

* Vulnerability & Resilience Approaches: Implications for Adaptation

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- * **Sustainability:** process of provisioning humankind, including development of economically marginal populations and future generations, without threatening the functioning of the Earth's systems, global to ecosystems.
- * **Adaptation:** process of change in anticipation of or in response to stimuli to the human-environment system (HES aka SES or CHANS).
 - * Where stimuli = pulse or press, perturbation or stress/stressor (both aka as *hazard* or *disturbance*)

* **TERMS**

- * Here, adaptation and adjustment are synonymous, and includes mitigation
- * In other literatures and communities
 - * Adjustment - near-term and more immediate responses to hazard (e.g., Tucson's progressive water costs in face of supply stress)
 - * Mitigation - action now to reduce future hazards or impacts (e.g., REDD+)
 - * Adaptation = deeper social-cultural changes to hazard taking longer time to emerge (e.g., consensus movement to green economy)
 - * Incremental or transformative adaptation
 - * Large scale adoption; new to region/resource system; hazard overwhelms system [Kates, Travis, Wilbanks PNAS 2012]

* **TERMS CLARIFIED**

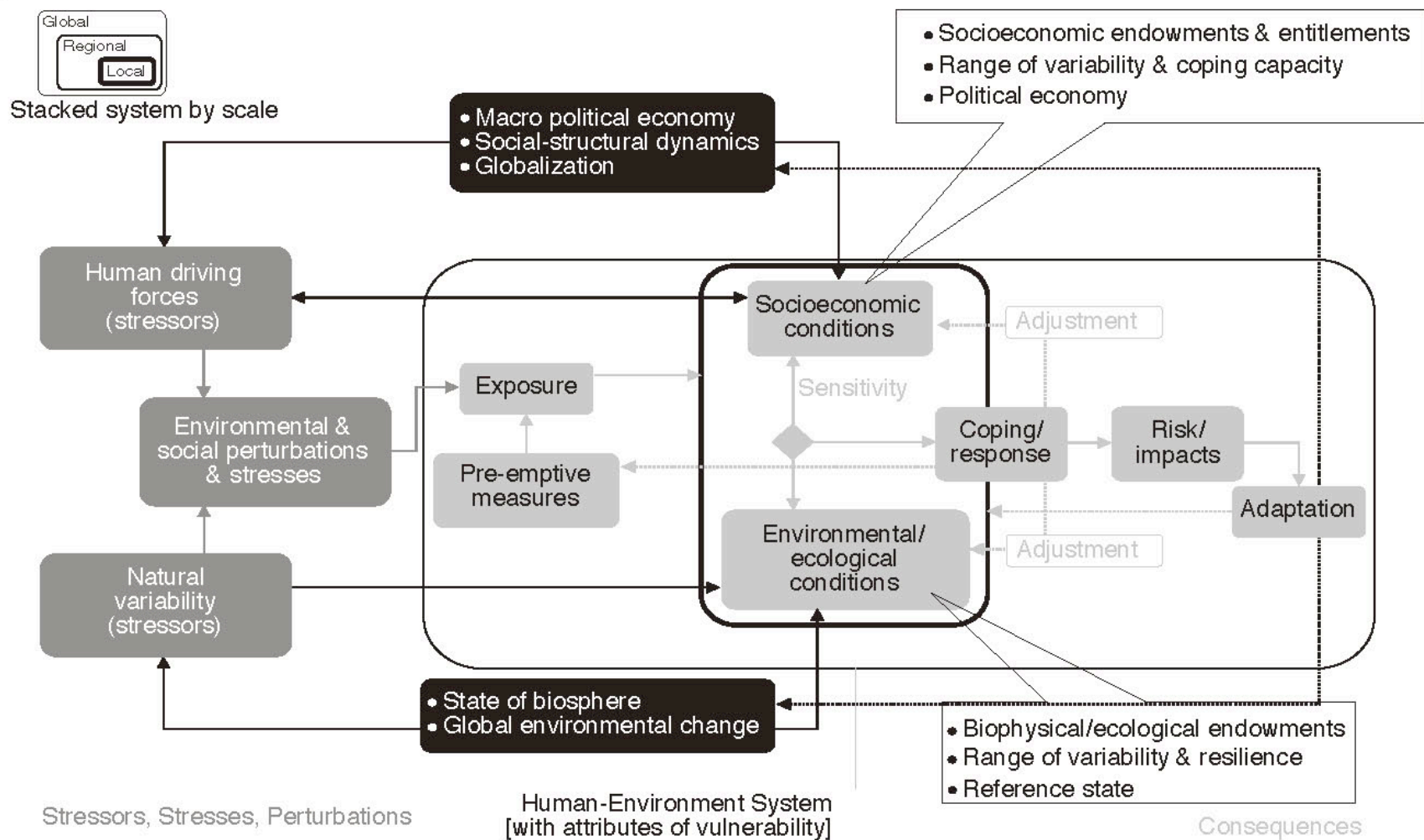
* *Americas Climate Choices* (Adapting vol.)

