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Challenges and Opportunities in Coding the Commons: Problems, Procedures, and Potential Solutions in Large-N Comparative Case Studies.

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Abstract:
On-going efforts to understand the dynamics of coupled social-ecological (or more broadly, coupled infrastructure) systems and common pool resources have led to the generation of numerous datasets based on a large number of case studies. This data has facilitated the identification of important factors and fundamental principles which increase our understanding of such complex systems. However, the data at our disposal are often not easily comparable, have limited scope and scale, and are based on disparate underlying frameworks inhibiting synthesis, meta-analysis, and the validation of findings. Research efforts are further hampered when case inclusion criteria, variable definitions, coding schema, and inter-coder reliability testing are not made explicit in the presentation of research and shared among the research community. This paper first outlines challenges experienced by researchers engaged in a large-scale coding project; then highlights valuable lessons learned in large-scale coding projects; and finally discusses opportunities for further research on comparative case study analysis focusing on social-ecological systems and common pool resources.

Keywords:
Common Pool Resources, Social-Ecological Systems, Complexity, Coupled Infrastructure Systems, Coding, Content Analysis, Intercoder Reliability Testing, Intercoder Agreement, Codebook Development.

Challenges and Opportunities in Coding the Commons: Problems, Procedures, and Potential Solutions in Large-N Comparative Case Studies.[*]

1. Introduction

Long-term efforts to understand the dynamics of coupled infrastructure systems (CIS) involving the management of common pool resources (CPR) have led to the creation of a large body of data which encompasses a broad range of case studies and comparative analyses (Baland and Platteau, 1999; Bardhan and Mookherjee, 2006; Berkes, 1989; Cox, 2014; Epstein et al., 2014; Fleischman et al., 2014; McKean, 1992; Netting, 1976; Ostrom 1990; Villamayor-Tomas et al., 2014; Wade, 1984). This work is often based on studies which rely upon secondary data gathered for other purposes using diverse measures and variables, even when capturing similar concepts. Relying on secondary data often makes synthesis difficult (Poteete et al., 2010) as existing data are often limited in their scope and scale, and are separated into independent databases using unique coding schema and storage structures which are not always made publicly available. These limitations and divisions hamper synthesis efforts and comparability. For example, there are a number of data repositories (Table 1) which are based upon the work of Elinor Ostrom and her collaborators. While each of these databases has increased and facilitated new knowledge related to the study of common pool resources, they each possess their own idiosyncrasies, sometimes leading to diverse interpretations of theory, coding schemes, organization, variables, and definitions. Examples of this divergence include databases which focus primarily on a single sector such as forestry or irrigation, a single geographic area, or certain theoretical concepts such as property rights or boundaries. A predominant focus on small-scale systems and the specification of overarching factors like "success" in these types of cases are other examples of problems in consistency and interpretation across studies which are commonly criticized in the literature (Agrawal, 2014; Araral, 2014; Laerhoven and Ostrom, 2007; McGinnis and Ostrom, 2008). In addition, studies often do not disclose sufficient methodological information to replicate, verify or compare findings, such as access to the codebooks, information on case or variable selection, theoretical assumptions, or intercoder reliability testing approaches. These differences and lack of a unified coding methodology (or transparency) have limited synthesis work and the possibility to advance research in common pool resource theory by identifying possible common factors related to biophysical, social, and contextual conditions upon which failure or success depends.

In order to increase coding replicability and transparency, some scholars assert that explicit identification and alignment of the coding rules, organization and work-process knowledge (or coding schema[†]) used in this type of methodology may be important in mitigating problems of missing data and theoretical ambiguity (MacQueen et al., 1998; Medjedović & Witzel, 2005; Stemler, 2001). In this paper, we critically explore the coding schema and processes utilized during a nine-month meta-analysis of sixty-nine case studies which were

[*] **Acknowledgements:** The team would like to acknowledge the support of this project from the National Science Foundation, grant number GEO—1115054.

[†] The term "schema" is defined as the organization and structure for a database as often used in computer programming literature.

found to explicitly reference Elinor Ostrom's (1990) Design Principles (DP), at the Center for Behavior, Institutions and Environment (CBIE)[‡] at Arizona State University (ASU). This project draws upon and extends a previous study conducted by Cox et al. (2010), although with somewhat different aims. While the Cox et al. (2010) study focused on possible relationships between *individual* DPs and social-ecological system (SES) success, our study sought to discover whether there is evidence of the *co-occurrence* of DPs in relation to either the success or failure of these systems (Baggio et al., this volume). Both research teams drew from the same set of case studies and relied upon the same basic variables. However, differences in the coding processes and assumptions utilized by each team raised fundamental issues regarding the use of meta-analysis that are the focus of this paper.

Table 1: Matrix of databases containing SES and/or Commons related datasets

Database	Affiliation	Case Studies	Coding Variables	Codebook	Basis
CommonsDB (on long-term dynamics of institutions)[1]	Utrecht University (collective-action.info)	~1000 cases	~100 variables	Codebook available by request	IAD Framework,
Common Pool Resources (CPR) Database	Indiana University	87 cases currently included in the SES Library at ASU	~600 variables	Original codebook developed by Elinor Ostrom et al. (1987)	IAD Framework
Social-Ecological Systems Governance Database (SESGO)	Martin-Luther University Halle-Wittenberg	Currently no data publicly available	~500 variables	No codebook is available[3]	SES Framework
International Forestry Resources and Institutions (IFRI) Database	University of Michigan (ifriresearch.net)	233 case studies	600+ variables[2]	Coding Manual and Forms are publicly available on website	CPR Database, IAD Framework
Nepal Irrigation Institutions and Systems (NIIS) Database	Indiana University	274 cases (not currently publicly available)	600+ variables[2]	Codebook not currently publicly available	CPR Database, IAD Framework
Social-Ecological Systems (SES) Library	Arizona State University (ASU) (seslibrary.asu.edu)	~130 case studies publicly available	CPR variables	Utilizes the original codebook from the CPR database	IAD Framework and Robustness Framework
Social-Ecological Meta-Analysis Database (SESMAD)	Dartmouth University (sesmad.dartmouth.edu)	Currently 7 case studies are publicly available	125 variables[3]	Coding schema and variable definitions are publicly available on website	SES Framework

1. The CommonsDB is focused on the long-term dynamics of commons, guilds, waterboards, and benguinages with some historical data going as far back as the 8th Century.
2. The NIIS and IFRI variables are based on the CPR variables with some modifications.
3. Users of the SESMAD database can propose to add their own cases to the database and can also propose to add and/or combine the SESMAD variables with their own variables within their own case studies.

The aim of this paper is to discuss the methods utilized by our team at ASU to generate the data that is the basis of Baggio et al. (this volume) and Barnett et al. (this volume). We discuss coding process, codebook development, and intercoder reliability testing, and will discuss our

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methodology, some of the issues it raises, and suggest some ways of increasing methodological rigor in this area of study by adopting certain techniques and strategies from disciplines such as anthropology (e.g. content analysis). We hope that by sharing the key methodological challenges and opportunities we discovered that we will stimulate a broader platform for communication and collaboration which will lead to better, more transparent research designs, new opportunities and discoveries that will enhance our understanding of CISs.

2. Coding methodology

In order to increase the replicability and the transparency of the coding process we have created a detailed Coding Manual and a recommended Coding Protocol (see Appendix). A coding protocol is the common set of systematic procedures that a research team agrees to follow during the coding process (Rourke and Anderson, 2004) and a coding manual typically contains the coding questions, answer codes, and information to aid in clarification and coder alignment which embody the research questions being explored in a study (MacQueen et al., 1998). Our coding manual and protocol (see Appendix) are the result of a synthesis between our own coding experience and best practices found in the literature.

One of the primary best practices identified in the literature for inclusion in the design of qualitative content analysis is intercoder reliability testing (Hruschka et al. 2004; MacQueen et al. 1998; Guest and MacQueen 2008, Mayring, 2000). We have found that this important step is often missing from reports on studies of SESs and the commons, but can be helpful when iteratively included throughout the coding process. We compare the methodology we used to the "best practices" for qualitative content analysis as suggested by the literature, which include the following steps (Fig. 1):[§] (Hruschka et al., 2004, MacQueen et al. 1998, and Mayring 2000).

1) Formulation of a research question;

2a) Designation and structuring of coding teams;

2b) Identification of a set of data to be analyzed including case selection and text segmentation[**];

3) Definition of theoretically based coding schema including categories, definitions, and coding rules/protocols;

4) Preliminary codebook development;

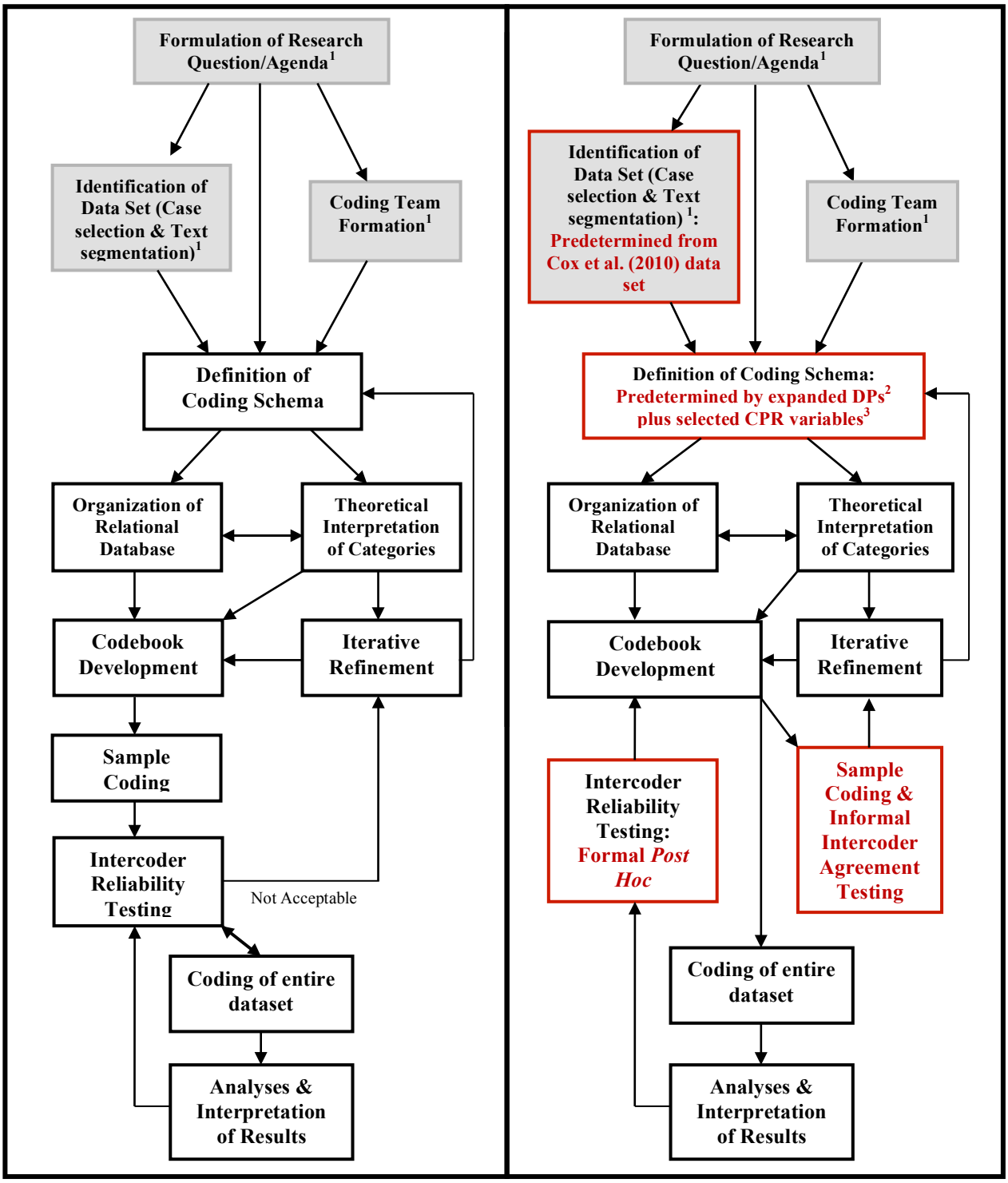
5) Iterative testing of the coding schema on samples of the data and codebook refinement until acceptable intercoder reliability ratings are achieved;

6) Use of the tested coding schema upon the entire data set, including continuous spot testing of intercoder reliability ratings until coding is complete; and

[§] The "Best Practices" model described here and illustrated in Figure 1 is adapted from the combination of models offered by Hruschka et al. 2004, MacQueen et al. 1998, and Mayring 2000.

[**] While there is plentiful literature on the formation of coding teams and identification of data, these steps are often assumed as completed within the literature. We have combined and adapted the methodological models cited in order to explicitly reduce ambiguities in assumptions.

7) Analysis and interpretation of the results which may lead to further refinement of the coding schema (Hruschka et al., 2004; Mayring, 2000).



Best Practices Model (adapted from Hruschka et al., 2004; MacQueen et al., 1998; Guest and MacQueen, 2008; Mayring, 2000; Weed, 2005)

Process used by team at ASU

Figure 1: Coding process comparison illustrating the process utilized by our team compared to the "best practices" model described above and discussed in further detail in the following sections. [1]Pre-coding process; [2] Table 2, this document; Cox et al., 2010; [3] Ostrom et al., 1987.

2.1 Coding process

Formulation of the Research Agenda and Definition of Coding Schema

The main objective of the research presented here was to look for combinations of DPs, along with biophysical conditions and technologies (i.e. sector), that increase the likelihood of successful CPR governance. This question was motivated by previous studies (Agrawal, 2001) and our intuitions that the DPs are not independent and likely do not contribute to successful governance in isolation. In addition, we were inspired to expand upon a previous study conducted by Cox et al. (2010), which provided some empirical support for the claim that there is a higher chance for each of Ostrom's (1990) individual DPs to be present in "successful" cases of SES management across a range of contexts. We also hoped to be able to link the expanded DPs (Table 2) found in Cox et al. (2010) with existing variables found within the existing database for the Common Pool Resources (CPR) Project (Ostrom et al., 1987). Because the DPs and the CPR variables are both based upon the theoretical foundations established by Elinor Ostrom (1990), the effective linking of these variables might establish a precedent for developing and testing a methodology that facilitates the synthesis of separate datasets that are based upon similar theoretical foundations but utilize different coding schema. Larger datasets of comparable cases improve researchers' ability to use mixed qualitative and quantitative methods, as well as improve analyses across multiple sectors, scales, and time periods, thus potentially enhancing our ability to understand complex system dynamics and adaptation (Poteete et al., 2010).

Case Selection

Case selection is a critical first step in any research design. According to the literature, cases should typically be screened and analyzed for fit within a secondary analysis based on both their applicability to the research questions and data completeness (Hinds et al. 1997; Stemler, 2001; Weed, 2005). For our study, the set of cases from which we drew was pre-determined by those cases previously utilized by Cox et al. (2010). We re-coded sixty-nine of the ninety-one studies presented in Cox et al., limiting our dataset to irrigation, fishery, and forestry sector cases. Ostrom (1987) found exclusion criteria to be extremely important and included careful screening criteria for cases to be included in the CPR project. Our exclusion criteria based on sector was intended as a pragmatic feature of the study design but could not include screening of cases for appropriate quality because the set of cases was pre-determined by the Cox study (2010). However, ambiguities in the assumptions made in previous studies, such as exclusion criteria, can sometimes be a significant problem in secondary analyses. While perhaps more of a problem in analyses and the reporting of findings rather than study designs, these types of ambiguity often contribute to the pervasive problem of incomplete data (Corti et al. 2005; Medjedović & Witzel 2005). Even when studies share the same theoretical basis, individual studies may focus on one part of the theory while ignoring other parts, or may not clearly communicate certain aspects in reporting. Our team found that some of the cases used for the study did not have sufficient information for thorough analysis due to missing data. For example, there were some cases which had sufficient social outcome data but not enough biological data, or vice versa, making the overall determination of success or failure in these cases difficult. Other cases were found to contain ample data on one or two specific DPs but lacked information on the presence or absence of the others. These cases illustrate some the difficulties that may be encountered when utilizing secondary data sources which were collected with different objectives than that of the current study.

Text segmentation

A coding protocol generally includes guidelines as to how a text should be segmented for data analysis and coding (Bernard and Ryan 2010, Bernard 2011, Hruschka et al., 2004). The literature recommends that texts be segmented into smaller units to increase intercoder agreement and reliability (Krippendorff, 2013) and decrease coding discrepancies. The segmentation of texts for our study was pre-determined by the division of texts into cases by the Cox et al. (2010) team. Since exclusion criteria and criteria for the segmentation of texts into cases within regional studies was not explicitly reported in the Cox, et al. (2010) publication, we initially debated whether to include or exclude cases based on our own screening criteria, but ultimately decided to limit our study to the same cases that were also evaluated by the Cox team.

Coding team structure

The use of two or more coders is important for assessing the replicability and reliability of the coded data (MacQueen et al. 1998). We divided all cases among eighteen distinct coding teams generally consisting of three coders each. The number of coders sufficient to establish reliability is not agreed upon in the literature and may depend on the level of inference required to identify relevant issues and themes, as well as on the frequency of coding themes and variables which occur in the texts (Bernard and Ryan 2010), i.e., the more coder inference required and/or the rarer that codes appear in texts, the greater the number of coders that should be utilized. Since our coding project involved case studies that reported on SES conditions from a variety of perspectives, utilizing three coders, rather than just two, was an appropriate and beneficial design feature, even though using a higher number of coders may have lowered intercoder reliability ratings.

Theoretical Interpretation of Categories

The primary coding variables used within our study were derived from the expanded design principles defined by the Cox et al. (2010) study (Table 2). It is important to note that in a recent paper discussing the applicability of case studies and meta-analysis to theories on the commons, Araral (2014) points out two distinct specification problems which he found in the Cox et al. (2010) study that may also apply to our study[††]. Araral's (2014) first concern is the re-specification of Ostrom's (1990) DP for clear boundary rules (DP1) into two distinct DPs for user boundaries (DP1A) and resource boundaries (DP1B) (Cox et al. 2010). Araral (2014) asserts that Ostrom (1990) intentionally did not separate the original design principle in this manner because within the "context of collective action in the commons" (p.18), boundaries refer to enforceable property rights, not spatial boundaries. He also points out that the relevant critical literature has previously illuminated that spatially based definitions of community are problematic because the "overlapping, fuzzy and temporal nature of rights" can lead to difficulties in defining community across scales, both spatial and temporal (Araral 2014). Others, however, have suggested that the distinction made by Cox et al. (2010) is a helpful tool in defining clear agent boundaries (Pitt et al., 2012). This illustrates a clear example of differences in theoretical interpretation which can exist between different researchers and which may not

[††] The ASU study was being conducted at the time of the writing of Araral's (2014) paper was not aware of that work at the time of study.

only fuel the dialogue within the literature but may also cause significant problems in intercoder agreement and data synthesis.

Table 2: Expanded Design Principle Questions (adapted from Cox et al., 2010)

Design Principle	Description
1a	The presence of the design principle 1A means that individuals or households who have rights to withdraw resource units from the common-pool resource must be clearly defined. Is this design principle present?
1b	The presence of the design principle 1B means that *the boundaries of the CPR must be well defined*. Is this design principle present?
2a	The presence of design principle 2A means that *appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions*. Is this design principle present?
2b	The presence of design principle 2B means that *the benefits obtained by users from a CPR, as determined by appropriation rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by provision rules*. Is this design principle present?
3	The presence of design principle 3 means that *most individuals affected by the operational rules can participate in modifying the operational rules*. Is this design principle present?
4a	The presence of design principle 4A means that *monitors are present and actively audit CPR conditions and appropriator behavior*. Is this design principle present?
4b	The presence of design principle 4B means that *monitors are accountable to or are the appropriators*. Is this design principle present?
5	The presence of design principle 5 means that *appropriators who violate operation rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, officials accountable to these appropriators, or both*. Is this design principle present?
6	The presence of design principle 6 means that *appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials*. Is this design principle present?
7	The presence of design principle 7 means that *the rights of appropriators to devise their own institutions are not challenged by external governmental authorities*. Is this design principle present?
8	The presence of design principle 8 means that *appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises*. Is this design principle present?

Araral (2014) also points to the definition of a "successful CPR" as the second specification error of concern. Our team found the defining of success and failure to be difficult and complex and found some significant differences in how success was defined between our study and the Cox et al. (2010) study. Cox, et al. (2010) defined "success" in cases that "reported successful long-term environmental management" (Cox, et al. 2010, p.40). Success in our study was defined in relation to a number of social and ecological outcome variables drawn from the CPR project coding schema (Ostrom et al., 1987), including dimensions of resource sustainability, process of collective choice arrangements, and equity among users. We also utilized CPR variables to augment each DP variable. In total, fifty-seven variables/questions were used, which were divided into theoretical categories for the three dimensions of outcome "success" and each of the eleven expanded design principle categories (Table 3).

Table 3: Coding variables/questions and categories

Outcomes Variables			
Resource Sustainability	**Process of Collective Choice Arrangements**	**Equity among users**	**Overall Success/Failure of the CIS**
1a & 1b: Quality of units being withdrawn	7a & 7b: Levels of trust among appropriators	10: Disadvantaged appropriators	14: Success or Failure
2a & 2b: Maintenance of public appropriation infrastructure	8: Changes in trust level	11: Harm to those who are worst off	
3a & 3b: Maintenance of public distribution infrastructure	9: Rule following	12: Distance between least and most advantaged	
4a & 4b: Maintenance of public production infrastructure		13: Changes in the levels of equity among appropriators	
5a & 5b: Balance of resource availability and withdrawal			
6a: Changes in condition of natural infrastructure			
6b: Changes in condition of human-made hard infrastructure			

Expanded Design Principle Variables					
DP1A	**DP1B**	**DP2A**	**DP2B**	**DP3**	
15: Well defined group	17: Spatial Boundary construction	19: Rule flexibility	21: Rule fairness	23: Options to express needs to decision makers	
16: Presence or absence of DP	18: Presence or absence of DP	20: Presence or absence of DP	22: Presence or absence of DP	24, 24.1 & 24.2: Chief exec. position	
				25 & 25.1: Proposed Collective Choice rules	
				26: Presence or absence of DP	
DP4A	**DP4B**	**DP5**	**DP6**	**DP7**	**DP8**
27 & 27.1: Records of use	30: Self-monitoring	33: Sanctions vary	35: Arenas for exchange of info	37, 37.1 & 37.2: Right to participate in management	39: Chief exec. report externally
28 & 28.1: Records of resource condition	31 & 31.1: Official guard	34: Presence or absence of DP	36: Presence or absence of DP	38: Presence or absence of DP	40: More than one organization
29: Presence or absence of DP	32: Presence or absence of DP				41: Presence or absence of DP

The problem of specifying success as identified by Araral (2014) may be a fundamental issue within our field and could be partially based on the legacy of shared theoretical roots which may sometimes be taken for granted. The Cox et al. (2010) definitions of success and failure are well aligned with the common definitions found in the literature. Ostrom (1990) defined "success"

within CPR governance as those "institutions that enable individuals to achieve productive outcomes in situations where temptations to free-ride and shirk are ever present" (p.15). "Institutions" are the rules, norms, and shared strategies that people use to organize all forms of repetitive and structured interactions at all scales (Ostrom, 2005). When Ostrom talks about "success," she is referring to successful collective action, essentially referencing the converse of the definition of "failure" used by Cox et al. (2010). Both the Cox et al. (2010) definition and the outcomes variables which we used to construct our definition of success capture this part of Ostrom's (1990) definition, however, the major difference comes from the inclusion of the temporal idea of "long-term environmental management" (Cox et al. 2010, p.40) which is not included within the outcome variables used in our study. While the idea of long-enduring CPR institutions is also well founded within the literature (Anderies et al., 2004; Cox et al., 2010; Ostrom 1990, 2005; Poteete et al., 2010), we found this to be a difficult concept to assess within a meta-analysis of secondary data, such as this study. While some of the outcome variables used (Variables 1-7) included a temporal qualification of the system as measured by a beginning to an end period of time, many of the cases in the dataset only captured a limited snapshot in time and did not include adequate longitudinal data to indicate the longevity of success within the case. In fact, we found that the outcome variables which included a two-part question aimed at capturing the beginning and end of the study period were problematic and could almost always be effectively reduced to a new outcome variable which captured only whether or not the indicator (such as resource quality) was maintained throughout the time period of the study. By looking more generally at the maintenance of quality over time rather than measured instances of beginning and end qualities, we were better able to assess and construct important take-away messages in analysis such as:

- In forests, success occurred most often when the resource and/or infrastructure were maintained; and when users trusted one another and followed the rules; but did not necessarily imply equity.
- In irrigation systems, success often was achieved on all dimensions, including resource and/or infrastructure maintenance, equity, and helping users in their ability to solve asymmetrical upstream/downstream collective action problems.
- Successful fisheries often included conservation of the resource, following of rules, and sometimes addressed equity issues, but did not necessarily include trust among users.

