

Supplementary Information

Shifting power in practice: Implementing relational research and evaluation in conservation science

Tamara J. Layden, Sofía Fernández, Mynor Sandoval-Lemus, Kelsey J. Sonius, Dominique David-Chavez, and Sara P. Bombaci

Contents

Table S1. Core values and related responsibilities applied	2
Supplementary S1: Community reflection survey questions used in analysis.....	4
Table S2. Codebook with summary statistics	6
SI References	11

Table S1. Core values and related responsibilities applied, based on Relational Science Model (RSM) recommendations.

Value	Key RSM Recommendations	Application
Integrity: “researcher’s commitment to understanding and honoring moral and ethical responsibilities to the communities impacted by the research.” (p. 5, David-Chavez et al., 2024)	- Clearly define and adhere to place-based ethical responsibilities and protocols in relation to Indigenous rights, such as Tribal or institutional review boards (IRB) - Formalize relational agreements, such as a memorandum of agreement or understanding (MOAs/MOUs) and/or data use and transfer agreements (DUTA) - Understand and respect protocols of Free, Prior, and Informed Consent (FPIC), such as adhering to both individual and collective consent procedures - Uphold CARE principles for Indigenous data governance, including through respecting community-defined data restrictions	- All researchers engaged in ongoing historical and contextual learning through independent readings and discussions with collaborators and community research partners - All external researchers, including CSU researchers, local technicians, and community experts from Utz Che’, completed ethical trainings for human subjects research to build a strong understanding of consent and “do no harm” protocols - Lead author drafted a values-centered researcher code of ethics (David-Chavez et al. 2024; Kūlana Noi’i Working Group 2021) and researcher introductions to share with community to help set expectations and intentions prior to requesting permission to conduct a project together (FAO 2016) - Collaborators drafted an MOU to protect Indigenous knowledges and rights - Researchers co-drafted a DUTA with the community, accompanied by a long-term data management and stewardship plan - Lead author actively pursued trainings, including Free, Prior, and Informed Consent (FPIC) online modules (FAO 2016), and readings in support of ethical collaborations with Indigenous Peoples prior to developing any research proposals (Carroll et al. 2022; David-Chavez and Gavin 2018; Kūlana Noi’i Working Group 2021; Suseeya 2014; Toomey 2016) - All researchers sought procedural guidance and consent from individuals involved in the project as well as collective, community consent throughout - Lead author familiarized with the CARE (Collective benefit, Authority to control, Responsibility, Ethics) Principles for Indigenous data governance to guide data management procedures and creation of the DUTA (Carroll et al. 2020; 2021; 2022) - All data and associated outputs from the project are attributed to the local community as the rightful owners - All researchers applied the use of Local Context Notices with data related to the project (https://localcontexts.org/)
Respect: researcher’s commitment to “sustaining or restoring Indigenous governance of research and data impacting Indigenous communities” (p. 6, David-Chavez et al., 2024)	- Seek research guidance from community advisory groups throughout all stages of the research process, including data generation and stewardship - Co-design research goals, objectives, and processes with the community - Maintain flexibility and adaptability in research design and approaches in alignment with community outcomes - Facilitate participatory approaches for community members to authentically inform and drive research processes	- Research built on over a decade of relationship-building between all project partners, including a local Indigenous-led non-profit organization originally founded by La Bendición community leaders (Gardner-Vandy et al. 2021) - Researchers sought wisdom and guidance from community experts, leadership councils, and community groups throughout all stages of the project - Collaborators facilitated project visioning sessions early on to inform and co-create initial project proposal - Research team included two local Guatemalan bilingual biologists to facilitate project activities and work to understand local customs and contexts - Researchers lived with the community for four months to further build relationships and support co-creation processes - Researchers facilitated ongoing co-creation of project activities, workshops, deliverables, and gatherings through regular meetings with community advisory groups - Researchers facilitated re-occurring project check-ins to outline roles and adjust project framework, timeline, and outputs in alignment with capacity and interests

