

**Electricity, Marginalization, and Empowerment:
For Whom? And Who Decides?
Evaluating Participatory Mapping in
Río Negro, Honduras**

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Jeff Robert DeGrave

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Caminante, son tus huellas
el camino, y nada más;
caminante, no hay camino,
se hace camino al andar.

-Antonio Machado

Dedication

Esta tesis está dedicada a tod@s l@s catrach@s marginalizad@s y que algún día tengan el empoderamiento que merecen.

Y, más que nada, a mi esposa, Analisa, con quien “todo es posible.”

Abstract

Participatory mapping's ability to empower its users has come under severe reproach by many scholars. Drawing on these critiques, this *ex-post* mapping study of the mountain village of Río Negro, Honduras that employed participatory mapping to prioritize access to electricity through hydro-microturbines echoes and extends these critiques. However, prevailing power structures within the community impacted the decision-making processes, affecting the outcomes of the participatory mapping project. Through various political and social interventions, village elites were able to influence the distribution of the microturbines, further enhancing differences in marginalization and empowerment within the community. Elites successfully directed the participatory mapping exercise toward their interests and continue today to reap the multiple benefits of electrical access. This dissertation assesses how participatory mapping in this exemplary case reinforced existing conditions of marginalization and empowerment over the long term.

Table of Contents

Abstract.....	iv
Table of Contents.....	v
List of Tables.....	viii
List of Figures.....	ix
CHAPTER 1: Introduction.....	1
1.1 Of Participatory Mapping, Marginalization, and Empowerment.....	1
1.2 Brief Background.....	5
1.3 The Utility of Participatory Mapping.....	7
1.4 Río Negro, Participatory Mapping, and Electrification.....	8
1.5 Overview of Research Activities.....	11
1.5.1 Theoretical Contributions.....	12
1.5.2 Electricity, Empowerment, and Development through Participatory Mapping	13
1.5.3 A Brief History of Participatory Mapping.....	15
1.6 Chapter Summary.....	20
CHAPTER 2: Literature Review.....	22
2.1 Overview	22
2.2 A Brief History of Participatory Mapping and its Intellectual Roots...24	
2.3 The Promise of Empowerment and the Roots of Participatory Mapping.....	28
2.3.1 The Rise of Action Research.....	30
2.3.2 Geography and Participatory Research.....	32
2.3.3 Participatory Research, Empowerment, and Indigenous Rights in Latin America.....	37
2.3.4 Disempowerment and Participatory Mapping.....	47
2.3.5 The Aporia that is Participatory Mapping.....	50
2.3.6 What is Empowerment? And Can It Be Measured?.....	55
2.3.7 How Can Empowerment and Marginalization be Defined?..	56
2.3.8 Measuring Empowerment.....	60
2.4 Chapter Summary.....	64
CHAPTER 3: Project Background and Research Methodology.....	67
3.1 Overview.....	67
3.2 Research Preparation for the Case Study: Río Negro, Honduras...70	
3.2.1 My Introduction to Río Negro.....	71
3.2.2 About Río Negro.....	72
3.2.3 The Participatory Mapping Project.....	75
3.2.4 Current Microturbine Ownership in Río Negro.....	80
3.2.5 Eras of Development.....	85
3.2.5.1 Pioneer Era.....	85
3.2.5.2 Revival Era.....	86
3.2.5.3 Tourism Era.....	88

3.2.6	Building Social Capital.....	90
3.2.7	Local Geographies of Power.....	91
3.2.7.1	The Carretera.....	92
3.2.7.2	Access to Water	96
3.2.7.3	External Political Forces.....	97
3.2.8	Understanding How Marginalization and Empowerment Act.....	100
3.2.9	A Confluence of Complexities.....	101
3.3	Empowerment and Marginalization through Participation: Triangulation	101
3.4	Limitations to Triangulation Methodology.....	105
3.5	Research Design and Methodology: A Multi-Method Participatory Approach.....	108
3.5.1	Interviews	109
3.5.1.1	Internal Interview Subjects	110
3.5.1.2	External Interview Subjects	111
3.5.2	Governmental Documentation.....	113
3.5.3	Geospatial Technologies.....	115
3.6	Chapter Summary.....	120
CHAPTER 4: Analysis and Results.....		123
4.1	Overview.....	123
4.2	Impacts of Participatory Mapping in Río Negro.....	124
4.2.1	Immediate Impacts of Participatory Mapping.....	125
4.2.2	Observations on the Participatory Mapping Exercise.....	127
4.3	Identifying Marginalization and Empowerment.....	131
4.4	Quantitative Analysis of Microturbine Ownership: The Haves and Have-Nots.....	133
4.4.1	Average Dwelling Size.....	134
4.4.2	Average Number of Residents per Household.....	135
4.4.3	Domestic Space per Person.....	136
4.4.4	Average Distance to the Carretera.....	137
4.4.5	Average Distance to the Nearest Waterway.....	139
4.4.6	Quantitative Analysis Summary.....	140
4.5	Radio Graph Analyses: Marginalization and Empowerment by Household.....	143
4.6	Long Term Impacts of Participatory Mapping in Río Negro	156
4.6.1	Increased Coffee Revenues.....	156
4.6.2	Alternate Revenue Generation.....	157
4.6.3	Increased Cultural Capital.....	159
4.6.4	Individual Cases of Empowerment through Participatory Mapping.....	161
4.6.4.1	MTO2.....	162
4.6.4.2	MTO3.....	163
4.6.4.3	MTO4.....	164
4.6.4.4	MTO5.....	165

4.6.5	Empowerment in Río Negro through Participatory Mapping.....	166
4.6.6	Empowerment in Río Negro without Participatory Mapping?.....	167
4.7	Chapter Summary.....	170
CHAPTER 5: Conclusions.....		173
5.1	Overview.....	173
5.2	How Did Participatory Mapping Reinforce Preexisting Conditions of Marginalization and Empowerment in Río Negro?.....	175
5.2.1	Consequences of Participatory Mapping.....	176
5.2.2	Impacts of the Research on Río Negro.....	177
5.3	The Question of Participation and Empowerment	178
5.3.1	The Role of Gender.....	179
5.3.2	Empowerment, Marginalization, Participatory Mapping, and Tourism.....	180
5.3.3	Did Participatory Mapping Impact the Distribution of Microturbines?.....	181
5.4	“Common Interests” Versus Individual Motivations	182
5.5	Methodological Reflections on the Research.....	184
5.6	Future Research Possibilities and Recommendations.....	186
5.6.1	Additional Long-Term Participatory Mapping Studies	187
5.6.2	Further Research in Río Negro.....	187
5.7	Final Thoughts.....	188
Bibliography.....		191
Appendices.....		216

List of Tables

CHAPTER 3

Table 3.1:	Profile of Microturbine Ownership in Río Negro.....	83
Table 3.2:	Eras of Microturbine Development in Río Negro.....	85

CHAPTER 4

Table 4.1:	Average Dwelling Size in Río Negro	134
Table 4.2:	Average Number of Residents per Household	135
Table 4.3:	Domestic Space per Person.....	136
Table 4.4:	Average Distance to the Carretera.....	137
Table 4.5:	Average Distance to the Nearest Waterway.....	139
Table 4.6:	Sample Cohorts Compared against Common Variables.....	140
Table 4.7:	Symbols of Empowerment in Río Negro through Participatory Mapping	167

APPENDICES

Table A1:	Classification of Hydro-Powered Electrical Systems.....	217
Table D1:	Río Negro Household Statistical Table.....	220
Table F1:	Mean Averages.....	227
Table F2:	Central Tendency.....	227
Table F3:	Mode Analysis.....	228

List of Figures

CHAPTER 1

Figure 1.1:	Río Negro, Honduras: The Site of the Case Study Utilized for this Dissertation.....	1
Figure 1.2:	The Village of Río Negro.....	3
Figure 1.3:	Location of El Cajón Dam.....	8
Figure 1.4:	Storm Path of Hurricane Mitch.....	9
Figure 1.5:	First Microturbine in Río Negro.....	10
Figure 1.6:	Sketch Map of Río Negro.....	14
Figure 1.7:	Proyecto Luz Results: Water Intake Locations for a Two-Microturbine Electrical System.....	15
Figure 1.8:	Chronology of the Development of Electrical Power in Río Negro and Related Events.....	16
Figure 1.9:	Map of Grid-Accessible Residences in Río Negro.....	17

CHAPTER 3

Figure 3.1:	Microturbine Connected to a Coffee Depulper.....	73
Figure 3.2:	Helping Children Depulp Coffee by Hand.....	74
Figure 3.3:	Río Negro Roadside Welcome Sign.....	75
Figure 3.4:	Locations of Microturbines in Río Negro.....	82
Figure 3.5:	A Portable Microturbine.....	87
Figure 3.6:	The Outdoor Kitchen at the Zúñiga Household.....	89
Figure 3.7:	Farmer to Farmer Logo.....	90
Figure 3.8:	Río Negro Residences within Comayagua National Park.....	93
Figure 3.9:	Map of the Carretera.....	94
Figure 3.10:	The Carretera (The Comayagua Mountain Highway).....	95
Figure 3.11:	Río Negro Visitors Center Welcome Sign.....	97
Figure 3.12:	The Río Negro Visitors Center.....	99
Figure 3.13:	Conducting an Interview in Río Negro.....	112
Figure 3.14:	First Digital Map of Río Negro.....	114
Figure 3.15:	One of Several Eco-Huts Located along the Carretera in Río Negro.....	119

CHAPTER 4

Figure 4.1:	The Microturbine belonging to MTO4 powers multiple residences as well as the cultural core of Río Negro.....	130
Figure 4.2:	Averages for all Residences of Río Negro.....	146
Figure 4.3:	Averages for All Residences With and Without a Microturbine....	147
Figure 4.4:	Averages for Era I and II Households with a Microturbine, Era III Households with a Microturbine, and Households without a Microturbine.....	148
Figure 4.5:	Radio Graph Analysis: Averages of Households with Microturbines by Era.....	149
Figure 4.6:	Radio Graph Analysis: Individual Households with Microturbines by Era.....	150

Figure 4.7:	Radio Graph Analysis: Households that Reflect Extreme Conditions of Marginalization in Río Negro According to the Five Variables Tested.....	152
Figure 4.8:	Radio Graph Analysis: Households that Reflect Extreme Conditions of Empowerment in Río Negro According to the Five Variables Tested	152
Figure 4.9:	Averages for the 10% Most Marginalized and Empowered Residences in Río Negro Overlaid on the Average for the Entire Community.....	154
Figure 4.10:	Using a Microturbine to Charge Automobile Batteries.....	158
Figure 4.11:	A Microturbine-Powered Cell Phone Charging Station	159
Figure 4.12:	Glass Windows Indicate Empowerment.....	160
Figure 4.13:	Electronic Equipment also Indicates Empowerment.....	161
Figure 4.14:	The Abandoned Microturbine at the House of MTO2.....	162
Figure 4.15:	Quonset-Style Coffee Drying Hut.....	165
Figure 4.16:	A Coffee Drying Hut “Hotel” for Tourists.....	166
Figure 4.17:	The “Club” at the Zúñiga Residence.....	169

APPENDICES

Figure A1:	Schematic of a Pico-Hydro Electrical System.....	217
Figure B1:	Pico-Hydro Power System Set within the Landscape.....	218
Figure E1:	Radio Graphs of Each Household in Río Negro.....	226
Figure G1:	Dwelling Size (m ²).....	229
Figure G2:	Number of Residents per Household.....	230
Figure G3:	Domestic Space per Person (m ²).....	231
Figure G4:	Average Distance to the Carretera (m).....	232
Figure G5:	Average Distance to the Nearest Waterway (m).....	233
Figure G6:	Average Marginalization and Empowerment Ranking by Household for the Five Variables Tested.....	234

APPENDICES

Appendix A: Pico Hydro Power System.....	217
Appendix B: Complete Pico Hydro Electrical System.....	218
Appendix C: Interview Questions.....	219
Appendix D: Río Negro Household Statistical Data.....	220
Appendix E: Radio Graphs of Each Household in Río Negro.....	222
Appendix F: Mean, Median, and Mode Averages for the Five Variables Tested by Era.....	227
Appendix G: Box-and-Whisker Graphs for Each Variable vis-à-vis Microturbine Ownership Status.....	229

CHAPTER 1: Introduction

1.1 Of Participatory Mapping, Marginalization, and Empowerment

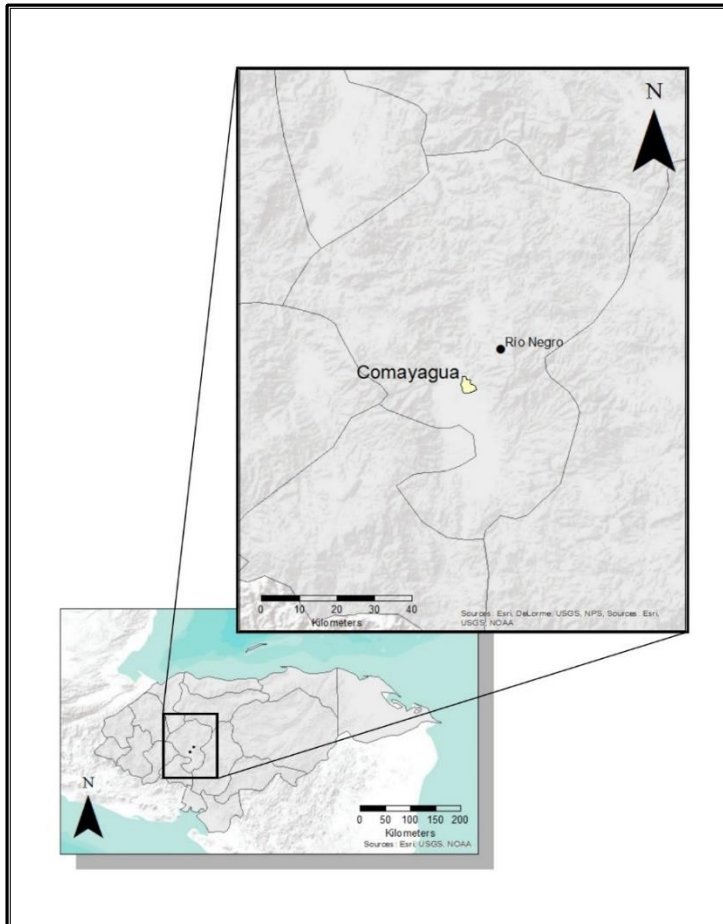


Figure 1.1: Río Negro, Honduras: The Site of the Case Study Utilized for this Dissertation
Map Produced by Jeff DeGrave, 2014

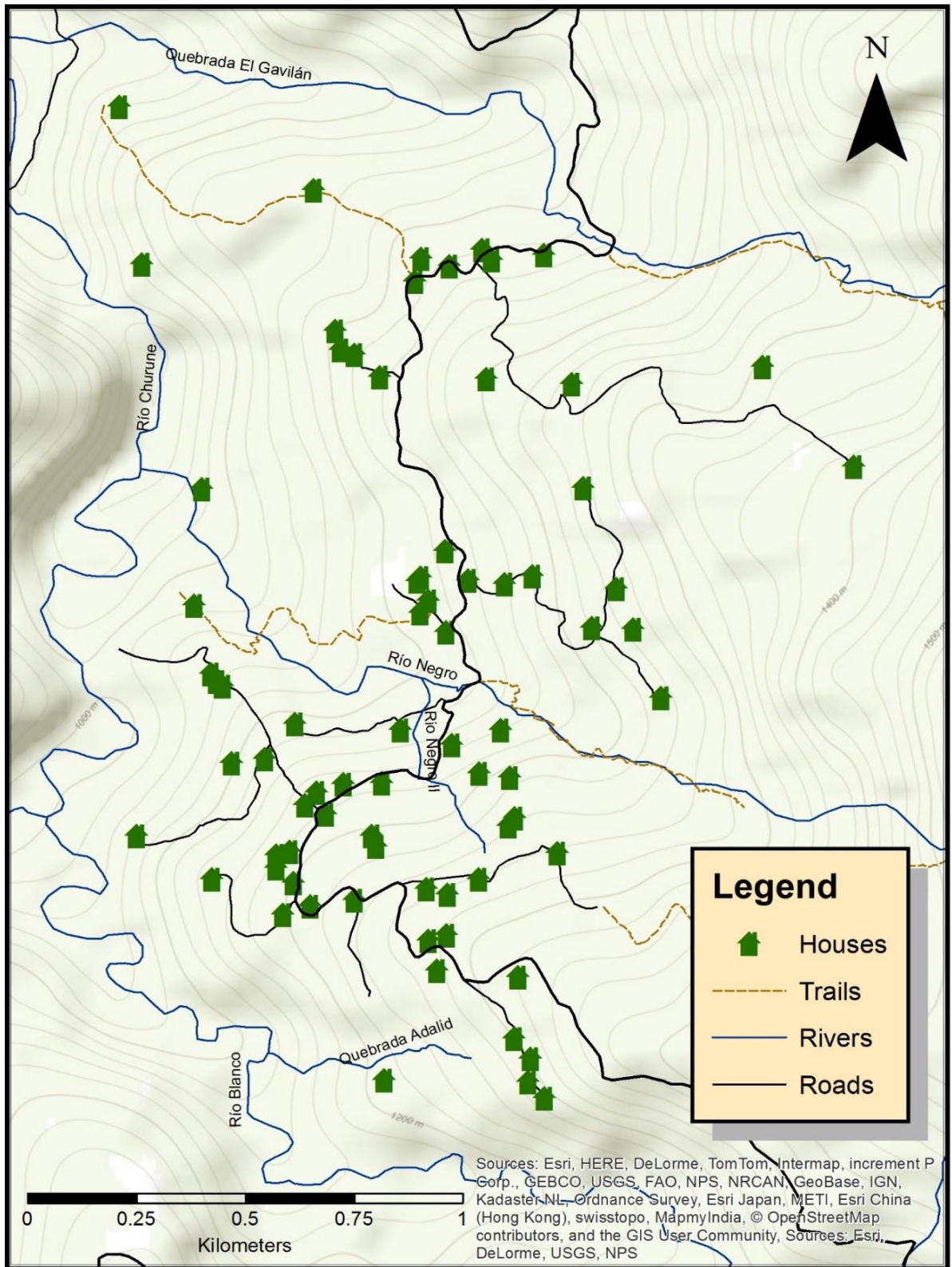
This dissertation is a study to determine if marginalization and empowerment are simultaneously reinforced through participatory mapping. Many practitioners and scholars view participatory mapping as a more democratic means of decision making than mainstream Western-led approaches to international development (Edney, 1991; Obermeyer,

1993; Pickles, 1995; Kyem, 2002b; Sieber, 2003; McCall and Minang, 2005; Chambers, 2006; Dunn, 2007; and many others). Reflecting this expectation, applications of participatory mapping have grown significantly in local and international development projects around the world. However, as many scholars have shown, participatory mapping has often served as a catalyst in enhancing existing disparities and, in contrast to outside aspirations, may contribute to the

continued marginalization of people. The results of this study suggest the potential of participatory mapping to both marginalize and empower—simultaneously sustaining and exacerbating existing conditions.

