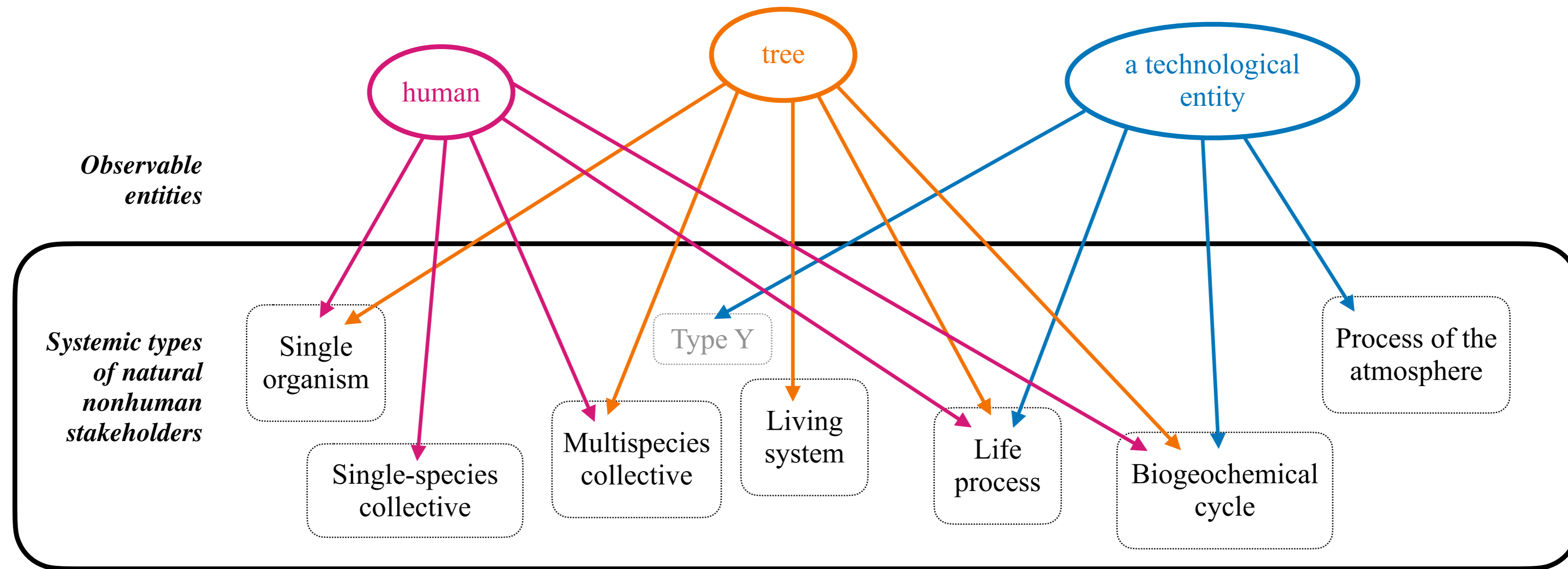


One entity = several systemic stakeholder types





- a paradigmatic shift from a fragmented, reductionist view of stakeholders in design processes to one which acknowledges and works with systemic complexity
- Mapping the visible entities then tracing back the systemic stakeholders.
- Requires transdisciplinary development integrating knowledge from varied scientific disciplines and non-academic actors



**Questions?
Comments?**

Emīlija Veselova

Doctoral Candidate

NODUS Sustainable Design Research Group,
Department of Design
Aalto University

emilija.veselova@aalto.fi

@emveselova