		• Researchers presented flexible project approaches based in participatory action research (Maiter et al. 2008) for the community to take ownership and authority of project processes • Researchers and community experts jointly facilitated the community creation of maps and timelines outlining communal lands as well as ancestral plant medicines
Humility: research commitment to supporting “shared learning by acknowledging the underlying premise that all those engaged in the research bring unique strengths, expertise, and experiential insights that when brought together generate new knowledge” (p. 7, David-Chavez et al., 2024)	• Uphold Indigenous knowledges as valid in their own right and contexts and for their own purposes • Engage multiple ways of knowing to enhance shared knowledge generation • Support mutual learning and engagement • Work to understand and address uneven power dynamics and social tensions	• Researchers broadened their knowledge of social science research, participatory methods, and Indigenous methodologies to complement ecological research approaches • Researchers continually reaffirmed the inherent expertise and valuable knowledge held by diverse community experts • Researchers encouraged and facilitated discussions for diverse community experts to share their insights and experiences on their communal lands, which in turn guided the research design and application of diverse methods • Researchers provided explanations and trainings of different social and ecological methods for the community members to learn about and choose from in alignment with communal goals and interests • Researchers shared in ongoing discussions at community center and engaged in forest walks to learn about community lands, interests, and concerns • The lead author engaged in reflexivity journaling and reflection in an effort to revisit and reflect on values and intentions and critically observe their expression (or limitations) in practice (Beck et al. 2021) • Researchers intentionally engaged all community groups, focusing particularly on the women’s group and youth group within the community to inform and direct project efforts
Reciprocity: research commitment to ensuring “Indigenous community members can access benefits from research outputs and outcomes” (p. 8, David-Chavez et al., 2024)	• Consider multigenerational and multispecies project benefits • Compensate project contributions to respect time, resources, and expertise shared • Pursue and generate community-centered data as well as outputs • Support and encourage community review of research data and outputs as well as authorship	• Research outcomes aimed to support both environmental sustainability and wildlife stewardship as well as knowledge continuity • Researchers provided research results in diverse formats (printed, books, digital) for sharing throughout the community • Researchers co-created DUTA templates in multiple languages (English and Spanish) that the community could use for future projects • Researchers provided a surprise honoraria to all community experts and co-facilitators of the project • Researchers brought treats or/and invested in community meals at each project gathering • Researchers co-planned, facilitated, and supported an end-of-project celebration, including a gift exchange of treats and project deliverables • Researchers continually sought feedback from community experts to align project outcomes with community interests, relevance, and benefits • Researchers continued engagement post-project to ensure long-term benefits • Researchers sought community review of all research outputs to ensure accuracy in community representation and knowledge • Researchers offered opportunities for authorship credit on all outputs, including publications

Supplementary S1: Community reflection survey questions used in analysis (open-ended questions in **bold**).

Please tell us about your project role

1. *If you DID participate in the study - why did you choose to participate in the study?* (Please write a response below - skip if not applicable)
2. *If you did NOT participate in the study - in what ways could project activities, processes, or collaborations be improved to support your engagement in the future?* (Please write a response below - skip if not applicable)

Please tell us about what you learned from the project

3. **What are some things that you learned from the project?** (Please write a response below)

Please tell us about your learning outcomes

4. Have you used anything you learned from the project so far? (Please check one)
 - **Yes (Please briefly describe how you have already used this information below)**
 - No, but I hope to apply this knowledge in the future (Please briefly describe how *hope to* use this information below)
 - No and I don't plan to use this information
 - I did not learn anything from this project
5. Are you more or less interested in forest conservation as a result of this project? (Please check one)
 - More interested
 - No change
 - Less interested
 - Not sure