The arguments I develop in this dissertation are based on several years of study of a grassroots, small-scale attempt at electrification and the underlying participatory mapping project in the small mountain village of Río Negro, Honduras (See Figures 1.1 and 1.2). This case study provides the opportunity to test the assumptions and aspirations of greater empowerment through participatory mapping by examining a participatory mapping project and its impacts nearly 16 years after implementation. The project in Río Negro is one of numerous participatory mapping projects conducted in Central America within the past 30 years. Many are well known to geographers, such as Peter Herlihy's examination of the Río Plátano in 1992, Bernard Nietschmann's 1995 effort in Honduras and Nicaragua, "Defending the Miskito Reefs with Maps and GPS: Mapping with Sail, Scuba, and Satellite," as well as his direction behind the renowned *A Maya Atlas: The Struggle to Preserve Maya Land in Southern Belize* in 1997. Other participatory mapping research projects are less known among academic readers, yet equally significant in understanding the challenges participatory mapping faces¹.

¹ For a comprehensive summary of participatory mapping projects that took place in Latin America between 1995 and 2007, see Section 2.3.3: Participatory Research, Empowerment, and Indigenous Rights in Latin America.



Map Produced by Jeff DeGrave. 2014

Figure 1.2: The Village of Río Negro
Map Produced by Jeff DeGrave, 2014

One of the contributions of this dissertation to existing critical assessments of participatory mapping is to examine the long term impacts of participatory mapping. Leading Latin American researchers who have utilized participatory mapping, such as Herlihy, Nietschmann, and Wainwright, have all participated in several significant participatory mapping projects in Latin America—in Honduras, Nicaragua, and Belize, respectively. These researchers analyzed the preparation, process, and short-term results of their individual projects. Although many assessments of the results of participatory mapping have recognized the critical need to evaluate its outcomes, no long term assessment of a participatory mapping project in Latin America has yet to be published in any academic journal or other publication. Assessing the consequences of the Río Negro participatory mapping project contributes such an evaluation—an evaluation of the marginalization and empowerment that can influence participatory mapping over the long-term.

This study considers the dualistic potential of participatory mapping to strengthen the already empowered and further marginalize the already disenfranchised. Prevailing power structures and inequalities in cultural capital permeate the participatory mapping process which may entrench existing disparities between marginalized and empowered populations. These power imbalances can influence a community's ability to effectively utilize participatory mapping and were visible in Río Negro's attempts to manage the development and distribution of microturbines for the production of electricity.

This dissertation proceeds in the following organizational structure: Chapter Two provides the historical context and existing literature that contribute to this

project. Chapter Three offers insight into the research preparation, design, and methodology applied to the case study while also addressing the limitations of the methodology. This chapter also includes an in-depth discussion and analysis of how the data obtained from the case study were acquired and utilized for this investigation. Chapter Four provides the empirical data and disseminates the results of the case study. Finally, in Chapter Five I reflect on the impacts of this study on the residents of Río Negro, discuss the inextricable relationship between participatory mapping, marginalization and empowerment, and present a number of possibilities that may be useful as follow-up investigations.

1.2 Brief Background

Río Negro is a small coffee-growing mestizo community of approximately 470 residents (Maznichenko, 2011) that lies among the mountainous cloud forests of Central Honduras. This remote village exemplifies the many struggles that Honduras, as a whole, continually faces. For example, as noted by the Instituto Nacional Estadísticas de Honduras (National Statistics Institute of Honduras):

Honduras...has the highest poverty rate in Central America [and] the lack of basic infrastructure in rural areas impedes the development of the rural economy. About half of the population of Honduras is rural, and 80 percent of the rural population lives in hillside areas practicing subsistence agriculture. Over 70 percent of the rural population lives under the poverty line (2013, 1).

Reflective of most of rural Honduras, the 76 households within Río Negro have historically relied upon subsistence corn and bean farming for their survival (Hernández, 2014). Due to the extremely labor-intensive rigors of this livelihood, most residents receive little formal education—averaging approximately four years

of schooling (Velásquez et. al, 1999). Therefore, a cycle of poverty persists in Río Negro where children will likely quit school at a young age to provide much needed agricultural labor (Hernández, 2014)—despite the dearth of opportunities this livelihood will offer. Furthermore, the Río Negro landscape is relatively void of infrastructure—like most of rural Honduras. Although most residences do have access to stream-fed water resources, modern sewage systems are not available. Connection to the local power grid is not available for residents of Río Negro, either.

To address some of these limitations while undertaking major reconstruction efforts after Hurricane Mitch, residents of Río Negro employed participatory mapping in the late 1990s to find the optimal locations for a series of hydro-microturbines that were, in part, constructed to provide household electricity (Gaertner, 2011a). This participatory mapping project was part of a larger set of activities that were initiated as part of a grander narrative of empowering local residents through public participation after the devastation of Mitch. Yet not all inhabitants of Río Negro equally participated in these decision-making processes. Local politics, economic disparities, and extant cultural hegemonies empowered certain individuals while simultaneously excluding other residents from participating and potentially receiving electricity. Through this case study I examine how the desire to achieve greater equity in access to electricity through participatory mapping may collide with the economic, social, and political realities that are imbedded within the participatory process.

1.3 The Utility of Participatory Mapping

Participatory mapping incorporates multiple approaches, objectives, and characterizations, but its ultimate purpose is to “empower communities” (Harris and Weiner 1998, 67). Such projects commonly engage members of society who may be lacking in basic understandings of technological, economic, or political systems—in both the Global North and South. For this and other reasons, the utilization and study of participatory mapping has appealed to both the academy and professionals in community development projects since its global emergence in the mid-1990s.

Over the past 20 years, international development agencies at every scale have produced an impressive compendium of publications, handbooks, and workbooks to assess marginalization and empowerment through participatory mapping (World Bank, 1996, 2005b, 2006; and others; USAID, 2008, 2011, and others; IFAD, 2009, 2011b, and others; Jupp and Sohel, 2010; and others). Research on participatory mapping includes its theoretical constructs (Chambers, 1994; Nietschmann, 1995; Harris and Weiner 1998b, and others), applications (Peluso, 1995; Weiner, Warner, Harris and Levin, 1995; Herlihy, 1998; Herlihy and Knapp, 2003; Corbett and Rambaldi, 2009; and others), related methodologies and outcomes (Rundstrom, 1995; Weiner and Harris, 1998a; Elwood and Leitner, 1998; Kwan, 2002; Warren, 2005; and others) and its inherent limitations (Kyem, 2001, 2002a, and 2004; Ghose and Elwood, 2003; Ghose, 2007; Sletto, 2009; and others). Yet no published academic geographic studies have included an *ex-post* assessment of the long-term impacts of participatory mapping due to its relatively

recent emergence into both academic and professional circles. Similarly, longitudinal studies focusing on the interplay between marginalization, empowerment, and participatory mapping are also undocumented. The case study of Río Negro provides an opportunity to assess the long-term impacts of participatory mapping.

1.4 Río Negro, Participatory Mapping, and Electrification

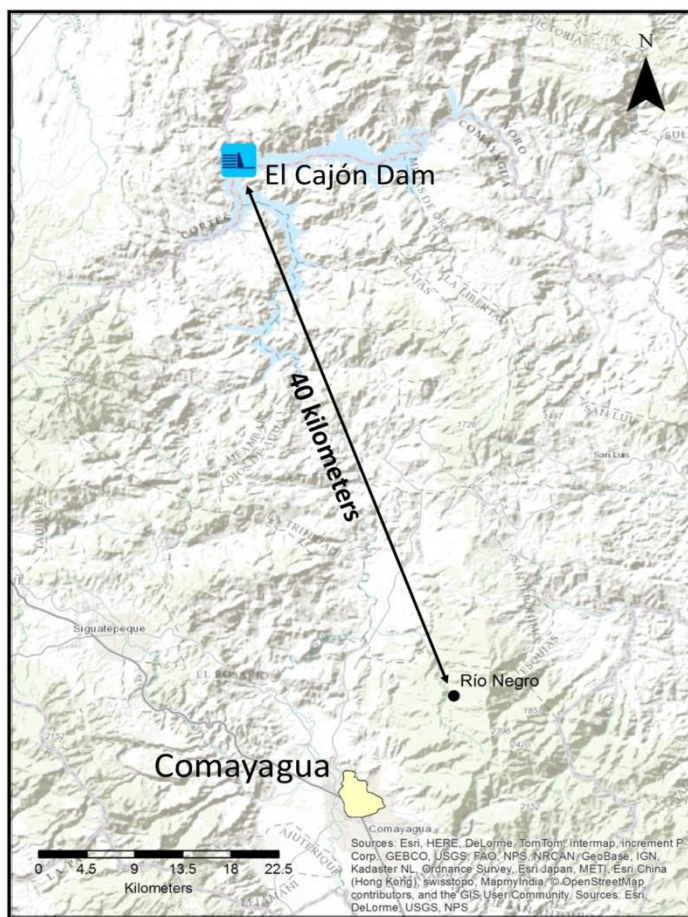


Figure 1.3: Location of El Cajón Dam
Map Produced by Jeff DeGrave, 2014

Residents of Río Negro employed participatory with the goal of aiding the placement of microturbines within the community (Gaertner, 2011c). Río Negro is one of many small agricultural mountainous communities within Honduras that has recently embraced microturbine technology to create electricity. Most of rural Honduras remains with minimal electrical

infrastructure after limited successes to expand the national electrical grid have been realized (ESMAP, 2010). The government of Honduras has chronically

struggled to address this national issue. Several large-scale projects have been undertaken with the help of the international community. For example, in 1985, Honduras collaborated with the World Bank and several international development institutions to construct a 300 megawatt hydroelectric dam, El Cajón.² El Cajón is located approximately 40 kilometers north-northwest of Río Negro and was designed to resolve issues of electrical access throughout the country and much of Central America (*El Heraldo*, 2013a).

Despite such large scale electrification projects in Honduras, multiple catastrophes necessitated the implementation of local solutions. For example, the devastation of Hurricane Mitch in 1998 forced a virtual reconstruction of the entire Honduran electrical grid (Mangurian, 1999) and a pragmatic reorientation around

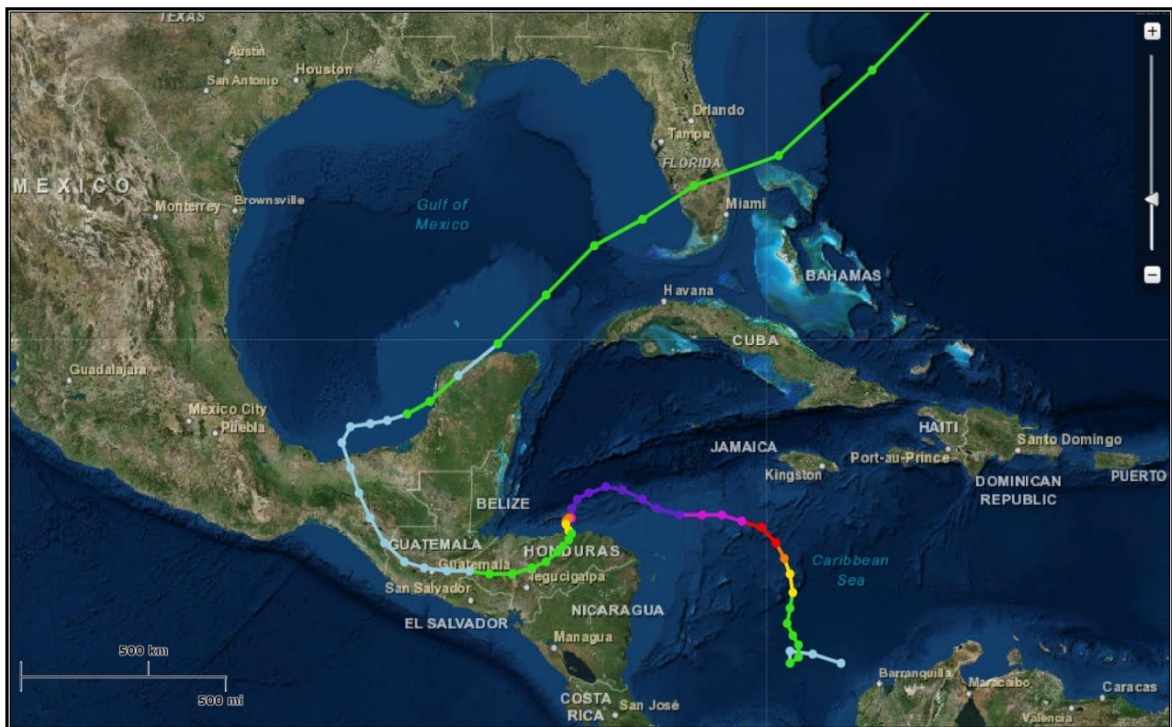


Figure 1.4: Storm Path of Hurricane Mitch.

Source: National Oceanic and Atmospheric Administration, 2014.

² Although commonly known as the El Cajón dam, its official name is the Central Hidroeléctrica Francisco Morazán (Translated as the Francisco Morazán Hydrological Center). Francisco Morazán was the President of the Federal Republic of Central America from 1830-1839 (*El Heraldo*, 2013a).

individual and community-based provisions of electrical power. Unstable tectonic, economic, and political forces have since caused Honduras' electrical supply to continually fluctuate between inconsistent and dysfunctional. To this day Honduras remains one of the least electrified countries in Latin America (World Bank, 2014).³

Like most of the country, Río Negro was also an ecological and infrastructural disaster after Hurricane Mitch (Partners of the Americas, 2002). In the wake of Mitch, two local coffee farmers in Río Negro, Hector Oviedo Castellanos and Adalid Zavala, learned of using microturbines to create electricity through “*Educación para Todos*” (“Education for Everyone”)—a Central American



Figure 1.5: First Microturbine in Río Negro
Source: Jeff DeGrave, 2011

³ For additional information concerning international development, politics, economics, and cultural issues in Honduras, see *Understanding Central America: Global Forces, Rebellion, and Change* (Booth, Wade, and Walker, 2014).

educational radio program (Zavala, 2012). Oviedo and Zavala subsequently built the first microturbine in the region in 1998 (Oviedo and Zavala, 2011). This microturbine prototype signaled the arrival of electricity into Río Negro. A collection of international reconstruction efforts also impacted Río Negro—most notably the Honduran Conservation Corps (HCC). Intended to aid in both infrastructural and ecological improvements, participatory mapping was deployed to “address the environmental problems brought about by Hurricane Mitch” (Partners of the Americas 2002, 1) and to help establish electrical access within the community (Gaertner, 2011c), among many other objectives set forth by the HCC.

However, the division between those with and without access to electricity in Río Negro today continues to bear the mark of this participatory mapping exercise over 15 years later. Some members of the community have access to electricity while the overwhelming majority of residents of Río Negro still remain without power and continue to seek alternatives to microturbines. The ongoing legacy of differential access to electricity in Río Negro raises questions concerning the ways in which participatory mapping further marginalized and empowered various residents within the community.

1.5 Overview of Research Activities

A theoretically-guided assessment that rests on empirical observations in Río Negro offers possibilities to develop a greater understanding of the processes and manifestations of marginalization and empowerment that emerge during and after participatory mapping. This investigation utilizes a multi-method, or triangulated,

approach that incorporates a wide spectrum of resources: interviews with many of the participants in the participatory mapping exercise as well as the heads of households of most residences within Río Negro, governmental documentation, geospatial data, and a diverse compendium of literary resources ranging from scholarly contributions to locally-produced monographs and studies. The question of whether or not participatory mapping contributed to greater marginalization and empowerment within the community over the long term is the central focus of this dissertation. I have employed a series of metrics to draw linkages between the participatory mapping exercise and representations of marginalization and empowerment in the community. This research also considers how varying degrees of marginalization and empowerment have been compounded over time through participatory mapping, extending existing discrepancies within Río Negro over its long-term benefits.

1.5.1 Theoretical Contributions

The theoretical contributions of this dissertation provide new insight on how conditions of marginalization and empowerment emerge and may be reinforced or reduced through participatory mapping over the long term. Frequently, the direction of participatory mapping projects may be manipulated by participants and outsiders to enforce a separate agenda or perspective that subverts the ambitions of the project. These external influences may be intentional or involuntary, but can nevertheless complicate and potentially threaten the direction, objectives, and “participatory” nature of the proceedings.

