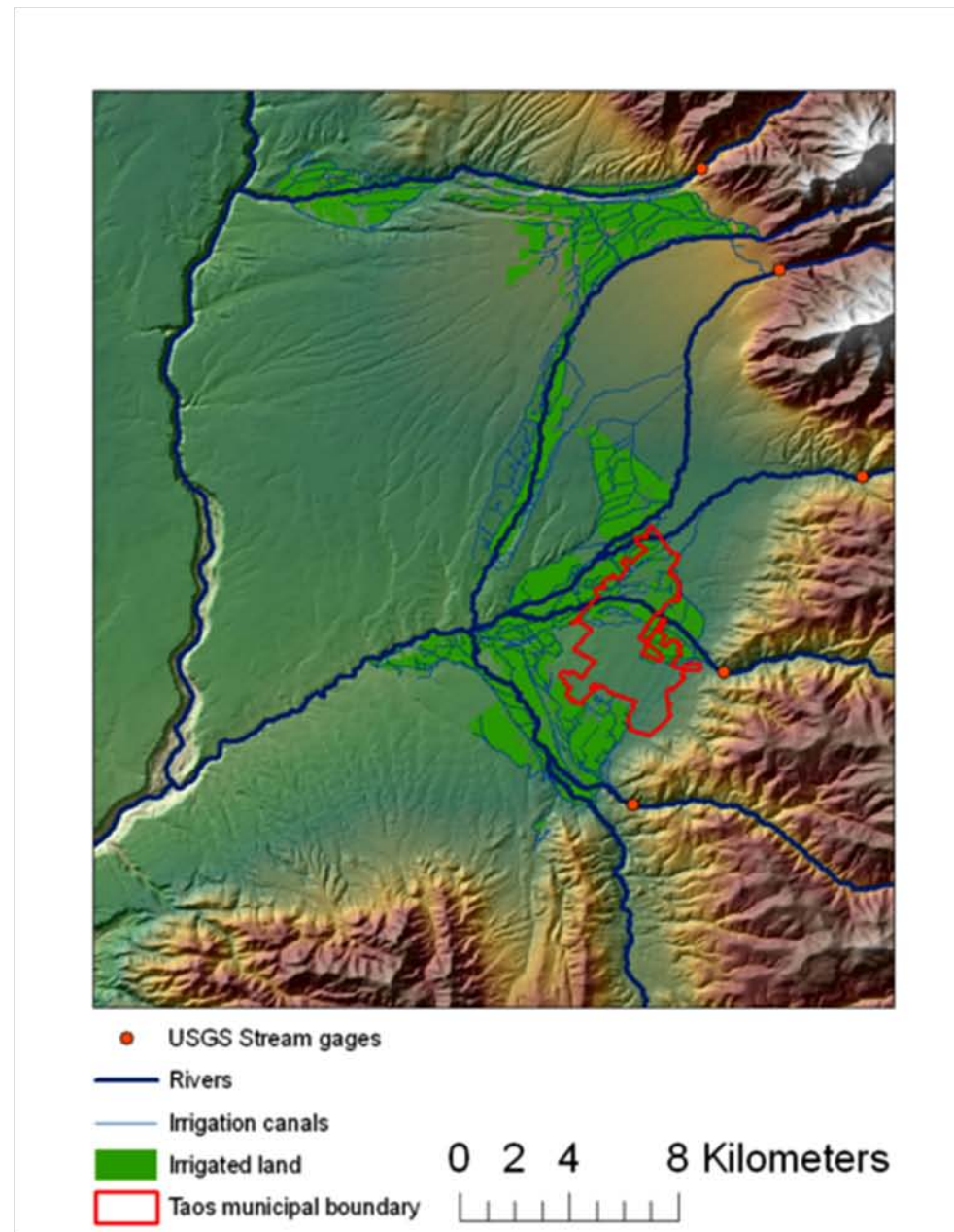


The Taos acequias

Michael Cox

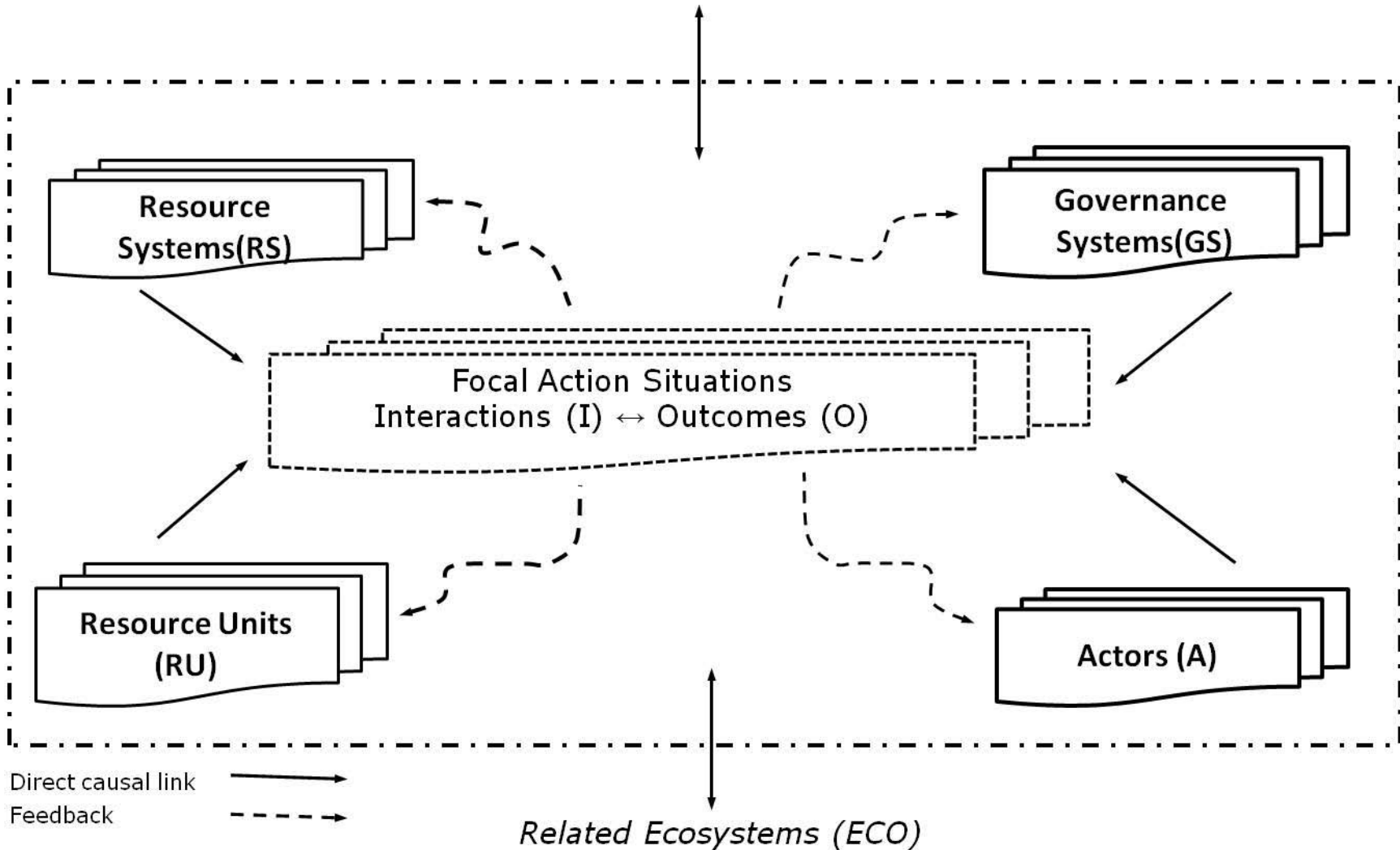
Environmental Studies Program

Dartmouth College



Social-ecological systems (Ostrom 2007)

Related Social, Economic, and Political Systems (S)



Social, Economic, and Political Settings (S)

**S1- Economic development. S2- Demographic trends. S3- Political stability.
S4- Government settlement policies. S5- Market availability.**

Resource System (RS)

**RS1- Sector (e.g., water, forests, pasture, fish)
RS2- Clarity of system boundaries
RS3- Size of resource system
RS4- Human-constructed facilities
RS5- Productivity of system
RS6- Equilibrium properties
RS7- Predictability of system dynamics
RS8- Storage characteristics
RS9- Location**

