Quotes Table A: Key criteria identified in the commons (design-principle-based)

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| **22 Key criteria of robust natural resource governance systems identified in the literature:** | **Design principles of robust institutions for CPR management (Ostrom 1990, Ostrom 2009, Cox et al. 2010)** | **Principles of adaptive governance in complex systems (Dietz, et al. 2003)** | **SES Variables (Ostrom & Cox 2010) *(Focus on last 2 categories: "Actors" and "Action Situations")*** |
| **1 Clearly defined rights of users to utilize resources** | Clearly defined boundaries: individuals or households who have rights to withdraw resource units from the common-pool resource (CPR) must be clearly defined **(DP1A)** | Clearly define the boundaries of resources and user groups | Group size (also covered in "governance systems" category - property rights regime) |
| **2 Clearly defined resource boundaries** | The boundaries of the CPR must be well defined (**DP1B)** | Clearly define the boundaries of resources and user groups | (Covered in "resource systems" category of SES variables) |
| **3 Congruence or fit of appropriation rules with local ecology and local culture (i.e. sustainable use of resources)** | Congruence between appropriation and provision rules and local conditions: Appropriation rules restricting time, place, technology and/or quantity of resource units are related to local environmental and social conditions **(DP2A)** | Devise rules that are congruent with ecological conditions | Socio-economic attributes of users - economic & cultural; Location (.5); Knowledge of SES (.5); Group size; Provision of infrastructure; Technology used |
| **4 Balance between costs expended / investments made into a resource and benefits received from resources (equitable resource use)** | Benefits obtained by users of a resource are proportional to inputs or costs required in the form of labor, material or money **(DP2B)** | Inducing rule compliance (.5) | History of Use; Resource dependence (.5) |
| **5 Collective choice arrangements (individuals affected by the rules can participate in making and modifying the rules)** | Collective choice arrangements: most individuals affected by the operational rules can participate in modifying the operational rules **(DP3)** | Analytic deliberation (all stakeholders) | Policymaking (.5) (Covered in more detail in "governance systems" category of SES variables) |
| **6 Monitoring resource conditions and appropriator behavior** | Monitoring (monitors present and actively audit resource conditions and appropriator behavior) **(DP4A)** | Providing trustworthy information; Induce compliance with rules | Environmental monitoring; Social monitoring |
| **7 Monitoring the monitors** | Monitoring (monitors are accountable to or are the appropriators) **(DP4B)** | Devise accountability mechanisms for monitors | Social monitoring |
| **8 Graduated sanctions** | Graduated sanctions: Appropriators who violate the rules are assessed sanctions that vary (depending on the seriousness and context of the offense) by appropriators or officials accountable to those appropriators or both **(DP5)** | Apply graduated sanctions for violations | Sanctioning |
| **9 Conflict resolution mechanisms** | Conflict resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts **(DP6)** | Establish/use low cost mechanisms for conflict resolution; Dealing with conflict | Conflict Resolution |
| **10 Minimal recognition of rights to organize** | Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities **(DP7)** | Providing infrastructure [both hard (physical, technological) and soft (institutional)], including property rights | (Covered in "governance systems" category of SES variables) |
| **11 Nested enterprises: governance activities are organized in multiple layers of nested enterprises** | Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises (**DP8)** | "institutional arrangements must be complex, redundant, and nested in many layers" | (Covered in "governance systems" category of SES variables) |
| **12 Institutional adaptability/ variety/ flexibility** |  | Encourage adaptation and change - adaptable institutional design; Institutional variety - mixtures of institutional types |  |
| **13 Social learning** |  |  |  |
| **14 Long-term commitment and shared understanding** |  |  |  |
| **15 Leadership** |  |  | Leadership |
| **16 Capacity building (e.g., training, resources)** |  |  | Provision of infrastructure; appropriation; technology used |
| **17 Knowledge building (e.g., learning, information sharing )** |  | Providing trustworthy information about environmental conditions & human-environment interactions | Provision of information |
| **18 Prior Networks** |  |  |  |
| **19 Trust and Social capital** | treats as indicator of success (.5.) | treats as in indicator of success (.5) | Social capital |
| **20 Resource dependence** | Fig. 5, p. 458 "Actors" box lists resource dependence as important to SES framework analysis. (.5) |  | Fig. 5, p. 458 "Actors" box lists group size and resource dependence as important to SES framework analysis. |
| **21 Group size** | Ostrom 2009 (robust DPs): Ostrom's explanation on the difference between resource dependence and the DPs. Resource dependence is causal variable of process that affects whether actors will organize to solve collective action dilemma. Resource dependence itself does not explain why the outcome of the collective action process is robust or fails. "Scholars have urged the inclusion of such variables as small size, homogeneous groups, and active leadership (Baland and Platteau 1996); dependence on a resource (Gibson 2001); market integration (Tucker 1999; Tucker, Randolph, and Castellanos 2007); external government policies (Rodriguez 2007); and cross-scale linkages (Berkes 2002; Young 2002). All of these and others are important variables, and I used them and other variables in related work to explain the factors affecting the emergence of new institutions (Ostrom 2001). They are among the variables that affect whether resource users will organize to solve the collective action problem of self-organization in the first place. As such, they are causal variables of a process. The design principles, on the other hand, are an effort to understand why the results of this process are robust in some cases and fail in others." (p. 38) (.5) |  | Fig. 5, p. 458 "Actors" box lists group size as important to SES framework analysis. |
| **22 Group homogeneity vs. heterogeneity** | Same notes and citations as above under "21 Group Size" | Appears to not support homogeneous - "Well-structured dialogue involving scientists, re- source users, and interest- ed publics, and informed by analysis of key information about environmental and human-environment systems, appears critical." |  |