The pervasiveness of such cultural biases in the acquisition, acceptance, and production of knowledge (Mayo, 2010) often undermines intended “participatory” methodologies. Despite the ethnically homogenous composition of Río Negro, prevailing political, economic, and social interests influenced how local elites aligned the development of microturbines to their interests, further marginalizing those in greater need. With access to electricity, the politically empowered became the electrically empowered, as well. The “gap” between the most empowered and least empowered has grown significantly over the course of 16 years since the participatory mapping exercise was completed. This ever-growing chasm continues to exacerbate divisions between the more marginalized and empowered members of the community.

1.5.2 Electricity, Empowerment, and Development through Participatory Mapping

A cohort of elite residents of Río Negro first deployed microturbine technology primarily for the depulping of harvested coffee beans in 1998 (Oviedo Castellanos, 2012 and Zavala, 2012). The HCC (sponsored by Partners of the Americas⁴) aided local residents in creating a participatory sketch map⁵ of Río Negro within the context of enhancing and encouraging greater local empowerment in the aftermath of Mitch (Gaertner, 2011c). The HCC had many objectives including to “rebuild local infrastructure, repair farm-to-market roads, build retention walls and

⁴ Partners of the Americas is a non-governmental organization (NGO) funded by the United States Agency for International Development (USAID) whose goal it is to “build partnerships that create opportunity, foster understanding, and solve real-life problems” (Partners of the Americas 2014b, “Get to Know Us”) within Latin America.

⁵ This sketch map remains in Río Negro today, screwed into the exterior wall of one of the local residents.



Figure 1.6: Sketch Map of Río Negro
Source: Jeff DeGrave, 2011

embankments, clean and stabilize waterways, and rebuild damaged watersheds” (Partners of the Americas 2002, 1). Participatory mapping assisted the HCC with these and other intentions, including to identify locations of area households and businesses, erosional risk zones, (Gaertner 2011c) and hydro-microturbine installations (Gaertner 2011a).

Río Negro today remains divided over politics, philosophies on economic development, and social inequality—as well as the impacts of participatory mapping on the distribution of microturbines and access to electricity. Multiple memories of the participatory mapping exercise and differing perceptions of its legacy suggest participatory mapping reinforced existing conditions of marginalization and empowerment. Though many of the wealthier residents who

benefitted from participatory mapping continue to push for more microturbine-based energy in Río Negro, most residents lack the access to private land, water, capital, education, or the technological knowhow to take advantage of this locally-produced form of hydroelectric power. Corresponding opportunity costs also prohibit most residents from participating in this technology. The lingering discrepancies of the perceived benefits of participatory mapping continue to divide the community today.

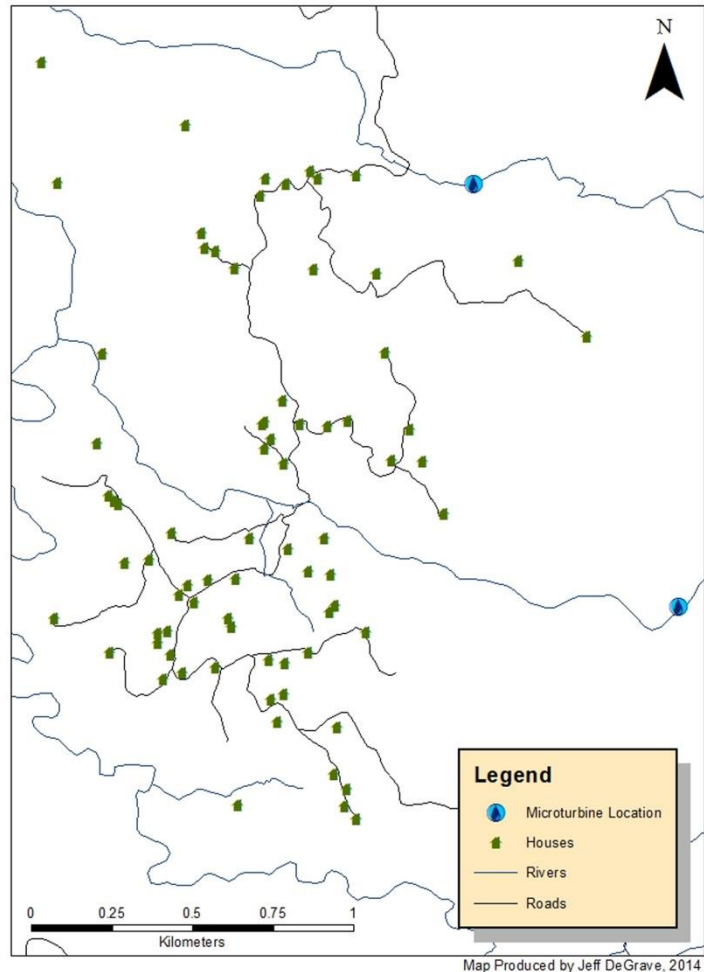


Figure 1.7:
 Proyecto Luz Results: Water Intake Locations for
 a Two-Microturbine Electrical System
 Source: Overmars, 2000.

1.5.3 A Brief History of Participatory Mapping and Microturbines in Río Negro

This convergence of differing political, social, geographic, and economic factors, constraints, and influences emerged during the participatory mapping processes. A cadre of (relatively) affluent residents presided over the participatory

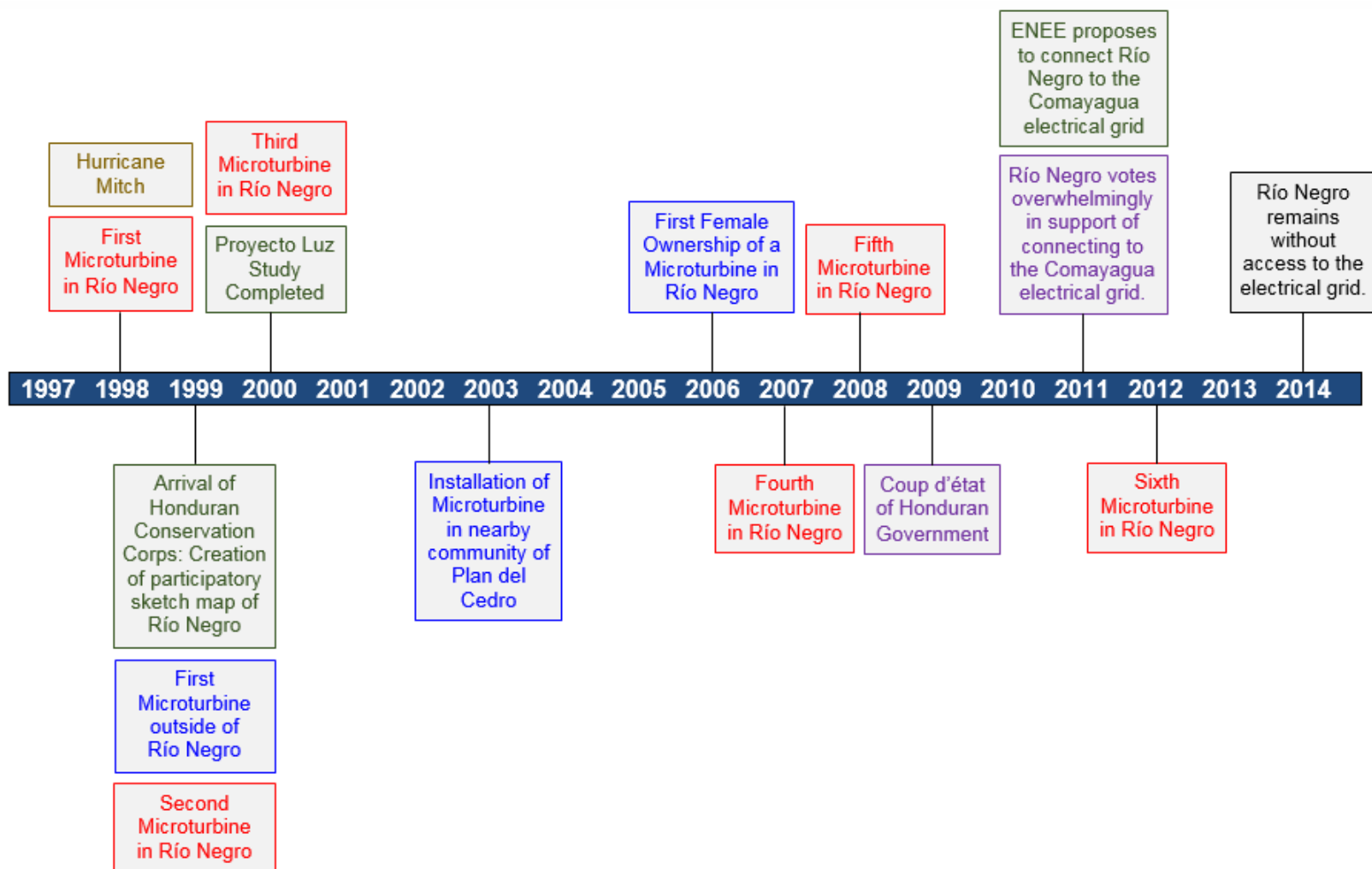


Figure 1.8: Chronology of the Development of Electrical Power in Río Negro and Related Events

mapping proceedings, dominating the direction of the mapping. Prevailing power structures successfully influenced the participatory mapping exercise, allowing these elites to claim priority in receiving a microturbine. Figure 1.8 provides a timeline of the development of electrical power in Río Negro and the related events.

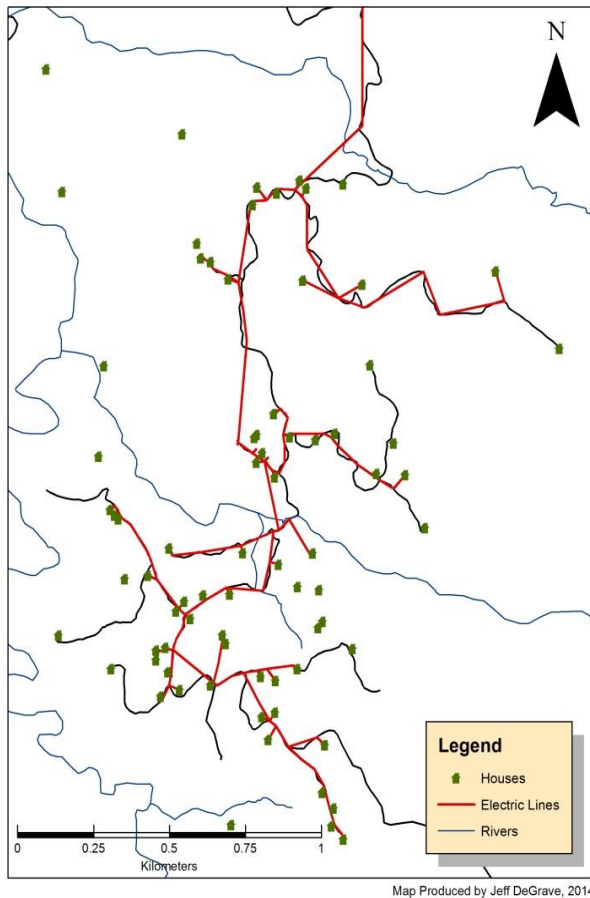


Figure 1.9:
Map of grid-accessible residences
in Río Negro
Source: ENEE, 2010.

A second microturbine system was also taken into consideration via the participatory mapping project, as well. ECOSIMCO collaborated with the Van Hall Larenstein University of Applied Sciences in the Netherlands to fund “*Proyecto Luz*” (“Project Light”). Proyecto Luz studied the viability of installing two large microturbines to power Río Negro (Overmars, 2000). These scientists investigated the possibilities of applying the microturbine concept to a much larger scale. Proyecto Luz revealed that two larger

microturbines could produce approximately ten kilowatts⁶ (10 kW) of energy—

⁶ The amount of energy a hydro-microturbine can produce is a function of the volume and speed of the water source utilized to power it; therefore, electrical production varies from season to season. The 10 kW figure was calculated during the high rainfall season and the study estimated that the maximum amount of electricity produced during the dry season would be reduced by approximately 15%. These calculations were also based on the use of a PVC pipe ranging between 5 and 5.5 inches in diameter. The pipe diameter

enough to supply electricity to nearly the entire village. Yet, this system also required significant infrastructural investments, again alienating most residents from electrical empowerment due to the initial costs of construction⁷ (Overmars, 2000). Proyecto Luz was never implemented.

More recently, new opportunities for large-scale electrification have surfaced. In 2011, the *Empresa Nacional de Energía Eléctrica*⁸ (ENEE) offered to provide power to approximately two-thirds of all households within the community (Velásquez, Yanes, Zavala, and others, 2012). Subsequent to this proposal, ninety-five percent of Río Negro's residents⁹ voted in favor of connecting to the Comayagua electrical grid, powered by the El Cajón dam. Despite the limitations of the often disparaged power grid, most of the community felt that receiving electricity via the grid would be more realistic than through the microturbine option.¹⁰ Opportunity costs to connect to the grid also appeared to be substantially lower than both of the previous microturbine options.¹¹

limits the volume of water that is available existing disparities and, in contrast to outside aspirations, may contribute to the continued marginalization of people. The results of this study suggest the potential to turn the microturbines, which also significantly impacts electrical output (Overmars, 2000).

⁷ Oviedo and Zavala sought the assistance of the nearby municipality of Comayagua to help fund the installation of system. However, the municipality expressed little interest. Oviedo and Zavala believe that the municipality denied their request because the city saw no opportunity to recover their investment as any hydro-microturbine system is generally void of cost-inducing forms of energy production (Oviedo and Zavala, 2011).

⁸ The National Electric Energy Company (of Honduras)

⁹ Figure based on voting results I obtained from the Municipality of Comayagua. For reasons of anonymity, I will not be including this list of voters or information on how any individual voted.

¹⁰ Based on survey responses as part of this study.

¹¹ According to local residents, ENEE would charge the village of Río Negro—including those with a functioning microturbine—a one-time service fee of 305,000 lempiras (approximately \$14,225 USD) and another 5,000 lempiras (approximately \$225 USD) to install the infrastructure (electric poles, wires, etc.). In sum, every grid-eligible household would have to pay nearly \$220 USD for installation and access. This up-front cost would not, of course, include monthly usage charges. ENEE allegedly promised residents that these costs would be waived for the first two years (Velásquez, Yanes, Zavala, and others, 2012), yet no official documentation exists on this alleged “promise” by ENEE. Dozens of residents of Río Negro independently confirmed this statement, but this confirmation by no means validates their claim. I was unable to find any document to support this understanding. However, it does reflect what most residents of Río Negro expect to receive from ENEE should they decide to be included into the grid.

Participatory mapping's inability to help ensure an equitable distribution of microturbine-generated electricity has left the community divided over how to proceed. Furthermore, the perception of increased empowerment and / or marginalization through participatory mapping is viewed differently by residents—largely influenced by social class, political clout, and cultural capital. Though most residents agree that “participation” was quite comprehensive during the mapping process, perceptions of how “participatory” the participatory mapping exercise actually was varies greatly between residents. Proponents of the participatory mapping exercise recall the process as “inclusive,” “democratic,” and with “full participation.”¹² Yet most heads of households in Río Negro feel as though participatory mapping was not the more equitable, self-empowering exercise for “voiceless” populations that proponents would suggest. Residents who received a microturbine through participatory mapping have added to their relative empowerment by selling electrically-powered services, attracting Western tourists who seek “modern” conveniences such as refrigeration, and expanding their own coffee production. Contrarily, those who did not benefit from participatory mapping continue to see few significant changes in their lives 16 years after the completion of the mapping exercise.

Discrepancies over the impacts of the participatory mapping project continue to linger over the future of electricity in Río Negro. Though nearly all residents of Río Negro desire electricity,¹³ differences persist over the preferred means of possible electrification depending one's economic limitations. Despite the use of

¹² Information obtained through anonymous interview responses as part of this study.

¹³ Based on survey responses as part of this study.

participatory mapping to create a more democratic means to foster local decision-making processes, prevailing cultural hegemonies continue to amplify the palpable gap between the marginalized and the empowered. For these reasons, self-empowerment through microturbines may now be less desirable than the empowerment offered by an external party such as the ENEE. The notion of connecting to the grid is due, in part, to the limited opportunities for electrification that participatory mapping has thus far provided for most residents.

1.6 Chapter Summary

This dissertation examines the question of whether or not participatory mapping reinforces existing conditions of marginalization and empowerment by assessing the long-term impacts of a completed participatory mapping project in Río Negro, Honduras. The essence of this study seeks out the impacts of participatory mapping to determine if participatory mapping indeed made a difference in leveling existing power inequalities through its more inclusive approach to knowledge production and to identify the role it played in exacerbating or ameliorating such inequalities over the long term. This research aims to develop insights into the many entanglements, contradictions, and interrelationships between marginalization and empowerment when participatory mapping is involved.

Participatory mapping was employed in Río Negro in an attempt to create locally-produced knowledge that could “pose alternatives to the languages and images of existing power structures and become a medium of empowerment by allowing [local residents] to represent themselves spatially” (International Fund for

Agricultural Development 2009, 7). Despite this more inclusive decision-making process, questions remain as to the degree of participation in the process and if participatory mapping in Río Negro only empowered the elite residents of the community while increasing the political and social alienation of the others. Participatory mapping's ability to prioritize access to electricity was impacted by political forces that have led to mixed views as to the degree of marginalization and empowerment realized by the community. This study offers an opportunity to examine if differences in marginalization and empowerment are reinforced through participatory mapping over the long term.

CHAPTER 2: Literature Review

2.1 Overview

This chapter centers on the theoretical basis of participatory mapping as well as the intersections between participatory mapping, marginalization and empowerment. Engaging the research questions connected to participatory mapping, marginalization, and empowerment studies helps locate the intellectual contributions of this dissertation. Participatory mapping was developed over the course of several decades during the latter half of the twentieth century, ostensibly to allow the “unheard voices” of both the Global South and North to be incorporated into and recognized within knowledge production. Many scholars view participatory mapping as a more democratic tool of spatial analysis, while others see it as another neocolonial tool of exploitation. In Río Negro participatory mapping did not live up to its billing as a more representative means of knowledge creation and did not empower its users as advocates of participatory mapping would suggest. In fact, only a select group of participants were empowered by its utilization and most users, those who participatory mapping intended to empower, were even further marginalized.