Ambiguities involved in the specification of variables make it difficult, if not impossible, to reproduce the analysis of a previous study and hinder synthesis and meta-analysis efforts. Furthermore, these types of specification problems are also key drivers of the missing data problem which can plague both analysis efforts and intercoder agreement (Araral, 2014).

Codebook Development and Sample Coding

The variables described above were initially documented in a set of coding questions and were pre-tested on a sample of three cases randomly selected from the existing CPR database to represent each of the sectors included in the study (irrigation, fishery, and forestry). Coding results[‡‡] were compared to the existing CPR coding of these cases in order to determine

[‡‡] Results from the Sample Coding of the three CPR cases were compared to the original results for those cases contained within the relational database for the CPR Project (Ostrom et al. 1987) and so were comparable with only

consistency in theoretical interpretation. Any questions related to the interpretation of variables were discussed and clarified by the entire research team. Coding results were subjected to informal intercoder reliability testing by one of the primary investigators of the project before coding of the entire dataset commenced. Ambiguities and questions that arose during coding were addressed in project meetings, and the answers/clarifications to those issues were incorporated into an informal coding guide and included the original list of 57 coding questions supplemented with explanations and answers derived from coder questions. Although the best practices model (Fig. 1) would call for formal intercoder reliability testing on a subset of the dataset, as well as sample intercoder agreement testing throughout and after the formal coding process, our team only tested coder agreement on the initial sample of CPR test cases. No formal intercoder reliability testing was conducted to "spot-check" coder agreement during the coding process, and official intercoder reliability ratings were not calculated until after coding was completed. Our informal coding guide development process, however, was aimed at establishing an informal feedback loop of intercoder alignment, refinement of theoretical interpretations and iterative adjustments to the coding questions based on ambiguities and questions that arose during coding. Assessment of studies based on coding (Cox, 2014; Ostrom et al., 1993; Wollenberg et al., 2007) suggests that this is a more common practice in our research community than the more formal methods. Hruschka et al., (2004), recognize this consensus based approach toward "interpretive convergence" (p.321) as a potentially useful method for increasing intercoder reliability, but state that more analysis may be needed to determine the validity of this approach.

Coding

The iterative process of team discussion on theoretical interpretations, and iterative refinement of the coding questions and guide continued throughout the coding process. In order to define a DP as present or absent or assign an answer to a CPR variable, coders looked for explicit evidence within the analyzed texts. These selected text segments were then utilized as "evidence" of an appropriate code when mitigating discrepancies between team members to arrive at an agreed-upon group code. It should be noted that no qualitative data analysis (QDA) software was utilized, which has been found to aid in increasing rigor and intercoder reliability during the coding process (Denzin and Lincoln, 2000; Rambaree, 2007). Instead, coders individually coded the texts assigned to them and recorded their coding results, notes and memos in Excel spreadsheets. Where there was consensus between the individual codes on any variable, the same answer was given as the group code for that variable. Any coding disagreements were resolved through group discussion among the coding team members and during project meetings where study PIs addressed unresolved issues. Individual coding sheets were later combined by team and case, after which group codes were added for each coding variable. Final coding results (individual and team) for all cases were later combined into a master Excel spreadsheet.

Coding Team Dynamics

Since there was no established written coding protocol or detailed codebook descriptions for each of the variables, and no qualitative data analysis (QDA) software used, the use of text segments as evidence to support coding results developed organically as teams met to compare

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those variables extracted from the CPR project (45 variables), not including the "Success" variable or any of the eleven expanded design principle variables.

their coding results and was not a consistent methodology among all coders. The conversational group decision process arguably resulted in advantages for coders who were able to more forcefully argue their positions, as well as for those who were better at documenting all instances of text that led them to code a variable in a certain way. The discovery of these differences in coding approach between individual members of the coding team supports the need for explicit rules of coding to increase intercoder agreement and replicability (Stemler, 2001; MacQueen et al., 1998). Select social network analyses was performed with the SNA package in R (Butts, 2007), showing that some coders agreed with the final group code more than others (Table 4). In addition, the dichotomized matrix in Table 5 shows which coders influenced other coders overall, and it is clear that some coders (such as "D") influenced all other coders while some coders (such as "B") were influenced more often.

Table 4: Coder agreement with group code

	A	B	C	D	E	F	G
Agreement	273	215	288	298	293	314	302
Total Possible	336	264	348	324	336	324	336
Percentage	0.8125	0.8144	0.8276	0.9198	0.8720	0.9691	0.8988

Table 5: Coder to coder influence matrix: A code of "1" indicates that the coder indicated within the row influenced the coder indicated in the column more often than vice versa.

	A	**B**	**C**	**D**	**E**	**F**	**G**
A	-	1	0	0	1	0	0
B	0	-	1	0	0	0	0
C	0	0	-	0	0	1	1
D	1	1	1	-	1	1	1
E	0	1	1	0	-	0	0
F	1	0	0	0	1	-	1
G	1	1	0	0	1	0	-

2.2 *Post Hoc* Intercoder reliability testing

The inconsistencies in interpretation and the coding team dynamics discussed above contributed to low intercoder reliability ratings in our coding project. However, these challenges are not insurmountable. They can and should be considered part of a normal coding process and are typical of many similar projects within our field of study. Coder agreement is expected to be low initially, particularly when coding "focuse[s] on identifying and describing both implicit and explicit ideas" (Namey et al., 2008, p.138), such as inferring the presence or absence of DPs to case studies. The fact that many of the case studies were lengthy texts may have further contributed to marginal intercoder agreement. In order to address such discrepancies in coder interpretation, the literature recommends coding several iterations of subsets of the data by question and/or text segment, followed by formal reliability testing (percent agreement *and* a Kappa statistic that takes chance into account), and iterative codebook revisions, until acceptable intercoder reliability ratings have been reached (MacQueen et al., 2008; Hruschka et al., 2004; Bernard, 2011). Once intercoder reliability ratings are in the acceptable range, the team codes the entire dataset. Additional reliability tests are recommended throughout the coding process to prevent "coder drift" or "code favoritism" (Carey and Gelaude, 2008 p.251).

As previously discussed, no formal intercoder reliability ratings within our coding teams were calculated during the coding process. Because there was a sense among coders that intercoder agreement was not high, *post hoc* calculations of intercoder reliability ratings were subsequently performed to examine the overall intercoder agreement by team, but also to determine which coding variables were more difficult to identify within the texts (see Baggio, et al., this volume).

Data preparation

In order to unify the coding data and minimize bias due to incompatible comparisons, cases which did not include the standard three-coder-team were eliminated from the intercoder reliability analysis, including five cases reported in Spanish and coded by only two coders. Furthermore, since intercoder reliability ratings require a comparison of more than one case per team, the four groups that only coded one case study together were also removed from the dataset, leaving a total of thirteen coding groups and sixty cases. Individual coding results were extracted from the group coding spreadsheets (Fig. 2) for each coder and case in order to create individual spreadsheets for these groups with the group coding results removed.

SECDESC	Cox Case	Group	Coder	1a.BEGQUAL	1b.ENDQUAL	NotesQUAL	2a.BEGCONDA
Rural coastal fishing village 50km south of Mombasa, Kenya	1	AEN	A	-1	-1	It says the stocks decline but does not mention the quality of the fish.	-2
Rural coastal fishing village 50km south of Mombasa, Kenya			E	-1	4	pg. 2773 mentions the decline of fish stocks in the area	-2
Rural coastal fishing village 50km south of Mombasa, Kenya			N	-1	3		-1
Rural coastal fishing village 50km south of Mombasa, Kenya			Group	-1	-1		-1

Figure 2: Excerpt of coding results by case study, coder and team. Team coding is highlighted in grey, blue indicated disagreement between coders which was resolved by group agreement.

The coding values utilized in the project were nominal and varied significantly. Although the bulk of the codes were structured in binary format (0/1 – absence/presence), coders could also code a value of (-1) to indicate that the information was "missing in case (MIC)" or (-2) to indicate that the question was not applicable to the examined text. Additionally, many of the variables testing for environmental and social conditions included values that were on a scale from 1 (extremely good) to 5 (extremely poor), with a majority of codes also allowing code value combinations, e.g., "1, 2 = extremely high or high" or "4,5 = poor or extremely poor" where exact condition could not be determined but generally good or poor conditions could be sufficiently determined. To address this coding value complexity, the following steps were necessary:

- Coding values of (-2) were converted to (-1) values. Whether information was missing or not applicable to a text is arguably a semantic issue. In either event, the coder determined there was not enough information to answer that particular question. Reducing variability in this area is likely not to result in a bias, but leaving it in will reduce intercoder agreement due to coder subjectiveness and/or coding mistakes, e.g., two coders feel there is not enough information to answer the question, but one uses code (-1) and the other (-2) resulting in a lack of agreement where there really is none.
- In instances where coding values were given as range of values (e.g. (4,5) or (1,2), the comma was removed from the coding values, thereby converting the coding results to simple numbers, i.e. (4,5) was converted to 45 and (1,2) to 12. This modification is justified since it does not bias the results but prevents programming errors during intercoder reliability testing.

Ultimately, eleven spreadsheets were created for each coding team. Each spreadsheet contained each coder's coding value for each variable in the set for each of the case studies assigned to that particular team (Fig. 3).

Var147 = Variable 14 (Success) + Case Study #7

A	B	C	D	E	F	G
VarCase	Var142	Var143	Var144	Var145	Var146	Var147
A	1	1	1	0	0	0
C	1	1	1	0	0	0
H	1	1	1	0	0	0

Figure 3: Example of coding team results by variable and case study

Intercoder reliability testing

After all 143 spreadsheets were created (13 teams x 11 variable groups), formal intercoder reliability testing could be conducted. Feng (2014) provides guidance on selecting the appropriate intercoder testing statistic. For coding projects involving >2 coders and coding values that are nominal and multiple (i.e., not binary), Feng recommends Krippendorff's alpha, Fleiss' kappa, and/or percent agreement (2014, p.1812, Table 4). Krippendorff's alpha is a reliability coefficient that is a "generalization of several known reliability indices" (Krippendorff, 2013, p.1). Its advantage lies in its ability to calculate intercoder agreement among an indefinite number of coders and any number of scale values. It can handle missing and incomplete data, as well as large and small sample sizes (Krippendorff, 2013; Bernard and Ryan, 2010). Although not widely used because many statistical packages do not include it, Krippendorff's alpha is considered a robust measure of intercoder reliability. Fleiss' kappa is a variant of the popular Cohen's kappa statistic which allows for more than two coders (Bernard and Ryan, 2010). Similar to Krippendorff's alpha, Fleiss is a statistic that measures "how much better than chance" the agreement is among a group of coders (Bernard, 2011, p.448). Finally, although simple percent agreement tends to overestimate intercoder reliability because it does not account for chance agreement (Hruschka et al., 2004; Feng, 2014), it is appropriate to utilize this technique in conjunction with other measures if the variables analyzed are nominal (Feng, 2014). Moreover, simple percent agreement provides a good yardstick to determine whether the intercoder reliability ratings obtained through Krippendorff and Fleiss may be skewed due to particularly high agreement or missing variables.

Utilizing the irr-package in R (Gamer et al., 2012), intercoder agreement for all three statistics was calculated for all 11 variable groups in each of the 13 coding teams (see Table 6 for excerpt and the Appendix for complete intercoder reliability ratings and R code). It should be noted that the original intent was to perform intercoder reliability testing on a dataset that included all the coding values, including (-1: missing in case), as well as on a dataset from which the missing values were excluded. However, due to a large proportion of (-1) coding values in some of the case studies, replacing them with "NA" generated erroneous intercoder reliability ratings which hindered the elimination of missing values in the process. The high number of (-1) values may be attributed to multiple factors, including ambiguities in the examined texts, and the lack of a formal codebook. Although it is important to further investigate the cause of the high number of (-1) values, doing so extends beyond the purpose of this paper. It should also be noted that Fleiss's kappa generated several error messages in instances in which neither Krippendorff's alpha nor simple percent agreement indicated any errors.

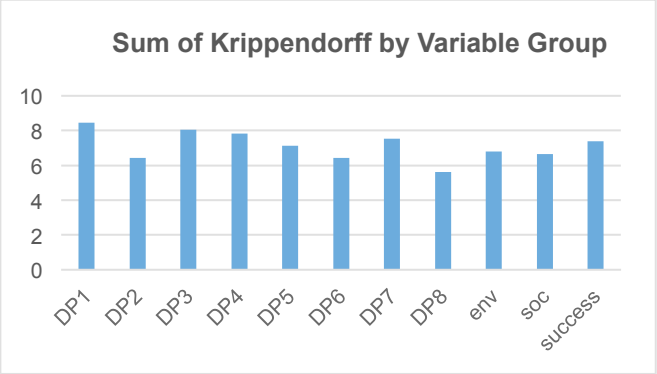
Table 6: Excerpt of intercoder reliability testing results (all statistics). Values for Krippendorff's alpha and Fleiss' kappa range between 0 and 1, with 1 demonstrating perfect agreement between coders and 0 indicating agreement that is consistent with chance, i.e., the absence of reliability. Negative alpha values signify coder agreement that is below chance (Krippendorff, 2008).

Coding Team	Variable Group	Krippendorff values	Fleiss values	Percent agreement
ACH	env	0.603	0.602	80.60
ACH	soc	0.693	0.692	68.80
ACH	success	1.000	1.000	100.00
ACH	DP1	0.261	0.256	33.30
ACH	DP2	0.327	0.322	37.50
ACH	DP3	0.387	0.384	64.30
ACH	DP4	0.591	0.590	59.30
ACH	DP5	-0.138	-0.149	50.00
ACH	DP6	-0.241	-0.258	16.70
ACH	DP7	0.389	0.385	50.00
ACH	DP8	-0.274	-0.286	33.30
CHN	env	0.636	0.634	66.70
CHN	soc	0.507	0.503	45.80
CHN	success	-0.063	-0.125	66.70
CHN	DP1	0.635	0.630	83.30
CHN	DP2	0.584	0.578	66.70
CHN	DP3	0.657	0.654	71.40
CHN	DP4	0.551	0.548	63.00
CHN	DP5	0.802	0.799	88.90
CHN	DP6	0.773	0.766	83.30
CHN	DP7	0.895	0.893	91.70
CHN	DP8	0.438	0.427	55.60
EHU	env	0.384	0.381	75.00
EHU	soc	0.285	0.280	54.20
EHU	success	0.292	0.250	33.30
EHU	DP1	0.624	0.618	75.00
EHU	DP2	0.560	0.554	66.70

Krippendorff (2013) recommends drawing study conclusions only from coded variables with reliabilities above 0.800, although variables with reported reliabilities in the range of 0.667

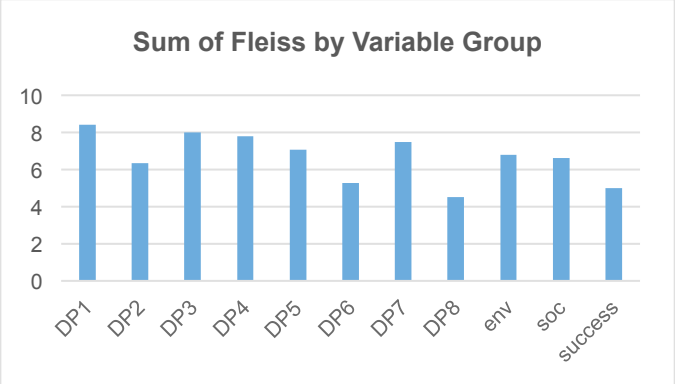
to 0.800 could be used to draw tentative conclusions. Landis and Koch (1977) outlined a set of values that mark different agreement levels based on the value of Fleiss' kappa: <0.00 Poor; 0.00-0.20 slight; 0.21-0.40 fair, 0.41-0.60 moderate, 0.61-0.80 substantial, and 0.81-1.00 almost perfect. Generally, researchers consider kappa values of >0.80 as evidence of high reliability, and values in the range of 0.70 to 0.79 are deemed acceptable, however, these standards are "ad hoc" and still evolving" (Bernard and Ryan, 2010). The desired range of value for simple percent agreement is ≥ 85% (MacQueen et al., 2008). As previously outlined, in our study, simple percent agreement values were used solely to assess the robustness of the other two coder agreement statistics.

Before evaluating whether coding agreement reached high (>0.80) or acceptable (0.70 to 0.79) levels of reliability, simply adding the Krippendorff and Fleiss values by variable group and coding team provides a first insight into those variable groups/teams with high/low scores. As Figures 4 through 7 reveal DP1 (clearly defined boundaries) and coding team "AEN" as those with the highest intercoder agreement. In contrast, DP8 (nested governance) and team "ACH" had the lowest intercoder agreement. For codebook and coding protocol development purposes, such initial high/low values can be important bellwethers of particularly well or poorly functioning coding questions/teams which require further investigation in order to strengthen intercoder agreement across all variables and teams.



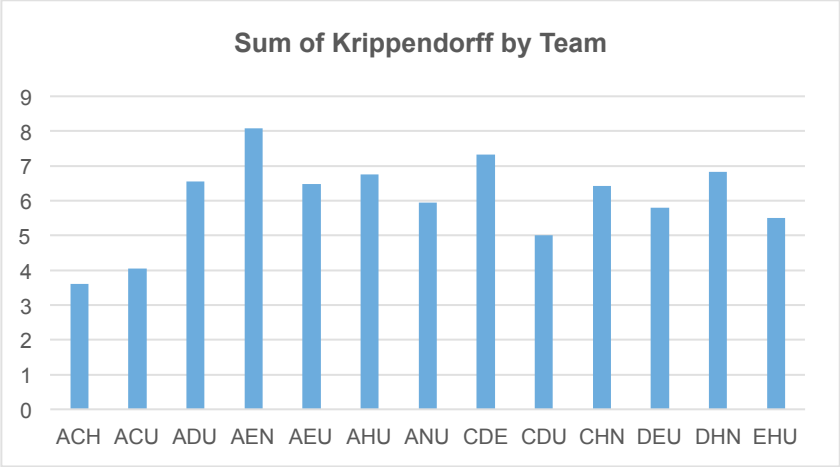
Variable Group	Sum of Krippendorff
DP1	8.462
DP2	6.431
DP3	8.043
DP4	7.813
DP5	7.136
DP6	6.416
DP7	7.543
DP8	5.626
env	6.812
soc	6.662
success	7.370

Figure 4: Sum of Krippendorff values by variable group for all coded cases. Results indicate that generally DP1 had the highest overall intercoder agreement and DP8 the lowest.



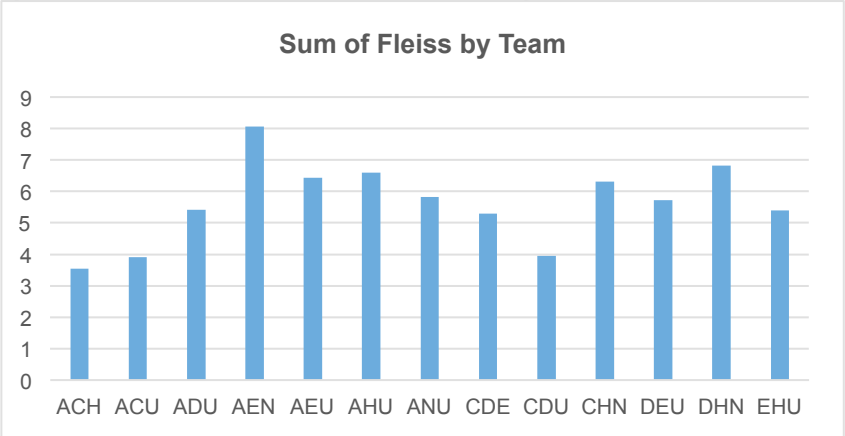
Variable Group	Sum of Fleiss
DP1	8.409
DP2	6.352
DP3	8.008
DP4	7.784
DP5	7.065
DP6	5.258
DP7	7.474
DP8	4.519
env	6.785
soc	6.621
success	5.003

Figure 5: Sum of Fleiss values by variable group for all coded cases. Results are similar to Krippendorff values further confirming DP1 as the variable with the highest intercoder agreement and DP8 with the lowest.



Team	Sum of Krippendorff
ACH	3.598
ACU	4.055
ADU	6.545
AEN	8.078
AEU	6.473
AHU	6.749
ANU	5.947
CDE	7.324
CDU	5.006
CHN	6.416
DEU	5.792
DHN	6.831
EHU	5.500

Figure 6: Sum of Krippendorff values by coding team/all cases coded. Results reflect highest coder agreement for team AEN and lowest coder agreement for team ACH.



Team	Sum of Fleiss
ACH	3.538
ACU	3.910
ADU	5.422
AEN	8.059
AEU	6.443
AHU	6.592
ANU	5.827
CDE	5.292
CDU	3.949
CHN	6.307
DEU	5.722
DHN	6.816
EHU	5.401

Figure 7: Sum of Fleiss values by coding team/all cases coded. Results are similar to Krippendorff values confirming highest coder agreement for team AEN and lowest for team ACH.

The initial findings from the simple summary calculations are further confirmed by evaluating the mean and median values of the intercoder agreement scores. Additionally, the mean/median values reveal significant skewing of the data for variables success, DP5, DP6, and less so for DP2 and DP3 (Fig. 8) as well as for many of the coding teams (Fig. 9). Although the skewing is replicated in a similar fashion in the mean/median simple percent agreement values for success, DP5, DP6, DP2, and DP3, it is not evident in the simple percent agreement values for the coding teams indicating that these distortions may be due to coding team dynamics, not missing values or other factors. In the case of the success variable, programming errors generated no Fleiss ratings in two cases which serves to further bias the statistics. An in-depth discussion of these discrepancies goes beyond the scope of this paper and will be addressed at a later time.