Resource Units (RU)

**RU1- Resource unit mobility
RU2- Growth or replacement rate
RU3- Interaction among resource units
RU4- Economic value
RU5- Size
RU6- Distinctive markings
RU7- Spatial and temporal distribution**

Governance System (GS)

**GS1- Government organizations
GS2- Non-government organizations
GS3- Network structure
GS4- Property-rights systems
GS5- Operational rules
GS6- Collective-choice rules
GS7- Constitutional rules
GS8- Monitoring and sanctioning processes**

Users (U)

**U1- Number of users
U2- Socioeconomic attributes of users
U3- History of use
U4- Location
U5- Leadership/ entrepreneurship
U6- Norms/ social capital
U7- Knowledge of SES/ mental models
U8- Dependence on resource
U9- Technology used**

Action Situation

Interactions (I) → Outcomes (O)

**I1- Harvesting levels of diverse users
I2- Information sharing among users
I3- Deliberation processes
I4- Conflicts among users
I5- Investment activities
I6- Lobbying activities**

**O1- Social performance measures
(e.g., efficiency, equity, accountability)
O2- Ecological performance measures
(e.g., overharvested, resilience, diversity)
O3- Externalities to other SESs
O4 - Social-ecological equilibrium**

Related Ecosystems (ECO)

**ECO1- Climate patterns. ECO2- Pollution patterns.
ECO3- Flows into and out of focal SES.**

Irrigation System (RS)

- RSI1 Sector: Irrigation
- RSI2 Strong physical boundaries
- RS4Ia Unlined canals
- RS4Ib Drainage canals (desagues)
- RS4Ic Canal branching
- RSI7 Low predictability
- RSI8 Low storage
- RSI9 High costs of exclusion

Aquifer System (RS)

- RSG1 Sector: Groundwater
- RSG2 Weak physical boundaries
- RSG7 Moderate predictability
- RSG8 High storage
- RSG9 High costs of exclusion

Land system (RS)

- RSL1 Sector: Pasture and agriculture
- RSL2 Moderate physical boundaries
- RSL9 High costs of exclusion
- RSL10 Strong surface/aquifer connection

Water (RU)

- RU1 High mobility
- RU2 Moderate renewability
- RU7a High spatial heterogeneity
- RU7b High temporal heterogeneity
- RU8 Moderate subtractability

Taos acequia governance system (GS)

- GS1a Local courts
- GS3a Moderate network Centrality
- GS3b High network Modularity
- GS3c Moderate network Hierarchy
- GS4a Heterogeneous property rights distribution
- GS4b Private/common property mix
- GS4c (Inter)Communal management regime
- GS5a High proportionality
- GS5b Rotational water distribution system
- GS8a Monitoring present
- GS8b Graduated sanctioning present
- GS9 Conflict resolution present

Acequias members (A)

- A1 Small group size
- A2a Low economic status
- A4a High spatial clustering
- A5 Strong leadership
- A6a Strong social capital
- A6b Norms of equity and reciprocity
- A8 High resource dependence
- A9 Low technology
- A10 High exit cost

Action situations

Interactions (I) → Outcomes (O)