In the mid-1990s scholars began to recognize how participatory mapping reinforced culturally hegemonic positions of power on both local and global scales. Many scholars have since addressed the limitations of participatory mapping as well as its dubious outcomes of empowering historically marginalized communities and individuals. The foundational element of empowerment through participatory mapping became open to question, leading to a flurry of criticism and skepticism

of its utility. Though many studies addressed the immediate and short-term limitations of participatory mapping, limited knowledge exists on the long-term impacts of participatory mapping.

Section 2.2 introduces the historical roots of participatory mapping and its connections to postcolonial theory while Section 2.3 focuses on the evolution of participatory research in both the Global North and South. Subsection 2.3.1 details the theoretical linkages between participatory action research (PAR), participatory mapping, and what is meant by the term “empowerment.” Subsection 2.3.2 then discusses a collection of historical groundbreaking applications of participatory research within the discipline of geography. Subsection 2.3.3 reviews several renowned participatory mapping projects, introduces some of the more notable participatory geographers within Latin America, and explicates the roles that participatory research has played in empowering indigenous societies. Subsection 2.3.4 examines the many critiques of participatory mapping that not only question its ability to empower, but how it tends to reinforce existing conditions of marginalization.

Subsection 2.3.5 adds to the discussion of the critiques of participatory mapping by further exploring the influences and impacts of external forces on participatory mapping projects. Subsection 2.3.6 explores the concept of empowerment and how scholars, international development organizations, and international financial institutions view the idea of defining and measuring it. Subsection 2.3.7 contextualizes what is meant by the terms empowerment and marginalization while Subsection 2.3.8 reviews various theories and approaches

to measuring empowerment through participatory research. Finally, I provide a chapter summary in Section 2.4.

2.2 A Brief History of Participatory Mapping and its Intellectual Roots

The theoretical origins of participatory mapping dates back over 50 years through PAR, or participatory action research (Fals Borda, 1958). PAR aided in the development of many of participatory mapping's foundational elements by emphasizing participatory "grassroots empowerment and local control" (Khan and Chovanec 2010, 34). PAR also "has a long history as the research method of choice for marginalized communities" (34) in the Global South, reflective of where participatory mapping is frequently applied today.

Although PAR had ignited the movement toward participatory geographic research and participatory mapping in the Americas, participatory research had generally remained a rather uncommon undertaking until the late 1960s. Many early participatory mapping projects emerged in the U.S. and Canada, focusing on indigenous territorial issues (Sonnenfeld, 1956; Freeman, 1976) and urban matters such as landscape architecture and neighborhood blight within the United States (Irwin, 1967; McHarg, 1969; Halprin, 1969; Bunge, 1969; Steinitz, 1970; and others).

Not until the advanced development of GIS systems in the mid-1990s did participatory mapping find significant usage in the Global South. The spread of public participatory GIS (PPGIS) projects across the developing world (Rundstrom, 1995, Peluso, 1995; Weiner et al., 1995; Smith, R.C. 1995; and others) included

several landmark projects within Latin America. Honduras, itself, is home to two of these groundbreaking PPGIS efforts to empower historically marginalized populations: Peter Herlihy's pioneering efforts to assist indigenous communities in Río Plátano and Bernard Nietschmann's studies of the Miskito Indians, in 1992 and 1995, respectively. Most participatory mapping exercises in Latin America have focused on indigenous issues, attempting to support tribal land claims and to aid in resolving territorial disputes through locally-produced spatial representations (Arvelo-Jiménez and Conn, 1995; Brown et al., 1995; González, Herrera and Chapin, 1995; Jarvis and Stearman, 1995; Nietschmann, 1995; Herlihy and Leake, 1997; Toledo Maya Cultural Council and Toledo Alcaldes Association, 1997; Dana, 1998; Herlihy, 1998; among others). However, this research project varies from this common application of participatory mapping in Latin America by focusing on the interplay between marginalization, empowerment, and participatory mapping within an entirely mestizo society.

With the objective to empower marginalized populations, participatory mapping and PPGIS fit within the rubric of postcolonial theory. Postcolonial theory aims to reconfigure Western-led (and Western-imposed) discourse, knowledge, and domination (Peet and Hartwick, 2009) in an attempt to empower "other" populations (Saïd, 1978) and to provide a forum in which "subaltern" populations may speak (Spivak, 1988). Recognizing that all knowledge is historically and culturally situated, postcolonialism critiques the hegemony of Western discourse that has tended to marginalize, homogenize, and simplify indigenous knowledge (Lawson, 2007). As knowledge and power are inextricable from one another,

marginalization and empowerment are therefore tied to all knowledge production—including that of participatory mapping.

Postcolonial theory attempts to counter historically dominant discourses and the “rule by experts” (Guldi 2013, “Can Participatory Maps Save the World?”). This intellectual approach parallels participatory mapping’s epistemology of empowerment through alternative knowledge production. Participatory mapping and postcolonial theory further complement one another as they share common values and ideologies—countering dominant discourses of power by seeking greater inclusiveness, multiple voices, and “bottom up” approaches to knowledge creation (Taylor-Lovell, 2007). Participatory mapping’s postcolonial approach to knowledge production aims to “[represent] the potential for an alternative means of storytelling and place-making” (Sletto 2012, 13) “[e]ndeavors to involve youth, elders, women, First Nations and other segments of society that are traditionally marginalized from decision making processes...[and] to help solve problems in specific sectors of society” (Aberley and Sieber 2002, “Public Participation GIS (PPGIS) Guiding Principles”).

The ideals of greater equity and inclusivity in participatory research have helped popularize participatory mapping as a viable research tool over the past two decades (Chambers, 1994; Nietschmann, 1995; Rundstrom, 1995, Peluso, 1995; Herlihy and Leake, 1997; Harris and Weiner, 1998b; and others). Scholars sought to facilitate the empowerment of local populations by intervening in specific areas, communities, and development projects. This increased awareness and inclusion of local, often “unheard” societal values within mapping reflected a

marked departure from previous positivistic understandings of both mapping and mapmaking.

Despite its wide proliferation throughout the Global South and North, participatory mapping continues to endure significant criticisms regarding the disconnect between its idealized goals of greater empowerment and the realities of its practices (Kyem, 2001; Craig, Harris, and Weiner, 2002; Harris and Weiner, 2002; Chapin, Lamb, and Threlkeld, 2005; Dunn, 2007, and others). Though the primary guiding principle of participatory mapping may state that it is “grounded in value and ethical frameworks that promote social justice, ecological sustainability, improvement of quality of life, redistributive justice, and the nurturing of civil society” (Aberley and Sieber 2002, “Public Participation GIS (PPGIS) Guiding Principles”), its ability to truly empower is open to question. For example, Peter Kwaku Kyem notes that despite the innumerable participatory mapping case studies regarding community empowerment, scholars remain uncertain as to “whether or not fundamental shifts [in empowerment] are occurring” as a result of the implementation of participatory mapping (2001).

The questionable extent to which participatory mapping actually empowers is impacted by multiple factors. Participatory mapping projects often require the external expertise and guidance of university researchers, NGOs, or international development agencies, potentially undermining locally produced knowledge and the voices “from below.” In the case of Río Negro, the Honduran Conservation Corps (HCC) helped facilitate the participatory mapping project under the auspices of “empowering” the local community to more effectively manage local resources

(Granada, 2002). Yet nearly two decades later, the degree of empowerment gained through this participatory mapping exercise remains in question as most local residents are now seeking empowerment through the ENEC, the national electrical company.

International development and financial institutions on every scale have also come to embrace the use of participatory mapping to empower inhabitants of the Global South. In fact, the World Bank's Year 2000 Millennium Goals included empowerment as a key component of its development agenda, identifying it as "one of the three pillars of poverty reduction" (World Bank, 2001). An untold number of metrics have been developed over recent decades to quantify empowerment through participatory research—including participatory mapping. Yet the methodologies employed to measure empowerment have proven to be as controversial and open for critique as participatory mapping, itself. As a result, participatory mapping's ability to empower its users continues to receive scrutiny—despite its vast propagation across the Global South and North.

2.3 The Promise of Empowerment and the Roots of Participatory Mapping

Among the earliest connections between participatory mapping and empowerment was the development of Participatory Action Research (PAR) in the 1950s. Colombian sociologist, Orlando Fals Borda, undertook participatory research not only to break the existing cultural hegemony of traditional science, but to provide a voice to rural, marginalized populations (Fals Borda, 1995). Changes in agricultural practices and land tenure policies led by the United States

(Ministerio de Agricultura, 1954)¹⁴ were altering traditional systems of food production in Latin America (Fals Borda, 1958). Fals Borda employed participatory techniques to gain a local understanding of geographic issues relating to marginalization and empowerment by examining changes in land rights, agricultural reform, mechanized farming, and planting techniques (1958). By creating participatory locally-produced geographic knowledge, local farmers would ostensibly be empowered to counter Western-led agricultural development in Colombia (1958).

As the use of PAR began to widely propagate, many researchers came to view it as a “cultural broker between powerful institutions and...disenfranchised citizens,” greatly influenced by the socially-activist ideologies of Fals Borda and Paulo Freire (Kemmis and McTaggart, 2008). Out of PAR evolved countless forms, objectives, and applications that became key components of participatory mapping that are still used today. Included within this rather entangled collection of various forms of participatory research are: PAR, Participatory Mapping, Participatory Rural Appraisal (PRA) (Chambers, 1997), Progress in Community Health Partnerships (PCHP) (O’Fallon and Deary, 2002), Community-Based Participatory Research (CBPR) (Israel, Schulz, Parker, and Becker, 1998), Asset Based Community Development (ABCD) (Kretzmann and McKnight, 1993), Participatory Development (PD), Community-Based Conservation (Campbell and Vainio-Mattila, 2003), amid a large and growing collection of community-orientated, socially-empowering participatory models.

¹⁴ Refers to the Colombian government’s Ministry of Agriculture

Yet within the many iterations of participatory research, it is “participatory mapping that has been the most widespread” (Chambers 2006, 2). Participatory mapping’s “versatility and power,[...] the relative ease with which it can be facilitated, the fun, fulfillment, and pride which people derive from it [...] have helped it to spread more than any other and like a pandemic” (2). Yet, the empowerment objectives and approaches of participatory mapping still closely parallel those of PAR and continue to share several common objectives such as:

to help communities articulate and communicate spatial knowledge to external agencies, [...] to assist communities in land-use planning and resource management, [...] to enable communities to advocate for change, [and] to increase the capacity for sharing ideas within communities (IFAD 2009, 9).

The inclusion of specific language such as “enable,” “advocate for change,” and “increase the capacity for sharing ideas” all center on the idea of empowerment. The diffusion of both PAR and participatory mapping throughout the developing world to challenge historically dominant approaches to knowledge production reflects both perceived and real opportunities to empower marginalized populations. PAR and participatory mapping created alternatives to knowledge production that had historically “served the ideological function of justifying the position and interests of the wealthy and powerful” (Kemmis and McTaggart, 2008).

2.3.1 The Rise of Action Research

Fals Borda’s participatory research agenda may also be considered one of the first iterations of “activist participatory research,” or APR (Fals Borda, 1991). APR refers to a “family of approaches and methods which use dialogue and

participatory research to enhance people's awareness and confidence, and to empower their action" (Chambers 1994, 953). Many scholars, in fact, view activist participatory research as the existential rationale for PAR and that PAR could not (and should not) exist without an activist element (Peet, 1969; Berry, 1972; Harvey, 1974; Massey, 2000; Bowman and Willis, 2002; Chatterton, Fuller, and Routledge, 2007; and others). In other words, "the principle [*sic*] justification for action research is that it makes a direct contribution to transformative action and to changing history" (Kemmis 2010, 425). And given the theoretical parallels between PAR and participatory mapping, one might also view participatory mapping as an activist-oriented form of research.

Like participatory mapping, "activist participatory research"¹⁵ is commonly viewed in the Global South as a postcolonial tool of empowerment (Cancian, 1993; Chambers, 1994; Lykes, 1997; Lipman 2005; Writers and Nagar, 2006; Nygreen 2006; Dyrness, 2008; and others). Participatory mapping is predicated on its utility as a tool for change, empowerment, greater equity, and new opportunities for those who engage it. Fals Borda's research in Colombia in the 1950s affirmed "activist" notions of empowerment by addressing issues of land rights and agricultural reform. It is also here where an interconnection between Fals Borda's "activist participatory research"—where "poor and exploited people can and should be enabled to conduct their own analysis of their own reality" (Chambers 1994,

¹⁵ Not all scholars view PAR and activist participatory research synonymously. The term "activist participatory research" is far less commonly used than PAR and using the term of "activist participatory research" may (unwittingly) imply research that is "less scholarly." Some scholars have even gone as far to say that using the "activist participatory research" term "often retards academic publication and career advancement" (Cancian 1993, 92).

954)—and the foundational objectives of participatory mapping may be recognized.

2.3.2 Geography and Participatory Research

The idea of empowerment through participatory mapping has existed for nearly 60 years. Joseph Sonnenfeld's 1956 study in Northern Alaska and Canada "documenting land use and occupancy for the purpose of negotiating aboriginal rights" (Chapin, Lamb, and Threlkeld 2005, 623) is viewed by many as the "the first notable application of [participatory] mapping methodologies to issues of public policy—specifically, conflicting land and resource use" (Ellanna et al. 1985, 64). Sonnenfeld employed an early participatory mapping approach known as the "map biography." A map biography consists of:

face to face interviews with individuals who are asked questions about their use of the community's territory. [...] The locations of the use and occupancy sites are indicated on a paper base map, or onto a clear overlay taped over the map" (Tobias 2000, 12).

The Iñupiat people were attempting to empower themselves through the map biography and defend their rights in the face of "white colonists, with backing from the Canadian government, [who] began moving with ever increasing frequency into their territory" (Chapin, Lamb, and Threlkeld 2005, 623).

The Sonnenfeld study ushered in a new era that would utilize the potential of participatory research to empower marginalized populations within the Global North. Participatory research was a response to the "malaise of modernity" (Taylor 1991, *The Malaise of Modernity*) that had dominated the quantitatively-based research paradigm of the 1950s by creating an opportunity to critique long-held

forms of knowledge, understanding, and power. Three important objectives emerged out of participatory research that continue to shape the widespread application of participatory mapping to empower ostracized societies: the “democratization of scientific practice” (Kemmis and McTaggart 2008, 287); the consideration of subjective, qualitative information, and the opportunity for “political agency” (288). These goals combine to capture the imperative of all participatory research—including participatory mapping: empowerment through local knowledge production.

One of the first major movements toward empowerment through participatory mapping involved inner city neighborhood organizations. Urban communities embraced this new approach to conduct self-directed neighborhood spatial analyses (Irwin, 1967). The Civil Rights Movement in the United States aided in the call for greater empowerment of black populations in urban centers, leading to the passage of the Model Cities Act of 1966 (Kaplan, 1970). The Model Cities Act “encouraged the formation of citizen groups” to address “issues of power” through urban planning (Guldi 2013, “Can Participatory Maps Save the World?”). This legislation served as the forerunner to the formations of citizen-led participatory action groups that spearheaded numerous experimental participatory projects centering on urban issues and African-American empowerment throughout the United States in the 1960s. These projects included organizations such as the Hough Development Corporation in Cleveland (1967), the Southwest Harlem Commonwealth Council (1967), and the Bedford-Stuyvesant ghetto of New York City (1968), among many others (Arnstein, 1969).

Sherry Arnstein's groundbreaking publication "A Ladder of Participation" (1969) reflected increasing interest by scholars in employing participatory mapping as a tool of empowerment. Bill Bunge's "Detroit Geographical Expedition" (1969) still serves as one the most recognizable (and controversial) examples of using participatory mapping for purposes of empowering marginalized populations. Bunge's "Detroit Geographical Expedition" (1969) "work[ed] with community groups on local research problems" (Horvath 1971, 85) by incorporating active societal contributions as essential components of this new geographical approach. These early experiments led to numerous urban participatory mapping projects that also aspired to empower disenfranchised and neglected urban communities (Elwood and Leitner, 1998; Shiffer, 1998; Kim, 1998; Ghose, 2001; Al-Kodmany, 2002; Elwood, 2006a; and many others)

What may be the most defining moment in empowering marginalized populations through participatory mapping was anthropologist Milton Freeman's undertaking of the *Inuit Land Use and Occupancy Project* (ILUOP) for the Canadian government in the early 1970s. Following the methodology of the Sonnenfeld study, the Inuit community of Northern Canada requested the creation of the ILUOP to "produce a comprehensive and verifiable record of Inuit land use and occupancy in the Northwest Territories" (Freeman 2011, 20). By "mapping...Aboriginal peoples' own recollections of their own histories" (Usher 2003, 375), the ILUOP employed participatory maps of "traditional" knowledge "from below" to research historical land and natural resource claims. The extend of these claims were unparalleled in modern Canadian history—including over

2.84 million square kilometers (2011)—approximately one-fifth of the total land area of Canada. Ultimately, the ILUOP was instrumental in the recognition and creation of the “autonomous” territory of Nunavut in 1999 (2011), largely based on the geographical knowledge and spatial representations by a collective of indigenous Inuit communities.

The methodologies, epistemologies, and ideologies behind the ILUOP maintain an unmistakable presence in participatory mapping to this day. The “map biographies” of the ILUOP “were unlike anything that existed before, [...] inaugurat[ing] a new trajectory in the history of mapmaking” (Wood, Fels, and Krygier 2010, 130). The ILUOP was both significant and innovative as it successfully utilized locally-held knowledge on a large scale in an effort to empower, support, and protect indigenous perspectives, land claims, and resources. In fact, the ILUOP is considered by many to be “the first systematic study recognizable as a public and participatory GIS” (Candler et al. 2006, 51) that utilized computer-driven mapping technology.