Despite the informal nature of our coding process and the aforementioned problems, many of the intercoder agreement ratings were >0.65 for both Krippendorff and Fleiss statistics. As outlined above, scores >0.80 evidence high data reliability, and values in the range of 0.70 to 0.79 indicate acceptable intercoder reliability (Bernard and Ryan 2010). This places our data reliability/replicability factor only slightly below the 0.70 score that is generally deemed as acceptable in the literature. Given the high level of inference required to determine some of the

variables, the large number of missing values, and the *ad hoc* nature of our coding process, such ratings are defensible for the completed project and may easily be improved in the future through the use of a detailed codebook and coding protocol. More importantly, by disclosing our intercoder reliability ratings, procedures, preliminary codebook and coding protocol, we have taken additional steps to enhance the ability of others to analyze and replicate our findings.

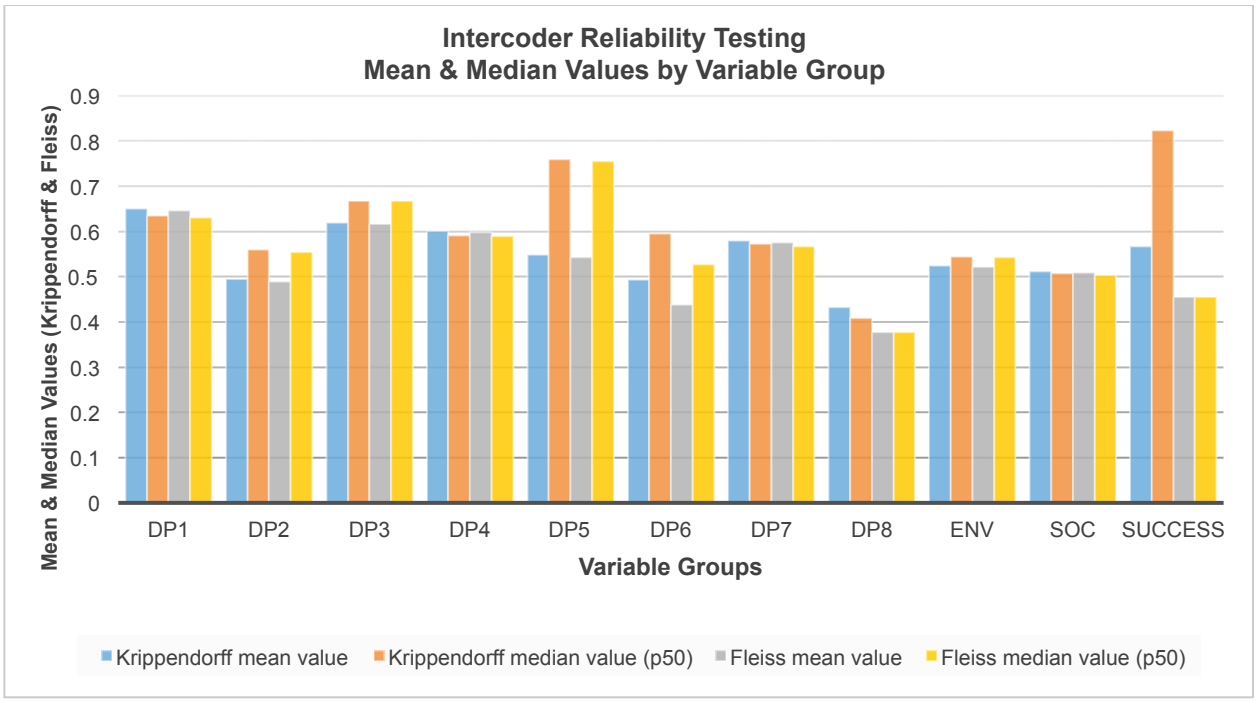


Figure 8: Mean and median values by variable group for Krippendorff and Fleiss statistics.

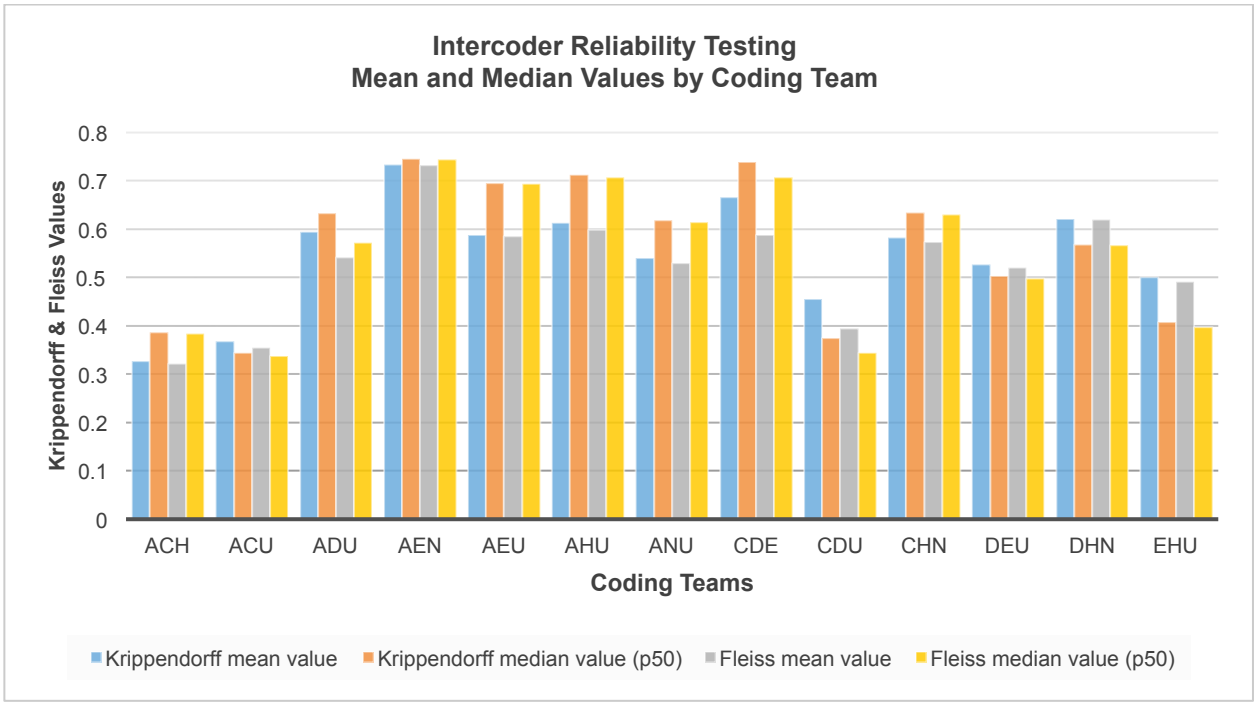


Figure 9: Mean and median values by coding team for Krippendorff and Fleiss statistics.

Coder Drift

Coder drift, or code favoritism, is the process over time, in which coders can become less reliable in their coding due to "sloppiness in applying coding criteria or adoption of idiosyncratic coding biases" (Bartholomew et al., 2000 p.303). This is part of the normal coding process and the reason why it is recommended that spot checking of coder agreement continue throughout the coding process, particularly in large coding projects (Carey and Gelaude, 2008). In our coding project, such spot checks may have mitigated some of the ambiguity with regard to coders' assessment of whether or not a case study was deemed "successful". After coding was completed and intercoder reliability ratings performed, discussion among coders revealed that there may have been some coder drift which may have produced inconsistencies in the way that coders applied information within the text to answer the question of overall success (Question 14). Random sampling of the answers given to question 14 as well as purposive sampling of ten cases revealed notes that indicated several coders may have considered more than the outcomes variables in answering. However, in all but two cases, coders were in agreement with their assessment of the studies overall success or failure, regardless of the potential for coder drift. In the two instances of coder drift where there was no initial coder agreement, the coders were able to resolve the disagreement through discussion. As outlined throughout this paper, a codebook containing detailed coding descriptions that is iteratively updated to include coder questions and coding ambiguities, as well as continuous spot-checking of intercoder agreement might have resolved these instances of coding bias.

3. Discussion and Conclusions

The libraries of data that have been compiled on CISs and the commons over the past several decades represent a rich and mostly unexploited resource of information that could be exploited to increase our understanding of common pool resources via meta-analysis and comparison with contemporary data (Corti et al., 2005). Secondary analysis of existing case studies has the advantage of being a relatively low cost approach compared to primary data collection and analysis. Further, by basing studies on an ensemble of secondary data, we are able to gather more information allowing wider comparison and, in turn, further increase our understanding of CPRs and CISs in general (Kelder, 2005; Savage, 2005). Meta-analysis and the use of synthesized datasets allows for the use of existing data in new ways including mixed qualitative and quantitative methods and analyses across multiple time periods, scales and sectors, thereby potentially improving researchers' ability to understand complex system dynamics and adaptation (Cox, 2014; Kelder, 2005; Ostrom, 1990, 2012; Poteete et al., 2010). Araral (2014) and Agrawal (2014) characterize this type of work in the study of the commons as the "emerging third generation" of research within the legacy of Elinor Ostrom, and see these efforts to generalize and extend her arguments across scales and with increased complexity as being of "fundamental importance" (Agrawal, 2014, p.87). Agrawal (2014) asserts that furthering this research will require methodological innovation, better theoretical sophistication and improved data. Furthermore, he states that the use of new methods involving more qualitative analysis and experimentation are the current drivers pushing the field forward. However, the successful use of these new methods will depend upon substantial amounts of new data, better integration of data, a sophisticated hierarchical organization of datasets, and increased analytical rigor (Agrawal, 2014).

Because meta-analysis of this type is a relatively new methodological approach in social science research (Corti et al., 2005), some authors argue that there has not yet been enough published research looking at the issues it may raise (Corti and Thompson, 2004). We have found, however, that the approach has been utilized often enough to generate some critical analyses (Araral, 2014; Corti et al., 2005; Kelder, 2005) which offer guidance and identify valid issues of concern involved in the use of this type of methodology. Furthermore, we find that enduring issues within the norms of current coding practices in commons research are two-fold: (1) very few publications disclose specific methodological information extending beyond the identification of coding themes and/or variables used; and (2) even fewer studies report intercoder reliability ratings or some informal process by which the reliability of coding outcomes can be assessed. Problems associated with ambiguous or missing information based on unreported assumptions, like those discussed here, hamper the replicability of study findings and undermine the reliability and validity of such research. The overall discourse of any area of research is always a work in progress and case studies and comparative analysis done in isolation may be disputed or later found to be wrong. Meta-analysis offers the opportunity to refine findings within a wider community, discover what the dominant discourses are and generate new knowledge through the validation and synthesis of previous findings. In addition, there may be issues of confirmatory bias or non-representative sampling involved in the selection of cases for secondary analyses, even when they contain sufficient levels of information. In order to advance the intra- and inter-institutional analysis of data, more rigorous standards should be established, such as common standards and protocols and the explicit reporting of assumptions. Even without consensus on standards or protocols, however, selection criteria should be made more transparent by research teams in order to facilitate the emergence of common practices and increased methodological rigor in social-ecological systems science in general. The conducting and reporting of intercoder reliability is also critically important, as is the disclosure of coding variables and codebooks which can facilitate better meta-analysis of data. The resource of CIS and commons data that exists can, itself, be viewed as a commons and institutions which govern the proper and productive use of these resources could effectively reduce the externalities which the private property dataset approach now generate.

Kelder (2005) succinctly explains why it is important for all researchers, but especially those using and creating secondary data, to explicitly consider and document their assumptions and interpretations throughout the process of coding and data analysis, when she states that "these elements soon become familiar and 'disappear' from the researcher's consciousness, and the record provides the context for the collection of data that informs later analysis" (p.6). Kelder further explains how incompleteness or lack of this type of information creates ambiguities that have consequences in any potential future research or utilization of the data. These problems are acutely reflected in our coding project. Agrawal (2014) argues that scholars of the commons have not clearly differentiated between different measures, dimensions, and outcomes but have relied upon the use of relatively vague terms like "sustainability", "success", and "long-term viability" instead. As previously discussed, the tendency to not disclose supplementary coding information and the failure to perform intercoder reliability ratings inhibits a deeper examination of the study findings by other researchers, including the replication and cross-comparison of the data. A possible explanation for the reluctance to assess coder agreement in some branches of social science is provided by Hruschka et al. (2004): (1) researchers may generally believe that the quantification of qualitative data is unnecessary because qualitative research is a "distinct

paradigm" that cannot or should not be subject to a quantitative evaluation; and (2) a general skepticism about the ability to actually measure subjective data and reproduce coding results.

We argue that full data disclosure and intercoder reliability rating protocols are important because qualitative research often generates complex information that is difficult to process and can lead to judgments based on "intuitive heuristics" (Hruschka et al., 2004). Even if one is inclined to believe that qualitative data analysis should not be quantified, it is helpful to know that two or more persons are generally able to glean the same information from the same text. It is precisely the subjective nature of the evaluations which makes them more susceptible to individual interpretation and the intentional or unintentional introduction of biases, random errors, and other distortions (Krippendorff, 2013; Hruschka et al., 2004). The establishment of a coding protocol and intercoder reliability testing regime represents an effort to "reduce the error and bias" (Hruschka et al., 2004) in text analysis by ensuring that the data meaning remains consistent across a variety of coders and research teams. In fact, it can be argued that coding is an essential element of classical content analysis because it converts qualitative data into datasets that are supportive of robust analyses which can be replicated by other scholars (Krippendorff, 2013). Replicability creates greater reliability which empirically grounds confidence in the data and, thus, the study findings (Krippendorff, 2013). In addition, we found that utilizing two or more coders increases data reliability because coding agreement between different people, who have been given the same instructions and have independently coded the same segments of text, demonstrates a reduction of subjective biases and increases trustworthiness (Guest and MacQueen, 2008). Depending on the code values (nominal/binary or ordinal/variable) and number of coders utilized, there are a variety of intercoder reliability statistics available to calculate coder agreement. Since each method has its drawbacks, however, it is considered best practice to utilize more than one intercoder reliability technique (Feng, 2014). Coding team dynamics may be a concern, however, which may be mitigated through the use of more rigorous coding protocols and coder training.

The study of coupled infrastructure systems (CIS) and the dynamics that affect human-environment interactions are varied across spatial and temporal scales and are extremely important to understanding and coping with many of the issues we now face as a global society. Many scholars, like Agrawal (2014) and Araral (2014), see these current trajectories within CIS research as fundamental and critical, yet at their infancy. Araral (2014) argues that Ostrom's theories may only be applicable to the special-case of locally governed, small-scale commons may not be easily generalized but recognizes that the body of evidence collected within Ostrom's legacy has thus far not much extended beyond these types of commons. We question whether there has yet been a sufficiently sizable body of data gathered and analyzed, including information on larger-scale systems, multi-scalar governance structures, temporal dimensions, and other important factors with which to compare the existing studies, or if there are any sufficiently developed methods by which to conduct such comparisons. It was one of Ostrom's (2005) deep convictions that beneath the coupled human and natural infrastructure processes are a set of universal building blocks which could be tapped to create adaptive and long-enduring governance systems. Work towards creating a methodology that will foster cooperation and cross-comparison of data could allow us to expand our understanding of these systems. By sharing our coding experience and protocols, we hope to stimulate the development transparency norms within the commons research community which others may build upon as we move further toward the identification of these universal building blocks. It is important to continue

pushing social-ecological science towards greater rigor and a greater understanding of the complex interactions that lead to successful outcomes. Towards this goal, we assert that methodology must be tested and refined for more precise measurement of the dependent and independent variables involved in CISs. Furthermore, the commons research community should work to ensure that studies are replicable and that different research teams are able to achieve similar answers. In conclusion, while there may be many challenges and opportunities associated with the coding and synthesis of case studies, increased collaboration and consensus in a few key areas within the research community may lead to new horizons and possibilities in understanding CISs and the commons.

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APPENDIX: Challenges and opportunities in coding the Commons: problems, procedures, and potential solutions in large-N comparative case studies

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CENTER FOR BEHAVIOR, INSTITUTIONS & THE ENVIRONMENT (CBIE)

CODING MANUAL

(Version 2)[1]

NOTE: BASED ON OUR CODING EXPERIENCE, WE BELIEVE THIS CODING MANUAL REPRESENTS AN IMPORTANT FIRST STEP TOWARDS A MORE STANDARDIZED CODING METHODOLOGY FOR THE TEXT ANALYSIS OF SECONDARY DATA. HOWEVER, THIS MANUAL HAS NOT BEEN FULLY REVIEWED OR TESTED AND SHOULD NOT BE CITED OR DISTRIBUTED WITHOUT THE AUTHORS' EXPRESS PERMISSION.

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We would also like to acknowledge the Cox, et al. (2010) study from which the revised design principle structure utilized in this manual was borrowed.

Finally, and most importantly, this coding manual aspires to be an extension of Elinor "Lin" Ostrom's (August 7, 1933 - June 12, 2012) work. It is her extraordinary scholarship in common pool resource governance and institutional theories that has provided the foundation, as well as the inspiration, to create this open source codebook. Furthermore, many of the key elements contained in the 1987 Common-Pool Resource Project created by Lin Ostrom, Edella Schlager, and Shui Yan Tang are included in this manual, and we hereby extend our gratitude and appreciation for their work.

The coding manual is a part of the Social-Ecological System (SES) Library at Arizona State University which is funded by National Science Foundation grants BCS-0527744 and SES-0645789.

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[1] Original version: March , 2015; revised July 8, 2015
[2] Formerly known as the Center for the Study of Institutional Diversity (CSID)

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Introduction

This coding manual is an open source document which can be accessed and used by researchers, students, and practitioners engaged in the analysis of social-ecological or other coupled infrastructure systems (CIS). It builds directly on the work of Elinor Ostrom, Edella Schlager, and Shui Yan Tang who, in 1987, created the common-pool resource (CPR) coding database which has become a part of the Social-Ecological Systems (SES) Library. The original CPR variables, codebook, and case studies are available for review and use at the SES Library's website [https://seslibrary.asu.edu/seslibrary/welcome].

SES Library

The SES Library is located within ASU's Center for Behavior, Institutions & the Environment (CBIE[3]) which was founded in the summer of 2006 by Elinor "Lin" Ostrom (August 7, 1933 - June 12, 2012) as a sister center to the Vincent and Elinor Ostrom Workshop in Political Theory and Policy Analysis at Indiana University.

CBIE, and by extension the SES Library, emerged from the collaborative work between Lin Ostrom, Marty Anderies, and Marco Janssen after their first meeting at a Resilience Alliance workshop in Stockholm in 2000. The core of the SES Library consists of 86 case studies that were initially coded by Lin Ostrom, Edella Schlager and Shui Yan Tang of Indiana State University in the 1980s. The primary goal of the coding analysis project was to gain an understanding of the conditions present in successful social-ecological systems (SES). In 1990, Lin Ostrom utilized the information gleaned from these cases in her seminal work "Governing the Commons" to identify the eight design principles present in successful, long-enduring common pool governance systems and to provide an alternative framework of collective action based on empirical observations. This work was a clear departure from the standard theory of the time which argued that only privatization or governmental regulation could prevent a tragedy of the commons (Hardin 1968).

In "Governing the Commons," Ostrom proved that in many SESs resource users were able to successfully govern their common resources over time. The Institutional Analysis and Development (IAD) Framework was one of the extensions of that work and provided a theoretical basis from which to systematically study institutional arrangements. It was this work that won Lin Ostrom the Nobel Prize for Economics in 2009.

The SES Library continues to be an integral part of the larger innovative cyber-infrastructure of the CBIE. At its core remain the 86 case studies coded by Schlager and Tan under the guidance of Lin Ostrom. These cases can be accessed directly through the SES Library's main page, and the original coding results are available through the SES Library's Common Pool Resource (CPR) database. We encourage users to make use of the SES Library resources, including this coding manual. However, more importantly, we ask that you consider contributing new case studies to the SES Library and provide us with your comments and suggestions to the detailed codebook descriptions provided herein. As we will elaborate further below, we hope that such collaborative efforts will move commons theory towards identifying the universal building blocks underlying the diversity of interactions, institutions, and other linked human-environment interactions that are described within these case studies, as Elinor Ostrom argued would be possible (Ostrom 2005).

[3] Formerly known as Center for the Study of Institutional Diversity (CSID)

Coding Protocol

This is the recommended Coding Protocol of a team of researchers at Arizona State University following an analysis of the issues raised during a lengthy coding project. For more information on the reasoning behind the establishment of this protocol, please reference "Challenges and opportunities in coding the commons" (Ratajczyk, et al., CBIE Working paper).

Step One: Preliminary Considerations

Case Selection

For more information on case selection, please reference "Challenges and opportunities in coding the commons" (Ratajczyk, et al., CBIE Working paper).

Text Segmentation

Although data segmentation is largely driven by epistemological considerations, the literature tends to recommend that a text be segmented into smaller units in order to facilitate better intercoder agreement and reliability (Krippendorff 2013:101), thereby avoiding an increase in the "complexity of coding decisions" (Hruschka, et al. 2004:319) and related coding discrepancies. However, if a researcher is attempting to compare the occurrence of certain themes or variables across a variety of texts, the whole text is considered the appropriate unit of analysis (Bernard 2011). In either event, text segmentation should be determined and defined prior to proceeding with coding.

Coding Team Structure

Utilizing two or more coders increases data reliability because coding agreement between different people, who have been given the same instructions and have independently coded the same segments of text, demonstrates a reduction of subjective biases within the study findings and increases trustworthiness (Guest and MacQueen 2008 Chap 10:215).

The question as to how many coders are sufficient to establish data reliability and replicability is an enduring one without a defined answer. We defer to Bernard and Ryan (2010) who encourage researchers to examine their data for two criteria: (1) "the level of inference required to identify themes/coding variables"; and (2) "the prevalence of themes/coding variables" within the texts (p. 306). If coding variables/themes occur frequently, then it is assumed that even inexperienced coders will find at least one supporting example of the variable within the text. However, if coding variables are assumed to be rare and/or difficult to identify due to the high level of inference required to recognize codes within the texts, researchers are encouraged to use more coders to ensure that rare and important themes are not missed.

Since most, although not all, of the data analyzed in the study of the commons is derived from secondary data sources, and the analyses requires examining the texts for the presence and absence of theoretical design principles requiring at times a high level of coder inference, we recommend utilizing 3 coders. However, we also acknowledge that time and budget constraints often drive these considerations. As a result, this coding protocol also supports coding projects utilizing coding teams of two.

Qualitative Data Analysis (QDA) Software

Although coders can enter their coding results in Excel spreadsheets, such a process is tedious, time-consuming, difficult to verify over time, and subject to entry error. This can, in part, be attributed to the fact that coders are unable to tag and assign codes to the text directly. Instead, utilizing spreadsheets requires coders to either independently keep track of the segment of text that

supports a particular code, and/or manually enter the supporting text passage in a separate column of the spreadsheet. This complicates the coding process and increases coding errors due to issues such as failure to keep track of supporting text, losing documentation, and entering supporting information in the wrong field of the spreadsheet. In contrast, QDA software facilitates the marking and tagging of texts with codes, eliminating the need to manually keep track of supporting text passages. Furthermore, most QDA software facilitates blind-coding by different coders and the subsequent merging of codes from various coders into a final document for further detailed analysis of coding discrepancies, including intercoder reliability ratings. We do not specifically endorse a particular QDA software, but recommend teams take advantage of free trial periods to test individual programs' usefulness prior to commencing coding. The guidelines in this coding protocol should be broad enough to support a variety of code tracking setups, including, if necessary, spreadsheets.

