

Foundations for the workshop

Bill Clark, Harvard University

-- reporting on work with Dr. Alicia Harley (see background paper for the workshop and publication (OA) in *Ann. Rev. Envir. Resources* 45: 331-86, 2020)

-- graphics reproduced courtesy of *Annual Reviews*

The problem of sustainable development...



"Environment is where we live;
Development is what we all do in
attempting to improve our lot within
that abode.

The two are inseparable...."

"Humanity has the *ability* to make
development sustainable...

To ensure that it meets the needs of the
present without compromising the
ability of future generations to meet
their own needs."

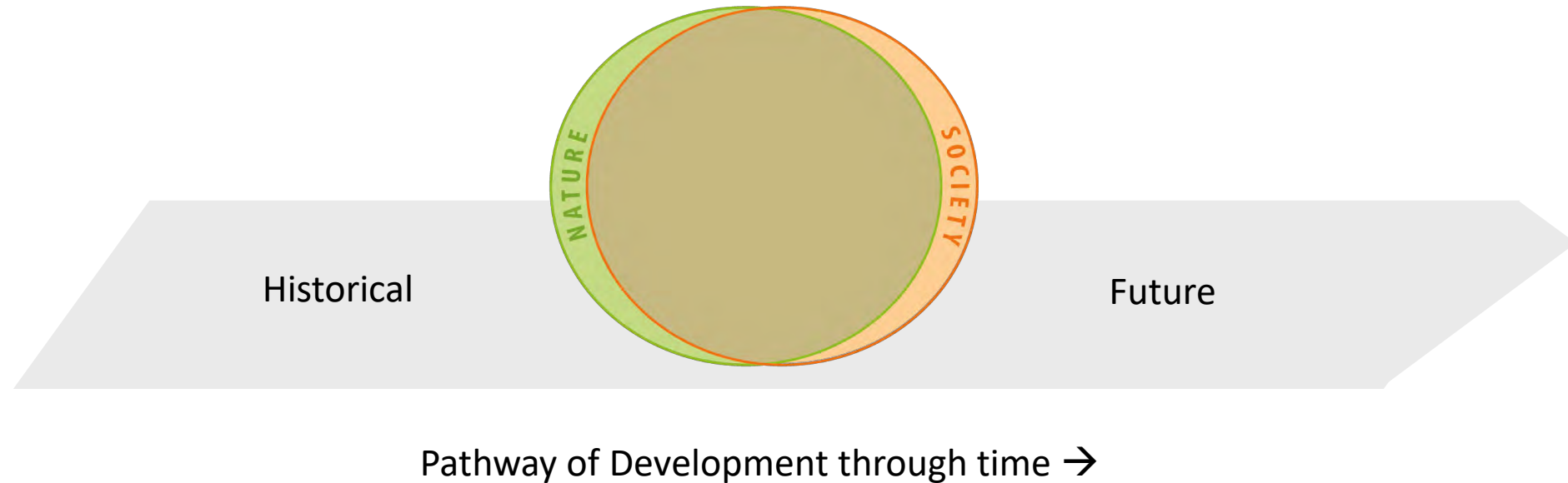
(WCED, 1987)

But how?