The impacts of the ILUOP became most evident in the 1990s when numerous GIS-driven participatory mapping projects addressing indigenous issues “simultaneously” (Chapin, Lamb, and Threlkeld 2005, 133) emerged across all continents of the Global South. As with the ILUOP, most of these efforts also aspired to empower local, yet culturally and politically distanced populations. In Latin America, Bernard Nietschmann (1995) and Peter Herlihy (1998), charter members of the “pantheon” of participatory mapping geographers, “initiated [PPGIS] projects modeled on the Inuit Land Use and Occupancy Project” (Wood,

Fels, and Krygier 2010, 132), which ultimately served as the genesis of the PPGIS movement in Latin America. This new GIS methodology, one that combined the facilities of computerized geospatial technology with public participation, came to be known as PPGIS, or public participatory GIS.

PPGIS was viewed as a more flexible tool that integrated a diverse array of methodologies and practices and could more effectively incorporate and empower the voices of historically unrepresented populations. PPGIS combined multiple approaches, objectives, and characterizations, but its ultimate purpose was to serve as “a GIS that empowers communities” (Harris and Weiner 1998a, 67). Nicholas Chrisman adds that “equity [was] the most important goal in the use of GIS” and that one of the fundamental principles of GIS is that “be developed on the primary principle [of] fairer treatment of all those affected by the use of the information” (Chrisman 1987, 40).

For these and other reasons, indigenous communities began adopting PPGIS as a “[tool] of empowerment in what advocates call ‘counter mapping,’ ‘power mapping,’ ‘social mapping,’ and ‘remapping’” (Herlihy and Knapp 2003, 303). Nancy Peluso’s “Whose Woods are These? Counter-mapping Forest Territories in Kalimantan, Indonesia” (1995); Daniel Weiner, Timothy Warner, Trevor Harris and Richard Levin’s “Apartheid Representations in a Digital Landscape: GIS, Remote Sensing and Local Knowledge in Kiepersol, South Africa” (1995), are but two examples of the global proliferation of PPGIS projects intended to empower historically marginalized indigenous populations. Most projects addressed similar issues of resource and land management, economic development (Jardinet and

Paizano P. 2004, Smith, R.C. 1995, 2000), land conservation (Herlihy, 2001; Stocks, 2003), and the protection and creation of legally-recognizable mineral, resource, and territorial rights (Colchester 2004; Stocks 2005; Unruh 2006) by including, infusing, and creating local knowledge and perspectives (Teague, 2012).

Participatory research has since exploded across the Global North and South, including within Latin America. Most participatory research in Latin America (and the Global South) has tended to explore empowerment issues through a postcolonial lens, examining empowerment through a “colonizer” / “colonized” binary. Such studies focus on the influence and / or imposition of Western cultural systems onto indigenous knowledge and practices. Among the most notable postcolonial participatory mapping projects in Latin America include Peter Herlihy and Andrew Leake’s first participatory mapping study, titled “The Tawahka Sumu: A Delicate Balance in Mosquitia” (1990), Bernard Nietschmann’s 1995 effort, “Defending the Miskito reefs with maps and GPS: Mapping with Sail, Scuba, and Satellite,” Herlihy and Leaky again with the “Participatory Zoning and Management of the Río Plátano Biosphere Reserve, Honduras” in 1998, and Joel Wainwright and Joseph Bryan’s 2009 publication, “Cartography, Territory, Property: Postcolonial Reflections on Indigenous Counter-Mapping in Nicaragua and Belize.”

2.3.3 Participatory Research, Empowerment, and Indigenous Rights in Latin America

The diffusion of indigenous empowerment through participatory mapping still remains limited throughout much of Latin America, however. Early participatory studies tended to focus on the public participation elements of the research over the mapping components as they were led by anthropologists, public administrators, and other researchers (Fals Borda, 1958; Hall, 1975; Bryceson, Manicom, and Kassam, 1982; Chambers, 1983; and others). Consequently, it was not until the emergence of radical geography in the late 1960s that mapping was generally viewed as a potential focal point of empowerment in participatory research. Perhaps related, indigenous territories in Latin America have historically been represented with “the poorest cartographic coverage” (Herlihy and Knapp 2003, 306). Nonetheless, participatory mapping persists in its expansion into the most remote regions of Latin America, grappling with indigenous issues such as land claims, territorial disputes, and rights to natural resources, among others.

Fals Borda’s and others’ efforts served as a precursor to the oncoming zeitgeist of participatory research as a means to empower marginalized populations across the Global South. Not only was this new awareness embraced by the academy, but international development and human rights organizations also adopted similar philosophies. The International Labour Organization (ILO), a social justice agency of the United Nations formed in 1919,¹⁶ enacted new language in 1991¹⁷ designed

¹⁶ The first annual International Labour Conference was held in 1919 at the Pan-American Building in Washington, D.C.—the headquarters for the Organization of American States (OAS). The OAS “brings together all 35 independent states of the Americas” and is chartered to create “an order of peace and justice, to promote their solidarity, to strengthen their collaboration, and to defend their sovereignty, their territorial integrity, and their independence” (OAS 1948, Part I, Ch. I, Art. I).

¹⁷ ILO 169, although approved in 1989, was not “in force” until September 5, 1991.

to empower indigenous societies by protecting indigenous rights, territories, and their culture through participation.

Titled the “Indigenous and Tribal Peoples Convention” (Number 169)—or simply ILO 169, this directive uses the power of participatory research (including participatory mapping) to help identify, describe, and address the most paramount of indigenous concerns—land, resources, and the right to participate in the “development” of their own lands. For example, Article 7 of ILO 169 states that:

the [indigenous] peoples concerned shall have the right to decide their own priorities for the process of development as it affects their lives, beliefs, institutions and spiritual well-being and the lands they occupy or otherwise use, and to exercise control, to the extent possible, over their own economic, social and cultural development. In addition, they shall participate in the formulation, implementation and evaluation of plans and programmes for national and regional development which may affect them directly.

The improvement of the conditions of life and work and levels of health and education of the peoples concerned, with their participation and co-operation, shall be a matter of priority in plans for the overall economic development of areas they inhabit. Special projects for development of the areas in question shall also be so designed as to promote such improvement.

Governments shall ensure that, whenever appropriate, studies are carried out, in co-operation with the peoples concerned, to assess the social, spiritual, cultural and environmental impact on them of planned development activities. The results of these studies shall be considered as fundamental criteria for the implementation of these activities (ILO 1989, *Indigenous and Tribal Peoples Convention, C169*).

Article 15 further adds that:

The rights of the peoples concerned to the natural resources pertaining to their lands shall be specially safeguarded. These rights include the right of these peoples to participate in the use, management and conservation of these resources (1989).

Previous ILO Conventions and Recommendations did not contain specific language that empowered indigenous societies to actively *participate* in their own interests over land rights, natural resources, or economic development initiatives. Since the creation of ILO 169, 22 countries have ratified the Convention—including 15 in Latin America. Within Latin America, most of the states that have ratified ILO 169 are those with significant indigenous populations, such as Brazil, Bolivia, Chile, Ecuador, Guatemala, Mexico, Nicaragua, Peru and Honduras.

The first attempt in the field of geography at empowerment through participatory mapping in Latin America is frequently credited to Peter Herlihy in the early 1990s (Herlihy, 2003).¹⁸ Indigenous leaders of several lowland societies (mostly within Central America) began collaborating with NGOs and other similar rights-based organizations to create their own geographic representations. Indigenous societies as well as the NGOs were acutely familiar with the realities of how “official” spatial and anthropological documentation continually reinforced national agendas, colonial perspectives, and identities of power while excluding those of indigenous societies (Orlove, 1993). This “othering” of native peoples eventually “brought unprecedented involvement of local [indigenous] communities” (Herlihy and Knapp 2003, 306), leading to eventual linkages with scholars and researchers from the Global North. Indigenous societies were able to adapt and “embrace participatory research methods and Western-style maps as tools of empowerment” (306) to recapture both their territorial and cultural identities. These locally produced and derived maps were “intended to call attention to the

¹⁸ Herlihy, himself, notes that a number of participatory projects had been initiated by several indigenous societies in the lowlands of Central America prior to 1990 (2003).

importance of local peoples and argue for a pluricultural vision of national space” (306).

For example, the Tawahka Sumu, an indigenous tribe occupying the isolated Eastern coastal territory of Honduras, had endured decades of marginalization, removal, forced relocation, exile, and mass deforestation of their territories. Yet they were able to empower themselves in reclaiming a significant percentage of their historical domain through the use of their own community-produced maps (Herlihy and Leake, 1990). Each participatory map was “based on the villagers' own population census and their own attempt at mapping the lands that they claimed” (15). This identification and designation of specific parcels as Tawahka Suma territory allowed “each indigenous community with a provisional guarantee to a specific plot of land within which they could administer land use based on their own traditional methods” (15). Although the Tawahka Sumu do not, themselves, recognize individualized parcels of land, through participatory mapping they were able to empower themselves by receiving legal ownership of a significant portion of their territory (1990).

Herlihy, along with environmentalist Andrew Leake, later combined the Tawahka Suma methodology with the knowledge gained from the ILUOP into what is perhaps Herlihy's signature participatory mapping research project in Latin America in 1992: The "Participatory Zoning and Management of the Río Plátano Biosphere Reserve, Honduras” (Herlihy, 1998). The purpose of the Río Plátano Project was also to empower indigenous tribes by stopping “the invasion of colonists onto [indigenous and ladino] lands and those of the Rio (*sic*) Plátano

Biosphere” and “to secure legal recognition” and control of their lands (Herlihy 1998, 2). Herlihy noted that the “lack of [geographic] information distorted views of the region by policy makers, who saw [the Mosquitia Corridor] as an uninhabited wilderness, largely outside the effective reach of the state” (Herlihy 2003, 316). Such uninformed perspectives of bureaucrats and speculators continually exposed the region to potential exploitation by non-indigenous populations for resource exploration and development (2003). The Río Plátano project ultimately demonstrated how researchers and local populations could combine their skills and expertise to transform spatial knowledge into action that may help empower indigenous societies “in the representation and management of their lands” (Herlihy and Knapp 2003, 306).

Herlihy’s “successful¹⁹ experience in Mosquitia” (Chapin, 1992 and 1994; González, 1996; González, Herrera, and Chapin, 1995) and other early participatory mapping studies in Latin America have led to—directly or indirectly—dozens of legally-recognized indigenous claims to land and resources (Sletto et al., 2012). The majority of these projects centered on the empowerment of indigenous societies—often in conjunction with social justice movements and calls for greater indigenous land rights (Herlihy and Knapp, 2003). Furthermore, the methodologies that Herlihy had borrowed from the Tawahka Suma and the ILUOP “diffused rapidly and initiatives developed up and down the Central American isthmus” over the course of the 1990s (306). Similar participatory mapping projects

¹⁹ It should be noted that in 2013 Sharlene Mollett authored a serious critique of the “success” attained in Herlihy’s Río Plátano Biosphere project. Mollett writes that “persistent and racialized discourses and practices cast doubt on the ability of any...countermapping projects to protect Miskito and Garifuna lands against the legitimacy and growing normalization granted to *ladino* land incursions inside indigenous space” (1229).

then mobilized quickly throughout Latin America as the “results...favored...native peoples” due to the apparent ability of participatory mapping to empower its users (Herlihy 2003, 327).²⁰

Herlihy further developed and tested participatory mapping methodologies in the Darién region of Panama, as well. Herlihy viewed the Darién Gap as “the Central American ‘poster child’” for a “remote, frontier and wilderness region” (316) where indigenous populations have lived (and continue to exist) under the looming pall of “colonization and development” (316). By combining indigenous mental maps, consensual maps,²¹ oral descriptions, sketch maps, and “standard” maps, the Darién project was able to successfully achieve a number of objectives and provide empowerment to the indigenous populations by protecting the interests of the indigenous community at risk (2003). Examples of this empowerment included “the document[ation of] the spatial extent of [indigenous] natural resource use” (326), the legitimization of indigenous identities by replacing colonial toponyms with ancestral indigenous place names, the recognition by the Panamanian government of the superior detail and accuracy of the maps, the construction of a “positive environment for exchange of information and ideas [that] could help

²⁰ According to Chapin, Lamb, and Threlkeld (2005), the following selection identifies all participatory mapping projects that were undertaken in Latin America within ten years of Herlihy’s “Río Plátano” project (listed alphabetically by country): Belize (Toledo Maya Cultural Council and Toledo Alcaldes Association, 1997), Bolivia (Jarvis and Stearman, 1995; Chapin and Threlkeld, 2001; Yubanore and Quiroga, 2003), Brazil (Brown et al., 1995), Colombia (Matapi and Velasco, 2003), Ecuador (Villamil and Tsamaraint, 2003), Guyana (James, 2003), Honduras (Herlihy and Leake, 1997; Chapin and Threlkeld, 2001), Nicaragua (Nietschmann, 1995; Dana, 1998; Gordon et al., 2003; Offen, 2003; Stocks, 2003), Panama (González, Herrera, and Chapin, 1995; Chapin and Threlkeld, 2001; Smith, 2003; Herlihy, 2003), Peru (CIPTA, 2003, Shinai Serjali, 2003; Smith et al., 2003; Tuesta, 2003), Suriname, (Brown et al., 1995), and Venezuela (Arvelo-Jiménez and Conn, 1995; Silva Monterrey, 2000; Tomedes, 2003).

²¹ Herlihy defines consensual maps as spaces that are “agreed upon by a specific group and compiled from individual mental maps or other sources” (2003, 324).

formulate better indigenous-state relations” (326), among other governmentally recognized representations of indigenous identity and place.

Also materializing out the ILUOP project was Bernard Nietschmann’s highly influential participatory mapping effort in Nicaragua titled, “Defending the Miskito Reefs and GPS: Mapping with Sail, Scuba, and Satellite (Nietschmann, 1995). The purposes of Nietschmann’s project were similar to those of Herlihy’s—to geographically reestablish territorial identity and natural resource claims for indigenous communities (1995). One of the specific goals of the project was to employ the power of maps in order to “defend the land and sea territories by accurately mapping them using new technology and traditional knowledge” (37). Combining locally-produced knowledge with modern geospatial technologies, indigenous communities were eager to [demonstrate] that the “sea territory and its resources were indeed theirs,” endeavoring to expel “the lobster pirates, the drug traffickers, and the destructive industrial fishermen” (1995, 35). Like Herlihy, Nietschmann employed a methodology similar to that of the ILUOP project, assisting locally-selected leaders in their desire to “map and inventory the Miskito Reefs and underwater habitats, using Miskito names and classifications” (35). Like the Río Plátano project, numerous successes related to empowerment were realized in the mapping, identification, and indigenization of place names (1995).

It was during the Miskito Reefs project when Nietschmann quipped his oft-quoted phrase regarding the power of participatory mapping when he stated that

“more indigenous territory can be reclaimed and defended by maps than by guns”²² (Nietschmann 1995, 37). Clearly Nietschmann was a bit overly-optimistic, if not overly ideological, in his beliefs as to how effective participatory mapping could be in actuating overt change in national policies and spurring greater empowerment of indigenous populations over their territories. Furthermore, Nietschmann imagined that maps would “have transcendental power because [they] can be easily translated by everyone everywhere” (37) and that they “can be a more powerful national symbol than a flag or an anthem” (37). Participatory mapping in Latin America has since revealed that actually achieving such aspirations has proven to be a notably challenging endeavor.

Bjørn Sletto, a graduate student of Herlihy, sparked the next generation of participatory mapping scholarship in Latin America. Just as Herlihy applied his knowledge and experience in the ILUOP to his own expeditions in Honduras, Sletto utilized the participatory mapping skills he acquired on the Río Plátano project in Trinidad and Tobago. Sletto’s 2002 publication, “Producing Space(s), Representing Landscapes: Maps and Resource Conflicts in Trinidad,” would “be used to argue the point of view of the subaltern”—the marginalized populations of Trinidad—by capturing and expressing local spatial knowledge and perspectives (2002, 390). At the time, relatively little research had explored the power structures and cultural contexts in which all maps are produced—including participatory maps—and are “inherently rhetorical texts” (390). The maps created as part of

²² This sentence is the latter passage of his entire statement that reads, “More indigenous territory has been claimed by maps than by guns. This assertion has its corollary: more indigenous territory can be reclaimed and defended by maps than by guns” (Nietschmann, 1995).

Sletto's project were then operationalized as "a means of elucidating counter-hegemonic or alternative views of space" (390) intended to empower marginalized societies against the cartographic hegemonies of governments, corporations, and international agencies (2002).

Of even greater import to participatory mapping and empowerment research than Sletto's participatory study in Trinidad is his research on Venezuela's *Gran Sabana* ("The Great Savanna"). Sletto has spent the better part of the past decade employing participatory mapping to gain additional understanding of fire management issues and territorial land claims of the Pemon indigenous community (Sletto, 2008). Sletto's participatory mapping efforts with the Pemon aim to challenge dominant, government-supported views of fire control and empower the Pemon by allowing local perspectives and knowledge to guide fire prevention strategies (Sletto and Rodríguez, 2013).