- * adapting today is about reducing **vulnerabilities** in future...fundamentally a risk-management strategy
- * risk-management strategy = means towards making adaptive responses which involve **resilience** of response system
- * attention to specific impact-outcomes that most affect society

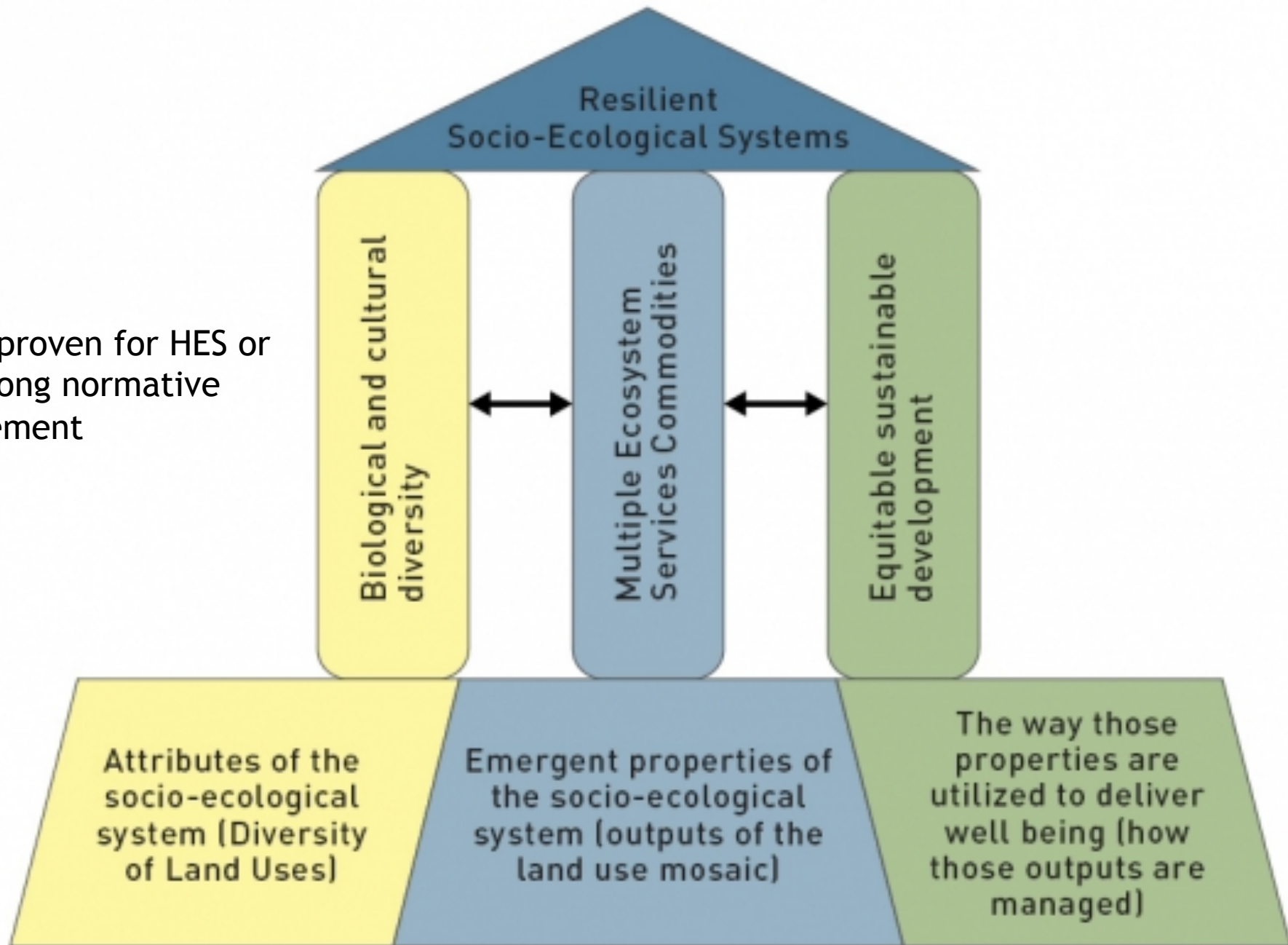
* **Meanings for Adaptation to
Climate Change**