1) **Nature and society** are intertwined as a coevolving system

*For sustainability, focus on coevolutionary pathways over many generations

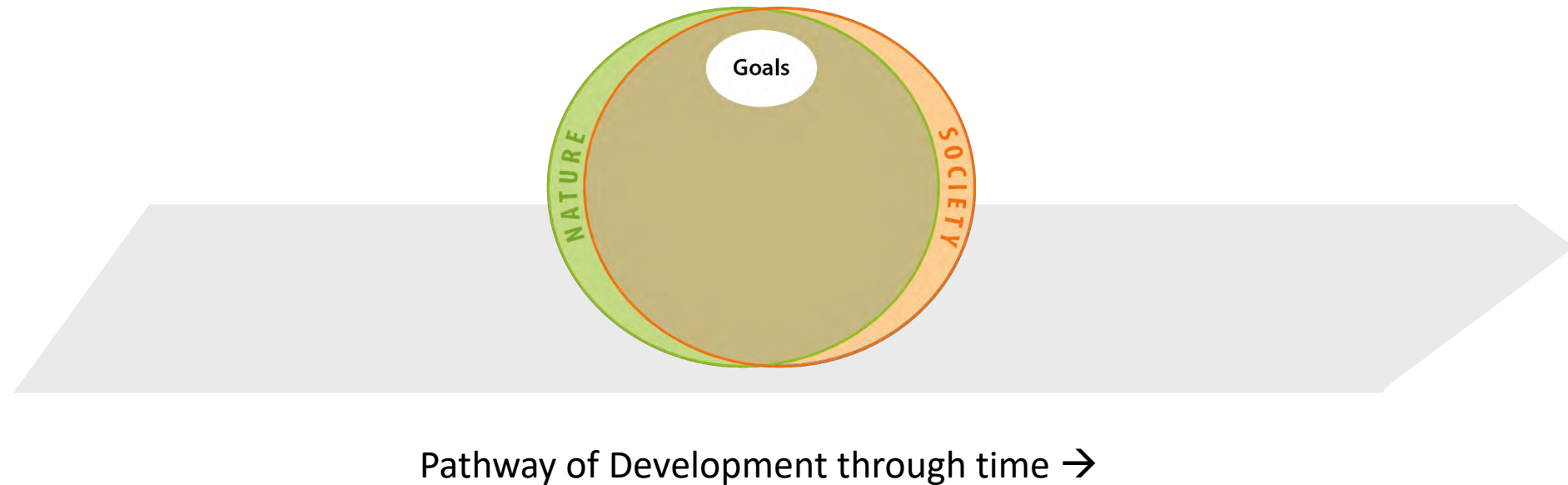
→ *Intertwined* means no hyphenated sustainability, just sustainable development



2) **Goals** for sustainable development...

*Global agreement on shared goal of *equitable* increases in human well-being...

→ How to address local variation in what matters most across time & space?



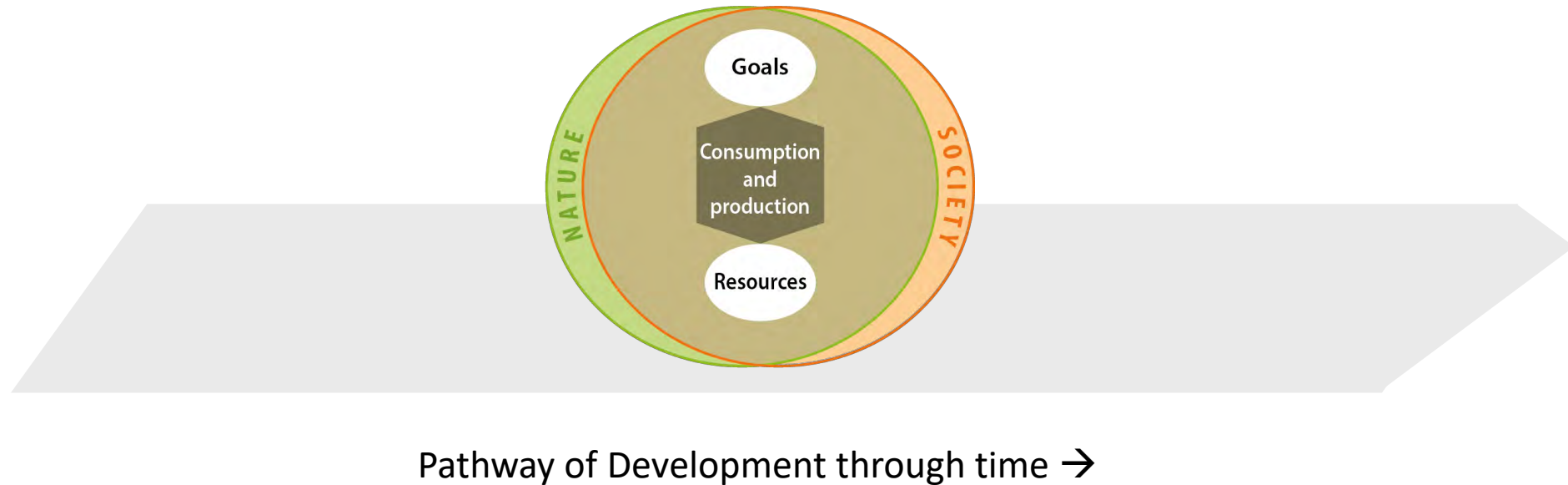
3) **Resources** are the fundamental determinants of sustainability