Please share more about your experience

6. Please rate the degree to which you agree or disagree with each statement (circle one number for each statement):

Reason for participating in the project	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
1. I felt that I knew what the project was about and how it would benefit my community from the start	-2	-1	0	1	2
2. I felt that the project was made relevant to community interests and concerns	-2	-1	0	1	2
3. I felt that the project team was flexible and accommodating of community needs and interests as they developed	-2	-1	0	1	2
4. I felt that there was a balance between what was asked of me and the benefits related to this research project	-2	-1	0	1	2
5. I felt listened to, respected, and honored in all my interactions with the research team	-2	-1	0	1	2
6. I felt that the research team was genuinely interested in learning from me and about my community or culture	-2	-1	0	1	2
7. I felt I was able to provide input, lead, or change aspects of the project or meetings if I desired	-2	-1	0	1	2
8. I felt that my community was able to control the outcomes and information gathered during this project	-2	-1	0	1	2
9. I feel that I am able to access information and findings related to the project	-2	-1	0	1	2

Please share your thoughts about your experience with other projects

7. **If you have participated in another research project, how was this project similar or different?** (Please write a response below - skip if not applicable)
8. Based on your experience with this project, are you more likely or less likely to participate in a similar project? (Please check one)
 - More likely
 - No change
 - Less likely
 - Not sure

Please share any additional thoughts you might have about the project

9. **In what ways, if any, did the project feel relevant, beneficial, or important to you, your family, or your community?**
10. **In what ways could project activities, processes, or collaborations be improved?**
11. **Do you have anything else that you would like to be included or considered in future projects?**
12. **Is there anything else you would like to share?**

Table S2. Codebook with summary statistics, including the number (*n*) and proportion (%) of respondents who mentioned each thematic code and kappa coefficients.

Thematic code	Code description	Sample quotation	Number (<i>n</i>)	Proportion (%)	Kappa Coefficient
RESPECT (76%)					
<i>Relevance (48%)</i>					
Project appreciation	Expressed gratitude or general excitement towards project, project activities, project insights, or/and project team	"I like a lot [of] your projects, thank you for giving us this workshop."	15	30	0.812
General community benefit	General benefit, relevance, or importance of the project to families and the community	"Very important for my community and also for my family."	13	26	0.892
Forest for livelihoods	Supporting the forest/environment and related projects supports community livelihoods and local economy	"It would help the environment, so my children and my husband don't hunt anymore. We didn't have this knowledge before."	6	12	0.834
<i>Utility (52%)</i>					
Project deliverable application	Use of project deliverables (guides, recipe book, or/and photo album)	"We have come to check the guides and album"	7	14	0.978
Enhance forest protection efforts	Desire to implement forest protection efforts	"Make forest protection activities, like fire break paths"	5	10	0.914
Care for forest and forest future	Learned the importance of caring for, watching over, and protecting the forest, environment, and water-forest relations to secure communal forest future	"We [were] exposed [to] the forest diversity and richness in addition [to] the services it provides through the well care we are able to manage new projects and there is more forest conservation conscience."	20	40	0.824
Ecotourism project benefits	Project supporting ecotourism goals or/and the benefits of ecotourism for the community, such as more visitors	"For the future my family could benefit through an ecotourism project. Could be a way to open this possibility."	6	12	0.808
<i>Support local decision-making (32%)</i>					

Community appreciation	General appreciation for connection to community and learning about the community	"It was interesting to talk and remember how we as a community are structured and share the role of each of us in the community."	3	6	1.00
Community context learning	Learned more about the community, history, and/or communal forest through project activities, such as participatory mapping and timelines	"About the maps, I learned the part of the community. Also I learned how the community was formed. My grandfather told me before but this time I learned more details."	6	12	0.938
Community cohesion	Evidence of the research or projects bringing the community closer together	"Know new people and share."	4	8	0.893
Communal support for unity	Desire to strengthen community unity through care and support among families and the community	"Be united to think about projects. And help each other to get involved more."	10	20	0.932
Self-determination (16%)					
Strengthen locally-led efforts	More insights, know-how, interest, and investment in leading future projects for the community and communal forest	"Organizing ourselves and collaborating"	5	10	1.00
Community collaboration and leadership	Desire for more collaboration with community leadership and the community more broadly in organizing the project and project activities	"Collaboration in assisting the meetings"	3	6	1.00
HUMILITY (90%)					
Capacity (60%)					
Continued knowledge generation	Strengthening future knowledge generation and insights in the community	"Create new knowledge."	3	6	0.998