Like Sletto, two other prominent scholars of participatory mapping in Latin America are continuing the legacies of Herlihy and Nietschmann. Joel Wainwright and Joe Bryan were members of Nietschmann's "Miskito Reefs" project as well as the epic production of *A Maya Atlas*²³ in 1997. Wainwright and Bryan have taken participatory mapping and empowerment research further by attempting to gauge the success of legal challenges supported by two countermapping projects in Belize and Nicaragua. Their 2009 collaboration, "Cartography, Territory, Property: Postcolonial Reflections on Indigenous Counter-Mapping in Nicaragua and Belize"

²³ *A Maya Atlas: The Struggle to Preserve Maya Land in Southern Belize* was an undertaking similar to the *Inuit Land Use and Occupancy Project*, although *A Maya Atlas* was an exploration directed by the Maya, themselves, not a federal government.

discusses the “cartographic-legal strategy” (153) that was used to assist two indigenous communities with their territorial claims. Both of these cases resonate the aspirations of Herlihy and Nietschmann’s vanguard projects in terms of empowerment, indigenous land rights, and the utilization of (counter)maps for spatial and legal representation.

This review of several of Latin America’s most significant participatory mapping researchers by no means offers a complete treatment of the diverse array of participatory mapping projects conducted in Latin America. As stated, participatory mapping has made enormous gains in its popularity and applications over the past twenty years, creating a bounty of research on empowerment through participatory mapping. Many disenfranchised societies continue to embrace participatory mapping to invoke their own power over space—frequently in collaboration with external parties. Today, more “indigenous communities and organization are forming alliances with scholars, activists, and NGOs to render legible community rights, resources uses, sacred places, and other important spatial features to outside entities” (Sletto 2012, 13).

However, participatory mapping has also revealed its abilities to disempower. For example, the participatory maps created by indigenous communities centuries ago “significantly influenced the colonial enterprise” through the “sharing” of their spatial knowledge, aiding “conquerors, explorers, and researchers to draw maps of their lands” (Herlihy and Knapp 2003, 303). That these indigenous communities were equipped with the *de facto* spatial knowledge of the very regions that captured the interests of the colonial powers, their “participation” was, of course,

ironically exploited to disempower these same communities from their historical homelands and to fuel the colonial project.

2.3.4 Marginalization and Participatory Mapping

Participatory mapping provided a host of new opportunities for indigenous populations to begin acquiring, representing, and utilizing locally-produced geographic knowledge to protect and empower their territorial and cultural interests. Yet to assume that participatory mapping will inevitably represent the interests of an entire community would be short-sighted. Despite the purported successes of participatory mapping, a host of critiques, doubts, and questions about its true effectiveness have continued to undermine its efficacy. Political conflicts, economic development agendas, and unanticipated consequences have undermined the lofty, perhaps naïve, aspirations of empowerment through participatory mapping—while simultaneously reinforcing political, social, and economic conditions of marginalization. As Craig, Harris, and Weiner noted, participatory mapping may be “seen as a powerful tool for empowering communities or as an invasive [tool] that advantages some people and organizations while marginalizing others” (1999, 1). Such issues can and do arise internally—among the very populations that may be employing participatory mapping, and externally—fomented by governments, land holders, pirates, or anyone with an interest in the outcomes of the projects, including academic researchers.

One of the larger contradictions within participatory mapping that often undermines its ability to empower is the ineffable “colonizer-colonized” aporia that emerges within many participatory mapping exercises. Though participatory mapping is designed to empower, to provide a “voice” to the culturally isolated, and to create knowledge “from below,” most participatory mapping projects are initiated, guided, managed, and funded from external, historically dominant positions (Rambaldi et al., 2006). These are, of course, the same influences that participatory mapping is ostensibly attempting to subvert. This hierarchical authority over decisions relating to participation, management and ownership of data, and direction of the research may disempower already marginalized populations by continually reinforcing the paradox that is participatory mapping.

Ironically, the presence of an external force to oversee a participatory mapping project is often critical to its success. Any number of practical and logistical matters may impede the successful outcome of a participatory mapping exercise and inviting an experienced outside member into the study may help ameliorate any number of issues. Technical problems, data integrity, organizational issues, training and expertise (Dunn et al., 1997), cultural and linguistic differences (Kyem, 2001), significant power imbalances (2001), and that the “rule of law is often weak or non-existent” (Chapin, Lamb, and Threlkeld 2005, 620), are but a few potential complications that can greatly limit the potential effectiveness of participatory mapping without the presence of an external mediator, particularly in the Global South.

Skeptics have also questioned empowerment through participatory mapping due to limitations in its inclusiveness and participation. Concerns over what and whom are implied by the term “participatory” and how can one tell if participation is actually occurring (Dunn, 2007) have frequently arisen. Chapin, Lamb, and Threlkeld summarize these uncertainties by arguing that “the term ‘participatory’ has been overused and abused [and] has been...used as a modifier for such a range of practices that it has been rendered next to meaningless” (2005, 627). Harris and Weiner add that “[u]nfortunately, most participation associated with development planning is essentially *participation as legitimization*. Community meetings are held, local input is gathered, reports are produced, and top-down planning is maintained” (2002, 248). This statement supports Aitken and Michel’s observation that participation “does not necessarily give any power to those involved in, and affected by, the decision-making” (1995, 17). Lorrilee McGregor further notes that subjects of participatory mapping projects may feel “their role is small in comparison to that” of external parties and that the “community aspect of the ‘blend’ [of participatory mapping] is simply used when convenient and when it does not interfere with the Western scientific approach” (2001, 11).

2.3.5 The Aporia that is Participatory Mapping

But most germane to this dissertation is the unsteady relationship between marginalization, empowerment, and participatory mapping. The hegemony of Western culture over the leadership and direction of most participatory mapping projects is the “aporia” about which Wainwright has expounded at length (2008).

The aporia is that, on one hand, participatory mapping provides an outlet for marginalized voices to be heard; yet, it often requires the management, interpretation, and representation of elites to bring this locally-produced knowledge forward. Of course, any attempt to empower “marginalized,” “voiceless,” and subjugated populations carries with it an implicit challenge to the prevailing cultural hegemonies (Kyem, 2001). And any such action to redistribute power “can be easily hijacked by community elites” (Rambaldi et al. 2006, 4).

Enabling this “hijacking of power” is the reality that participatory mapping projects are often “resource poor” and become subject to the direction of “external experts” (Rambaldi et al. 2006, 6) which may severely limit the amount of empowerment that actually takes place. Reinforced by limited local financial resources, participatory mapping projects may become heavily reliant on external assistance in order to simply function. This dependency may then compound various difficulties due to competing agendas, ideas, and opinions as to how the funding could be most effectively operationalized (Chapin and Threlkeld, 2001).

Participatory mapping projects also regularly involve an amorphous melting pot of issues that hinder their ability to empower. Consequently, questions continue to linger as to whether or not participatory mapping embodies an “adequate conceptualization of ‘empowerment,’ the way in which to achieve it, or indeed who or what empowerment [is] for” (Kemmis and McTaggart 2008, 285). Participatory mapping exercises must ably negotiate between any number of preexisting economic, political, and social power structures and forces. If not, authoritative entities may then impose dogmatic policies on the direction, degree of

participation, and desired outcomes—rendering the participatory mapping project unable to deliver the empowerment (or participation) it professes to imbue.

The limitations, liabilities, and *d*isempowerment potential of participatory mapping are all visibly evident in the 1993 project led by Peter Herlihy and anthropologists Mac Chapin and Bill Threlkeld. The study, undertaken on behalf of the Center for the Support of Native Lands in Panama, provides a comprehensive “showcase” of how participatory mapping—whether referring to the process or the results—may not be the utopian approach to empowerment that Nietschmann had envisioned. The Native Lands study, in fact, brings to light a number of examples of how the users of participatory mapping were further marginalized by this purportedly “more democratic approach” to knowledge creation.

Perhaps most strikingly, the foundational principle that participatory mapping is designed to empower its users was being challenged during the Native Lands project as indictments of colonialist practices began to surface. Issues of control, organization, direction, purpose, participation, representation, management and ownership of the project’s data, maps, texts, results, artifacts, and finances dogged the entire mission. Accuracy of the data and results were overtly questioned (Chapin and Threlkeld, 2001) and the project was also \$50,000 over budget (2001). Chapin and Threlkeld even went so far to accuse Herlihy of taking proprietary liberties over the ownership of the (participatory) maps created by the consortium of indigenous participants “to give prominence to his name on the final map’s credit list...as the ‘Principal Investigator’...at the head of the ‘credits’

section” (Chapin and Threlkeld 2001, 83).²⁴ Though participatory mapping was intended as a tool of empowerment to foster change, promote greater equity, and enable new opportunities by “decolonizing” knowledge and extant power structures, these goals were subverted by those who were already in positions of power—the researchers. Therefore, by extracting information from the indigenous populations and assuming proprietary license over the data and artifacts produced, participatory mapping failed to empower those for whom it was employed. And, in fact, it also further marginalized and already disadvantaged population while providing greater empowerment for the already privileged. The issues that surfaced during the Native Lands project provide a comprehensive account of how marginalization and empowerment are frequently reinforced through participatory mapping.

Herlihy (and Jerome Dobson) was also involved in another controversial participatory mapping project in 2006 that has raised larger questions regarding empowerment, colonial practices, and the use of advanced mapping technologies (Sedillo, 2009; Wainwright, 2012a, 2012b, 2013a). This PPGIS project, entitled “*México Indígena*,” is part of a much larger U.S. Governmental study: the Bowman Expeditions Program (American Geographical Society, 2014). The Bowman Expeditions Program is directed by the American Geographical Society and “provides a framework for gathering human geography data through fieldwork in foreign areas” (American Geographical Society 2014, “Bowman Expeditions”). Herlihy and other proponents of the Bowman Expeditions claim that the purpose

²⁴ Herlihy denied these and several other accusations against him.

of the program is “to use maps made with indigenous communities..., ostensibly with an eye towards securing legal recognition of their property rights” (Bryan 2013, “Bowman Expedition 2.0”).

Yet, because most of the funding for the Bowman Expeditions originates in the U.S. Department of Defense (Sedillo, 2009), many feel that the program is “little more than intelligence gathering efforts carried out by civilian professors and their graduate students” (Bryan 2013, “Bowman Expedition 2.0”). Given that the data collected as part of these participatory mapping projects end up in the hands of the United States military, concerns of not only disempowerment but geopiracy have also surfaced (2013). Though Herlihy and Dobson claim they were “...aware of the implications of the technical advances of [GIS] with regards to...geoslavery, or the abuse of geographic data to control populations” (Sedillo 2009, “The Demarest Factor”), many scholars feel the Bowman Expeditions “replay some of colonialism’s oldest tactics of extracting information from communities for people (the U.S. Army) who live elsewhere” (Bryan 2013, “Bowman Expedition 2.0”). Ironically, the data from *México Indígena* still remains untranslated (into Spanish or any indigenous languages) and unavailable to the local participants who produced it (Sedillo, 2009). The debate over the scholarly contributions of the *México Indígena* project continue to linger to this day (Wainwright, 2012a, 2012b, 2013a; Bryan, 2014; Willis, 2014, and others). Or, as Harris and Weiner might attest, the *México Indígena* project was an example of “*participation for publication*, in which academics undertake research to produce books and journal articles while

leaving the subject communities with little (if any) tangible benefits” (Harris and Weiner 2002, 248).

Without access to the data, the technology, or the specialized knowledge needed to question this new form of geospatial science, the indigenous populations who participated in the *Mexico Indígena* project have effectively become even more marginalized, voiceless, and disempowered through participatory mapping. Although it may be philosophically aligned with empowerment through the production of local knowledge, many scholars have raised critical questions regarding participatory mapping’s ability to empower marginalized populations. When contestations of power arise, such conflicts may not only impede, subvert, or discredit the research (and researcher), but may be used as a (neo)colonial tool to exacerbate the marginalization of the very same participants that participatory mapping is seeking to empower. As Joel Wainwright states, “a [participatory] map that turns the tables on colonialism may produce a worlding that still turns within a colonial form a power” (Wainwright 2008, 272). Wainwright’s perspective on participatory mapping echoes a prevailing skepticism of the ideological (and idealistic) aspirations behind participatory mapping.

2.3.6 What is Empowerment? And Can It Be Measured?

Participatory mapping maintains an inextricable relationship with the concepts of marginalization and empowerment as it was “founded on the belief that engaging lay community members in the research process will contribute to the empowerment of individuals and, in turn, facilitate community mobilization to

overcome oppression” (Taylor-Lovell 2007, 66). In order to achieve empowerment, participatory mapping attempts to “engag[e] in counter-hegemonic cultural activity,” to stimulate political action, and to empower excluded populations (Mayo 2010, 28) through local participation. In other words, participatory mapping seeks to more effectively represent those who Antonio Gramsci defined as the “subaltern” (Gramsci, Hoare, and Nowell-Smith, 1971) reflecting the “unheard voices” of the disenfranchised, oppressed, and marginalized masses. This potential for empowerment is borne out of participatory mapping’s more “integrative and inclusive process-based set of methods” that are “amenable to public participation, multiple viewpoints, and diverse forms of information” (Krygier 1998, “Public Participation Visualization, GIS, and the WWW”).

Participatory mapping’s community-based approach has greatly contributed to its popularity and increased application among historically underrepresented and marginalized groups (O’Sullivan, 2006). Mapping and mapmaking have been traditionally defined, shaped, and produced according to the terms of the hegemonic (frequently colonial) forces behind the maps (Wood, 1992). However, participatory mapping evolves from an entirely different theoretical, social, and political perspective— aspiring to represent the voices of the colonized, the marginalized, and the disaffected—and to increase the empowerment of its users (Harris and Weiner, 1996 and 1998; Kyem, 2001; Harris and Hazen, 2006; Sletto, 2012, and others).

But what of this notion of “empowerment?” What does empowerment mean? Who defines it and for what purposes? Defining who or how one is empowered (or

marginalized) through participatory mapping is unquestionably an exercise in ambiguity, but one that has garnered a “surfeit of interest” over the past several decades (Perkins and Zimmerman 1995, 571). During this timeframe, academics, NGOs, international development agencies, and international financial institutions have all endeavored to measure empowerment through participatory research (including participatory mapping), leading to an overwhelming volume of empowerment theory and metrics.

2.3.7 How Can Empowerment and Marginalization Be Defined?

The World Bank notes that “empowerment” possesses “different meanings in different sociocultural and political contexts, and does not translate easily into all languages” (2002, 10). For this reason no single definition of empowerment can be applied to all situations and circumstances—even within participatory mapping. In fact, virtually every agency, international financial institution, or international development-oriented NGO has their own definition of empowerment. To offer but a few examples of the myriad understandings of “empowerment,” UNICEF’s definition of empowerment focuses on structural gender inequalities that affect women and girls (UNICEF, 2015), the International Fund for Agricultural Development (IFAD) also sees empowerment through the lens of access to resources, satisfying one’s “basic needs,” and the degree of participation in decision making by vulnerable populations (IFAD, 2014), while the World Bank views “the expansion of assets and capabilities of poor people to participate in, negotiate with, influence, control, and hold accountable institutions that affect their

lives” as their measure of empowerment (2002, vi). Although no singular definition of empowerment is universally agreed upon, common themes frequently emerge within empowerment discourse—including those espoused by participatory mapping.

The theory behind participatory mapping reveals notable linkages between these and other definitions of empowerment, despite the absence of a singular meaning. For example, participatory mapping has been utilized to defend land rights (Chapin, Lamb, and Threlkeld, 2005), to “decolonize” science knowledge (Kemmis and McTaggart, 2008), to achieve integration and greater inclusivity (Krygier, 1998), to reestablish territorial identity and control (Herlihy and Leake, 1990; Nietschmann, 1995, and others), to enable natural resource claims of indigenous populations (1995), to counter prevailing power structures (Orlove, 1993), to support greater political and social agency (Kemmis and McTaggart, 2008; Elwood, 2006a; Sletto, 2002, and others), among numerous additional representations of empowerment. However, within the multiple permutations of empowerment and its meanings within participatory mapping, the academy, and development organizations, identifiable commonalities do surface: political agency for vulnerable populations, addressing questions of inequity, and challenging dominant (colonial) discourse that fails to recognize alternative forms of knowledge.

Grappling with what is meant by “marginalization” is equally challenging. As with empowerment, “marginalization” is not simply one thing, not just one status” (Jenson, 2000). For this reason, a multitude of definitions abound within

participatory research, scholarship, and professional activities, as well. Many researchers view marginalization as a form of or synonym for social exclusion (Sen, 2000; Kabeer, 2000; Salais, 2003; and others). For example, Dr. Digumarti Bhaskara Rao, the Chairman of the Board of Studies in Education at Acharya Nagarjuna University in India, notes in his book, *For All: Issues and Trends* (2007), that “[m]arginalization occurs when people are systematically excluded from meaningful participation in economic, social, political, cultural and other forms of human activity in their communities and thus are denied the opportunity to fulfil themselves as human beings” (223). Similarly, UNESCO also sees marginalization from a political perspective, as a “form of acute and persistent disadvantage rooted in underlying social inequalities” that “is the product of institutionalized disadvantage – and of policies and processes that perpetuate such disadvantage” (135).

Revisiting the underlying themes of each concept reveals the notably inverse relationship between marginalization and empowerment. For instance, empowerment endorses greater inclusivity while marginalization suggests exclusion. Empowerment implies the ability to counter prevailing power structures while marginalization exists, in part, because of them. Empowerment also necessitates greater equality while marginalization implies results of pervasive inequities within a given society.

This is not to say, however, that one cannot be simultaneously marginalized and empowered. As neither marginalization nor empowerment solely exist in a singular form, any number of forces of marginalization or empowerment may be

present at the same time. For this reason, determining who is or is not marginalized or empowered by a particular activity or influence may not be fruitful as the intertwining and commingling of forces of marginalization and empowerment reveal multiple, complex, and multifaceted social, political, and economic dimensions within any given society. For this reason, this study of participatory mapping does not attempt to isolate these forces, imply a “cause and effect” relationship between participatory mapping and the marginalization or empowerment of individuals who engaged with it, or identify which individual factors were most significant in determining who was marginalized and / or empowered through participatory mapping. The goal of this dissertation is to examine if existing conditions of marginalization and empowerment may be reinforced through participatory mapping.