*Both natural resources (minerals, ecosystems, climate....) and anthropogenic resources (human, manufactured, social, knowledge) can be grown, degraded
→ Explore how (partial) substitutability, tradeoffs, access affect sustainability



4) **Consumption-production** relationships link resources, goals

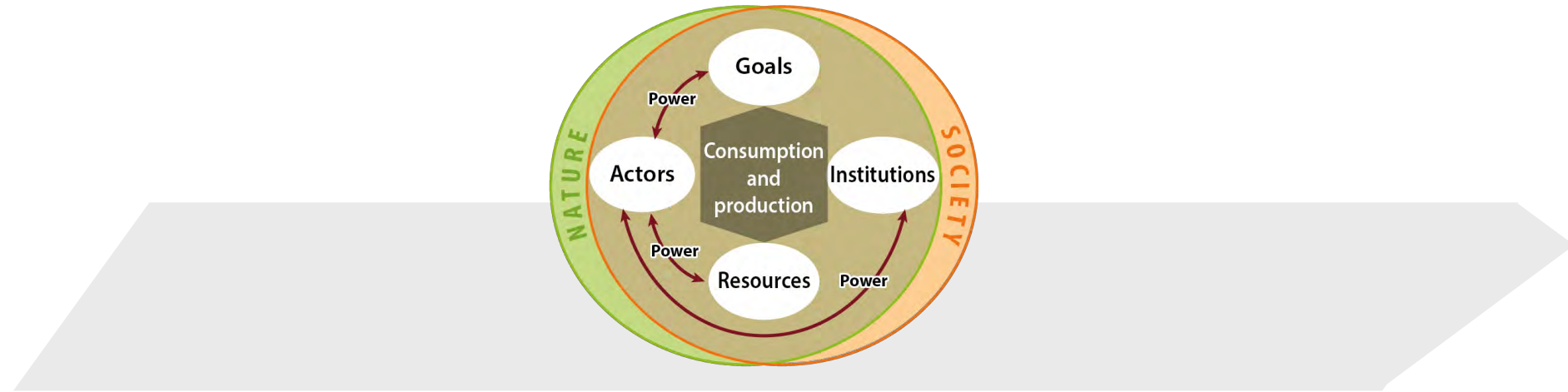
*But because “vaccines don’t prevent infection, only vaccination does...,” must
→ Explore supply & demand side management (eg. energy service providers)