I1 Water harvesting levels

O1 – Sustained Collective action

I5 Infrastructure investment activities

Levels of governance

Governance Level 2:
Repartimientos
between acequias

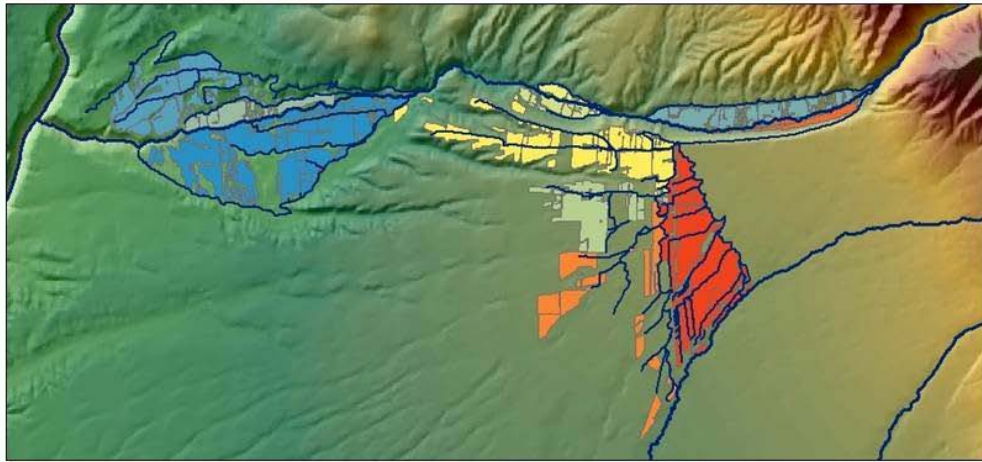


Governance Level 1:
Within acequias

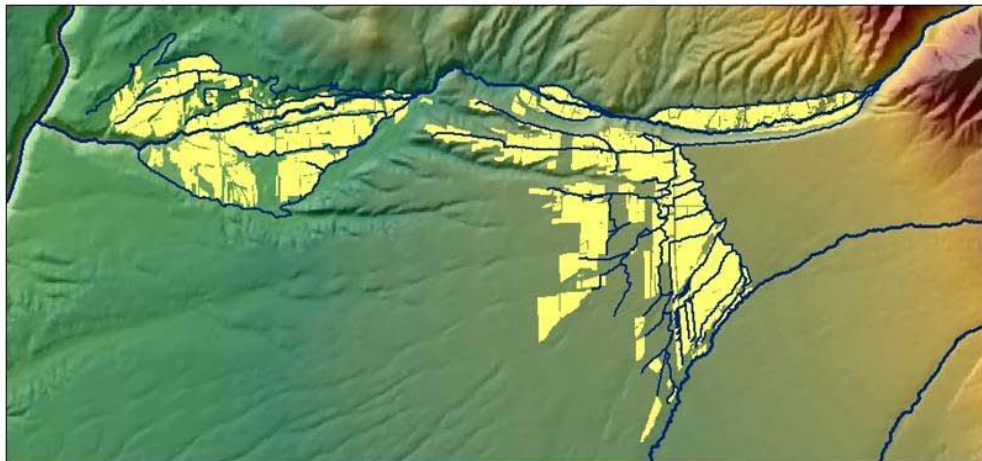




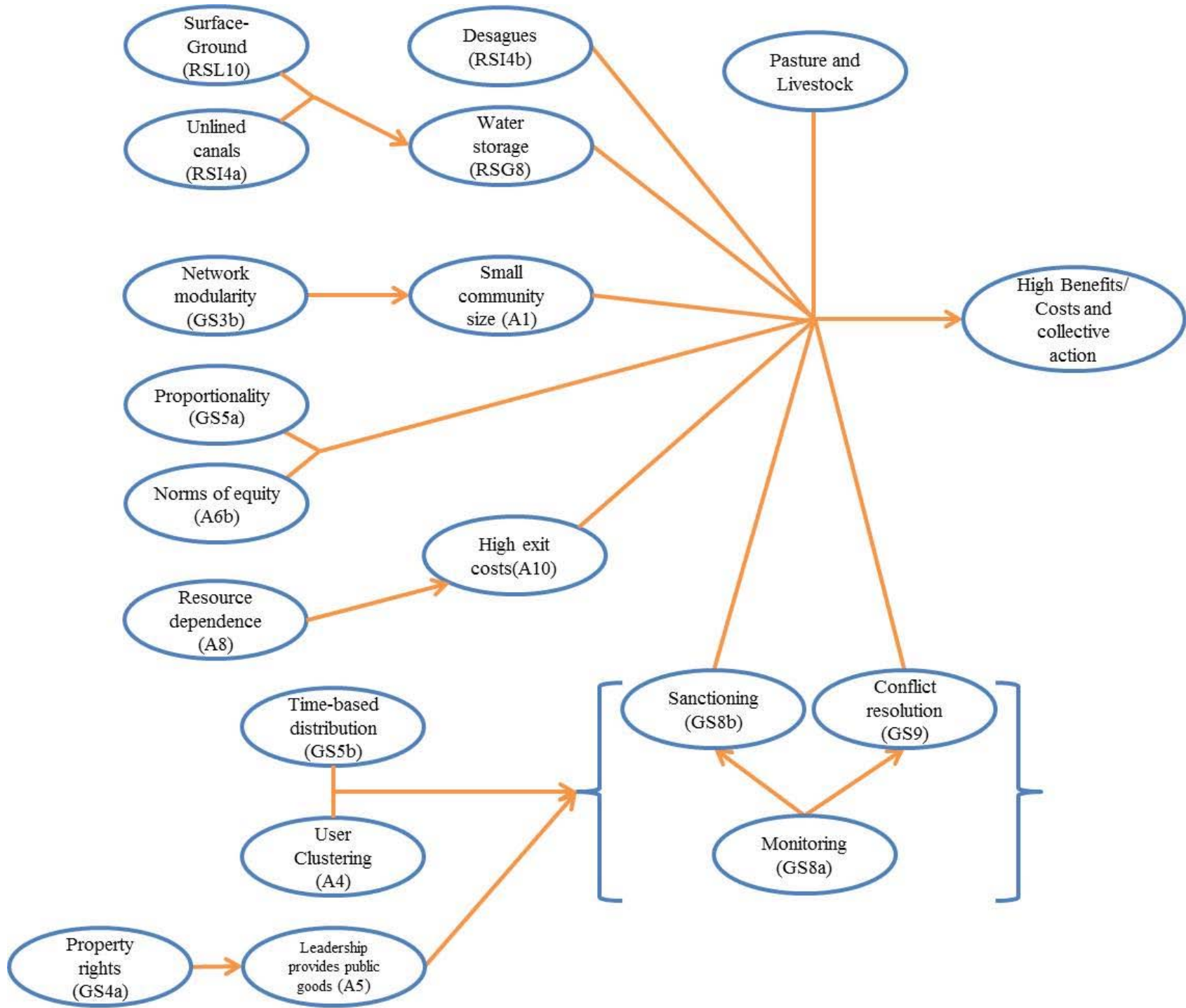
Level 0:
Property: Private
Management: Mostly private
Unit: private farms



Level 1:
Property: Communal
Management: Communal
Unit: acequias



Level 2:
Property: Communal
Management: Inter-communal
Unit: Repartimiento



Changes...

Variable	Native	Non-native	Overall
Number of respondents	73	34	107
Children Expectation	80%	48%	71%
Dependence on farming	1.9	1.44	1.76
Parents' dependence on farming	2.53	1.42	2.3
Farming dependence difference	-0.63	0.02	-0.54
Change in acres farmed	1.81	2.3	2.05
Own livestock	42%	33%	39%
Parents owned livestock	80%	26%	64%
Dependence on pasture/livestock	1.56	1.27	1.47
Parents' dependence on livestock	2.39	1.42	2.09
Livestock dependence difference	-0.83	-0.15	-0.62
Change in livestock owned	1.3	1.96	1.53

Disturbances

Disturbance	Native	Non	Difference	Overall
Droughts	3.81	3.12	0.69	3.58
Less participation	3.26	3.09	0.17	3.20
Newcomers	3.35	2.88	0.47	3.19
Infrastructure	3.13	3.09	0.04	3.12
Physical	3.01	2.68	0.34	2.90
Officers	2.72	2.64	0.08	2.69
Water markets	2.64	2.33	0.31	2.54
Abeyta	2.81	1.70	1.11	2.44
Leadership	2.33	1.91	0.42	2.20
Floods	2.10	1.66	0.44	1.95
USFS	2.08	1.20	0.88	1.79
M&D pressure	0.33	0.21	0.12	0.30
Average	2.63	2.21	0.42	2.49

Challenges and future directions

- Challenges:
 - For communities: adaptation
 - For researchers: collaboration, comparison and synthesis
- Future research:
 - Additional research on irrigation systems in Taos and the San Luis valley
 - Meta-analysis of diverse social-ecological systems

Contact

- Michael Cox
 - Michael.e.cox@dartmouth.edu
 - 603-646-0544