2.3.8 Measuring Empowerment

As noted above, participatory mapping was developed to engender greater empowerment for historically marginalized populations through a postcolonial bottom-up, locally-produced form of knowledge production. Among the first researchers to attempt to measure empowerment was Pierre Bourdieu. His 1984 publication,²⁵ *Distinction: A Social Critique of the Judgement of Taste*, combines theory, quantitative, and qualitative (via interviews) methodologies to gauge how social class may influence a person’s individual tastes—reemphasizing the power of cultural capital (1984). Bourdieu’s pioneering multi-methodological approach

²⁵ Originally published in French as *La Distinction* in 1979

that linked theory with empirical analysis garnered him the distinction of having written “one of the ten most important books of sociology of the 20th century” (International Sociological Association 1998, “Books of the Century”). This research project also employs a multi-method analysis to assess if existing conditions of marginalization and empowerment are reinforced through participatory mapping²⁶.

Many scholars, NGOs, international financial institutions, and international development organizations have adopted various forms of Bourdieu’s multi-method approach in their attempts to measure complex social issues such as empowerment, social inclusion, resilience, equity, and others (Dunn, 2005; Wallerstein, 2006; Bevan and Pankhurst, 2007; DESA, 2010; Hughes and Bushnell, 2013). As previously noted, the World Bank’s Year 2000 Millennium Goals included empowerment²⁷ as a key component of its development agenda (2001). Since 2000, the World Bank has published an overwhelming (if not absurd) number of “measuring empowerment” tools, analytics, learning modules, discussions, best practices, training techniques, amid hundreds of documents that speak to empowerment assessment (2002, 2004, 2005a, 2005b, 2007, 2008, 2013a, 2013b, 2013c, and many others). Most of the approaches that the World Bank advocates for measuring empowerment also apply a multi-method theoretical and empirical approach (2007).

²⁶ For the full assessment of how participatory mapping reinforced conditions of marginalization and empowerment in Río Negro, see Chapter 4: Analysis and Results.

²⁷ The World Bank defines empowerment as “the process of enhancing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes” (World Bank 2005a, 1).

The World Bank's Year 2000 Millennium Development Goals arguably kick-started the ongoing paradigm of "empowerment measuring" in international development. Still, measuring empowerment remains a rather complex undertaking. International financial and development institutions such as the World Bank have since produced reams of technocratic econometric data as part of a larger effort to measure or describe the realization of "empowerment." These studies have been met with skepticism, ambivalence, and differing interpretations of their purpose, accuracy, and value (O'Rawe, 1999; Jolly, 2003; Ariffin, 2004; Fernandez-Armesto, 2004; Attaran, 2005; Amin, 2009; Hulme, 2010, and others).

The World Bank's interest in participatory mapping and measuring empowerment began to surface in the mid-1990s. In fact, one of the World Bank's earliest utilizations of participatory mapping was to help conduct a poverty assessment in Cameroon (World Bank, 1995). This study measured the degree of poverty and (dis)empowerment of women in the region (Bosak and Schroeder, 2005). However, the World Bank altered its participatory approaches after "recogniz[ing] that different stakeholders have different levels of power, different interests, and different resources" (World Bank 1996, 7). Despite this awareness, the World Bank (and others) continues to struggle in its attempts to assess and measure the empowerment it has been seeking to instill through participatory mapping (2013c).

For this reason, Jon Corbett and Peter Keller contend that "empowerment," specifically through participatory mapping, is a "widely and often casually used term" which has "suffered from semantic inflation and...has come to mean almost

nothing” (2005, 93). “Empowerment” is indeed a subjective and relative term and clearly no definition or measurement of empowerment can be universally accepted nor openly repudiated. Therefore, the degree to which empowerment may be achieved through participatory mapping remains open to critique.

Bourdieu’s theoretical and empirical perspectives also create a useful link to connect marginalization, empowerment, and participatory mapping. Bourdieu’s *magnum opus*, *The Forms of Capital* (1986) elucidates his theory of cultural capital. Bourdieu views culture as a form of power, steering and directing activities in a manner that reproduce preexisting power structures and conditions of marginalization and empowerment (1986). In Bourdieu’s words, cultural capital has a “capacity to...reproduce itself in identical or expanded form, contains a tendency to persist in its being, [and] is a force inscribed in the objectivity of things so that everything is not equally possible or impossible” (1986, 46). In other words, those who have greater cultural and political authority (or cultural capital) are inclined to reproduce their positions of power within a given society (1986). A disproportionate influence of cultural capital has the ability to limit the intended “democratic approach” of participatory mapping and affect the possibilities of marginalization and empowerment within any participatory mapping project.

Similarly, many theorists have engaged the idea of power and, therefore empowerment, from alternate, non-technocratic perspectives. For example, Elisheva Sadan is most succinct in her summary of quantifying empowerment by stating, “[p]ower is exercised and not held. In other words, it is not at all important to measure power, or to attempt to locate it. The important question is how power

acts and what it produces” (Sadan 2004, 63). In this vein, this research project does not attempt to *measure* marginalization and empowerment, but does employ a number of criteria (see Section 4.3: Identifying Marginalization and Empowerment for the specific criteria used in this study) that may be used to *contextualize* the increased marginalization and empowerment of various individuals in Río Negro through participatory mapping. In this dissertation I essentially embrace Sadan’s perspective by contextualizing how participatory mapping reproduces conditions of marginalization and empowerment rather than assessing empowerment through a quantitative rubric.

2.4 Chapter Summary

The theoretical basis of participatory mapping comprises multiple epistemologies, ideologies, methodologies, and cultural contexts present in both the Global North and South. Participatory mapping was a response to prevailing hegemonies in society, science, and approaches to international development. Countering prevailing power structures in what had been historically “acceptable” knowledge, participatory mapping has evolved to include a number of alternative supporting philosophies, epistemologies, ontologies, and methodologies. Among the profusion of influences that have helped shape participatory mapping over the past twenty years include the development of postcolonial theory, the facility of GIS, and concerted international development efforts to empower marginalized populations throughout the world. These elements continue to play significant roles

in the proliferation of participatory mapping across the Global South—including within Latin America.

Nonetheless, an unending onslaught of questions continues to surface regarding not only the difficulties in measuring “empowerment,” but with participatory mapping’s tendencies to further entrench existing conditions of marginalization and empowerment among its users. Scholars continue to wrestle with such “power relations” (Weiner, Harris, and Craig, 2001) and the “simultaneous empowerment and marginalization of people and communities” (2001, 7) through participatory mapping and PPGIS. Moreover, the “participatory” in participatory mapping has come under significant scrutiny, as well, as participatory mapping, itself, is an aporia that often involves externally imposed power structures that may or may not enable previously silenced voices to be heard. Participatory mapping can allow for its users to enjoy various degrees of empowerment; however, it might only be achieved through the mapping agenda of a member of the global elite. Perhaps participatory mapping is yet another “imaginative geography” that fails to allow marginalized populations to speak.

Despite its limitations, participatory mapping continues to expand its application throughout the world. As a hybridized form of knowledge creation, participatory mapping may be able to empower its users by offering a “third space” that allows for greater inclusiveness outside of the “colonizer-colonized” rubric. But precautions are still necessary to ensure that the tools of research are serving their intended purposes and audiences and are not used in a manner that may in fact lead to greater marginalization. Participatory mapping may have the ability to

incorporate greater cultural consciousness, but increased empowerment or equity for its participants may not result from its deployment. Criticisms of participatory mapping's ability to break dominant cultural hegemonies and empower voiceless populations raise poignant questions as to who becomes marginalized and empowered through participatory mapping—and how. In the remaining chapters of this dissertation I will explore these and other issues related to determine if participatory mapping in Río Negro has helped elite members of the community enhance their economic and social positions through participatory mapping, and if it has ultimately fostered greater inequities in the marginalization and empowerment of its users.

CHAPTER 3: Project Background and Research Methodology

3.1 Overview

In this chapter I present relevant historical antecedents to help contextualize how prevailing power structures within the community reinforced existing conditions of marginalization and empowerment through the participatory mapping exercise in Río Negro. Like many of the participatory mapping projects referenced in the preceding chapter, the goals of the Río Negro participatory project were centered on social justice ecological sustainability, quality of life improvements, and to encourage greater civic participation (Partners of the Americas, 2002). Based on five months of field research over the course of three years, the data I collected on the consequences of participatory mapping serve as the foundation to examine the knotted relationships between existing power structures, participatory mapping, marginalization, and empowerment over the long term.

As introduced in chapter one, the issues of marginalization, empowerment, and access to energy that emerged through participatory mapping in Río Negro fit within a much larger discourse on development in Honduras at a national level, as well. In 2009, former president Porfirio Lobo Sosa declared the country “open for business” by aggressively seeking foreign investment from large multinational corporations, most notably in energy and infrastructure (Honduras Secretary of Foreign Affairs 2010, “Honduras is Open for Business.”). Lobo subsequently approved the improvement and construction of dozens of large-scale infrastructural projects, including hydroelectric dams, mining operations, logging

industries, (Bell and Field, 2013),²⁸ highways, seaports, airports, and more (Central Law, 2013).

Echoic of the critiques of many participatory mapping exercises—including the one in Río Negro, the collective voice of the majority of citizens was not included in the decision-making processes. This top-down approach to development was also in direct violation of the International Labor Organization Convention Number 169, commonly known as ILO 169. ILO 169 states that the Honduran government is legally obligated to engage in participatory governance with its citizenry, and to seek and receive “free, prior, and informed consultation of indigenous peoples before anything can be built on, or taken from, their lands” (Bell and Field 2013, “Defending Indigenous Lands and Waters in Honduras”). Despite this call for greater inclusiveness, the government’s plans moved forward without true participation (Conant, 2013).

The participatory mapping exercise in Río Negro followed a similar path. Though corporate interests played no role in the participatory mapping exercise in Río Negro, the economically elite and politically powerful of the community maintained their own special interests—affecting decisions and outcomes in the direction of their choosing. Questions continue to persist in Río Negro as to how much “empowerment” those with the greatest “need” actually received through participatory mapping.

²⁸ On November 24, 2013, Hondurans elected (amid much controversy) a new president, Juan Orlando Hernández, who represents the same political party as Lobo (the National Party). Accordingly, Hernández will continue to support the neoliberal “Open for Business” agenda of the Lobo regime (*El Herald*, 2013b).

As seen on a national scale, external interests and influences bear significant impacts on decision making processes—particularly regarding the direction of development initiatives. In the case of Río Negro, western-based development organizations such as the Honduran Conservation Corps, the Peace Corps, and Farmer to Farmer have left indelible impressions on Río Negro since the devastation of Hurricane Mitch in 1998. In fact, if it were not for the significant influence of these organizations, participatory mapping would likely never have occurred in Río Negro. The unmistakable power wielded by these external parties further complicates the idea of actual *participation* within the community and through participatory mapping.

In order to facilitate greater local participation in this research project and to achieve a more comprehensive, postcolonial representation of perspectives on participatory mapping, this investigation utilizes a multi-method, or triangulated, approach. The study comprises both qualitative and quantitative data captured through a variety of methodologies and epistemologies. The purpose for using such an array of methods of inquiry is to acquire a more holistic set of grounded understandings and representations from the data. The data obtained in this study also derive from a wide spectrum of resources: interviews with remote and disadvantaged populations, varying levels of governmentally-produced information, technologically-driven data, and publications from a diverse hierarchy of literary resources. Despite this robust collection of data sources, limitations within the methodology, theory, and empirical analysis of this research project remain evident. This chapter details the entanglements of the many research-

related elements of this project, including the complicated interconnections between residents of Río Negro, my position as the researcher, the research design and methodology, and the limitations of the research, itself.

Section 3.2 backgrounds the participatory mapping project that took place after Hurricane Mitch as well as my own research preparation specific to this study. This vignette of Río Negro includes a number of geographical, cultural, historical, and technical challenges that required significant contextual preparation in order to effectively feature this rural community for the case study. In addition, this section also addresses various geographies of power within Río Negro—all of which played significant roles in the participatory mapping project. Section 3.3 develops the linkages between Río Negro, participatory mapping, and the rationale for employing a multi-method research design for this study while Section 3.4 offers perspectives on the limitations of the research design through a number of issues encountered during the research component of this project. This section then puts forth several considerations to take into account while reviewing the findings of this study. Section 3.5 details the methodologies and tools of inquiry that were employed to gather the data used in this study. Finally, Section 3.6 provides a brief summary of the chapter.

3.2 Research Preparation for the Study in Río Negro, Honduras

The case study used in this investigation is an evaluation of the participatory mapping exercise that took place in Río Negro, Honduras in 1998. In order to understand the interrelationship between the community and the participatory

mapping exercise, contextual knowledge of the community's desire for electrical access is critical. Similarly, recognizing my position within the community, the research, and the results of the study also provides essential contexts to the study. The ensuing text offers a brief sketch of Río Negro, microturbines, and marginalization and empowerment within the community.

3.2.1 My Introduction to Río Negro

I became aware of Río Negro through an interest in “fair trade”²⁹ products—particularly coffee. Just Local Food, a “fair trade” and “farmer direct” grocery store in Eau Claire, Wisconsin, arranges opportunities for interested parties to meet the producers of the store's products. In January, 2011, I traveled to Río Negro, Honduras, to meet the farmers of the COFEACOMA³⁰ coffee cooperative who supply Just Local Food with a significant percentage of the coffee they sell. I encountered the microturbines during this initial visit to Río Negro.

Although virtually everyone in Río Negro engages in coffee farming, it was clear that certain farmers had particular advantages over others in terms of access to mechanization, electrification, and transportation. My preliminary observations suggested that community elites were generally the possessors of the

²⁹ The term “fair trade” is open to interpretation and is frequently conflated among a variety of similar terms, definitions, and understandings. In this dissertation I am using “fair trade” to represent the concept whereby a farmer who cultivates a given product receives an equitable portion of the profits directly from the sale of the product and that the cultivation of the product is performed in an environmentally sustainable manner. The term, “Fairtrade” is copyrighted by Fairtrade International, a non-profit organization that serves as an “alternative approach to conventional trade and is based on a partnership between producers and consumers” (Fairtrade International 2011a, “Introducing Fairtrade”) to signify a given product has adequately met Fairtrade International's standards to be classified as a Fairtrade product (Fairtrade International, 2011b).

³⁰ COFEACOMA is an acronym for *Cooperativa Agrícola de Familias Ecologistas de la Montaña de Comayagua* (Translated as Agricultural Cooperative of Ecologically-Minded Families of Comayagua Mountain).

microturbines. Those who were not empowered with the necessary political capital to influence decision-makers regarding microturbines ownership continue to remain without electricity and are unable to mechanize coffee production.

3.2.2 About Río Negro

The devastation of Hurricane Mitch in 1998 ushered in dramatic changes for millions of Hondurans. Much of Honduras was rendered a virtual *tabula rasa*, forcing families, communities, and cities of all sizes to not just rebuild, but start over. For Río Negro, the destruction signaled a major change in agricultural investment. The community had historically been centered on the cultivation of staple foods such as beans and rice and now sought greater economic opportunity through cash crops. Among the first to be planted was cardamom; however, the plants were low to the ground and the attraction of snakes made cultivation undesirable and extremely dangerous (Velásquez, 2012). Coffee proved to be one of the more lucrative commodities and, with the help of the Honduras Conservation Corps (HCC), the Peace Corps, and ECOSIMCO, organic coffee farms began to appear in the landscape.

As the impacts of the growing demand for coffee began to take hold in Río Negro, farmers investigated new methods of increasing production. Two area coffee growers, Hector Oviedo, an environmental engineer, and Adalid Zavala, a craftsman and mechanic, were the first who applied the knowledge they acquired from an educational radio program to construct an environmentally friendly means of generating electricity: hydro-powered microturbines (Oviedo and Zavala, 2011).



Figure 3.1: Microturbine Connected to a Coffee Depulper
Source: Jeff DeGrave, 2012

The power of the microturbine could be connected directly to a coffee depulper, automating the depulping process and increasing productivity.³¹ In addition, children were liberated from the task of turning labor-intensive hand-powered depulpers (Figure 3.2), allowing rural youths to attend school instead of processing coffee during harvest season. Many other electrical applications of the microturbines were eventually realized. As Río Negro lies about a three-hour ride on a dirt road by truck from the metropole of Comayagua, electricity had only been accessible in the city. But the arrival of microturbines into Río Negro soon sparked the first electric lights in the community.

³¹ For a schematic of the working components of a microturbine, see Appendix 1: Pico Hydro Power System. For a visualization of how a small hydropower electrical system typically functions within the landscape, see Appendix 2: Complete Pico-Hydro Electrical System.



Figure 3.2: Helping Children Depulp Coffee by Hand
Source: Analisa DeGrave, 2011

With electrification, fledgling microenterprises, home improvements, and other reflections of electric power began to appear within the community. For example, houses could be illuminated without the use of candles, refrigeration would be possible, and efforts to increase tourism (Figure 3.3) in Río Negro might be realized (Gaertner, 2011b). To utilize this new technology most effectively within the community, residents sought to democratically manage the distribution of microturbines—and participatory mapping was introduced to serve this purpose.

Since the construction and installation of the first microturbine in Río Negro in 1998, five additional microturbines have been installed throughout the community. The microturbines vary greatly in size, type, and function—as well as how they were acquired. Interestingly, one of these microturbine has been handed down

three times. As larger, more efficient models were developed, the smaller, less utile machines were handed down to neighbors and friends who previously had no access to electricity. As will be discussed in greater detail in this chapter, most of the microturbines are currently used for depulping coffee, providing electric lighting in homes, and charging batteries and cell phones.