VULNERABILITY AND RESILIENCE COMPARED

- * **Vulnerability:** degree to which a HES (or some component of HES) is likely to experience harm due to hazard
 - * From social & medical sciences, with legacies to risk-hazards and critical theory, where
 - * **Risk** = probability & magnitude of consequences from a hazard
 - * Adaptation-adjustment component of $V = \text{resilience}$
- * **Resilience:** amount of change [to a disturbance] a HES may incur & retain its structure and function or self-reorganize while retaining essential characteristics of former SF
 - * From ecological sciences (but antecedents in engineering)
 - * Seen as inverse of *vulnerability*
- * Both embed hazard/disturbance explicitly or implicitly in definitions

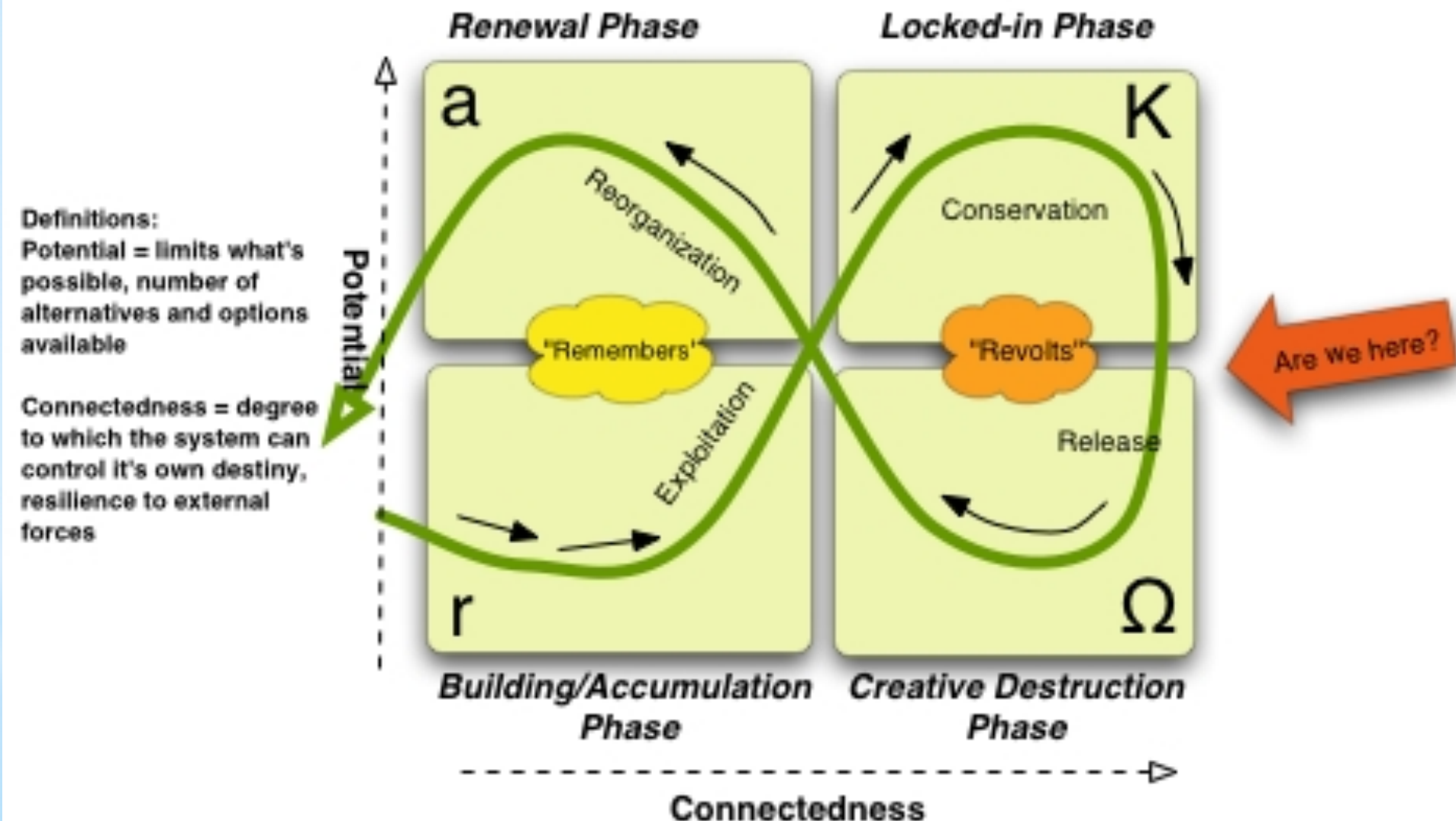


Unproven for HES or
strong normative
element



Resilience and Adaptive Cycles in Human and Natural Systems

- The Simplified Panarchy Model -



Adapted from L. Gunderson and C.S. Holling (eds.), *Panarchy: Understanding Transformations in Human and Natural Systems* (2002)

- * Address both the *human and biophysical subsystems* and the interactions within and between them
- * Treat **natural capital (NC)** and **ecosystem services (ES)**
- * Treat **range of human agency-structure** (HAS: individuals to global groups)
- * Account for **tradeoffs** among NC-ES and HAS
- * [?] Useful, relatively simple decision-making guidelines

* **ATTRIBUTES REQUIRED FOR
ADAPTATION-SUSTAINABILITY**

- * V = composed of Exposure, Sensitivity, & Adaptive/Coping Capacity of the HES to a hazard or sets of hazards
 - * Adaptive or Coping Capacity = resilience of HES
- * #1 HES can be addressed
 - * but applied largely to components in the H subsystem
- * #2 NC-ES embedded conceptually
 - * But yet to be applied in many studies; “place” V [?]
- * #3 Agency-structure of different groups addressed
- * #4 Tradeoffs—role not well defined
- * #5 Major decision making lesson (redundant to me):
 - * socio-politico-economic marginal individual, groups, communities = less coping capacity and more vulnerable