Step Two: Test Coding

Detailed Coding Variable Descriptions

The coding variables provided with this coding protocol are a synthesis of coding questions developed by Lin Ostrom, Edella Schlager, and Shui Yang Tan during their CPR coding project in the mid to late 1980s, as well as additional variables created by members of the CBIE team during a large-scale coding project in 2013-2014. For further information on the coding project, please reference "Challenges and opportunities in coding the commons" (Ratajczyk, et al., CBIE Working paper).

In order to describe the coding variables in enough detail so that coders are independently able to identify and tag a code in texts, each coding variable (question) utilized in the 2013-2014 coding project was given a one-page detailed explanation in the following ten-component format:

- Code title and name (e.g. Code 13: Equity level over time)
- Variable name: provides the code mnemonic and the coding question it relates to (e.g. BEGCONDP (Question #4a)
- Theory area: identifies the underlying theory to which the variable is linked (e.g., Outcomes – Resource Sustainability).
- Short description: short phrase that communicates to the coder what the coding variable is looking for (e.g., condition of public production infrastructure at beginning of time)
- Detailed description: Detailed explanation as to what information the coding variable is looking for.
- Inclusion criteria: List features or conditions that would automatically require that a text segment be coded with this specific variable.
- Exclusion criteria: List specific features or conditions that would automatically exclude a text segment from being coded with this variable.
- Typical exemplars: Typical examples of instances where a particular code would apply.
- Atypical exemplars: Examples of less common instances where a particular code would apply.
- Close, but no: Examples of ambiguous instances where coders may feel that the code applies, but it does not.

(MacQueen, et al. 2008 Chap 6:121-122, Bernard & Ryan 2010).

Codebook Evolution through Collaboration

Codebook development is a dynamic and ongoing process, and the attached codebook descriptions are provided as an initial pool of variables to utilize. This is a living document! It is designed to evolve. Accordingly, we invite and welcome contributions, comments, corrections, criticism, and suggestions from others; both researchers and practitioners alike. It is our hope that these variables provide the fertile ground from which, over time, the seeds of collaboration will grow those variables that are most meaningful and applicable to cross-sectoral and/or cross-scalar analyses.

Recommended Test Coding Procedure

- Following MacQueen, et al.'s (2008) recommendation, we encourage users of this codebook to review the attached coding variables with their respective coding teams until everyone is familiar with the codes.
- The next step is for the principal investigator and members of the coding team to independently test code a subset of the data (either select case studies or passages of text from within designated case studies).
- Test coding should be followed up with an assessment of intercoder agreement (at minimum simple percent agreement which is, ideally, compared to an intercoder reliability statistic that takes chance into account, such as Krippendorff's alpha or Cohen's/Fleiss' kappa).
- Based on the intercoder reliability ratings and feedback from the coding team, the codebook variables should be revised to address ambiguities and problems.
- Once the coding descriptions have been revised, iterative rounds of test coding are conducted with subsequent intercoder reliability testing and coding variable adjustments until acceptable intercoder agreement has been reached (MacQueen, et al. 2008 Chap 6:130-131; Hruschka 2004:325, Bernard 2011:448). (For more information on acceptable intercoder agreement ratings, see the "Intercoder reliability statistics" section below).
- Once acceptable intercoder reliability ratings have been reached, the team codes the entire dataset.
- To ensure continued coding reliability, we recommend that the principal investigator continue spot-checking intercoder reliability throughout the entire coding process in order to prevent "coder drift" or "coder bias" (Carey and Gelaude 2008 Chap 11:251). Codebook revisions should also continue throughout the coding process, as necessitated by coder questions and requests for clarification.

Step Three: Intercoder Reliability Testing

As outlined above, intercoder reliability testing is important in the test coding phase to identify and mitigate any coder questions and/or ambiguities in the coding variable descriptions. Spot-checking coder reliability throughout the coding process is necessary to prevent coder bias/drift from setting in and affecting coding outcomes. Once the entire dataset has been coded, formal intercoder reliability ratings on the entire coding project should be calculated to determine the overall agreement among coders. For more information on intercoder reliability statistics, please reference "Challenges and opportunities in coding the commons" (Ratajczyk, et al., CBIE Working paper).

Calculation of Intercoder Agreement

The open source statistical program R (R Core Team 2013) has programming scripts to calculate all three statistics outlined above. We have modified these scripts to facilitate intercoder agreement of all three statistics for the attached variables utilizing the irr-package in R (Gamer, et

al. 2012), and these scripts are available for download through the SES Library. Users will need to set up matrices as follows in order for R to be able to calculate the statistics:

Coders A, C, and H

Var147 = Variable 14 + Case Study #7

	A	B	C	D	E	F	G
1	VarCase	Var142	Var143	Var144	Var145	Var146	Var147
2	A	1	1	1	0	0	0
3	C	1	1	1	0	0	0
4	H	1	1	1	0	0	0
5							

Table 1: Sample matrix setup for R

Determining Acceptable Intercoder Reliability Ratings

Please reference "Challenges and opportunities in coding the commons" (Ratajczyk, et al., CBIE Working paper).

Concluding Remarks

By providing this coding protocol, we hope to create a collective action forum in which scholars, students, and practitioners can come together and collaboratively develop a more unified methodological approach to the analysis of complex SES/CIS. We believe that the tendency to not disclose supplementary coding information and the reluctance to perform intercoder reliability ratings creates a positive feedback loop that inhibits a deeper examination of the study findings across institutions and fields of study, including the replication and cross-comparison of data. It was one of Lin Ostrom's deep convictions that beneath the vast diversity of regularized coupled human-built and natural infrastructure processes lies a set of universal building blocks which can be tapped to create adaptive and long-enduring governance systems (Ostrom 2005:5-6). As admirers of her teachings and followers of her theories, we at CBIE owe it to her to work towards creating a methodology that will foster cooperation and cross-comparison of the data we collect and analyze. By sharing our coding protocol, we are sharing what we believe is a useful tool for others to utilize, criticize, improve upon, but above all as a means of collaboration. In doing so, we hope to move the field forward to tackle some of the world's most intractable problems. We invite you to join us in this endeavor.

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Definition of Key Concepts and Terms

Appropriation

Appropriation infrastructure

Coupled infrastructure system

De facto

De jure

Distribution infrastructure

Infrastructure

Production infrastructure

Provision

Social-ecological system

Success

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CODING VARIABLE DESCRIPTIONS

OUTCOMES: RESOURCE SUSTAINABILITY

Code 1a: Resource quality – initial condition	
Variable Name	BEGQUAL (Question #1a)
Theory Area	Outcomes – Resource Sustainability
Short Description	Quality of units withdrawn at the beginning of the time period examined.
Detailed Description	Characterize the **quality** of common pool resource units withdrawn at the **beginning** of the time period examined in the text. Quality is defined as the amount of effort involved in resource extraction. Considering the way in which the units are used, how would you evaluate the resource quality? (1) Extremely high quality (2) High quality (12) Extremely high or high quality (3) Passable (4) Poor quality (5) Extremely poor quality (45) Poor or extremely poor quality (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the quality of the resource units being withdrawn at the beginning of the time period examined. If the author does not outline a historical time period for resource quality, code "99" in answer to this question, and then evaluate the contemporary quality of the resource unit as described by the author in answer to #1b.
Exclusion criteria (when not to use)	These variables generally do not apply to irrigation cases, unless the text specifically provides information regarding water pollution, including increasing turbidity and/or salinity levels.
Typical exemplars	Fishermen are able to easily fish target species with minimal effort. Fodder is readily available in sufficient quantities to forest community members.
Atypical exemplars	Strong genetic diversity of Salmon species, which reduces the likelihood of genetic bottlenecks, and improves the adaptive capacity of the species. Discussions indicating that the age-class structure is maintained, which indicates that the resource users are not taking too many adults, which could result in a loss of reproductive capacity in the species.
Close but no	The economic value or quality of a resource unit. This may indicated strong genetic diversity, or age-class structure, but cannot be inferred without some data indicating that the economic value is related to these resource quality indicators.

Code 1b: Resource quality – end condition	
Variable Name	ENDQUAL (Question #1b)
Theory Area	Outcomes – Resource Sustainability
Short Description	Quality of units withdrawn at the end of the described time period.
Detailed Description	Characterize the **quality** of common pool resource units withdrawn at the **end** of the time period examined in the text. Quality is defined as the amount of effort involved in resource extraction. Considering the way in which the units are used, how would you evaluate the resource quality? (1) Extremely high quality (2) High quality (12) Extremely high or high quality (3) Passable (4) Poor quality (5) Extremely poor quality (45) Poor or extremely poor quality (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the quality of the resource units being withdrawn at the end of the time period examined. If the author does not outline a historical time period for resource quality, evaluate the contemporary quality of the resource unit as described by the author in answer to this question.
Exclusion criteria (when not to use)	These variables generally do not apply to irrigation cases, unless the text specifically provides information regarding water pollution, including increasing turbidity and/or salinity levels. [**Took this from our coding sheet, but I am not sure this is accurate?**]
Typical exemplars	Fishermen are able to easily fish target species with minimal effort. Fodder is readily available in sufficient quantities to forest community members.
Atypical exemplars	Strong genetic diversity of Salmon species, which reduces the likelihood of genetic bottlenecks, and improves the adaptive capacity of the species. Discussions indicating that the age-class structure is maintained, which indicates that the resource users are not taking too many adults, which could result in a loss of reproductive capacity in the species.
Close but no	The economic value or quality of a resource unit. This may indicated strong genetic diversity, or age-class structure, but cannot be inferred without some data indicating that the economic value is related to these resource quality indicators.

Code 2a: Appropriation infrastructure – initial condition	
Variable Name	BEGCONDA (Question #2a)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition and maintenance of public appropriation infrastructure at the beginning of the described time period.
Detailed Description	Characterize the **condition** of the public appropriation infrastructure at the **beginning** of the time period examined in the text. In consideration of the construction and physical environment of the public appropriation infrastructure and the financial and technological capabilities of the appropriators, how well maintained is the appropriation infrastructure? Appropriation is defined as harvesting/extraction activities. Public appropriation infrastructure is defined as the infrastructure within which the allocation of the flow of resource units from the resource system to the appropriators takes place. Public appropriation infrastructure can be natural, human-made (physical), or a combination of natural and human-made infrastructures. (1) Well maintained - excellent working order (2) Moderately well maintained - good working order (12) From well to moderately well maintained (3) Some- infrastructure deterioration occurring due to insufficient maintenance (4) Considerable infrastructure deterioration occurring due to poor maintenance (34) Some or considerable infrastructure deterioration due to insufficient or poor maintenance (5) Considerable infrastructure deterioration, but due to a natural disaster (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the public appropriation infrastructure at the beginning of the time period examined. Assess the allocation of the flow of resource units from the resource system and the described allocation conflict between appropriators. If the author does not outline a historical time period for the appropriation infrastructure, code "99" for this question, and then evaluate the contemporary condition of the appropriation infrastructure as described by the author in answer to #2b. In cases where a major natural disaster occurs and damages the resource beyond the appropriators' or responsible agents' capability to prevent and repair, immediately code "5".
Exclusion criteria (when not to use)	Institutional arrangements (soft infrastructure) governing resource extraction, such as catch limits, seasonal closure rules, size and age limits, etc. Private appropriation infrastructure, such as individually owned vessels and gear, water pumps, or cattle (?)
Typical exemplars	Weir or gate used in an irrigation system to direct water from the canal/river to the agricultural field. Public auction halls and markets provided at ports. Publically funded fishing ports for accessing fisheries.
Atypical exemplars	Kicking a hole in the side of a dirt canal to direct water onto field.
Close but no	In Japan they sunk a series of large concrete blocks into a seabed to stop scallop trawlers from trawling the area (if they tried, they would destroy their gear). This would thus be, a conservation tool, but not an appropriation infrastructure.

Code 2b: Appropriation infrastructure – end condition	
Variable Name	ENDCONDA (Question #2b)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition and maintenance of public appropriation infrastructure at the end of the described time period.
Detailed Description	Characterize the **condition** of the public appropriation infrastructure at the **end** of the time period examined in the text. In consideration of the construction and physical environment of the public appropriation infrastructure and the financial and technological capabilities of the appropriators, how well maintained is the appropriation infrastructure? Appropriation is defined as harvesting/extraction activities. Public appropriation infrastructure is defined as the infrastructure within which the allocation of the flow of resource units from the resource system to the appropriators takes place. Public appropriation infrastructure can be natural, human-made (physical), or a combination of natural and human-made infrastructures. (1) Well maintained - excellent working order (2) Moderately well maintained - good working order (12) From well to moderately well maintained (3) Some- infrastructure deterioration occurring due to insufficient maintenance (4) Considerable infrastructure deterioration occurring due to poor maintenance (34) Some or considerable infrastructure deterioration due to insufficient or poor maintenance (5) Considerable infrastructure deterioration, but due to a natural disaster (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the public appropriation infrastructure at the end of the time period examined. Assess the allocation of the flow of resource units from the resource system and the described allocation conflict between appropriators. If the author does not outline a historical time period for the appropriation infrastructure, then evaluate the contemporary condition of the appropriation infrastructure as described by the author in answer to #2b. In cases where a major natural disaster occurs and damages the resource beyond the appropriators' or responsible agents' capability to prevent and repair, immediately code "5".
Exclusion criteria (when not to use)	Institutional arrangements (soft infrastructure) governing resource extraction, such as catch limits, seasonal closure rules, size and age limits, etc. Private appropriation infrastructure, such as individually owned vessels and gear, water pumps, or cattle (?)
Typical exemplars	Weir or gate used in an irrigation system to direct water from the canal/river to the agricultural field. Public auction halls and markets provided at portsPublically funded fishing ports for accessing fisheries.
Atypical exemplars	Kicking a hole in the side of a dirt canal to direct water onto field. Creation and maintenance of human-made artificial reefs to improve habitat. Public attempts to improve shellfish recruitment by collecting "spat," rearing to a mature stage, and reintroducing into the shellfish beds.
Close but no	In Japan they sunk a series of large concrete blocks into a seabed to stop scallop trawlers from trawling the area (if they tried, they would destroy their gear). This would thus be, a conservation tool, but not an appropriation infrastructure.

Code 3a: Distribution infrastructure condition – initial condition	
Variable Name	BEGCONDD (Questions #3a)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition and maintenance of public distribution infrastructure at the beginning of the described time period.
Detailed Description	Characterize the **condition** of the public distribution infrastructure at the **beginning** of the time period examined in the text. In consideration of the initial construction and physical environment of the public distribution infrastructure and the financial and technological capabilities of the appropriators, how well maintained is the distribution infrastructure? Distribution is defined as the spatial and temporal distribution of resource units among appropriators. Public distribution infrastructure is defined as the infrastructure within which the resource unit flow is distributed among appropriators. The public distribution infrastructure can be natural, human-made (physical), or a combination of natural and human-made infrastructures. (1) Well maintained - excellent working order (2) Moderately well maintained - good working order (12) From well to moderately well maintained (3) Some- infrastructure deterioration occurring due to insufficient maintenance (4) Considerable infrastructure deterioration occurring due to poor maintenance (34) Some or considerable infrastructure deterioration, insufficient or poor maintenance (5) Considerable infrastructure deterioration, but due to a natural disaster (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the public distribution infrastructure at the beginning of the time period examined. Assess the spatial and temporal distribution of and access to resource units among appropriators and the described heterogeneity and uncertainty of the same. If the author does not outline a historical time period for the distribution infrastructure, code "99" for this question, and then evaluate the contemporary condition of the distribution infrastructure as described by the author in answer to #3b. In cases where a major natural disaster occurs and damages the resource beyond the appropriators' or responsible agents' capability to prevent and repair, immediately code "5".
Exclusion criteria (when not to use)	Institutional arrangements (soft infrastructure) governing resource distribution, such as fishing regulations that give spatially explicit rules regarding how many fish can be caught and where, designed for the purpose of maintaining stock and sub-stock metapopulation structure. Private distribution infrastructure.
Typical exemplars	Logging roads, irrigation canals, community saw mill, public refrigeration storage unit for marine catch, etc.
Atypical exemplars	NEED EXAMPLE
Close but no	Marine protected areas, which have significant implications for the spatial distribution of species, but is a soft-infrastructure.

Code 3b: Distribution infrastructure – end condition	
Variable Name	ENDCONDD (Questions # 3b)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition and maintenance of public distribution infrastructure at the end of the described time period.
Detailed Description	Characterize the **condition** of the public distribution infrastructure at the **end** of the time period examined in the text. In consideration of the construction and physical environment of the public distribution infrastructure and the financial and technological capabilities of the appropriators, how well maintained is the distribution infrastructure? Distribution is defined as the spatial and temporal distribution of resource units among appropriators. Public distribution infrastructure is defined as the infrastructure within which the resource unit flow is distributed among appropriators. The public distribution infrastructure can be natural, human-made (physical), or a combination of natural and human-made infrastructures. (1) Well maintained - excellent working order (2) Moderately well maintained - good working order (12) From well to moderately well maintained (3) Some- infrastructure deterioration occurring due to insufficient maintenance (4) Considerable infrastructure deterioration occurring due to poor maintenance (34) Some or considerable infrastructure deterioration, insufficient or poor maintenance (5) Considerable infrastructure deterioration, but due to a natural disaster (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the public distribution infrastructure at the end of the time period examined. Assess the spatial and temporal distribution of and access to resource units among appropriators and the described heterogeneity and uncertainty of the same. If the author does not outline a historical time period for the distribution infrastructure, then evaluate the contemporary condition of the distribution infrastructure as described by the author in answer to this question. In cases where a major natural disaster occurs and damages the resource beyond the appropriators' or responsible agents' capability to prevent and repair, immediately code "5".
Exclusion criteria (when not to use)	Institutional arrangements (soft infrastructure) governing resource distribution, such as as fishing regulations that give spatially explicit rules regarding how many fish can be caught and where, designed for the purpose of maintaining stock and sub-stock metapopulation structure. Private distribution infrastructure.
Typical exemplars	Logging roads, irrigation canals, community saw mill, public refrigeration storage unit for marine catch, etc.
Atypical exemplars	NEED EXAMPLE
Close but no	Marine protected areas, which have significant implications for the spatial distribution of species, but is a soft-infrastructure (lines drawn on a map).

Code 4a: Production infrastructure – initial condition	
Variable Name	BEGCONDP (Question #4a)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition and maintenance of public production infrastructure at the beginning of the time period described.
Detailed Description	Characterize the **condition** of the public production infrastructure at the **beginning** of the time period examined in the text (if the production infrastructure is different from the appropriation or distribution infrastructure). In consideration of the construction and physical environment of the public production infrastructure and the financial and technological capabilities of the appropriators, how well maintained is the production infrastructure? Production is defined as the spatial and temporal distribution of resource units among appropriators. Public production infrastructure is defined as the infrastructure within which the resource unit flow is produced. The public production infrastructure can be natural, human-made (physical), or a combination of natural and human-made infrastructures. (1) Well maintained - excellent working order (2) Moderately well maintained - good working order (12) From well to moderately well maintained (3) Some- infrastructure deterioration occurring due to insufficient maintenance (4) Considerable infrastructure deterioration occurring due to poor maintenance (34) Some or considerable infrastructure deterioration due to insufficient or poor maintenance (5) Considerable infrastructure deterioration, but due to a natural disaster (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the public production infrastructure at the beginning of the time period examined. Assess the production of resource units by the appropriators and the described heterogeneity and uncertainty of the same. If the author does not outline a historical time period for the production infrastructure, code "99" in answer to this question, and then evaluate the contemporary condition of the production infrastructure as described by the author in answer to #4b. In cases where a major natural disaster occurs and damages the resource beyond the appropriators' or responsible agents' capability to prevent and repair, immediately code "5".
Exclusion criteria (when not to use)	Institutional arrangements (soft infrastructure) governing production infrastructure, such as monitoring and sanctioning. Private production infrastructure.
Typical exemplars	River dam, well, pump, water tank
Atypical exemplars	Planting trees in a forest, artificial reef? Public attempts to improve shellfish recruitment by collecting "spat," rearing to a mature stage, and reintroducing into the shellfish beds. (e.g. scallop fisheries in Australia, Bay of Brest, France)
Close but no	Sometimes it is argued that we need to remove fish to reduce competition. So taking more fish means improving production. This is not an argument for improving production, but for catching more(?)

Code 4b: Production infrastructure – end condition	
Variable Name	ENDCONDP (Question #4b)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition and maintenance of public production infrastructure at the end of the time period described.
Detailed Description	Characterize the **condition** of the public production infrastructure at the **end** of the time period examined in the text (if the production infrastructure is different from the appropriation or distribution infrastructure). In consideration of the construction and physical environment of the public production infrastructure and the financial and technological capabilities of the appropriators, how well maintained is the production infrastructure? Production is defined as the spatial and temporal distribution of resource units among appropriators. Public production infrastructure is defined as the infrastructure within which the resource unit flow is produced. The public production infrastructure can be natural, human-made (physical), or a combination of natural and human-made infrastructures. (1) Well maintained - excellent working order (2) Moderately well maintained - good working order (12) From well to moderately well maintained (3) Some- infrastructure deterioration occurring due to insufficient maintenance (4) Considerable infrastructure deterioration occurring due to poor maintenance (34) Some or considerable infrastructure deterioration, insufficient or poor maintenance (5) Considerable infrastructure deterioration, but due to a natural disaster (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the public production infrastructure at the end of the time period examined. Assess the production of resource units by the appropriators and the described heterogeneity and uncertainty of the same. If the author does not outline a historical time period for the production infrastructure, then evaluate the contemporary condition of the production infrastructure as described by the author in answer to this question. In cases where a major natural disaster occurs and damages the resource beyond the appropriators' or responsible agents' capability to prevent and repair, immediately code "5".
Exclusion criteria (when not to use)	Institutional arrangements (soft infrastructure) governing production infrastructure, such as monitoring and sanctioning. Private production infrastructure.
Typical exemplars	River dam, well, pump, water tank
Atypical exemplars	Planting trees in a forest. Artificial reefs. Public attempts to improve shellfish recruitment by collecting "spat," rearing to a mature stage, and reintroducing into the shellfish beds.
Close but no	Sometimes it is argued that we need to remove fish to reduce competition. So taking more fish means improving production. This is not an argument for improving production, but for catching more. (?)

Code 5a: Resource beginning condition	
Variable Name	BEGBLNC (Question #5a)
Theory Area	Outcomes – Resource Sustainability
Short Description	Balance between quantity of units withdrawn and units available at the beginning of the time period described.
Detailed Description	This is an assessment of the **beginning** balance of the common pool resource utilized within the action arena during the time period examined in the text. What is the balance between the quantity of units withdrawn and the quantity of units needed given the usual patterns of use for these units? (In fisheries and other biological systems, this is the maximum sustainable yield (MSY)).)). (1) Extreme shortage (2) Moderate shortage (12) Shortage (3) Apparently balanced (4) Moderately abundant (5) Quite abundant (45) Abundant (99) MIC (98) NA *In fisheries and other biological systems, this is the maximum sustainable number of units.
Inclusion criteria (when to use)	Discussion by the author as to the beginning rate of resource withdrawal. Does the text provide information as to: (1) rate of withdrawal; and (2) quantity of units needed. If the author does not outline a historical time period of resource withdrawal, code "99" in answer to this question, and then evaluate the current resource withdrawal rate in answer to #5b.
Exclusion criteria (when not to use)	These variables generally do not apply to irrigation cases, unless the text specifically provides information regarding water pollution, including increasing turbidity and/or salinity levels. [**Took this from our coding sheet, but I am not sure this is accurate?**]
Typical exemplars	"… [the forest was] in a degraded state when NGO started…" "…although the forest has retained high value timber trees, it exhibits limited regeneration due to the community's inability to limit damage from grazing and fire.…" Any indications of a decline in "Catch per unit effort (CPUE)" in fisheries, when environmental variable have been ruled out (when/if possible).
Atypical exemplars	Irrigation system is experiencing increased salinity levels due to marine salt water intrusion caused by excessive groundwater extraction and decreasing groundwater levels.
Close but no	Irrigation case: "…Water distribution involves breaching one of the shallow ditches to allow water to run down cultivated slopes… 30 to 40 percent of the flow is wasted through inefficient distribution, but there is enough water to meet most needs in most years…" Declining catch per unit effort due to changing spatiotemporal patterns caused by climate change. Herring have declined considerably inshore in the Bay of Fundy, but it is unclear what has caused the decline, for example.