Interest in future projects	Interest in wanting to continue with research and workshops in the future	"I would like to share knowledge and help the rest feel supported in other future projects"	18	36	0.853
Expand knowledge exchange	More collaborations and connections both within and outside the community to expand knowledge and knowledge sharing	"You can include more people that are not [a] partner of the community."	12	24	1.00
Individual investment	Desire to invest more time, support, or engagement in the project	"An effort to give my time to support the unconditional help from Colorado [State] University. Because [of] your collaboration for my community La Bendicion."	8	16	0.893
<i>Collective action (70%)</i>					
Future community development	Support for future community improvement or/and local development.	"It helped for the community's development."	8	16	0.832
Medicinal plants for community healing	General knowledge of medicinal plants as well as their direct application or use	"The most important thing was the medicinal plants. That is something that we can use in our families."	30	60	0.945
<i>Innovation through knowledge generation (58%)</i>					
Creation and application of new knowledge	Generation and use of new knowledge learned during the project	"Because we knew new animal species in the forest that we didn't know before."	10	20	1.00
Project novelty	Comments on the uniqueness or novelty of the project	"Haven't participated in a similar project"	10	20	0.962
Bird learning and excitement	Specific learning or/and appreciation related to birds	"I learned about birds, that caught my attention a lot."	8	16	0.832
Camera trap learning and excitement	Learned about how to use and install camera traps and their benefits	"Set camera traps was something I enjoyed and the walk through the forest as well."	15	30	0.859
Forest diversity and richness	Learned about the diversity and richness of species within the	"I learn[ed] that I need to take care of the forest	5	10	0.874

	forest (could be plants, animals, etc.)	more, because of the diversity We have."			
Forest fauna knowledge	Learned about particular animal species in the forest	"I got to know the species that live in the forest, like birds and quadrupeds."	16	32	0.866
Strengthen knowledge transmission (54%)					
Communal knowledge exchange	Comments on how knowledge was/is being shared amongst the community	"We share and exchange experiences."	11	22	0.879
Intergenerational knowledge sharing	Community members (adults and elders) sharing knowledge with younger generation to pass on ancestral knowledge	"I tell my children and the family about the animals that live in the forest and about the existence of camera traps"	9	18	0.971
Medicinal recipe sharing	Explicit exchange and sharing of medicinal recipes within the community and families	"New medicinal recipes that were shared."	14	28	0.941
Indigenous language translation	Include translation to Mayan mam so that mam speakers can understand and engage in the project	"That somebody that is able to translate mam in all the activities, so mam speakers can understand."	1	2	1.00
Engage youth	Involve all young people in the community to participate in the project and activities	"Transmit the information to the youth so they can start getting involved and interested"	7	14	0.845
RECIPROCITY (86%)					
Access (38%)					
Knowledge for community	Information for and retained by the community	"The job that you came to do here will remain here at the community, you didn't take it away."	6	12	0.832
More community participation	Desire for more of the community to participate in the project/project activities (from community to community)	"More participation from the community."	8	16	0.923

Literacy barriers	Not being able to understand the project due to reading and writing barriers	"Learned indirectly about the cameras but, because I'm not able to read and write"	1	2	1.00
Barriers to access or application	Barriers to participating in different aspects of the research project, including both physical (e.g., schedule misalignment) and conceptual (e.g., not understanding the project)	"Meetings in afternoon/evening time or in a more favorable schedule."	8	16	0.803
<i>Sustained relationships & support (46%)</i>					
Sustained project efforts	Desire/hope for the project and project efforts to continue	"That the work team keeps going on."	10	20	0.994
More learning opportunities	Interest in more meetings, information, workshops, talks, and comments about the project	"More meetings to inform the community that the project is to help us."	16	32	0.970
Elevate researcher presence	More frequent visits from research team	"More visits, with more frequency, so we don't forget."	12	24	0.912
<i>Equitable outcomes (54%)</i>					
Motivate and inspire	Using project to motivate and raise awareness in the community	"Inviting more community members and motivating them to assist and improve the community."	9	18	0.928
Improve project facilitation	Improve communication, facilitation, organization, and connection/closeness to community	"Better communication and being closer to the people of the community"	8	16	0.881
Include and engage community	Engage more of the community and community demographics in activities and education	"Include more married sons and daughters so they can feel involved."	16	32	0.906