5) **Governance** is required for CPS to advance well-being *equitably*

**Institutions* (norms, rules), *Actors* (communities, firms, states), *Power* all matter

→ Researchers must take responsibility for which actors our work (dis)empowers

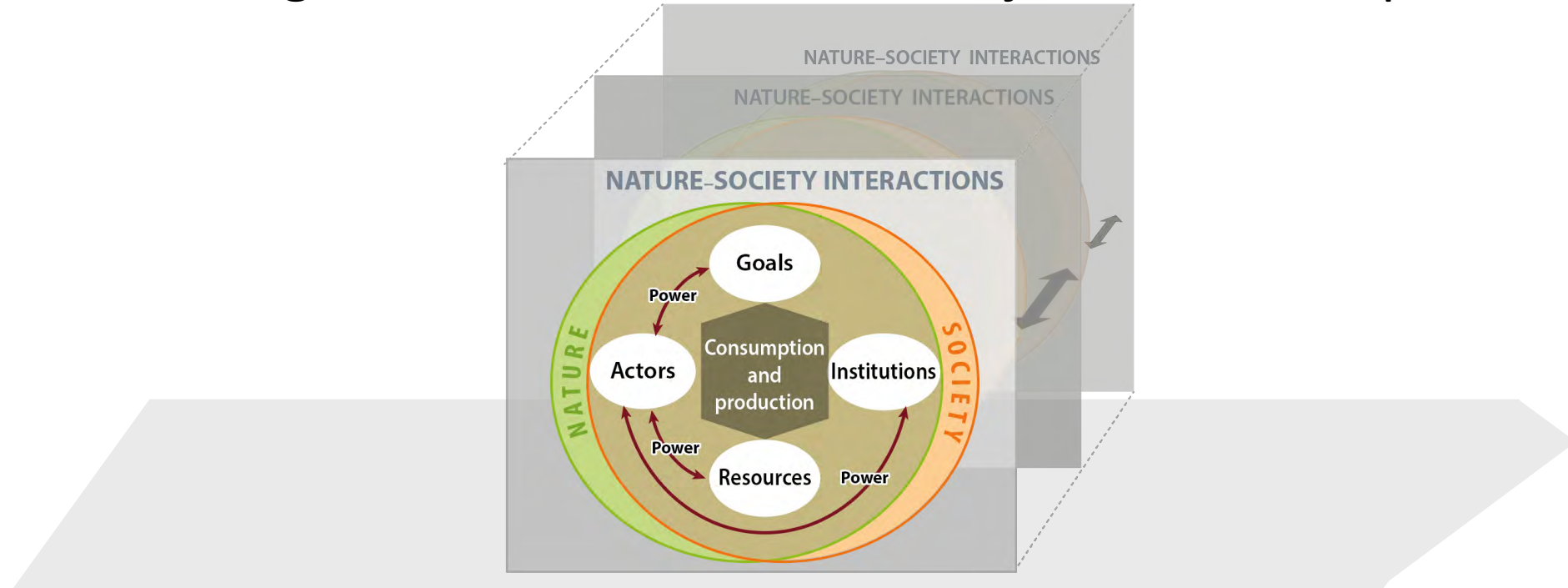


Pathway of Development through time →

6) **Neighboring places/sectors** are increasingly connected

*Now beginning to be researched as nexus linkages, teleconnections, networks

→ Ask where we get our resources? Send our junk? Find our political allies?