Code 5b: Resource end condition	
Variable Name	ENDBLNC (Question #5b)
Theory Area	Outcomes – Resource Sustainability
Short Description	Balance between quantity of units withdrawn and units available at the end of the time period described.
Detailed Description	This is an assessment of the **end** balance of the common pool resource utilized within the action arena during the time period examined in the text. What is the balance between the quantity of units withdrawn and the quantity of units needed given the usual patterns of use for these units? (In fisheries and other biological systems, this is the maximum sustainable yield (MSY)). (1) Extreme shortage (2) Moderate shortage (12) Shortage (3) Apparently balanced (4) Moderately abundant (5) Quite abundant (45) Abundant (99) MIC (98) NA *In fisheries and other biological systems, this is the maximum sustainable number of units.
Inclusion criteria (when to use)	Discussion by the author as to the end rate of resource withdrawal. Does the text provide information as to: (1) rate of withdrawal; and (2) quantity of units needed. If the author does not outline a historical time period of resource withdrawal, then evaluate the current resource withdrawal rate in answer to this question.
Exclusion criteria (when not to use)	These variables generally do not apply to irrigation cases, unless the text specifically provides information regarding water pollution, including increasing turbidity and/or salinity levels. [**Took this from our coding sheet, but I am not sure this is accurate?**]
Typical exemplars	"… [the forest was] in a degraded state when NGO started…" "…although the forest has retained high value timber trees, it exhibits limited regeneration due to the community's inability to limit damage from grazing and fire.…" Any indications of a decline in "Catch per unit effort (CPUE)" in fisheries, when environmental variable have been ruled out (when/if possible).
Atypical exemplars	Irrigation system is experiencing increased salinity levels due to marine salt water intrusion caused by excessive groundwater extraction and decreasing groundwater levels.
Close but no	Irrigation case: "…Water distribution involves breaching one of the shallow ditches to allow water to run down cultivated slopes… 30 to 40 percent of the flow is wasted through inefficient distribution, but there is enough water to meet most needs in most years…"

Code 6a: Natural infrastructure condition over time	
Variable Name	NATINFRACOND (Question #6a)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition of natural infrastructure over time
Detailed Description	This is a temporal assessment of the condition of the natural infrastructure of the common pool resource. Assess whether the condition of the natural infrastructure over time has improved, remained the same, or worsened due to the appropriators' behavior. (1) Improved (2) Remained the same (3) Worsen (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the natural infrastructure over time.
Exclusion criteria (when not to use)	This variable does not apply to non-biological common pool resources, such as knowledge commons.
Typical exemplars	Depletion of fishery and forestry resources. Increasing drought conditions due to over-allocation of water resources by appropriators. Overdraft of aquifers and groundwater sources.
Atypical exemplars	Fish stock depletion due to commercial activities in international waters.
Close but no	Drought conditions due to conditions beyond the appropriators or responsible agents' control and capability to prevent (global climate change).

Code 6b: Human-made infrastructure condition over time	
Variable Name	HUINFRACOND (Question #6b)
Theory Area	Outcomes – Resource Sustainability
Short Description	Condition of human-made infrastructure over time
Detailed Description	This is a temporal assessment of the condition of the human-made hard (physical) infrastructure of the common pool resource. Assess whether the condition of the human-made physical infrastructure has improved, remained the same, or worsened over time due to the appropriators' behavior. (1) Improved (2) Remained the same (3) Worsen (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the condition of the human-made hard (physical) infrastructure over time.
Exclusion criteria (when not to use)	This variable does not apply to soft human-made infrastructure, such as laws, rules, regulations, etc.
Typical exemplars	Deterioration of irrigation canal, public fishing ports/wharves to access fishing grounds.
Atypical exemplars	"Spat" (rearing juvenile scallops to be reintroduced into a bay to increase survivorship and protect from disease) program, juvenile fish rearing program
Close but no	The Japanese case, (cement blocks used to exclude scallop trawlers),

OUTCOMES: PROCESS OF COLLECTIVE CHOICE ARRANGEMENTS

Code 7a: Mutual trust among appropriators – initial condition	
Variable Name	BEGTRUST (Question #7a)
Theory Area	Outcomes – Process of collective choice arrangements
Short Description	Level of mutual trust among appropriators at the beginning of the time period described.
Detailed Description	Characterize the described level of mutual trust among appropriators at the **beginning** of the time period examined in the text. Mutual trust is defined as a level of community cohesion that fosters certainty about the actions of other community members. (1) Moderate to high level of trust (e.g. oral promises given high credence) (2) Modest levels of trust (e.g. oral promises are used but appropriators may be uncertain about performance) (12) From moderate to modest levels of trust (3) Low levels of trust (e.g. oral promises rarely used) (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the level of trust among appropriators at the beginning of the time period examined. If the author does not outline a historical time period for trust among appropriators, code "99" in answer to this question, and then evaluate the contemporary level of trust among appropriators as described by the author in answer to #7b.
Exclusion criteria (when not to use)	Distrust of appropriators towards others, such as overarching governing or administrative bodies, NGO representatives, and people from outside communities.
Typical exemplars	Descriptions of community cohesion, high levels of cooperation, etc.
Atypical exemplars	Low frequency of rule infractions
Close but no	NEED EXAMPLE

Code 7b: Mutual trust among appropriators – end condition	
Variable Name	ENDTRUST (Question #7b)
Theory Area	Outcomes – Process of collective choice arrangements
Short Description	Level of mutual trust among appropriators at the end of the time period described.
Detailed Description	Characterize the described level of mutual trust among appropriators at the **end** of the time period examined in the text. Mutual trust is defined as a level of community cohesion that fosters certainty about the actions of other community members. (1) Moderate to high level of trust (e.g. oral promises given high credence) (2) Modest levels of trust (e.g. oral promises are used but appropriators may be uncertain about performance) (12) From moderate to modest levels of trust (3) Low levels of trust (e.g. oral promises rarely used) (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author as to the level of trust among appropriators at the end of the time period examined. If the author does not outline a historical time period for trust among appropriators, then evaluate the contemporary level of trust among appropriators as described by the author in answer to this question.
Exclusion criteria (when not to use)	Distrust of appropriators towards others, such as overarching governing or administrative bodies, NGO representatives, and people from outside communities.
Typical exemplars	Descriptions of community cohesion, high levels of cooperation, etc.
Atypical exemplars	Low frequency of rule infractions
Close but no	NEED EXAMPLE

Code 8: Trust level among appropriators over time	
Variable Name	TRUSTLEVEL (Question #8)
Theory Area	Outcomes – Process of collective choice arrangements
Short Description	Level of mutual trust among appropriators over time.
Detailed Description	This is a temporal assessment of the trust level among appropriators. Assess whether the level of trust among appropriators has improved, remained the same, or worsened over time. (1) Improved (2) Remained the same (3) Worsen (99) MIC
Inclusion criteria (when to use)	Discussion by the author as to the evolution of trust among appropriators over time.
Exclusion criteria (when not to use)	Increased animosity towards actors outside the action arena, such as people from overarching governing or administrative bodies, NGO representatives.
Typical exemplars	Descriptions of persistent community cohesion, high levels of cooperation over a period of time.
Atypical exemplars	Low frequency of rule infractions.
Close but no	NEED EXAMPLE

Code 9: Rule following	
Variable Name	RULEFOLI (Question #9)
Theory Area	Outcomes – Process of collective choice arrangements
Short Description	Do the appropriators generally follow the local rules-in-use related to the resource appropriation process?
Detailed Description	Characterize the usual behavior of the appropriators with respect to local operational level rules-in-use related to the appropriation process from this resource. (1) Almost all members follow the rules (2) Most members follow the rules (12) More than half of the members follow the rules (3) About half of the members follow the rules (4) Most members do not follow the rules (5) Almost all members do not follow the rules (35) Half or less of the members follow the rules (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion by the author with regard to any rule-following behavior related to resource extraction.
Exclusion criteria (when not to use)	Appropriator behavior that is not related to common pool resource extraction, e.g., NEED EXAMPLE
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	Rule following behavior in years of extreme resource shortage.

OUTCOMES: EQUITY AMONG USERS

Code 10: Disadvantaged appropriators	
Variable Name	REALOSER (Question #10)
Theory Area	Equity among users
Short Description	Disadvantaged appropriators
Detailed Description	Describe whether the author identifies any appropriators who have been consistently disadvantaged during the time period examined in the text? (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	This question refers only to appropriators/users. An appropriator is disadvantaged if he or she is always assigned a smaller amount of units, a bad time slot, lower priority in withdrawing units, etc. When evaluating this question, consider the physical and governance structure boundaries of the CPR analyzed. Appropriators that may be peripherally affected but are not directly examined are not to be included.
Exclusion criteria (when not to use)	A group that has consistently been disadvantaged but is outside the action arena.
Typical exemplars	"…Gitsan law requires equitable access to fishing sites within houses and distribution of resources to those who cannot fish…" [Code: "0"]
Atypical exemplars	"The establishment of community forestry in 1980 did not change the basic power imbalance between an elite from the central village and the predominantly Mixtec villagers from the out-lying settlements, nor did it correct an inequitable distribution of forestry benefits..." [Code: "1"]
Close but no	Neighboring villagers who used to have access rights to community forest resources, but who have been excluded from those resources due to the implementation of Joint Forest Management (JFM) policies. (Neighboring villagers are not considered appropriators in the sense of this question. Their equity concerns would be addressed under question #11 [WORSTOFF]).

Code 11: Loss of benefits or harm	
Variable Name	WORSTOFF (Question #11)
Theory Area	Equity among users
Short Description	Appropriators who have lost access to resource benefits or sustained other harm.
Detailed Description	Characterize any evidence within the text that indicates that there is inequity among appropriators. Have the relatively worst off been cut out of their benefits from this resource or otherwise substantially harmed? (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	This question refers to individuals who used to be or are currently appropriators.
Exclusion criteria (when not to use)	Individuals outside the described action arena who are cut out of benefits or otherwise harmed. People who are not appropriators.
Typical exemplars	Village elites restructure resource benefits to their advantage by taking over resources previously allocated to poor community members.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 12: Equity gap among appropriators	
Variable Name	RELEQUTY (Question #12)
Theory Area	Equity among users
Short Description	Disparity in equity level among appropriators.
Detailed Description	Think about the relationship between those who are the least advantaged (e.g., the poor) and those who are the most advantaged (e.g., elites) during the time period described and the distance between them. By the end of the situation identified in the text, would you characterize the distance between those who are the least advantaged and those who are the most advantaged as increasing, constant, or decreasing? (1) Increasing over time (2) Remaining relatively constant over time (3) Decreasing over time (99) MIC (98) NA
Inclusion criteria (when to use)	This question refers to individuals who used to be or are currently appropriators. Evaluate the level of fairness within the rules (written and/or rules-in-use) – is there disparity in rule application between those that are most advantaged and those who are least advantaged at the end of the time period? What is the level of fairness in the governance structure/institutional arrangement?
Exclusion criteria (when not to use)	Individuals outside the described action arena. People who are not appropriators. Do not evaluate the social equity within the system. Do not evaluate the level of fairness in CPR inputs or outputs.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 13: Equity level over time	
Variable Name	EQUITYLEVEL (Question #13)
Theory Area	Equity among users
Short Description	Level of equity among appropriators/users over time.
Detailed Description	Think about the relationship between those who are the least advantaged (e.g., the poor) and those who are the most advantaged (e.g., elites) during the time period described and the level of equity between them. Over the entire time period identified in the text, has the level of equity among appropriators increased, remained the same, or decreased? (1) Increased (2) Remained the same (3) Decreased (99) MIC
Inclusion criteria (when to use)	This question refers to individuals who used to be or are currently appropriators. Evaluate the level of fairness within the rules (written and/or rules-in-use) – has the level of disparity in rule application between those that are most advantaged and those who are the least advantaged changed over time? How has the level of fairness in the governance structure/institutional arrangement changed during the time period described?
Exclusion criteria (when not to use)	Individuals outside the described action arena. People who are not appropriators. Do not evaluate the social equity within the system. Do not evaluate the level of fairness in CPR inputs or outputs.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

OUTCOMES: CONCLUSION

Code 14: CPR governance evaluation	
Variable Name	SUCCESS (Question #14)
Theory Area	Outcomes: Conclusion
Short Description	Evaluate whether the CPR is governed successfully or unsuccessfully.
Detailed Description	**Based on your answers to questions 1 through 13,** determine if this case is a success or failure in governing the CPR. Briefly explain your answer (e.g., due to resource overexploitation, inequality, cross-scale interactions). **A successful case is defined as one in which the common pool resource was used sustainably *and* the social system was productive and conflict-free**. (1) Success (0) Failure (99) Unknown or Unsure
Inclusion criteria (when to use)	This question needs to be answered for all cases analyzed.
Exclusion criteria (when not to use)	If the case study does not include enough information to assess success or failure in CPR governance. Code [99].
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

DESIGN PRINCIPLE 1

(USER AND RESOURCE BOUNDARIES)

Code 15: User boundaries	
Variable Name	WELLDEFN (Question #15)
Theory Area	Design Principles: 1a – User Boundaries
Short Description	Appropriator withdrawal rights boundary
Detailed Description	Characterize whether the set of individuals who have rights to withdraw from the resource is well defined? (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion within the text with regard to user boundaries (hard or soft), i.e., defined user access to the resource.
Exclusion criteria (when not to use)	If the set of rules about withdrawal rights is ambiguous or it is practically difficult to determine from the text who has the rights, answer "no" [0]. Evaluate only the presence or absence of rules. Ignore whether the rules are implemented or enforced.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 16: Design principle 1a	
Variable Name	DP1A (Question #16)
Theory Area	Design Principles: 1a – User Boundaries
Short Description	Determine the presence or absence of design principle 1a.
Detailed Description	The presence of design principle 1a means that individuals or households who have rights to withdraw resource units from the CPR must be clearly defined. Determine whether design principle 1a is present [1] or absent [0]. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text confirming the existence of user boundaries (hard or soft).
Exclusion criteria (when not to use)	If the set of rules about withdrawal rights is ambiguous or it is practically difficult to determine from the text who has the rights, answer "no" [0]. Evaluate only the presence or absence of rules. Ignore whether the rules are implemented or enforced.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 17: Resource boundaries	
Variable Name	BOUNDAR2 (Question #17)
Theory Area	Design Principles: 1b – Resource Boundaries
Short Description	Resource withdrawal rights boundary
Detailed Description	Determine whether the boundary of the resource is primarily a result of one of the following conditions: (1) Natural/constructed attributes which limit entry (2) Natural/constructed attributes which do not limit entry (3) Institutional arrangements (4) Natural/constructed and institutional arrangements which limit entry (5) Natural/constructed and institutional arrangements which do not limit entry Natural/constructed attributes are those which limit entry if the topology of the resource is such as to focus entry to the resource on one or a few places. These attributes can be natural (e.g., geological) or human-made (e.g., physical infrastructure or technological).
Inclusion criteria (when to use)	Discussion within the text with regard to resource boundaries (natural, human-built, institutional).
Exclusion criteria (when not to use)	Evaluate only the presence or absence of boundaries. Ignore whether the boundaries are implemented or enforced.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 18: Design principle 1b	
Variable Name	DP1B (Question #18)
Theory Area	Design Principles: 1b – Resource boundaries
Short Description	Determine the presence or absence of design principle 1b.
Detailed Description	The presence of design principle 1b means that the boundaries of the CPR must be well defined. Determine whether design principle 1b is present [1] or absent [0]. Definition of well defined: resource boundary is successfully limiting entry to the CPR. [**IS THIS CORRECT?**] (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text confirming the existence of resource boundaries (hard or soft).
Exclusion criteria (when not to use)	Evaluate only the presence or absence of boundaries. Ignore whether the boundaries are implemented or enforced.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

DESIGN PRINCIPLE 2

(CONGRUENCE WITH LOCAL CONDITIONS & APPROPRIATION AND PROVISION)

Code 19: Flexible rules-in-use	
Variable Name	FLEXIBLE (Question #19)
Theory Area	Design Principles: 2a – Congruence with local conditions
Short Description	Flexibility of rules-in-use
Detailed Description	Determine whether the rules-in-use are flexible in dealing with times of emergency or unusual problems facing particular members of the group of appropriators/users? (1) Yes (0) No (99) Don't Know
Inclusion criteria (when to use)	Discussion within the text regarding the flexibility of the rules-in-use governing common pool resources to accommodate emergency situations faced by individual appropriators/users/community members. Are the rules responsive and adaptive?
Exclusion criteria (when not to use)	Evaluate only the flexibility of rule-in-use to respond to individual/household emergencies/special circumstances. Does not apply to emergency situations that involve the entire community (e.g., a natural disaster that affects the entire community). Does not apply to private strategies of individuals to adjust to emergency situations (e.g., digging a private well).
Typical exemplars	Water rights within the Ait Sidi Musa Clan are tied to the land and rigidly based on kinship ties to the founders of the irrigation system. These water rights cannot be transferred to another community member who is in need under any circumstances. Code no [0].
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 20: Design principle 2a	
Variable Name	DP2A (Question #20)
Theory Area	Design Principles: 2a – Congruence with local conditions
Short Description	Determine the presence or absence of design principle 2a.
Detailed Description	The presence of design principle 2a means that the appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions. Is this design principle present within the examined CPR? Do the appropriation rules match local conditions? Appropriation is defined as harvesting/extraction activities. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text confirming that appropriation rules exist which match local conditions and which limit access to the CPR to allow the system to persist over time without significant depletion of resources.
Exclusion criteria (when not to use)	Evaluate only the presence or absence of appropriation rules that match local conditions. Ignore whether these rules are implemented or enforced.
Typical exemplars	Annual seasonal closures in fisheries limit the extraction of commercially valuable species and allow the species time to recover from exploitation. In an irrigation system, access to water rights is dependent on the effort individuals invest in maintaining the irrigation infrastructure.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 21: Perceived fairness of rules	
Variable Name	DP2B (Question #21)
Theory Area	Design Principles: 2b – Appropriation and Provision
Short Description	Perceived fairness of the rules-in-use.
Detailed Description	Based on the information in the text, determine whether the appropriators/users perceive the rules-in-use as fair. (1) Yes (0) No (99) Don't Know
Inclusion criteria (when to use)	Discussion within the text indicating whether users accept the rules-in-use as fair/legitimate or not. Rules-in-use can be written laws/regulations or accepted/traditional norms.
Exclusion criteria (when not to use)	The presence of aggregation rules that specify constraints/requirements on user actions and/or the extraction process is not enough to deduce perceived fairness.
Typical exemplars	A majority of resource users follow the rules-in-use. "Tziscao's communal land use rules are also clear and easily understood, and there was near universal agreement among interviewees regarding the specific aspects and applicability of rules. Although the creation of certain rules by external authorities contradicts the prescription of common property institutional design principles, use rules within Tziscao are essentially functional and robust."
Atypical exemplars	NEED EXAMPLE
Close but no	When majority of resource users follow the rules-in-use, but a smaller group do not because they think it is unfair for them.

Code 22: Design principle 2b	
Variable Name	DP2B (Question #22)
Theory Area	Design Principles: 2b – Congruence of Appropriation and Provision
Short Description	Determine the presence or absence of design principle 2b.
Detailed Description	The presence of design principle 2b means that the benefits obtained by users from a CPR, as determined by the appropriation rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by the provision rules. Determine whether the text indicates the presence or absence of this design principle. Appropriation rules are defined as those rules governing resource extraction. They are *time independent.* Provision rules assign responsibility to users for building, restoring, or maintaining the CPR. They are *time dependent*. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text confirming a congruence between appropriation and provision rules and local conditions.
Exclusion criteria (when not to use)	Evaluate only the presence or absence of appropriation rules. Ignore whether these rules are implemented or enforced.
Typical exemplars	Free-riding behavior: When some resource users [e.g. water for irrigation] do not contribute resources (labor or money) for to the public infrastructure maintenance are excluded from harvesting.[e.g the canal or reservoir] but still appropriates resource units without any consequence. [code = 0]
Atypical exemplars	NEED EXAMPLE
Close but no	When resource users do not contribute with a fee for the public infrastructure maintenance but they contribute with labor [code = 1]

DESIGN PRINCIPLE 3

(COLLECTIVE CHOICE ARRANGEMENTS)

Code 23: Users' ability to express needs and concerns	
Variable Name	EXPOWN (Question #23)
Theory Area	Design Principles: 3 – Collective choice arrangements
Short Description	Users'/appropriators' ability to communicate needs and concerns.
Detailed Description	Based on the information in the text, determine whether the appropriators/users as a group have options to express their needs and concerns to officials in the group's organization who make collective choice decision in relation to the CPR. Can most individuals affected by the operational rules participate in modifying the operational rules? Are there activities that the users can use to express their needs and concerns to officials who make collective choice decisions, and do users find these activities useful, i.e., are officials responsive to their needs? (1) Yes, at least one of these activities are used (0) No, none of these activities are used (99) MIC (98) NA *Options may include: elections, formal petitions, formal hearings, advice and consent on nominations to non-elected positions, demonstrations, general meetings, illegal exchange with officials or other activities.
Inclusion criteria (when to use)	Discussion within the text outlining collective choice arrangements that are open to all users and in which users can participate and express needs and concerns (e.g., forums, hearings, community meetings, etc.).
Exclusion criteria (when not to use)	Instances in which users express needs and concerns to officials who do not make collective choice decisions. Forums to which users are invited but where they cannot express their needs and concerns. There has to be some evidence that users *actually participate* in these activities. Very often there are general meetings and options for petitioning may exist on paper but are not actually used.
Typical exemplars	Monthly meetings of village Van Panchayat to which all community members are invited and in which concerns and needs can be addressed to leaders of the Van Panchayat. Other options include: elections, formal petitions, formal hearings, advice and consent on nominations to non-elected positions, demonstrations, general meetings, or other activities.
Atypical exemplars	Illegal exchange with officials. Bribery(?)
Close but no	Resource users are invited to forums and are asked for their needs, but in the end users' needs are not taken into account. In the long term even though they still get invited, users stop attending to the forums. In this case the code should be 0.