- * Conducive to theory of the mid-range that serves much of the social sciences (and application work) BUT majority of work focuses specific outcomes
- * Resonates among decision makers

* Vulnerability Elaborated

- * Resilience = amount of change in, but retain same controls of, SF of system; capacity to self-organize; ability to increase learning and adaptation
 - * Critical aspects terms = latitude (max. change before loss of recovery); resistance (ease/difficulty to change); precariousness (proximity to thresholds); panarchy (degree to which a hierarchical level of HES influenced by other levels)
- * #1 HES = focus
 - * but arguably E treated in most studies
- * #2 Natural capital-environmental services are key to functioning
- * #3 Minimal attention to difference in agency-structure to date
- * #4 Tradeoffs—role well defined
- * #5 Major decision-making lesson:
 - * diversity & redundancy positive; slow variables rule; adaptive management
- * Drawn from ecosystems and laid over HES
 - * SS wary given past of env. determinism
- * Framework resides in systems theory and results framed this way (with recall to variance in outcomes owing to complexity)
 - * Conceptually viable/robust; testable in principle; perhaps lessons too broad to implement
- * Unclear how resonates with decision makers

* RESILIENCE

BASE WEAKNESS OF V AND R

- * Unless systematic and quasi-exhaustive, attention to specific **vulnerabilities** runs danger of interactions of different components of HES with multiple consequences
 - * Reducing V for x or y may increase V for w and z
- * State of knowledge of **R of HES** = general system principles that will prove hard to enact in reality and may offer minimal insights into specific impact-outcomes

POSSIBLE FUSION-LINKAGE

- * Combine the general systems-coherency of R and its attention to environmental subsystem (NC-ES) with the attention to different stakeholders-sectors and hazards of V
 - * How much redundancy; identifying thresholds; are these attributes consistent across subsystems
 - * Articulate (more than marginal politico-economic groups) specific targets of attention regarding full array of hazards expected with CC

* **OBSERVATIONS**