SI References

- Beck, Jacalyn M., Kevin C. Elliott, Charlie R. Booher, Kristen A. Renn, and Robert A. Montgomery. 2021. "The Application of Reflexivity for Conservation Science." *Biological Conservation* 262 (October):109322. <https://doi.org/10.1016/j.biocon.2021.109322>.
- Carroll, Stephanie Russo, Ibrahim Garba, Oscar L. Figueroa-Rodríguez, Jarita Holbrook, Raymond Lovett, Simeon Materechera, Mark Parsons, et al. 2020. "The CARE Principles for Indigenous Data Governance." *Data Science Journal* 19 (November):43. <https://doi.org/10.5334/dsj-2020-043>.
- Carroll, Stephanie Russo, Ibrahim Garba, Rebecca Plevel, Desi Small-Rodriguez, Vanessa Y. Hiratsuka, Maui Hudson, and Nanibaa' A. Garrison. 2022. "Using Indigenous Standards to Implement the CARE Principles: Setting Expectations through Tribal Research Codes." *Frontiers in Genetics* 13 (March):823309. <https://doi.org/10.3389/fgene.2022.823309>.
- Carroll, Stephanie Russo, Edit Herczog, Maui Hudson, Keith Russell, and Shelley Stall. 2021. "Operationalizing the CARE and FAIR Principles for Indigenous Data Futures." *Scientific Data* 8 (1): 108. <https://doi.org/10.1038/s41597-021-00892-0>.
- David-Chavez, Dominique M, and Michael C. Gavin. 2018. "A Global Assessment of Indigenous Community Engagement in Climate Research." *Environmental Research Letters* 13 (12): 123005. <https://doi.org/10.1088/1748-9326/aaf300>.
- David-Chavez, Dominique M., Michael Gavin, Norma Ortiz, Shelly Valdez, and Stephanie Carroll. 2024. "A Values-Centered Relational Science Model: Supporting Indigenous Rights and Reconciliation in Research." *Ecology and Society* 29 (2): art11. <https://doi.org/10.5751/ES-14768-290211>.
- FAO, UN Food and Agriculture Organization. 2016. "Free Prior and Informed Consent: An Indigenous Peoples' Right and a Good Practice for Local Communities." <https://www.refworld.org/docid/57fdec864.html>.
- Gardner-Vandy, Kat, Daniella Scalice, Juan Carlos Chavez, Dominique M. David-Chavez, Kathryne J. Daniel, Eddie Gonzales, Annette Lee, et al. 2021. "Relationships First and Always: A Guide to Collaborations with Indigenous Communities." *Bulletin of the AAS* 53 (4): 1–8. <https://doi.org/10.3847/25c2feb.0de1af1a>.
- Kūlana Noi'i Working Group. 2021. "Kūlana Noi'i v. 2." University of Hawai'i Sea Grant College Program, Honolulu, Hawai'i.
- Maiter, Sarah, Laura Simich, Nora Jacobson, and Julie Wise. 2008. "Reciprocity: An Ethic for Community-Based Participatory Action Research." *Action Research* 6 (3): 305–25. <https://doi.org/10.1177/1476750307083720>.
- Suiseeya, Kimberly R. Marion. 2014. "Negotiating the Nagoya Protocol: Indigenous Demands for Justice." *Global Environmental Politics* 14 (3): 102–24. https://doi.org/10.1162/GLEP_a_00241.
- Toomey, Anne H. 2016. "What Happens at the Gap between Knowledge and Practice? Spaces of Encounter and Misencounter between Environmental Scientists and Local People." *Ecology and Society* 21 (2): art28. <https://doi.org/10.5751/ES-08409-210228>.