Code 24: Chief executive position	
Variable Name	EXECAPR (Question #24)
Theory Area	Design Principles: 3 – Collective choice arrangements
Short Description	Is the chief executive a CPR user/appropriator?
Detailed Description	Based on the information in the text, determine whether the chief executive/administrator position(s) are filled by appropriators/users. (1) Yes (0) No (99) MIC (98) NA (no executive positions) If answer is yes or MIC, answer Code 24.1 next. If answer is no, skip Code 24.1 and proceed to Code 24.2. If answer if NA, answer for code 24.1 and code 24.2 should be NA
Inclusion criteria (when to use)	Discussion within the text about the accountability of chief executives/administrators to the appropriators.
Exclusion criteria (when not to use)	Chief executive is appointed by the government and not a community member.
Typical exemplars	Chief executive of an irrigation system is a farmer within the same irrigation system.
Atypical exemplars	NEED EXAMPLE
Close but no	The Chief executive is a member of the community but not a resource user.

Code 24.1: Election of chief executive	
Variable Name	EXECAPR (Question #24.1)
Theory Area	Design Principles: 3 – Collective choice arrangements
Short Description	If the chief executive/administrator position is filled by appropriator/user, how is that position filled?
Detailed Description	If the chief executive/administrator position is filled by appropriator/user, what is the procedure to fill that position? What are the position rules? How does someone move from being just a "member" of a group of appropriators to someone who has a specialized task, such as the chair of a management committee or a water distributor-guard? (1) Through direct or indirect elections by appropriators (2) Appointed by external government (3) Through inheritance (4) Other: _____
Inclusion criteria (when to use)	Discussion in the text with regard to how an appropriator/user can position themselves in a chief executive/administrator position within the CPR system.
Exclusion criteria (when not to use)	Chief executive is appointed by the government and not a community member.
Typical exemplars	The president of a fisheries cooperative is a fisherman in the community. Farmers form an irrigation association and all of them vote for a term president that is also a farmer.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 24.2: Appointment of chief executive	
Variable Name	EXECAPR (Question #24.2)
Theory Area	Design Principles: 3 – Collective choice arrangements
Short Description	If the chief executive/administrator position is appointed by an external government, do appropriators participate in the election?
Detailed Description	If the chief executive/administrator position is appointed by an external government, what is the level of involvement of appropriators in that appointment process? (1) The chief executive(s) or administrator(s) position(s) is appointed by external government with active advice by appropriators (2) The chief executive(s) or administrator(s) position(s) is appointed by external government without active advice by appropriators (99) MIC (98) NA
Inclusion criteria (when to use)	Discussion in the text with regard to the appointment process of chief executives/administrators within a CPR system.
Exclusion criteria (when not to use)	Chief executive is elected by the community.
Typical exemplars	Under the Joint Forest Management scheme in India, the chief executive of a forest community is directly appointed by the government (with no input from community so coded (2)).
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 25: Action by users/appropriators	
Variable Name	PRONURUL (Question #25)
Theory Area	Design Principles: 3 – Collective choice arrangements
Short Description	Evidence of proposed group action by appropriators/users.
Detailed Description	Based on the information in the text, determine whether the group of appropriators has proposed action in a collective-choice or constitutional choice arena to alter the operational or collective choice rules affecting the operation of the CPR. Definition of collective choice: [NEED TO SUPPLEMENT] Definition of constitutional choice: [NEED TO SUPPLEMENT] (1) Yes (0) No (99) MIC (98) NA If answer is yes or MIC, answer Code 25.1 next. If answer is no, skip Code 25.1 and proceed to Code 26.
Inclusion criteria (when to use)	Any appropriator/user activity in which an alteration to the institutional arrangements or rules-in-use are discussed, proposed, or taken.
Exclusion criteria (when not to use)	Any activity in which the alteration of the physical components of the CPR are discussed, proposed, or taken. Any activity to change the operational and/or collective choice rules affecting CPR operation that is taken by an individual within the community, not the group of appropriators.
Typical exemplars	Group of water users petitions the water users' association to implement water saving measures.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 25.1: Type of action taken by users/appropriators	
Variable Name	PRONURUL (Question #25.1)
Theory Area	Design Principles: 3 – Collective choice arrangements
Short Description	Type of group action taken by appropriators/users.
Detailed Description	Based on the information in the text, determine what type of action the group of appropriators/users has proposed or taken: (1) Collective choice arena (2) Constitutional-choice arena (3) Both (99) MIC (98) NA
Inclusion criteria (when to use)	Any appropriator/user group action to alter the institutional arrangements or rules-in-use within the collective choice and/or constitutional choice arena.
Exclusion criteria (when not to use)	Any appropriator/user group action to alter the institutional arrangements or rules-in-use that does not take place within the collective choice and/or constitutional choice arena. Any action to alter the institutional arrangements or rules-in-use taken by individual users/appropriators or imposed by the government
Typical exemplars	Example when proposal made by users to water users association or irrigation district. Fishermen at Lake Titicaca fought against the government to claim back their rights, and they kept their customary hold on the onshore water. They recovered the right to manage the resource but it is not legally stated. Code = 1. If they had gained legal rights, then it would have been (3).
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 26: Design principle 3	
Variable Name	DP3 (Question #26)
Theory Area	Design Principles: 3 – Collective choice arrangements
Short Description	Determine the presence or absence of design principle 3.
Detailed Description	The presence of design principle 3 means that most individuals affected by the operational rules can participate in modifying these rules. Determine whether the text indicates the presence or absence of this design principle. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text indicating that most individuals affected by the CPR governance rules can participate in modifying them.
Exclusion criteria (when not to use)	Evaluate only the presence or absence of collective choice arrangement. Ignore whether users choose to utilize them or not.
Typical exemplars	Mention of user group association meetings where most users can participate and propose changes "Tziscao has a very robust system of collective-choice arrangements. All major decisions in Tziscao are made jointly in the community asamblea. The asamblea is essentially a town meeting in which the business of the community is discussed. Each meeting has a particular focus and an agenda, but anyone can bring up issues for discussion." Page 723 Johnson, K., and K. Nelson 2004. Common property and conservation: the potential for effective communal forest management within a national park in Mexico. Human Ecology 36(6):703-733.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

DESIGN PRINCIPLE 4 (MONITORING)

Code 27: Resource withdrawal records	
Variable Name	RECORDWI (Question #27)
Theory Area	Design Principles: 4a – Monitoring users and the resource
Short Description	Are records of withdrawals from the CPR kept in any systematic way?
Detailed Description	Based on the information in the text, determine whether there is evidence that withdrawal records from the CPR are kept in any systematic way. Systematic way implies that the records are kept in a way that allows for easy inspection by users/appropriators. Systematic records are defined as any form of collective memory that becomes a public good of information. That public good of information may be written, oral, or otherwise. Analyzing the text, is there evidence that someone within the group of users/appropriators knows who to ask to obtain CPR withdrawal information. (1) Yes (0) No (99) MIC If answer is yes or MIC, answer Code 27.1 next. If answer is no, skip Code 27.1 and proceed to Code 28.
Inclusion criteria (when to use)	Discussion within the text about record-keeping of CPR withdrawals. Records of withdrawals may include the amount of units withdrawn by each appropriator/user or the total amount withdrawn by all appropriators/users.
Exclusion criteria (when not to use)	Discussion on remote sensing as used by the scientists, but not available to local resource users. This variable is associated with the "withdrawals from the resource", not with the "condition of the resource" you can see in Question #28. NEED EXAMPLE
Typical exemplars	Fishing logs. Metering the amount of grass extracted.
Atypical exemplars	You cannot infer that the bad condition of the resource implies the more withdrawals from the resource. This is because the bad condition of the resource is caused by various factors including purely natural phenomena (e.g. flood, drought, fire). NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 27.1: Frequency of tallying withdrawal records	
Variable Name	RECORDWI (Question #27.1)
Theory Area	Design Principles: 4a – Monitoring users and the resource
Short Description	How often are records of withdrawals from the CPR logged?
Detailed Description	Based on the information in the text, determine how often the withdrawal records from the CPR were kept in any systematic way. (1) Always (2) Most times (3) Sometimes (99)MIC (98) NA
Inclusion criteria (when to use)	Any evidence about the frequency of systematic record-keeping of CPR withdrawals.
Exclusion criteria (when not to use)	Vague statements that information is available, but it is not clear to whom and when.
Typical exemplars	Monthly harvesting data reported to forest council.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 28: Resource condition records	
Variable Name	RECORDCO (Question #28)
Theory Area	Design Principles: 4a – Monitoring users and the resource
Short Description	Are records of the CPR condition kept in any systematic way?
Detailed Description	Based on the information in the text, determine whether there is evidence that records of the condition of the CPR are kept in any systematic way. Systematic way implies that the records are kept in a way that allows for easy inspection by users/appropriators. Systematic records are defined as any form of collective memory that becomes a public good of information. That public good of information may be written, oral, or otherwise. Analyzing the text, is there evidence that someone within the group of users/appropriators knows who to ask to obtain information on the condition of the CPR. (1) Yes (0) No (99) MIC If answer is yes or MIC, answer Code 28.1 next. If answer is no, skip Code 28.1 and proceed to Code 29.
Inclusion criteria (when to use)	Discussion within the text about record-keeping of CPR condition, including records about the level of pollution of the resource, the amount of units available, etc..
Exclusion criteria (when not to use)	When records on the CPR condition are not available to local community (such as remote sensing data).This variable is associated with the "condition of the resource", not with the "withdrawals from the resource" you can see in Question #27. NEED EXAMPLE
Typical exemplars	Groundwater measurements, reports of water association, reports of forester.
Atypical exemplars	You cannot infer that the more withdrawals from the resource imply the worse condition of the resource. This is because the entire condition of the resource is determined by various factors including natural events, biophysical elements, provision rules, and the population size. NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 28.1: Frequency of tallying CPR conditions	
Variable Name	RECORDCO (Question #28.1)
Theory Area	Design Principles: 4a – Monitoring users and the resource
Short Description	How often are records of the condition of the CPR logged?
Detailed Description	Based on the information in the text, determine how often the CPR conditions are logged in any systematic way. (1) Always (2) Most times (3) Sometimes (99) MIC (98) NA
Inclusion criteria (when to use)	Any evidence about the frequency of systematic record-keeping of CPR conditions.
Exclusion criteria (when not to use)	No evidence that there is record keeping by community
Typical exemplars	Annual reports
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 29: Design principle 4a	
Variable Name	DP4A (Question #29)
Theory Area	Design Principles: 4a – Monitoring users and the resource
Short Description	Determine the presence or absence of design principle 4a.
Detailed Description	The presence of design principle 4a means that monitors are present **and** actively audit CPR conditions and appropriator/user behavior. Determine whether the text indicates the presence or absence of this design principle. "Audit" is defined as measuring or assessing a condition or behavior in some way. To meet this design principle, evidence of both user monitoring and resource monitoring should be present. However, the presence of CPR monitoring has greater weight, since it can imply and/or capture some level of user monitoring as well. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text indicating that monitors are present in the system who systematically tally resource conditions and appropriator behavior. Evidence that appropriators/users are utilizing information on the resource condition and/or their collective behavior.
Exclusion criteria (when not to use)	Evaluate only the presence or absence of systematic record-keeping. Ignore whether users choose to inspect or otherwise utilize the records. Emphasis on collective behavior patterns, not individual ones. (unclear when to exclude is there are systematic record. Maybe some standard data collection that is never looked at? If people actively measure state of CPR this may affect their mental model. But monitoring might not be a continuous activity).
Typical exemplars	See the exemplars in Code 27, 27.1, 28, 28.1 NEED EXAMPLE.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 30: Appropriator/user self-monitoring	
Variable Name	SELFMON (Question #30)
Theory Area	Design Principles: 4b – Monitors accountability
Short Description	Determine whether users monitor the activities of each other.
Detailed Description	Determine whether appropriators/users monitor the appropriation activities of each other apart from the monitoring of any "official" guards? (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text indicating that users/appropriators are monitoring the extraction activities of other users. If the community is small enough in membership and size so as to make monitoring easy, you can select "yes" in this question (e.g. case #19).
Exclusion criteria (when not to use)	Monitoring activities only by a designated and/or elected guard.
Typical exemplars	Rule-breakers being caught by other local users.
Atypical exemplars	NEED EXAMPLE
Close but no	Monitoring of outsiders' use of CPR by users/appropriators.

Code 31: Official monitoring	
Variable Name	GUARD (Question #31)
Theory Area	Design Principles: 4b – Monitors accountability
Short Description	Determine whether an "official" position of CPR monitor exists.
Detailed Description	Determine whether an "official" position of monitor exists (apart from the willingness of all appropriators/users to monitor the CPR)? (1) Yes (0) No (99) MIC (98) NA If answer is yes or MIC, answer Code 31.1 next. If answer is no, skip Code 31.1 and proceed to Code 32.
Inclusion criteria (when to use)	Evidence of a monitor/guard position occupied by a person or person acting on behalf of some organization or authority. [This could be a rotating position? Each day another person is the guard?] If the guard position is in the rules and clearly defined, it can be considered an "official" position, even if all appropriators rotate into the position.
Exclusion criteria (when not to use)	Appropriators/users who monitor others by their own initiation.
Typical exemplars	Forest guard in an Indian Van Panchayat who is elected by the local forest council and who may also be a member of that forest community.
Atypical exemplars	Rotating positions?
Close but no	Fishery official who is appointed by the national government but is not accountable to local appropriators.

Code 31.1: Official monitoring	
Variable Name	GUARD (Question #31.1)
Theory Area	Design Principles: 4b – Monitors accountability
Short Description	Determine whether an "official" position of CPR monitor exists.
Detailed Description	If an "official" position of monitor exists (apart from the willingness of all appropriators/users to monitor the CPR), how is that position selected? (1) Appropriators (not necessarily all) rotate into this position (2) Appropriators are selected by appropriators for this position (3) Local non-appropriators are selected by appropriators for this position (4) Local non-appropriators are selected by a local general purpose government (5) Monitors are employees of an external governmental authority (6) Some are selected by appropriators and some are selected by a local general purpose government (7) Some are selected by appropriators and some are employees of an external government authority (8) Some are selected by a local general purpose government and some are employees of an external government authority (9) Some are selected by appropriators, some are selected by a local general purpose government, and some are employees of an external government authority (10) Others:_____ (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence of a formal or informal selection process for the position of CPR monitor/guard.
Exclusion criteria (when not to use)	Appropriators/users who monitor others on their own initiation. In other words, it is important that there exist the "rules-in-use" to define who the monitors are and how they are selected.
Typical exemplars	If the government has a forest guard, you can select "(5)" in this question. And you can select (1) if you find this kind of sentence: "In Jyalachitti, the FUG hired two people from its membership for regular monitoring of the forest ... The forest guards are thus accountable to the users" (case #16).NEED EXAMPLE.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 32: Design principle 4b	
Variable Name	DP4b (Question #32)
Theory Area	Design Principles: 4b – Monitors accountability
Short Description	Determine the presence or absence of design principle 4b.
Detailed Description	The presence of design principle 4b means that monitors are accountable to the appropriators/users or they are themselves appropriators/users. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text indicating the presence of monitors. The position of monitor can be self-organized with community members voluntarily taking turns monitoring the CPR, or the position of monitor can be "official", i.e., elected or appointed by an internal or external governance body.
Exclusion criteria (when not to use)	Monitor/guard who is not accountable to the appropriators/users (e.g., guard appointed by an external government who exerts power with impunity and without local oversight).
Typical exemplars	Forest guard in an Indian Van Panchayat who is elected by the local forest council and who may also be a member of that forest community. Fishermen who monitor the fishing activity of other fishermen in their cooperative. See the typical exemplars in Code 31.1.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE (local user who gets hired by external government and reports to them?)

DESIGN PRINCIPLE 5 (GRADUATED SANCTIONS)

Code 33: Graduated sanctions	
Variable Name	VARSANCT (Question #33)
Theory Area	Design Principles: 5 – Graduated sanctions
Short Description	Evidence of graduated social, physical, and official sanctions.
Detailed Description	Determine whether there is a graduation of social, physical, and official sanctions that varies with the severity of rule violations? Considering the possible social, physical and official sanctions described in the text, is the severity of the sanctions dependent on the type of rule infraction? (1) Yes (0) No, little or no variation on sanction (99) MIC (98) NA If answer is yes or MIC, answer Code 33.1 next. If answer is no, skip Code 33.1 and proceed to Code 34.
Inclusion criteria (when to use)	Evidence within the text indicating the presence of social, physical, and/or other official sanctions that are applied at different scales depending on the type of violation committed. (what is an elder defines the punishment level, as long as it varies do we assume graduated sanctioning?)
Exclusion criteria (when not to use)	Any type of sanction that is fixed (e.g., set monetary fine regardless of level of infraction).
Typical exemplars	Sanctions that range from warnings to small monetary fines for minor infractions to legal prosecution and revocation of CPR access rights for severe violations. You can select (1) if you find this kind of sentence: "According to the FUG leaders, a first-time violator of the rules faces verbal warning and seizure of product and equipment used in illegal harvesting, but if the same person is caught breaking the rules a second time, the users' committee leaders impose a cash penalty" (case #16).
Atypical exemplars	Social shunning that varies from public shaming for minor infractions to exclusion from community council meetings for major violations. --> Can you explain in more detail why this is an atypical exemplar?
Close but no	NEED EXAMPLE

Code 33.1: Graduated sanctions	
Variable Name	VARSANCT (Question #33.1)
Theory Area	Design Principles: 5 – Graduated sanctions
Short Description	Evidence of graduated social, physical, and official sanctions.
Detailed Description	If there is evidence of a graduation of social, physical, and official sanctions that vary with the severity of rule violations, what is the range of the same? (1) Considerable range of sanctions are imposed depending on type of rule infractions (2) Moderate range of sanctions are imposed depending on type of rule infractions (12) Considerable or moderate range of sanctions are imposed depending on type of rule infractions (3) Limited range of sanctions are imposed depending on type of rule infractions (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text of the level of social, physical, and/or other official sanctions that are applied at different scales depending on the type of violation committed.
Exclusion criteria (when not to use)	Any type of sanction that is fixed (e.g., set monetary fine regardless of level of infraction).
Typical exemplars	Sanctions that range from warnings to small monetary fines for minor infractions to legal prosecution and revocation of CPR access rights for severe violations. For example, you can select (1) if you find the following sentence: "... render written or public apologies, confiscate cutting implements such as scythes, strip villagers of use rights, impose fines, report villagers to government officials, and sometimes, seek redress in courts". (case #7)
Atypical exemplars	Social shunning that varies from public shaming for minor infractions to exclusion from community council meetings for major violations. --> Can you explain why this is an atypical exemplar?
Close but no	NEED EXAMPLE

Code 34: Design principle 5	
Variable Name	DP5 (Question #34)
Theory Area	Design Principles: 5 – Graduated sanctions
Short Description	Determine the presence or absence of design principle 5.
Detailed Description	The presence of design principle 5 means that appropriators who violate operation rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, officials accountable to these appropriators, or both. Is there evidence that this design principle is present? Operation rules are rules-in-use dealing with the regulation of resource extraction/appropriation. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence within the text indicating a range of sanctions are applied to violators of operation rules. These sanctions are assessed by other appropriators or officials accountable to those appropriators (e.g. monitors, guards). Code for the presence or absence of graduated sanctions. Ignore whether these sanctions are actually levied/imposed or not.
Exclusion criteria (when not to use)	Sanctioning scheme that is not graduated (e.g., fixed fines regardless of level of violation). No evidence of sanctions at all.
Typical exemplars	You can select (1) if you find this kind of sentence: "Sanctions, particularly, fines are regularly employed to ensure compliance with management principles (p. 110). As can be seen in table 21, monetary fines constitute the most common punishment for infractions. There are other types of sanctions such as "Fine and Cutoff," "Lose Water for Cycle," "Lose Turn," "Jail," and so on" (case #21). NEED EXAMPLE
Atypical exemplars	You can select (0) if you find this kind of sentence: "... any punishments are unsystematic (not graduated)" (case #15). NEED EXAMPLE
Close but no	NEED EXAMPLE

DESIGN PRINCIPLE 6

(CONFLICT-RESOLUTION MECHANISMS)

Code 35: Information arenas	
Variable Name	ARENAS (Question #35)
Theory Area	Design Principles: 6 – Conflict resolution mechanisms
Short Description	Determine the existence of arenas to exchange information about CPR conditions.
Detailed Description	Determine whether there are arenas that are being used by appropriators/users to exchange information about the conditions of the resource? An "arena" is defined as a particular place, time, or occasion for appropriators to gather to communicate CPR conditions with each other. An arena does not have to be an official venue, such as a meeting hall. Arenas can be venues to deal with conflict-resolution matters, but do not have to be. (1) Yes (0) No (99) MIC
Inclusion criteria (when to use)	Evidence within the text indicating that appropriators are communicating the CPR conditions with each other. Appropriators who utilize particular places, times, or occasions to discuss CPR conditions.
Exclusion criteria (when not to use)	Appropriators discussing CPR conditions during casual encounters. The existence of "arenas" that are not being used.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	Farmers gathering at an irrigation canal to discuss the annual repair schedule.
Close but no	NEED EXAMPLE

Code 36: Design principle 6	
Variable Name	DP6 (Question #36)
Theory Area	Design Principles: 6 – Conflict resolution mechanisms
Short Description	Determine the presence or absence of design principle 6.
Detailed Description	The presence of design principle 6 means that appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials AND/OR That appropriators have access to local arenas of information exchange. [THIS NEEDS TO BE FURTHER DISCUSSED] (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Evidence of the existence and use of formal and informal arenas/venues for appropriators and their officials to exchange information about CPR conditions. Evidence of the existence of and low-cost, rapid-access local arenas/venues (e.g., courts, judiciary, elder/tribal council) to resolve conflicts among appropriators/users or between appropriators/users and officials.
Exclusion criteria (when not to use)	NEED EXAMPLE
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

DESIGN PRINCIPLE 7

(MINIMAL RECOGNITION OF RIGHTS)

Code 37: Appropriator right to manage	
Variable Name	MANAGE (Question #37)
Theory Area	Design Principles: 7 – Minimal recognition of rights to organize
Short Description	Determine whether users/appropriators have the right to manage CPR.
Detailed Description	Determine whether members of the group of appropriators/users have the right to participate in the management of the CPR? Do appropriators/users have the capability to make decisions over the use of the CPR? (1) Yes (0) No (99) MIC If answer is yes or MIC, answer Code 37.1 next. If answer is no, skip Code 37.1 and proceed to Code 37.2.
Inclusion criteria (when to use)	Evidence within the text that the appropriators/users have the capability to make decisions over resource use and exercise that capability.
Exclusion criteria (when not to use)	This question does *not* ask you to evaluate the level of management capability that users have (great deal of authority or little authority). Users who have de jure rights but are unable to or do not exercise them. Code no (0). Users who have de facto rights but are unable to or do not exercist them.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 37.1: De jure or de facto right to manage	
Variable Name	MANAGE (Question #37.1)
Theory Area	Design Principles: 7 – Minimal recognition of rights to organize
Short Description	Determine whether users/appropriators have de jure or de facto rights to manage CPR.
Detailed Description	If members of the group of appropriators/users have the right to participate in the management of the CPR are those rights de jure (legal) or de facto (actual)? (1) De jure (2) De facto (99) MIC (98) NA If answer is de jure or de facto, skip Code 37.2 and proceed to Code 38. If answer is MIC or NA, proceed to Code 37.2.
Inclusion criteria (when to use)	Evidence within the text that the appropriators/users have de jure or de facto rights to manage the CPR **and** exercise those rights.
Exclusion criteria (when not to use)	This question does *not* ask you to evaluate the level of management capability that users have (great deal of authority or little authority). If users/appropriators do not have the right to participate in the management of the CPR. Do not code both de jure and de facto. It can only be one or the other.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 37.2: Presence of de jure rights	
Variable Name	MANAGE (Question #37.2)
Theory Area	Design Principles: 7 – Minimal recognition of rights to organize
Short Description	Are de jure rights present?
Detailed Description	If appropriators/users do not have the right to participate in the management of the CPR, determine whether de jure rights are present/exist? (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Users who do not have rights to manage the CPR even though de jure rights exist.
Exclusion criteria (when not to use)	Users who do not have rights to manage the CPR and no de jure rights exist.
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 38: Design principle 7	
Variable Name	DP7 (Question #38)
Theory Area	Design Principles: 7 – Minimal recognition of rights to organize
Short Description	Determine the presence or absence of design principle 7.
Detailed Description	The presence of design principle 7 means that the rights of appropriators to devise their own institutions are not challenged by external governmental authorities. There exists a minimal recognition of appropriators' rights to organize. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Appropriators who have de jure rights to manage CPR and are exercising those rights. Appropriators who have de facto rights to manage CPR and are exercising those rights.
Exclusion criteria (when not to use)	NEED EXAMPLE
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

