

1. SUPPLEMENTARY MATERIAL

This section delves into the methodological tools implemented to obtain the data needed to analyze diversity, nesting, and dynamics properties. In addition, the data processing procedures used to obtain the binary matrices used in the NeD program to evaluate nesting from the NODF (Nestedness metric based on the overlap and decreasing fill) metric are specified.

1.1. Diversity property

A quick survey composed of four questions was conducted to identify stakeholders and institutions related to the management of the water supply system for domestic use in the 13 communities included in this study. The questions are placed in the corresponding governance order: either operational (first-order) or institutional (second-order, Table S1).

Table S1. Structure of the survey used in this study. We employed four questions and their possible answers. In the answers, the “others” option was left in order to not to limit the eventual appearance of different stakeholders at the local level.

Governance orders	Second-level variables (items)	Possible answers
First-order	1. Who is responsible for managing and providing water for domestic use in your community?	Municipal President Municipal Agent Water Committee Commissariat of Communal/Ejido Assets ¹ Others
Second-order	2. Who makes decisions about domestic water issues in your community?	Municipal President Municipal Agent Water Committee Commissariat of Communal/Ejido Assets ¹ Others
First-order	3. Who gets paid for the domestic water service in your community?	Municipal President Municipal Agent Water Committee Commissariat of Communal/Ejido Assets ¹ Others
Second-order	4. Who decides what to do with the payments of the water service for domestic use in your community?	Municipal President Municipal Agent Water Committee Commissariat of Communal/Ejido Assets ¹ Others

¹ The Commissariat of Communal/Ejido Assets is in charge of executing and enforcing the agreements made by the assembly and the representation and administration of the agrarian community/ejido (agrarian social property).

1.2. Nestedness property

The NODF is a metric that averages the nested Ncol column and nested Nrow of the matrix. However, for our purposes, only the nested of Ncol is relevant (jurisdictional levels of the stakeholders). For these cases, the only necessary condition for perfect nesting is a continuous decrease in the marginal totals (MT) from left to right among columns. In other

words, in each binary matrix with n columns, column k is positioned to the left of column l , and MT is the sum of any column of any matrix. Thus, a perfect nested matrix is present when $MT_j < MT_k$, resulting in a decreasing fill (DF_{kj}) equal to 100.

We used a matrix table in the semi-structured interview in which the rows represent the ten different activities of the first and second orders of governance: financing of hydraulic works, construction of new hydraulic works, maintenance of the hydraulic system, repairs to the hydraulic system, management training, advice for problem-solving related to the hydraulic system, financing the restoration of the water basin (first-order), use of a new water source, the election of a manager for the hydraulic system, and conflict resolution (second-order). The columns are the juridical levels to which the stakeholders involved in the ten activities belong (Table S2).

We asked interviewees the following generic structure question: Who of the [jurisdictional level in the column] gets involved or participates in [any of the ten activities in the rows]? We filled in the matrix with the names of the stakeholders (i.e., governmental, non-governmental, civil society, and private entities) mentioned by the interviewees.

Table S2. Matrix used to note the answers obtained from interviewing stakeholders regarding cross-level and internal interactions in the communities to carry out ten activities of the first and second governance orders.

Order of governance/activities		Jurisdictional level of the stakeholders			
		National	Subnational (State)	Local	
				Municipality	Others
First order	Financing of hydraulic work				
	Construction of new hydraulic work				
	Maintenance of the hydraulic system				
	Repairs to the hydraulic system				
	Management training				
	Problem-solving advice related to the hydraulic system				
	Financing water basin restoration				
Second order	Use of a new water source				
	Election of a manager for the hydraulic system				
	Conflict resolution				

The data obtained from the interviews were captured and processed with Microsoft Office Excel. For this analysis, the matrices for all communities (rows) would contain presence (1) data if the interviewees identified a governmental stakeholder of the different jurisdictional levels. For example, in community 1, if any of the interviewees (n) identified one or more interactions with different stakeholders at the national jurisdictional level, we filled the cell corresponding to row 1 column 1 (national) with a 1. Otherwise, the cell was filled with a zero. We used the same procedure to fill the cells with the other jurisdictional levels and the rest of the communities (rows).

Subsequently, we collapsed all the interviewees by the community and the ten activities by community. For example, if any interviewee of community 1 mentioned a government stakeholder at the national jurisdictional level in any of the ten activities, then the matrix for the national level was filled with a 1 for that community. Otherwise, a zero was noted (Table S3).

Table S3. Matrix of binomial presence (1) / absence (0) data resulting from the collapse of the results obtained from all interviewees and the ten activities of each community.

Community	Municipality	Subnational	National
Enebro	1	0	1
San Miguel Azcatla	1	1	1
Santa Cruz Corunda	1	0	1
San Antonio Abad	1	0	0
San Miguel Tequixtepec	1	1	1
Santiago Quixotepec	1	1	1
La Mexicana	1	1	1
San Francisco Teopan	1	1	1
Santa Magdalena Jicotlan*	1	1	1
Concepcion Buenavista*	1	1	1
Santiago Ihuitlan Plumas*	1	1	1
San Juan de los Cues*	1	1	1
Santiago Tepetlapa*	1	0	1

*Municipal seats that represent the municipality

For the analysis using NeD, the central matrix was divided into two matrices: one with all the communities that are municipal seats or that represent the municipality (Table S4) and another matrix with the communities of the municipal agency or those that have water committees that operate the water supply system for domestic use (Table S5).

Table S4. Results of the binomial presence/absence matrix of the communities that are municipal seats responsible for the water supply system for domestic use. This matrix was used to carry out the nesting analysis with the NODF (Nestedness metric based on the overlap and decreasing fill) metric in NeD software.

Community	Municipality	Subnational	National
Santa Magdalena Jicotlan	1	1	1
Concepcion Buenavista	1	1	1
Santiago Ihuitlan Plumas	1	1	1
San Juan de los Cues	1	1	1
Santiago Tepetlapa	1	0	1

Table S5. Results of the binomial presence/absence matrix of the communities that are municipal agencies or that have a water committee responsible for the water supply system for domestic use. This matrix was used to carry out the nesting analysis with the NODF (Nestedness metric based on the overlap and decreasing fill) metric in NeD software.

Community	Municipal agent/ Water committee	Municipality	Subnational	National
Enebro	1	1	0	1
San Miguel Aztatla	1	1	1	1
Santa Cruz Corunda	1	1	0	1
San Antonio Abad	1	1	0	0
San Miguel Tequixtepec	1	1	1	1
Santiago Quiotepec	1	1	1	1
La Mexicana	1	1	1	1
San Francisco Teopan	1	1	1	1

1.3. Dynamic property

We implemented three questions to generate information regarding institutional changes in the management of the water supply system for domestic use, based on the knowledge of the interviewees (Table S6). These questions were part of the same semi-structured interview tool used in the nestedness section, which contained the matrix of interactions in the ten different activities of the first and second orders of governance among stakeholders belonging to the different jurisdictional levels (local, state, and national).

Table S6. Open-ended questions of the semi-structured interviews were applied to elders and experts to identify possible institutional changes related to water for domestic use in rural communities.

Open questions	
1.	Since when do you remember that the water committee/municipality has operated the water supply system for domestic use?
2.	Has water management ever been carried out by someone other than the municipal/water committee?
3.	If so, do you remember what happened that caused the change in water management for domestic use?