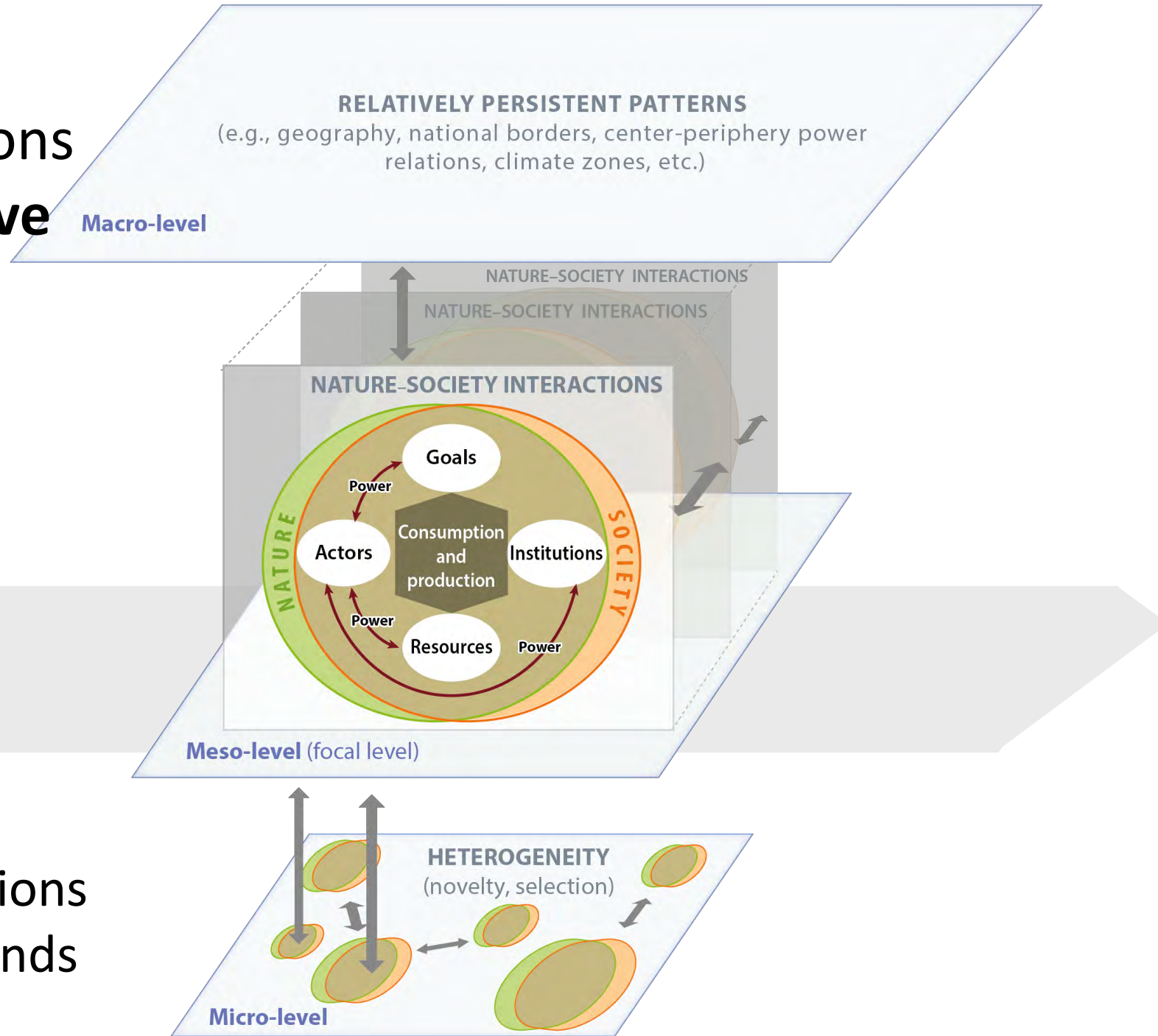
Pathway of Development through time →

7) Nature-society interactions constitute **complex adaptive systems**, characterized by:

- *persistent heterogeneity
- *local connections
- *autonomous selection

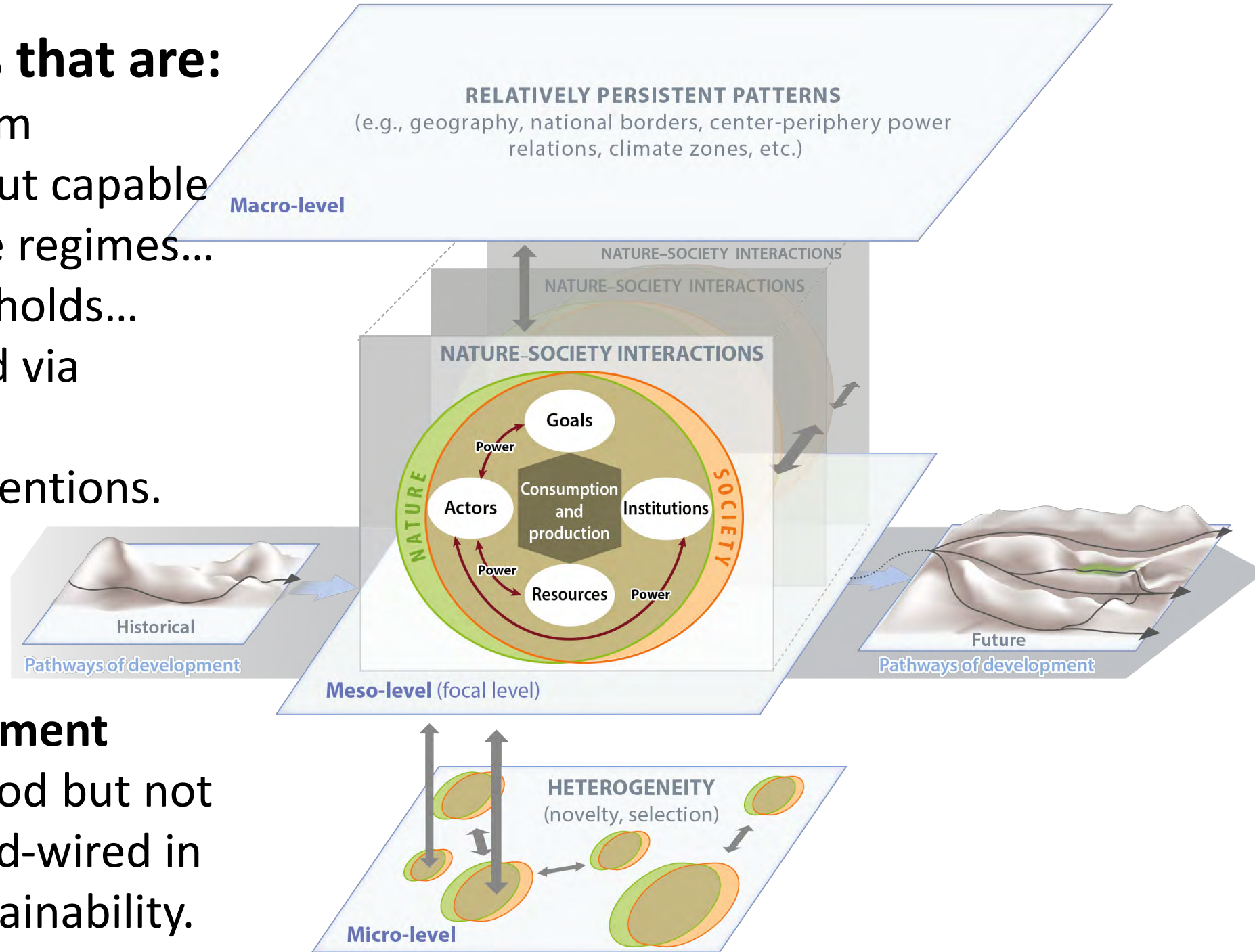
These fundamentals yield:

- *hierarchical structure
- *micro-level novelty/ innovations
- *mediated by macro-level trends



Result is dynamics that are:

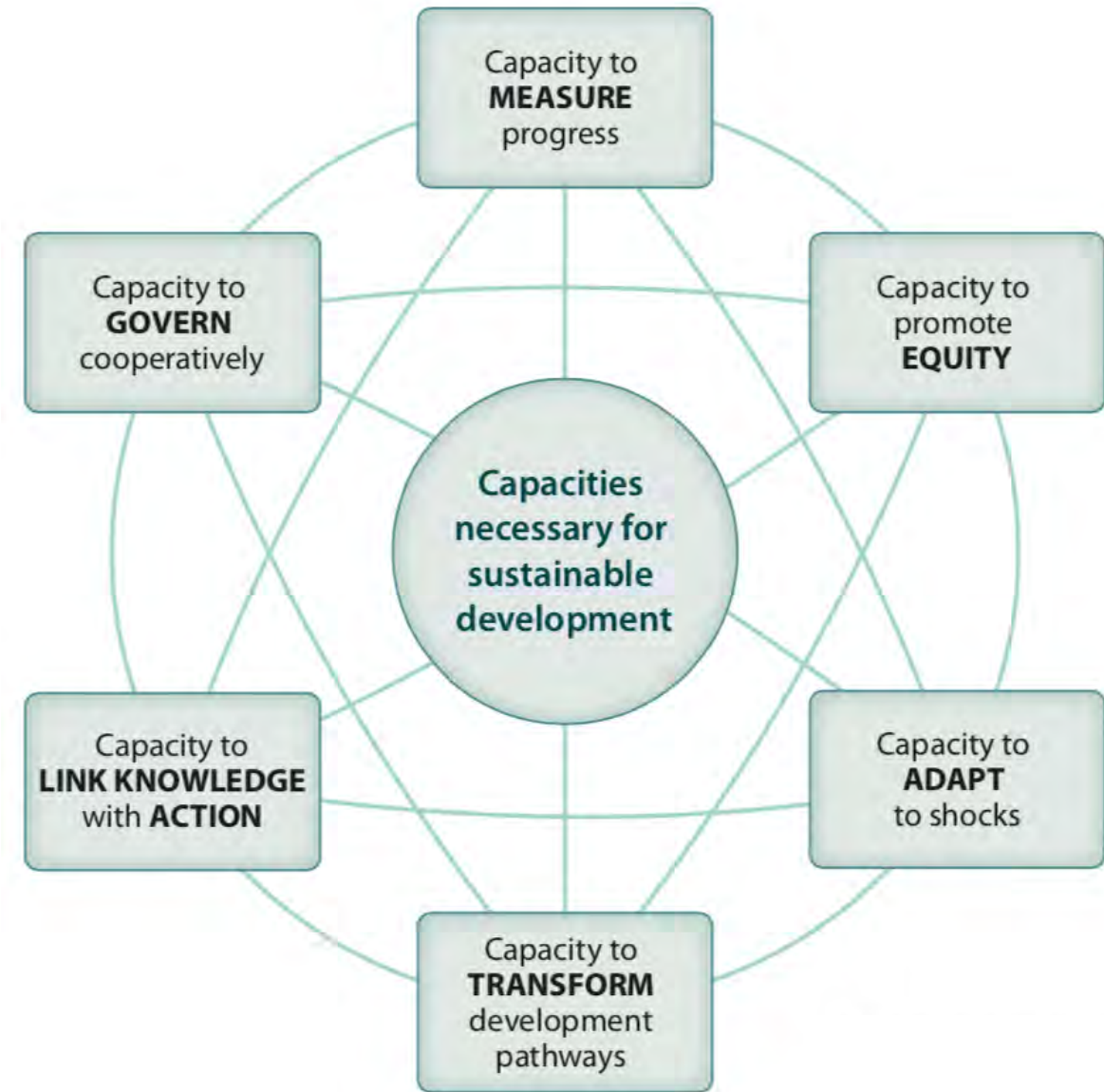
- *Far from equilibrium
- *Path-dependent, but capable of inhabiting multiple regimes...
- *separated by thresholds...
- *that can be crossed via external shocks or transformative interventions.



Pathways of development

can thus be understood but not fully predicted or hard-wired in ways that assure sustainability.

- Because pathways of development for our complex nature-society systems cannot be fully predicted, the pursuit of sustainability also requires **operational capacities for learning by doing**.
- Six such capacities have emerged as foci of substantial sustainability research →
- All are interlinked, interdependent
- Progress in strengthening these capacities would benefit a wide range of efforts to promote sustainability solutions
- This workshop...



Further information...

- The details behind this presentation, including an expanded treatment of the capacities argument, is published (OA) as:

Clark, William C., and Alicia G. Harley. 2020. "Sustainability Science: Toward a Synthesis." *Annual Review of Environment and Resources* 45 (1): 331–86. <https://doi.org/10.1146/annurev-environ-012420-043621>.

An on-line version that invites comments and corrections is at:

www.sustainabilityscience.org

The authors can be reached at william_clark@hks.harvard.edu and alicia_harley@hks.harvard.edu