DESIGN PRINCIPLE 8

(NESTED ENTERPRISES)

Code 39: Reporting to external authority	
Variable Name	EXTREP (Question #39)
Theory Area	Design Principles: 8 – Nested enterprises
Short Description	Does the chief executive/administrator report to external authority?
Detailed Description	Determine whether the chief executive or administrator of the users' group reports to any external/higher level authority? (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	Hierarchical flow of reporting. Horizontal information sharing. Look for evidence of any form of regular reporting conducted by the chief executive or administrator to a higher level authority that is part of his/her regular responsibilities.
Exclusion criteria (when not to use)	Special reports provided to higher governance structures that are not part of the usual responsibilities of the chief executive (e.g., reports made in the event of a natural disaster or accident).
Typical exemplars	Annual reporting of catch by head of the fishery cooperative to the regional cooperative and/or national fishery department.
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 40: Embeddedness in other organizations	
Variable Name	ORGTYPE (Question #40)
Theory Area	Design Principles: 8 – Nested enterprises
Short Description	Are the appropriators of the CPR part of more than one organization?
Detailed Description	Determine whether the appropriators of the CPR are embedded in more than one organization? * (1) Yes (0) No (99) MIC (98) NA *The types of organizations are: General Purpose Government and Communal Enterprises A = a regular agency of the national government B = a regular agency of a regional government C = a regular agency of a local government D = a local communal enterprise Sector Specific Government E = a specially created national enterprise F = a specially created regional governmental enterprise G = a specially created local governmental enterprise Special Organizations Related to Resource I = an AGO organized as a cooperative J = an AGO not organized as a cooperative K = a group that has achieved coordination without formal organization General Voluntary and Private Associations L = private for profit M = co-ops with broader jurisdiction than resource N = unions Others
Inclusion criteria (when to use)	Look for any evidence of a degree of modularity or autonomy in the system in which individual units have power to make decisions but there are also some higher level coordination and/or conflict resolution mechanisms present for mediating between units.
Exclusion criteria (when not to use)	NEED EXAMPLE
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

Code 41: Design principle 8	
Variable Name	DP8 (Question #41)
Theory Area	Design Principles: 8 – Nested enterprises
Short Description	Determine the presence or absence of design principle 8.
Detailed Description	The presence of design principle 8 means that the appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises. (1) Yes (0) No (99) MIC (98) NA
Inclusion criteria (when to use)	CPR governance structure is connected horizontally and/or vertically with other independent parts of the governance structure. Information about the CPR flows within the system. Look for the capacity for conflict resolution beyond the local level. Look for any evidence of a degree of modularity or autonomy in the system in which individual units have power to make decisions but there are also some higher level coordination and/or conflict resolution mechanisms present for mediating between units.
Exclusion criteria (when not to use)	NEED EXAMPLE
Typical exemplars	NEED EXAMPLE
Atypical exemplars	NEED EXAMPLE
Close but no	NEED EXAMPLE

OUTCOMES: Resource sustainability

1. As of the beginning and end of this period, characterize the quality of the units being withdrawn:

1a. BEGQUAL
(1) Extremely high quality
(2) High quality
(1,2) Extremely high or high quality
(3) Passable
(4) Poor quality
(5) Extremely poor quality
(4,5) Poor or extremely poor quality
(-l) MIC
(-2) NA

1b. ENDQUAL
(1) Extremely high quality
(2) High quality
(1,2) Extremely high or high quality
(3) Passable
(4) Poor quality
(5) Extremely poor quality
(4,5) Poor or extremely poor quality
(-l) MIC
(-2) NA

2. As of the beginning and end of this period, how well-maintained is the public appropriation infrastructure?

2a. BEGCONDA
(1) Well maintained - excellent working order
(2) Moderately well maintained - good working order
(1,2) From well to moderately well maintained
(3) Some- infrastructure deterioration occurring due to insufficient maintenance
(4) Considerable infrastructure deterioration occurring due to poor maintenance
(3,4) Some or considerable infrastructure deterioration, insufficient or poor maintenance
(5) Considerable infrastructure deterioration, but due to a natural disaster
(-l) MIC
(-2) NA

2b. ENDCONDA
(1) Well maintained - excellent working order
(2) Moderately well maintained - good working order
(1,2) From well to moderately well maintained
(3) Some- infrastructure deterioration occurring due to insufficient maintenance
(4) Considerable infrastructure deterioration occurring due to poor maintenance
(3,4) Some or considerable infrastructure deterioration, insufficient or poor maintenance
(5) Considerable infrastructure deterioration, but due to a natural disaster
(-l) MIC
(-2) NA

3. As of the beginning and end of this period, how well-maintained is the public distribution infrastructure (if this is different from the appropriation infrastructure)?

3a. BEGCONDD
(1) Well maintained - excellent working order
(2) Moderately well maintained - good working order
(1,2) From well to moderately well maintained
(3) Some- infrastructure deterioration occurring due to insufficient maintenance
(4) Considerable infrastructure deterioration occurring due to poor maintenance
(3,4) Some or considerable infrastructure deterioration, insufficient or poor

3b. ENDCONDD
(1) Well maintained - excellent working order
(2) Moderately well maintained - good working order
(1,2) From well to moderately well maintained
(3) Some- infrastructure deterioration occurring due to insufficient maintenance
(4) Considerable infrastructure deterioration occurring due to poor maintenance
(3,4) Some or considerable infrastructure deterioration, insufficient or poor

MIC=Missing in case
NA=Not available

maintenance
(5) Considerable infrastructure deterioration, but due to a natural disaster
(-l) MIC
(-2) NA

maintenance
(5) Considerable infrastructure deterioration, but due to a natural disaster
(-l) MIC
(-2) NA

4. As of the beginning and end of this period, how well-maintained is the public production infrastructure (if this is different from the appropriation or distribution infrastructure)?

4a. BEGCONDP
(1) Well maintained - excellent working order
(2) Moderately well maintained - good working order
(1,2) From well to moderately well maintained
(3) Some- infrastructure deterioration occurring due to insufficient maintenance
(4) Considerable infrastructure deterioration occurring due to poor maintenance
(3,4) Some or considerable infrastructure deterioration, insufficient or poor maintenance
(5) Considerable infrastructure deterioration, but due to a natural disaster
(-l) MIC
(-2) NA

4b. ENDCONDP
(1) Well maintained - excellent working order
(2) Moderately well maintained - good working order
(1,2) From well to moderately well maintained
(3) Some- infrastructure deterioration occurring due to insufficient maintenance
(4) Considerable infrastructure deterioration occurring due to poor maintenance
(3,4) Some or considerable infrastructure deterioration, insufficient or poor maintenance
(5) Considerable infrastructure deterioration, but due to a natural disaster
(-l) MIC
(-2) NA

5. For natural resources at the beginning and end of this period, the balance between the quantity of units withdrawn and the number of units available is*:

5a. BEGBLNC
(1) Extreme shortage
(2) Moderate shortage
(1,2) Shortage
(3) Apparently balanced
(4) Moderately abundant
(5) Quite abundant
(4,5) Abundant
(-l) MIC
(-2) NA

5b. ENDBLNC
(1) Extreme shortage
(2) Moderate shortage
(1,2) Shortage
(3) Apparently balanced
(4) Moderately abundant
(5) Quite abundant
(4,5) Abundant
(-l) MIC
(-2) NA

*In fisheries and other biological systems, this is the maximum sustainable number of units.

6. During this period, have the condition of the natural and human-made hard infrastructures improved, remained the same, or worsen due to the appropriators' behavior?

6a. NATINFRACOND
(1) Improved
(2) Remained the same
(3) Worsen
(-l) MIC
(-2) NA

6b. HUINFRACOND
(1) Improved
(2) Remained the same
(3) Worsen
(-l) MIC
(-2) NA

MIC=Missing in case
NA=Not available

OUTCOMES: Process of collective choice arrangements

7. As of the beginning and end of this period, how would you characterize the levels of mutual trust described among appropriators?

7a. BEGTRUST
(1) Moderate to high level of trust (e.g. oral promises given high credence)
(2) Modest levels of trust (e.g. oral promises are used but appropriators may be uncertain about performance)
(1,2) From moderate to modest levels of trust
(3) Low levels of trust (e.g. oral promises rarely used)
(-l) MIC
(-2) NA

7b. ENDTRUST
(1) Moderate to high level of trust (e.g. oral promises given high credence)
(2) Modest levels of trust (e.g. oral promises are used but appropriators may be uncertain about performance)
(1,2) From moderate to modest levels of trust
(3) Low levels of trust (e.g. oral promises rarely used)
(-l) MIC
(-2) NA

8. During this period, has the level of trust among appropriators improved, remained the same, or worsen? <TRUSTLEVEL>
(1) Improved
(2) Remained the same
(3) Worsen
(-1) MIC

9. Characterize the usual behavior of the appropriators with respect to local operational level rules-in-use related to the appropriation process from this resource in years other than extreme shortage: <RULEFOLI>
(1) Almost all members follow the rules
(2) Most members follow the rules
(1,2) More than half of the members follow the rules
(3) About half of the members follow the rules
(4) Most members do not follow the rules
(5) Almost all members do not follow the rules
(3,5) Half or less of the members follow the rules
(-l) MIC
(-2) NA

OUTCOMES: Equity among users

10. Are there any appropriators who have been consistently disadvantaged in this period? <REALOSER>
(1) Yes
(0) No
(-1) MIC
(-2) NA

11. Have the relatively worst off been cut out of their benefits from this resource or substantially harmed? <WORSTOFF>
(1) Yes
(0) No
(-1) MIC

MIC=Missing in case
NA=Not available

(-2) NA

12. By the end of the situation, would you characterize the distance between those who are the least advantaged and those who are the most advantaged as increasing, constant, or decreasing? <RELEQUTY>
    (1) Increasing over time
    (2) Remaining relatively constant over time
    (3) Decreasing over time
    (-1) MIC
    (-2) NA

13. During this period, has the level of equity among appropriators increased, remained the same, or decreased? <EQUITYLEVEL>
    (1) Increased
    (2) Remained the same
    (3) Decreased
    (-1) MIC

OUTCOMES: Conclusion

14. Determine if this case is a success/failure in governing the common-pool resource. Briefly explain why (e.g. resource overexploitation, inequality, cross-scale interactions…)<SUCCESS>

DESIGN PRINCIPLES: 1A User boundaries

15. Is the set of individuals who have rights to withdraw from this resource well-defined? <WELLDEFN>:
    (1) Yes
    (0) No
    (-l) MIC
    (-2) NA

16. The presence of the design principle 1A means that individuals or households who have rights to withdraw resource units from the common-pool resource must be clearly defined. Is this design principle present? <DP1A>
    (1) Yes
    (0) No
    (-l) MIC
    (-2) NA

DESIGN PRINCIPLES: 1B Resource boundaries

17. The boundary of the resource is primarily a result of: <BOUNDAR2>
    (1) Natural/constructed attributes which limit entry
    (2) Natural/constructed attributes which do not limit entry
    (3) Institutional arrangements
    (4) Natural/constructed and institutional arrangements which limit entry
    (5) Natural/constructed and institutional arrangements which do not limit entry

MIC=Missing in case
NA=Not available

18. The presence of the design principle 1B means that *the boundaries of the CPR must be well defined*. Is this design principle present? <DP1B>
    (1) Yes
    (0) No
    (-l) MIC
    (-2) NA

DESIGN PRINCIPLES: 2A Congruence with local conditions

19. In your estimation, are the rules-in-use flexible in dealing with times of emergency or unusual problems facing particular members of the group of appropriators? <FLEXIBLE>
    (1) Yes
    (0) No
    (-1) Don't Know

20. The presence of design principle 2A means that *appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions*. Is this design principle present? <DP2A>
    (1) Yes
    (0) No
    (-l) MIC
    (-2) NA

DESIGN PRINCIPLES: 2B Appropriation and provision

21. In your estimation, are the rules-in-use perceived by appropriators of appropriators as fair? <FAIR>
    (1) Yes
    (0) No
    (-1) Don't Know

22. The presence of design principle 2B means that *the benefits obtained by users from a CPR, as determined by appropriation rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by provision rules*. Is this design principle present? <DP2B>
    (1) Yes
    (0) No
    (-l) MIC
    (-2) NA

DESIGN PRINCIPLES: 3 Collective-choice arrangements

23. Do the group of appropriators have options* to express their needs and concerns to those official of the group's organization who make collective choice decision in relation to the resource? <EXPOWN>
    (1) Yes, at least one of these activities are used
    (0) No, none of these activities are used
    (-1) MIC
    (-2) NA

MIC=Missing in case
NA=Not available

*Options may include: elections, formal petitions, formal hearings, advice and consent on nominations to non-elected positions, demonstrations, general meetings, illegal exchange with officials or other activities.

24. Is the chief executive(s) or administrator(s) position(s) filled by appropriators? <EXECAPR>
(1) Yes
(0) No
(-1) MIC
(-2) NA (no executive positions)

24.1 If yes, how?
(1) Through direct or indirect elections by appropriators
(2) Appointed by external government
(3) Through inheritance
(4) Others: _____
(-1) MIC
(-2) NA

24.2 If appointed by external government, do appropriators participate in the election?
(1) The chief executive(s) or administrator(s) position(s) is appointed by external government with active advice by appropriators
(2) The chief executive(s) or administrator(s) position(s) is appointed by external government without active advice by appropriators
(-1) MIC
(-2) NA

25. Has this group of appropriators proposed action in a collective-choice or constitutional-choice arena to alter the operational or collective choice rules affecting the appropriation from this resource? <PRONURUL>
(1) Yes
(0) No
(-l) MIC
(-2) NA

25.1 If yes, collective choice, constitutional choice or both?
(1) Collective choice arena
(2) Constitutional-choice arena
(3) Both
(-l) MIC
(-2) NA

26. The presence of design principle 3 means that *most individuals affected by the operational rules can participate in modifying the operational rules*. Is this design principle present? <DP3>
(1) Yes
(0) No
(-l) MIC
(-2) NA

DESIGN PRINCIPLES: 4A Monitoring users and the resource

27. Are records of the withdrawals from this resource kept in any systematic way? <RECORDWI>

MIC=Missing in case
NA=Not available

(1) Yes
(0) No
(-1) MIC

27.1 If yes, how often?
(1) Always
(2) Most times
(3) Sometimes
(-1) MIC

28. Are records of the condition of the resource kept in any systematic way? <RECORDCO>
(1) Yes
(0) No
(-1) MIC

28.1 If yes, how often?
(1) Always
(2) Most times
(3) Sometimes
(-1) MIC

29. The presence of design principle 4A means that *monitors are present and actively audit CPR conditions and appropriator behavior*. Is this design principle present? <DP4A>
(1) Yes
(0) No
(-l) MIC
(-2) NA

DESIGN PRINCIPLES: 4B Monitors accountability

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30. Do appropriators monitor the appropriation activities of each other apart from the monitoring of any "official" guards? <SELFMON>
(1) Yes
(0) No
(-1) MIC
(-2) NA

31. Does an "official" position of monitor exist (apart from the willingness of all appropriators to monitor)? <GUARD>
(1) Yes
(0) No
(-1) MIC
(-2) NA

31.1 If yes, how is this position selected?
(1) Appropriators (not necessarily all) rotate into this position
(2) Appropriators are selected by appropriators for this position
(3) Local non-appropriators are selected by appropriators for this position
(4) Local non-appropriators are selected by a local general purpose government
(5) Monitors are employees of an external governmental authority
(6) Some are selected by appropriators and some are selected by a local general purpose government

MIC=Missing in case
NA=Not available

(7) Some are selected by appropriators and some are employees of an external government authority
(8) Some are selected by a local general purpose government and some are employees of an external government authority
(9) Some are selected by appropriators, some are selected by a local general purpose government, and some are employees of an external government authority
(10) Others:_____
(-1) MIC
(-2) NA

32. The presence of design principle 4B means that *monitors are accountable to or are the appropriators*. Is this design principle present? <DP4B>
(1) Yes
(0) No
(-l) MIC
(-2) NA

DESIGN PRINCIPLES: 5 Graduated sanctions

33. Is there a gradation of social, physical, and official sanctions that varies with the severity of rule violations? <VARSANCT>
(1) Yes
(0) No, little or no variation on sanction
(-1) MIC
(-2) NA

33.1 If yes, at which range?
(1) Considerable range of sanctions are imposed depending on type of rule infractions
(2) Moderate range of sanctions are imposed depending on type of rule infractions
(1,2) Considerable or moderate range of sanctions are imposed depending on type of rule infractions
(3) Limited range of sanctions are imposed depending on type of rule infractions
(-1) MIC
(-2) NA

34. The presence of design principle 5 means that *appropriators who violate operation rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, officials accountable to these appropriators, or both*. Is this design principle present? <DP5>
(1) Yes
(0) No
(-l) MIC
(-2) NA

DESIGN PRINCIPLES: 6 Conflict-resolution mechanisms

35. Are there arenas being used for the exchange of information about conditions of the resource? <ARENAS>
(1) Yes
(0) No
(-1) MIC

MIC=Missing in case
NA=Not available

36. The presence of design principle 6 means that *appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials*. Is this design principle present? <DP6>
    (1) Yes
    (0) No
    (-l) MIC
    (-2) NA

DESIGN PRINCIPLES: 7 Minimal recognition of rights to organize

37. Do members of this group of appropriators have the right to participate in the management of this resource? <MANAGE>
    (1) Yes
    (0) No
    (-l) MIC

37.1 If yes, De jure or De facto?
    (1) De jure
    (2) De facto
    (-1) MIC
    (-2) NA

37.2 If not, are De jure rights present?
    (1) Yes
    (0) No
    (-1) MIC
    (-2) NA

38. The presence of design principle 7 means that *the rights of appropriators to devise their own institutions are not challenged by external governmental authorities*. Is this design principle present? <DP7>
    (1) Yes
    (0) No
    (-l) MIC
    (-2) NA

DESIGN PRINCIPLES: 8 Nested enterprises

39. Does the chief executive(s) or administrator(s) report to any external or higher level authority? <EXTREP>
    (1) Yes
    (0) No
    (-1) MIC
    (-2) NA

40. Are the appropriators of this resource part of more than one organization*? <ORGTYPE>
    (1) Yes
    (0) No
    (-1) MIC
    (-2) NA

*The types of organizations are:

MIC=Missing in case
NA=Not available

General Purpose Government and Communal Enterprises
A = a regular agency of the national government
B = a regular agency of a regional government
C = a regular agency of a local government
D = a local communal enterprise
Sector Specific Government
E = a specially created national enterprise
F = a specially created regional governmental enterprise
G = a specially created local governmental enterprise
Special Organizations Related to Resource
I = an AGO organized as a cooperative
J = an AGO not organized as a cooperative
K = a group that has achieved coordination without formal organization
General Voluntary and Private Associations
L = private for profit
M = co-ops with broader jurisdiction than resource
N = unions
Others

41. The presence of design principle 8 means that *appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises*. Is this design principle present? <DP8>
(1) Yes
(0) No
(-l) MIC
(-2) NA

MIC=Missing in case
NA=Not available

CENTER FOR BEHAVIOR, INSTITUTIONS & THE ENVIRONMENT (CBIE)

Intercoder Reliabilty Testing
Coding Project 2013-2014

For questions please contact Ute Brady at ute.brady@asu.edu

CENTER FOR BEHAVIOR, INSTITUTIONS & THE ENVIRONMENT (CBIE)
Intercoder Reliabilty Testing: Summary split by groups and variables
Coding Project 2013-2014

Team	vargroup	Krippendorff	Fleiss	Percent Agree
ACH	env	0.603	0.602	80.60
ACH	soc	0.693	0.692	68.80
ACH	success	1.000	1.000	100.00
ACH	DP1	0.261	0.256	33.30
ACH	DP2	0.327	0.322	37.50
ACH	DP3	0.387	0.384	64.30
ACH	DP4	0.591	0.590	59.30
ACH	DP5	-0.138	-0.149	50.00
ACH	DP6	-0.241	-0.258	16.70
ACH	DP7	0.389	0.385	50.00
ACH	DP8	-0.274	-0.286	33.30
ACU	env	0.435	0.432	52.80
ACU	soc	0.270	0.265	58.30
ACU	success	-0.240	-0.312	0.00
ACU	DP1	0.536	0.530	66.70
ACU	DP2	0.116	0.103	50.00
ACU	DP3	0.342	0.337	47.60
ACU	DP4	0.341	0.337	51.90
ACU	DP5	0.759	0.755	88.90
ACU	DP6	0.344	0.325	50.00
ACU	DP7	0.696	0.692	75.00
ACU	DP8	0.456	0.446	55.60
ADU	env	0.156	0.150	54.20
ADU	soc	0.221	0.213	31.20
ADU	success	0.312	0.250	50.00
ADU	DP1	0.325	0.311	25.00
ADU	DP2	0.877	0.874	87.50
ADU	DP3	0.525	0.519	64.30
ADU	DP4	0.921	0.921	94.40
ADU	DP5	0.836	0.832	83.30
ADU	DP6	0.739	0.727	75.00
ADU	DP7	0.633	0.625	75.00
ADU	DP8	1.000		100.00
AEN	env	0.824	0.823	91.70
AEN	soc	0.701	0.701	75.00
AEN	success	0.823	0.819	85.70
AEN	DP1	0.477	0.474	64.30
AEN	DP2	0.784	0.782	82.10
AEN	DP3	0.674	0.673	69.40
AEN	DP4	0.591	0.590	66.70
AEN	DP5	0.715	0.712	76.20
AEN	DP6	0.829	0.827	85.70

Team	vargroup	Krippendorff	Fleiss	Percent Agree
AEN	DP7	0.914	0.914	92.90
AEN	DP8	0.746	0.744	81.00
AEU	env	0.548	0.547	72.60
AEU	soc	0.457	0.455	51.80
AEU	success	1.000	1.000	100.00
AEU	DP1	0.696	0.694	71.40
AEU	DP2	0.784	0.782	78.60
AEU	DP3	0.767	0.766	81.60
AEU	DP4	0.706	0.705	74.60
AEU	DP5	-0.030	-0.039	85.70
AEU	DP6	0.595	0.590	64.30
AEU	DP7	0.712	0.710	71.40
AEU	DP8	0.238	0.232	33.30
AHU	env	0.349	0.345	70.80
AHU	soc	0.838	0.836	81.20
AHU	success	-0.100	-0.200	50.00
AHU	DP1	0.879	0.876	87.50
AHU	DP2	0.713	0.707	75.00
AHU	DP3	0.792	0.789	85.70
AHU	DP4	0.450	0.445	61.10
AHU	DP5	0.803	0.798	83.30
AHU	DP6	0.671	0.657	75.00
AHU	DP7	0.573	0.564	62.50
AHU	DP8	0.781	0.775	83.30
ANU	env	0.618	0.615	75.00
ANU	soc	0.378	0.371	31.20
ANU	success	1.000	1.000	100.00
ANU	DP1	0.873	0.870	87.50
ANU	DP2	0.386	0.373	50.00
ANU	DP3	0.800	0.798	85.70
ANU	DP4	0.657	0.654	66.70
ANU	DP5	0.836	0.832	83.30
ANU	DP6	-0.150	-0.200	50.00
ANU	DP7	0.174	0.157	25.00
ANU	DP8	0.375	0.357	66.70
CDE	env	0.544	0.543	66.70
CDE	soc	0.762	0.761	75.00
CDE	success	1.000		100.00
CDE	DP1	1.000	1.000	100.00
CDE	DP2	-0.188	-0.200	50.00
CDE	DP3	0.391	0.387	42.90
CDE	DP4	0.739	0.737	77.80

Team	vargroup	Krippendorff	Fleiss	Percent Agree
CDE	DP5	1.000	1.000	100.00
CDE	DP6	1.000		100.00
CDE	DP7	0.710	0.707	75.00
CDE	DP8	0.366	0.357	66.70
CDU	env	0.747	0.747	75.00
CDU	soc	0.322	0.319	32.50
CDU	success	1.000		100.00
CDU	DP1	0.914	0.913	95.00
CDU	DP2	0.375	0.370	80.00
CDU	DP3	0.668	0.667	77.10
CDU	DP4	0.714	0.713	73.30
CDU	DP5	-0.110	-0.122	0.00
CDU	DP6	-0.017	-0.035	90.00
CDU	DP7	0.280	0.273	50.00
CDU	DP8	0.113	0.103	20.00
CHN	env	0.636	0.634	66.70
CHN	soc	0.507	0.503	45.80
CHN	success	-0.063	-0.125	66.70
CHN	DP1	0.635	0.630	83.30
CHN	DP2	0.584	0.578	66.70
CHN	DP3	0.657	0.654	71.40
CHN	DP4	0.551	0.548	63.00
CHN	DP5	0.802	0.799	88.90
CHN	DP6	0.773	0.766	83.30
CHN	DP7	0.895	0.893	91.70
CHN	DP8	0.438	0.427	55.60
DHN	env	0.473	0.473	69.40
DHN	soc	0.657	0.656	77.10
DHN	success	0.868	0.866	91.70
DHN	DP1	0.550	0.549	64.60
DHN	DP2	0.535	0.533	58.30
DHN	DP3	0.798	0.798	79.80
DHN	DP4	0.731	0.730	74.10
DHN	DP5	0.496	0.494	55.60
DHN	DP6	0.398	0.394	58.30
DHN	DP7	0.568	0.567	58.30
DHN	DP8	0.757	0.756	80.60
DEU	env	0.495	0.493	77.10
DEU	soc	0.571	0.569	53.10
DEU	success	0.477	0.455	50.00
DEU	DP1	0.692	0.688	75.00
DEU	DP2	0.578	0.574	62.50

Team	vargroup	Krippendorff	Fleiss	Percent Agree
DEU	DP3	0.529	0.526	64.30
DEU	DP4	0.433	0.430	61.10
DEU	DP5	0.817	0.814	83.30
DEU	DP6	0.475	0.464	50.00
DEU	DP7	0.503	0.498	56.20
DEU	DP8	0.222	0.211	33.30
EHU	env	0.384	0.381	75.00
EHU	soc	0.285	0.280	54.20
EHU	success	0.292	0.250	33.30
EHU	DP1	0.624	0.618	75.00
EHU	DP2	0.560	0.554	66.70
EHU	DP3	0.713	0.710	71.40
EHU	DP4	0.388	0.384	51.90
EHU	DP5	0.350	0.338	33.30
EHU	DP6	1.000	1.000	100.00
EHU	DP7	0.496	0.489	66.70
EHU	DP8	0.408	0.397	44.40

CENTER FOR BEHAVIOR, INSTITUTIONS & THE ENVIRONMENT (CBIE)

Intercoder Reliability Testing: Detailed results for all teams
Coding Project 2013-2014

Team ACH:

```
Env-var:

Krippendorff's alpha
 Subjects = 72
   Raters = 3
    alpha = 0.603


Fleiss' Kappa for m Raters
 Subjects = 72
   Raters = 3
    Kappa = 0.602
        z = 15.5
  p-value = 0


Percentage agreement (Tolerance=0)
 Subjects = 72
   Raters = 3
  %-agree = 80.6


Soc-var:

Krippendorff's alpha
 Subjects = 48
   Raters = 3
    alpha = 0.693


Fleiss' Kappa for m Raters
 Subjects = 48
   Raters = 3
    Kappa = 0.692
        z = 15.4
  p-value = 0


Percentage agreement (Tolerance=0)
 Subjects = 48
   Raters = 3
  %-agree = 68.8
```

Success:

```
Krippendorff's alpha
 Subjects = 6
   Raters = 3
    alpha = 1


Fleiss' Kappa for m Raters
```

```
 Subjects = 6
   Raters = 3
    Kappa = 1
        z = 4.24
  p-value = 2.21e-05


Percentage agreement (Tolerance=0)

 Subjects = 6
   Raters = 3
  %-agree = 100


DP1:

Krippendorff's alpha
 Subjects = 24
   Raters = 3
    alpha = 0.261


Fleiss' Kappa for m Raters
 Subjects = 24
   Raters = 3
    Kappa = 0.256
        z = 3.54
  p-value = 0.000399


Percentage agreement (Tolerance=0)
 Subjects = 24
   Raters = 3
  %-agree = 33.3


DP-2:

Krippendorff's alpha
 Subjects = 24
   Raters = 3
    alpha = 0.327


Fleiss' Kappa for m Raters
 Subjects = 24
   Raters = 3
    Kappa = 0.322
        z = 3.83
  p-value = 0.000129


Percentage agreement (Tolerance=0)
 Subjects = 24
   Raters = 3
  %-agree = 37.5


DP-3:

Krippendorff's alpha
 Subjects = 42
   Raters = 3
    alpha = 0.387
```

```
Fleiss' Kappa for m Raters
 Subjects = 42
   Raters = 3
    Kappa = 0.384
        z = 4.31
  p-value = 1.62e-05


Percentage agreement (Tolerance=0)
 Subjects = 42
   Raters = 3
  %-agree = 64.3
```

DP-4:

```
Krippendorff's alpha
 Subjects = 54
   Raters = 3
    alpha = 0.591


Fleiss' Kappa for m Raters
 Subjects = 54
   Raters = 3
    Kappa = 0.59
        z = 11.3
  p-value = 0


Percentage agreement (Tolerance=0)
 Subjects = 54
   Raters = 3
  %-agree = 59.3
```

DP-5:

```
Krippendorff's alpha
 Subjects = 18
   Raters = 3
    alpha = -0.138


Fleiss' Kappa for m Raters
 Subjects = 18
   Raters = 3
    Kappa = -0.149
        z = -1.38
  p-value = 0.169


Percentage agreement (Tolerance=0)
 Subjects = 18
   Raters = 3
  %-agree = 50
```

DP-6:

```
Krippendorff's alpha
 Subjects = 12
```

```
   Raters = 3
    alpha = -0.241


Fleiss' Kappa for m Raters
 Subjects = 12
   Raters = 3
    Kappa = -0.258

        z = -1.91
  p-value = 0.0556


Percentage agreement (Tolerance=0)
 Subjects = 12
   Raters = 3
  %-agree = 16.7


DP-7:

Krippendorff's alpha
 Subjects = 24
   Raters = 3
    alpha = 0.389


Fleiss' Kappa for m Raters
 Subjects = 24
   Raters = 3
    Kappa = 0.385
        z = 3.99
  p-value = 6.58e-05


Percentage agreement (Tolerance=0)
 Subjects = 24
   Raters = 3
  %-agree = 50


DP-8:

Krippendorff's alpha
 Subjects = 18
   Raters = 3
    alpha = -0.274


Fleiss' Kappa for m Raters
 Subjects = 18
   Raters = 3
    Kappa = -0.286
        z = -2.1
  p-value = 0.0358


Percentage agreement (Tolerance=0)

 Subjects = 18
   Raters = 3
  %-agree = 33.3
```

Team ACU:

Env-var:

```
Krippendorff's alpha
 Subjects = 36
   Raters = 3
    alpha = 0.435


Fleiss' Kappa for m Raters
 Subjects = 36
   Raters = 3
    Kappa = 0.432
        z = 8.3
  p-value = 0


Percentage agreement (Tolerance=0)
 Subjects = 36
   Raters = 3
  %-agree = 52.8
```

Soc-var:

```
Krippendorff's alpha
 Subjects = 24
   Raters = 3
    alpha = 0.27


Fleiss' Kappa for m Raters
 Subjects = 24
   Raters = 3
    Kappa = 0.265
        z = 3.57
  p-value = 0.000357


Percentage agreement (Tolerance=0)
 Subjects = 24
   Raters = 3
  %-agree = 58.3
```

Success:

```
Krippendorff's alpha
 Subjects = 3
   Raters = 3
    alpha = -0.24


Fleiss' Kappa for m Raters
 Subjects = 3
   Raters = 3
    Kappa = -0.312
        z = -1.19
  p-value = 0.236


Percentage agreement (Tolerance=0)
 Subjects = 3
```

```
   Raters = 3
  %-agree = 0


DP1:

Krippendorff's alpha
 Subjects = 12
   Raters = 3
    alpha = 0.536


Fleiss' Kappa for m Raters
 Subjects = 12
   Raters = 3
    Kappa = 0.53
        z = 4.94
  p-value = 7.65e-07


Percentage agreement (Tolerance=0)
 Subjects = 12
   Raters = 3
  %-agree = 66.7


DP2:

Krippendorff's alpha
 Subjects = 12
   Raters = 3
    alpha = 0.116


Fleiss' Kappa for m Raters
 Subjects = 12
   Raters = 3
    Kappa = 0.103
        z = 0.792
  p-value = 0.429


Percentage agreement (Tolerance=0)
 Subjects = 12
   Raters = 3
  %-agree = 50


DP3:

Krippendorff's alpha
 Subjects = 21
   Raters = 3
    alpha = 0.342


Fleiss' Kappa for m Raters
 Subjects = 21
   Raters = 3
    Kappa = 0.337
        z = 3.57
  p-value = 0.000356
```

```
Percentage agreement (Tolerance=0)
 Subjects = 21
   Raters = 3
  %-agree = 47.6
```

DP4:

```
Krippendorff's alpha
 Subjects = 27
   Raters = 3
    alpha = 0.341


Fleiss' Kappa for m Raters
 Subjects = 27
   Raters = 3
    Kappa = 0.337
        z = 3.68
  p-value = 0.000236


Percentage agreement (Tolerance=0)
 Subjects = 27
   Raters = 3
  %-agree = 51.9
```

DP5:

```
Krippendorff's alpha
 Subjects = 9
   Raters = 3
    alpha = 0.759


Fleiss' Kappa for m Raters
 Subjects = 9
   Raters = 3
    Kappa = 0.755
        z = 3.92
  p-value = 8.83e-05


Percentage agreement (Tolerance=0)
 Subjects = 9
   Raters = 3
  %-agree = 88.9
```

DP6:

```
Krippendorff's alpha
 Subjects = 6
   Raters = 3
    alpha = 0.344


Fleiss' Kappa for m Raters
 Subjects = 6
   Raters = 3
    Kappa = 0.325
        z = 1.38
  p-value = 0.168
```

```
Percentage agreement (Tolerance=0)
 Subjects = 6
   Raters = 3
  %-agree = 50
```

DP7:

```
Krippendorff's alpha
 Subjects = 12
   Raters = 3
    alpha = 0.696


Fleiss' Kappa for m Raters
 Subjects = 12
   Raters = 3
    Kappa = 0.692
        z = 6.82
  p-value = 9.01e-12


Percentage agreement (Tolerance=0)
 Subjects = 12
   Raters = 3
  %-agree = 75
```

DP8:

```
Krippendorff's alpha
 Subjects = 9
   Raters = 3
    alpha = 0.456



Fleiss' Kappa for m Raters
 Subjects = 9
   Raters = 3
    Kappa = 0.446
        z = 3.13
  p-value = 0.00173


Percentage agreement (Tolerance=0)
 Subjects = 9
   Raters = 3
  %-agree = 55.6
```

Team ADU:

Env-var:

```
Krippendorff's alpha
 Subjects = 24
   Raters = 3
    alpha = 0.156


Fleiss' Kappa for m Raters
 Subjects = 24
   Raters = 3
    Kappa = 0.15
        z = 1.94
  p-value = 0.0528


Percentage agreement (Tolerance=0)
 Subjects = 24
   Raters = 3
  %-agree = 54.2
```

Soc-var:

```
Krippendorff's alpha
 Subjects = 16
   Raters = 3
    alpha = 0.221


Fleiss' Kappa for m Raters
 Subjects = 16
   Raters = 3
    Kappa = 0.213
        z = 2.76
  p-value = 0.00586


Percentage agreement (Tolerance=0)
 Subjects = 16
   Raters = 3
  %-agree = 31.2
```

Success:

```
Krippendorff's alpha
 Subjects = 2
   Raters = 3
    alpha = 0.312


Fleiss' Kappa for m Raters
 Subjects = 2
   Raters = 3
    Kappa = 0.25
        z = 0.612
  p-value = 0.54


Percentage agreement (Tolerance=0)
 Subjects = 2
```

```
   Raters = 3
  %-agree = 50


DP1:

Krippendorff's alpha
 Subjects = 8
   Raters = 3
    alpha = 0.325


Fleiss' Kappa for m Raters
 Subjects = 8
   Raters = 3
    Kappa = 0.311
        z = 2.74
  p-value = 0.00616


Percentage agreement (Tolerance=0)
 Subjects = 8
   Raters = 3
  %-agree = 25


DP2:

Krippendorff's alpha
 Subjects = 8
   Raters = 3
    alpha = 0.877


Fleiss' Kappa for m Raters
 Subjects = 8
   Raters = 3
    Kappa = 0.874
        z = 6.04
  p-value = 1.53e-09


Percentage agreement (Tolerance=0)
 Subjects = 8
   Raters = 3
  %-agree = 87.5


DP3:

Krippendorff's alpha
 Subjects = 14
   Raters = 3
    alpha = 0.525


Fleiss' Kappa for m Raters
 Subjects = 14
   Raters = 3
    Kappa = 0.519
        z = 4.4
  p-value = 1.06e-05
```

```
Percentage agreement (Tolerance=0)
 Subjects = 14
   Raters = 3
  %-agree = 64.3
```

DP4:

```
Krippendorff's alpha
 Subjects = 18
   Raters = 3
    alpha = 0.921

Fleiss' Kappa for m Raters
 Subjects = 18
   Raters = 3
    Kappa = 0.921
        z = 7.57
  p-value = 3.69e-14

Percentage agreement (Tolerance=0)
 Subjects = 18
   Raters = 3
  %-agree = 94.4
```

DP5:

```
Krippendorff's alpha
 Subjects = 6
   Raters = 3
    alpha = 0.836

Fleiss' Kappa for m Raters
 Subjects = 6
   Raters = 3
    Kappa = 0.832
        z = 4.97
  p-value = 6.8e-07

Percentage agreement (Tolerance=0)
 Subjects = 6
   Raters = 3
  %-agree = 83.3
```

DP6:

```
Krippendorff's alpha
 Subjects = 4
   Raters = 3
    alpha = 0.739

Fleiss' Kappa for m Raters
 Subjects = 4
   Raters = 3
    Kappa = 0.727
        z = 3.39
  p-value = 0.00071
```

```
Percentage agreement (Tolerance=0)
 Subjects = 4
   Raters = 3
  %-agree = 75
```

DP7:

```
Krippendorff's alpha
 Subjects = 8
   Raters = 3
    alpha = 0.633


Fleiss' Kappa for m Raters
 Subjects = 8
   Raters = 3
    Kappa = 0.625
        z = 3.06
  p-value = 0.0022


Percentage agreement (Tolerance=0)
 Subjects = 8
   Raters = 3
  %-agree = 75
```

DP8:

```
Krippendorff's alpha
 Subjects = 6
   Raters = 3
    alpha = 1


Fleiss' Kappa for m Raters
 Subjects = 6
   Raters = 3
    Kappa = NaN
        z = NaN
  p-value = NaN                NOTE:  all coded values 2 cases/3 var = -1


Percentage agreement (Tolerance=0)
 Subjects = 6
   Raters = 3
  %-agree = 100
```

```
##Read in environmental coding variable data
Environ<-read.table("EHUenv-var-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
Environ  ##R will display all the data
names(Environ)  ##R will display column headers of data
dim(Environ) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(Environ, as.numeric))
Environ1<-as.matrix(Environ)
Environ1

# Exclude columns with NA values
Environ1.exclude<-Environ1[ , colSums(is.na(Environ1)) == 0]
Environ1.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(Environ1.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
Environ2<-t(Environ1.exclude)
Environ2
kappam.fleiss(as.matrix(Environ2,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(Environ2) # Simple percentage agreement

##################################################################################################################
##Read in social coding variable data
Social<-read.table("EHUsoc-var-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
Social  ##R will display all the data
names(Social)  ##R will display column headers of data
dim(Social) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(Social, as.numeric))
Social1<-as.matrix(Social)
Social1

# Exclude columns with NA values
Social1.exclude<-Social1[ , colSums(is.na(Social1)) == 0]
Social1.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(Social1.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
Social2<-t(Social1.exclude)
Social2
kappam.fleiss(as.matrix(Social2,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(Social2) # Simple percentage agreement

##################################################################################################################
##Read in success variable coding data
Success<-read.table("EHUsuccess-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
Success  ##R will display all the data
names(Success)  ##R will display column headers of data
dim(Success) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(Success, as.numeric))
Success1<-as.matrix(Success)
Success1

# Exclude columns with NA values
Success1.exclude<-Success1[ , colSums(is.na(Success1)) == 0]
Success1.exclude
```

```
##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(Success1.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
Success2<-t(Success1.exclude)
Success2
kappam.fleiss(as.matrix(Success2,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(Success2) # Simple percentage agreement

##################################################################################################################

##Read in DP1 coding variable data
DP1<-read.table("EHU-DP1-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP1  ##R will display all the data
names(DP1)  ##R will display column headers of data
dim(DP1) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP1, as.numeric))
DP11<-as.matrix(DP1)
DP11

# Exclude columns with NA values
DP11.exclude<-DP11[ , colSums(is.na(DP11)) == 0]
DP11.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP11.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
DP12<-t(DP11.exclude)
DP12
kappam.fleiss(as.matrix(DP12,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(DP12) # Simple percentage agreement

##################################################################################################################

##Read in DP2 variable coding data
DP2<-read.table("EHU-DP2-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP2  ##R will display all the data
names(DP2)  ##R will display column headers of data
dim(DP2) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP2, as.numeric))
DP21<-as.matrix(DP2)
DP21

# Exclude columns with NA values
DP21.exclude<-DP21[ , colSums(is.na(DP21)) == 0]
DP21.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP21.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
DP22<-t(DP21.exclude)
DP22
kappam.fleiss(as.matrix(DP22,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
```

```
##Calculate simple percent agreement
agree(DP22) # Simple percentage agreement

##################################################################################################################
##Read in DP3 coding variable data
DP3<-read.table("EHU-DP3-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP3  ##R will display all the data
names(DP3)  ##R will display column headers of data
dim(DP3) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP3, as.numeric))
DP31<-as.matrix(DP3)
DP31

# Exclude columns with NA values
DP31.exclude<-DP31[ , colSums(is.na(DP31)) == 0]
DP31.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP31.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
DP32<-t(DP31.exclude)
DP32
kappam.fleiss(as.matrix(DP32,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(DP32) # Simple percentage agreement

##################################################################################################################

##Read in DP4 coding variable data
DP4<-read.table("EHU-DP4-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP4  ##R will display all the data
names(DP4)  ##R will display column headers of data
dim(DP4) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP4, as.numeric))
DP41<-as.matrix(DP4)
DP41

# Exclude columns with NA values
DP41.exclude<-DP41[ , colSums(is.na(DP41)) == 0]
DP41.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP41.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
DP42<-t(DP41.exclude)
DP42
kappam.fleiss(as.matrix(DP42,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(DP42) # Simple percentage agreement

##################################################################################################################

##Read in DP5 coding variable data
DP5<-read.table("EHU-DP5-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP5  ##R will display all the data
names(DP5)  ##R will display column headers of data
dim(DP5) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP5, as.numeric))
DP51<-as.matrix(DP5)
DP51
```

```
DP51

# Exclude columns with NA values
DP51.exclude<-DP51[ , colSums(is.na(DP51)) == 0]
DP51.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP51.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
DP52<-t(DP51.exclude)
DP52
kappam.fleiss(as.matrix(DP52,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(DP52) # Simple percentage agreement

##################################################################################################################

##Read in DP6 coding variable data
DP6<-read.table("EHU-DP6-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP6  ##R will display all the data
names(DP6)  ##R will display column headers of data
dim(DP6) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP6, as.numeric))
DP61<-as.matrix(DP6)
DP61

# Exclude columns with NA values
DP61.exclude<-DP61[ , colSums(is.na(DP61)) == 0]
DP61.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP61.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
DP62<-t(DP61.exclude)
DP62
kappam.fleiss(as.matrix(DP62,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(DP62) # Simple percentage agreement

##################################################################################################################

##Read in DP7 coding variable data
DP7<-read.table("EHU-DP7-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP7  ##R will display all the data
names(DP7)  ##R will display column headers of data
dim(DP7) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP7, as.numeric))
DP71<-as.matrix(DP7)
DP71

# Exclude columns with NA values
DP71.exclude<-DP71[ , colSums(is.na(DP71)) == 0]
DP71.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP71.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
```

```
DP72<-t(DP71.exclude)
DP72
kappam.fleiss(as.matrix(DP72,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(DP72) # Simple percentage agreement

##################################################################################################################

##Read in DP8 coding variable data
DP8<-read.table("EHU-DP8-NA.csv",header=TRUE,sep=",",row.names=1)

##Explore data
DP8  ##R will display all the data
names(DP8)  ##R will display column headers of data
dim(DP8) ## R will display the number of rows & the number of columns

###Turn dataframe into matrix format and exclude NA values
as.matrix(sapply(DP8, as.numeric))
DP81<-as.matrix(DP8)
DP81

# Exclude columns with NA values
DP81.exclude<-DP81[ , colSums(is.na(DP81)) == 0]
DP81.exclude

##Load irr library
library(irr)
library(lpSolve)

##Calculate Krippendorff's alpha on binary values (0/1)
## first assume the default nominal classification
kripp.alpha(DP81.exclude,method="nominal")

##Calculate Fleiss' kappa (need to transpose matrix to perform this calculation)
DP82<-t(DP81.exclude)
DP82
kappam.fleiss(as.matrix(DP82,exact=FALSE,detail=FALSE))

##Calculate simple percent agreement
agree(DP82) # Simple percentage agreement
```