Figure 3.3: Río Negro Roadside Welcome Sign
Source: Jeff DeGrave, 2011

3.2.3 The Participatory Mapping Project

Coupled with the arrival of a number of HCC volunteers and the construction of the first microturbine, the community of Río Negro embraced a number of public participatory projects to undertake the community's reconstruction efforts—including participatory mapping. The Honduran Conservation Corps spearheaded

the recovery effort after “receiv[ing] \$723,605 for an 18 month period from USAID / Honduras as part of Hurricane Mitch funding” (Partners of the Americas 2002, 1).

Among the many of the HCC’s objectives included:

...fostering greater community participation in municipalities affected by hurricane Mitch, ...to rebuild local infrastructure, repair farm-to-market roads, build retention walls and embankments, clean and stabilize waterways, and rebuild damaged watersheds. In addition, corps worked with subsistence farmers located in environmentally fragile areas to promote sound agricultural practices as many of its members come from farm families (Partners of the Americas 2002, 1).

The discernable elements of participation, empowerment, and social justice in the above passage recall similarities between the ideology behind participatory mapping HCC’s approach to rural redevelopment. As with many other participatory mapping projects, the HCC also collaborated with numerous local, national, and international volunteer organizations and organized “public forums and debates to involve [local] citizens in discussions about local community development priorities (Granada 2002, 16). Public participation of the local community was “fundamental to the success” of the HCC’s goals (Partners of the Americas 2002, 2) and “when conservation corps projects [were] designed, the local community [was] involved along with other environmental organizations, civic groups, and private citizens (2).

Reflecting the theoretical foundations of participatory mapping, the HCC promoted “the concept of social responsibility and community participation in conservation and community service projects” (Partners of the Americas 2002, 3).

In fact, among the HCC's "eight major objectives" (3) were several that sought to increase citizen engagement and (self)empowerment.³²

The HCC also supported a more democratic and inclusive form of decision-making—establishing a clear theoretical link between the objectives of the project and the utilization of participatory mapping. For example, as part of their reconstruction efforts, the HCC approved the incorporation of the RID project (Red InterAmericana para la Democracia³³), an "initiative that resulted from an emphasis on democratic skills instilled in the HCC" (Partners of the Americas 2002, 3). The specific RID project in Río Negro was known as "Acción Cívica para el Ambiente"³⁴ (ACA) which engaged in multiple participatory, democratic, and social justice-oriented activities—including participatory mapping. The ACA also assisted with the administration of "interactive radio sessions and providing training to communities involved in defining democracy" (Partners of the Americas 2002, 7). These discussions included topics such as "civil society participation, human rights, women's rights, justice, the responsibilities of citizens to their natural resources, sustainable development" (7) among many others.

Participatory mapping fit well within the goals and ideological approach of the HCC and the ACA, who advocated for greater public participation, community involvement, democratic decision making, and social justice on a local scale. Another NGO was also introduced to assist with the participatory mapping

³² These objectives were "[i]ncreased use of sustainable agriculture and conservation techniques by [the] community...; Creation of a permanent leadership training program for environmental leaders, teaching them to take a more pro-active role in the protection of their environment; [and] Increased public consciousness about the need to protect the environment" (Partners of the Americas 2002, 3).

³³ Direct Translation: InterAmerican Network for Democracy

³⁴ Direct Translation: Civic Action for the Environment

exercise: CENET, the Centro Nacional de Educación para el Trabajo³⁵ (Velásquez, 2012). CENET's objective was to "augment the technical and methodological capacities of the labor force...in entrepreneurial business to promote the creation of skilled employees" (CENET, 2015a). CENET also espouses "citizen participation," "personal respect," "ongoing commitment to human development," and "transparency" among other organizational values that fit well with those of participatory mapping (CENET, 2015b).

Yet it is important to recognize that for every international development agency that exists, a unique model of international development exists, as well—including different rubrics and approaches concerning which members of the local populace will participate—and to what degrees. For example, Partners of the Americas--"the largest private voluntary organization in the Western Hemisphere engaged in international cooperation and training" (Partners of the Americas 2015, "Welcome to Vermont-Honduras") follows a more corporate engagement of international development. For example, Partners' development structure is formed through "inter-institutional partnerships between northern and southern universities, development agencies and civic organizations (Partners of the Americas, 2014b). Partners also notes that "[i]ndividuals who make up Partner chapters are local citizens -- professionals active in health and population programs, environmental conservation, AIDS education and prevention, small business development, drug abuse prevention, and agriculture -- to name but a few" (Kestenbaum 2002, 165).

³⁵ Direct Translation: National Workforce Development Center

Given the elite nature of the citizenry, institutions, and agencies identified as the “partners” through whom Partners of the Americas operates—such as universities, professionals, and civic organizations—the potential emergence of elite bias may be easily inferred from such a model. For example, future microturbine owner #4³⁶ (MTO4) was chosen by the various agencies to lead the participatory mapping project, managing three groups of community members selected to represent the varied perspectives of the residents of Río Negro—particularly those of the coffee farmers (Velásquez, 2012). When asked about the level of participation among the residents of Río Negro, MTO4 stated that “everyone participated.” Other elites and community leaders also shared similar perspectives that “the entire community” attended meetings, assisted with the map creation, and offered valued input into Río Negro’s new direction of development.³⁷

Although nearly every interviewee confirmed the existence of “community participation” during the participatory mapping process, the responses of residents who did not receive a microturbine through participatory mapping were notably less affirming. Respondents without microturbines described “participation” in a different light, including comments such as “yes, sometimes, yes” or “yes, for some [people],” as well as “Well, it depends, but yes.” Many responses included any number of vocal pauses, perhaps suggesting not all residents were not as confident about the degree of actual participation that took place.³⁸

³⁶ From this point forward I will refer to an owner of a microturbine as “MTO” followed by the number of the microturbine as identified in Table 4.1.

³⁷ Information obtained through anonymous interview responses as part of this study.

³⁸ Information obtained through anonymous interview responses as part of this study.

After speaking with many members of the community who did not receive a microturbine through the participatory mapping process, I revisited the question of participation with a number of village elites to see if they would shed additional light on these differing perspectives. They noted that although “everyone” participated in the community mapping exercise, “participation was high at the beginning” of the mapping process, but “little by little” the number of participants began to shrink. Community leaders ultimately carried forth the project to its completion.³⁹ Though their claims that the entire community participated were “confirmed,” evidence of an elite bias within the participatory mapping exercise became palpable. Certainly the understanding and perception of “participation” was varied and differentiated—particularly between community elites and those with less political or social clout. As was discussed in Chapter 2, questions surrounding the ability of participatory mapping to empower the more marginalized members of its users continue to linger—and the participatory mapping project in Río Negro is no exception.

3.2.4 Current Microturbine Ownership in Río Negro

The historical and geographical backgrounds behind the six microturbines that currently dot the Río Negro landscape can be used to identify major directional shifts that have defined and redefined the community since 1998. Hurricane Mitch may have ushered in the presence of electricity in Río Negro, but the distribution, purpose, capacity, and history of each microturbine is unique unto itself. In

³⁹ Information obtained through anonymous interview responses as part of this study.

conjunction with Figure 3.4, Table 3.1 offers a description of each microturbine, including the year of installation, its maximum voltage, its primary functions at the time it was installed, how it was acquired, the gender of the owner, along with additional information that helps to further contextualize microturbine ownership in Río Negro today.

Several noteworthy observations are evident in the chart. First, an inextricable relationship exists between microturbine ownership and gender. Even beyond the ownership of the microturbines, most associations with microturbines have historically (and still today) been dominated by men. The two women that currently do own a microturbine (MTO3 and MTO6) did not have the initial means to acquire it and secured access to electricity only through the death of a spouse and as a charitable donation, respectively.

The role of political, intellectual, and cultural capital is also present, though ensconced within the chart. Familial, professional, and social networks have greatly impacted who now owns a microturbine, as well. For example, MTO2, MTO4, and MTO5 are all part of a network of craftsmen and mechanics who possess the skills, technical knowledge, and economic means to build, install, and repair microturbines. All of these households are part of the same social network of community leaders who have continually urged area residents to invest in microturbines for Río Negro.

Furthermore, MTO4 and MTO5 have a familial relationship. Perhaps not coincidentally, MTO1a was the first person to receive what has become the

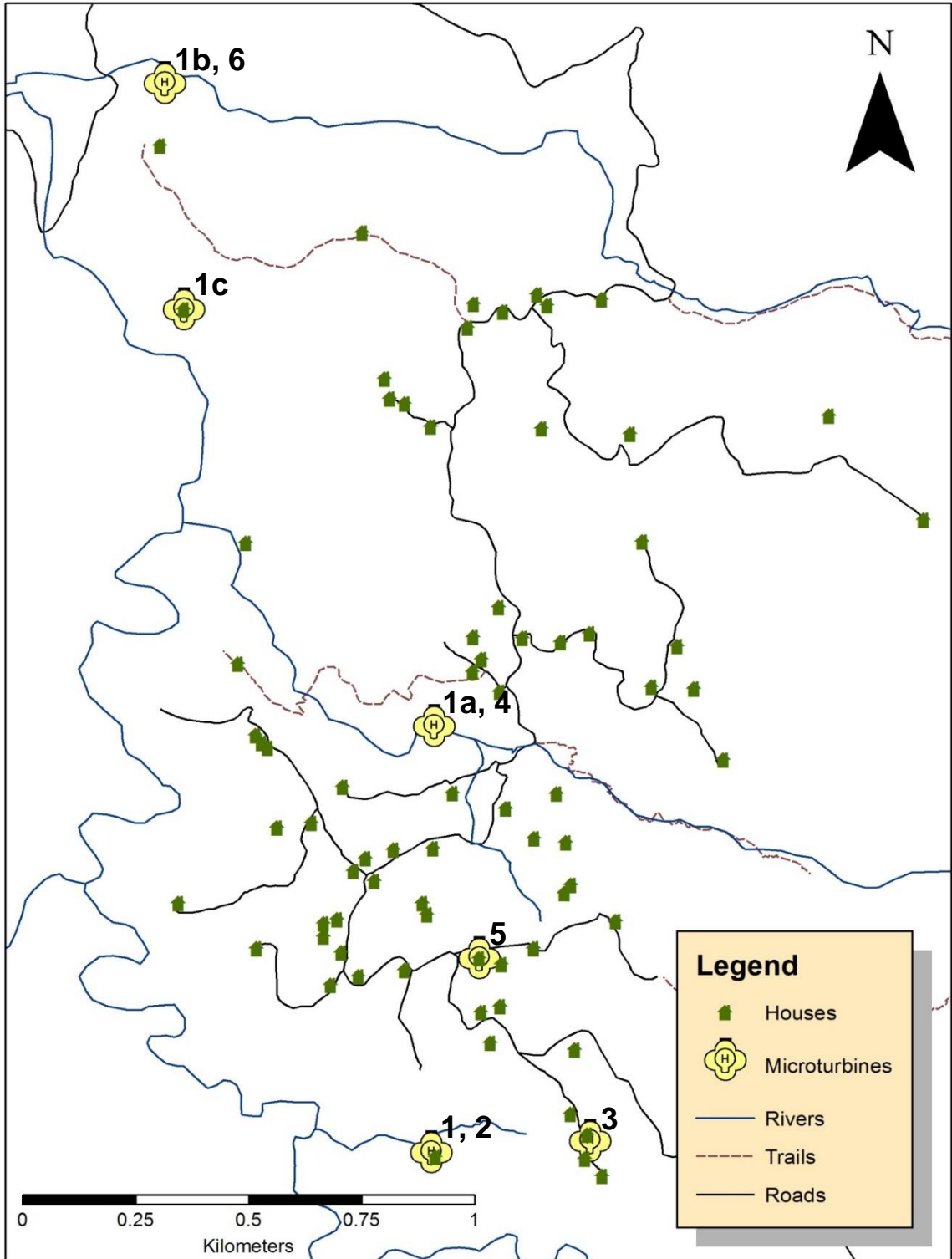
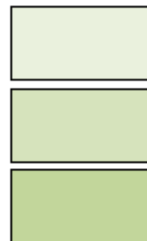


Figure 3.4: Locations of Microturbines in Río Negro
 Map produced by Jeff DeGrave, 2014

No.	Year	Max. Power (volts)	Functions	How Acquired	Gender of Owner	Additional Notes
1*	1998	200	A, B	Self-constructed	M	Constructed by Zavala and Oviedo
2	1998	1500	A, B, C, D, E	Self-constructed	M	Constructed by Zavala and Oviedo
1a	1999	50	A, B	Handed down	M	Same microturbine as microturbine 1 Now powered by microturbine 4
3	2000	200	A, B, C	Purchased	F	Constructed by Zavala and Oviedo; Inherited as widow
4	2007	1,000	A, B, C, D	Self-constructed	M	Powers three residences and workers quarters
5	2007	1,500	A, B, C, D	Self-constructed	M	Portable microturbine; Also used as promotional model
1b	2011	50	A	Handed down	M	Same microturbine as 1
6	2011	1,200	A, C, D	Donated by F2F	F	Constructed by Zavala and Oviedo
1c	2012	50	A, B, C, D	Handed down	M	Same microturbine as 1

Function Key:

- A Electric Lighting
- B Charge Automobile Batteries
- C Depulp Coffee
- D Charge Cell Phones
- E Grind Corn



Pioneer Era

Revival Era

Tourism Era

* Microturbine 1 was relocated three times and, due to a number of variables, the voltage produced by the microturbine varied.

Table 3.1: Profile of Microturbine Ownership in Río Negro
Source: Jeff DeGrave, 2012

ostensible “hand-me-down” microturbine—the prototype created by Adalid Zavala in 1998. MTO1a was the uncle of MTO4. As noted in the chart, this same microturbine—the first one in Río Negro—is still functioning today and has recently been handed down to its fourth owner, MTO1c. In 2007, MTO4 constructed a larger microturbine to power the houses of most of his family members, seasonal workers’ quarters, and several public buildings. MTO5 followed the lead of his cousin, MTO4, and developed his own microturbine, as well.

MTO4 is also the son of one of the original settlers of Río Negro in 1950 along the carretera in what is now the center of the village. The elevated status of the family within the community is spatially, economically, and socially apparent. In fact, the home of MTO4 is frequently chosen as the site of community meetings, including those of the COFEACOMA coffee cooperative and for the participatory mapping exercise. MTO3 is an elite community leader, as well. She is the head of the local women’s cooperative that generates income through the sale of jewelry constructed from plants, seeds, nuts, and refuse. She is also connected to the network of elites in Río Negro as her deceased husband was mechanically adept and part of the original brain trust that brought microturbines to Río Negro.

As stated, microturbine distribution within Río Negro resonates historical legacies of the empowerment of the earliest settlers within the community. Those who arrived first claimed the most arable lands and those that were most accessible to The Comayagua Mountain Highway. The economic advantages of these two factors regularly reveal themselves within Río Negro—including within the distribution of microturbines—as will be discussed in Section 3.2.6. Those who

have been empowered with greater economic opportunities due to the possession of superior land and easy access to the carretera were also among the first to acquire a microturbine—through participatory mapping.

3.2.5 Eras of Development

Reflected in Table 3.2: Eras of Microturbine Development in Río Negro are three distinct intervals of the microturbine history in Río Negro ushered in through participatory mapping. Each period signaled a new direction in the application of and access to microturbine-powered electricity—all originating in the participatory mapping exercise. The following chart contains a summary of these three eras:

Era	Years	Characteristics
I. Pioneer	1998-2000	Utilization of participatory mapping for post-Mitch recovery; reconstruction and innovation
II. Revival	2007	Entrepreneurialism: Participatory mapping supporters enable wider proliferation of coffee farming, mechanization of depulping process; promotion of microturbines to increase coffee production
III. Tourism	2011-2012	External influences helped create access to electricity for residents whose input was largely left out of the participatory mapping exercise.

Table 3.2: Eras of Microturbine Development in Río Negro
Source: Jeff DeGrave, 2013

3.2.5.1 Pioneer Era

Residents of Río Negro employed participatory mapping as one of several strategies to manage and direct the recovery from Hurricane Mitch in 1998 (Gaertner, 2011c). Río Negro and the rest of Honduras were particularly open to new innovations and opportunities for development as 70 to 80 percent of Honduran roadways as well as most of the country’s bridges were destroyed due

to Hurricane Mitch (National Oceanic and Atmospheric Administration, 2009). Electricity had never existed in Río Negro prior to 1998 and was at first used for simple tasks such as providing electric lighting and charging automobile batteries. (Velásquez, 2012). Shortly thereafter the power of the microturbine was applied to modified hand-powered coffee depulpers and corn grinders. Elite members of the community with the knowhow to construct and install microturbines influenced the participatory mapping exercise to where the already empowered “pioneers” of microturbine technology received the first microturbines instead of the more marginalized members of the community.

3.2.5.2 Revival Era

After the participatory mapping exercise came to its largely unfruitful conclusion, the fervor over microturbines waned. Although residents in Río Negro desired electricity, many came to view microturbines as unreliable, overly complex, and only a tool for the elite. MTO4 and MTO5 both played significant roles in the participatory mapping process and strongly supported the utilization of microturbines for electrical production in the community. In an effort to revive the idea of microturbine-powered energy in the region, these two elite members of the community built two larger microturbines to demonstrate the greater potential of the machines. MTO4 connected his 1,000 volt microturbine to several family residences, the local elementary school, the church, and the Visitors Center. Not only did he assist family members and the community with the electrical connection, but also showcased the larger potential for microturbines in the

community. MTO5 created a portable 1,500 volt microturbine with which he could demonstrate the power of microturbines quickly and easily (see Figure 3.5). Both of these entrepreneurs had the ability to install and repair any microturbine in the community. But despite their efforts during the participatory mapping exercise as well as these attempts to revive the idea of microturbines, few Río Negro residents expressed enthusiasm for larger scale uses of microturbines and significant renewed interest in the devices did not materialize.



Figure 3.5: A Portable Microturbine
Source: Jeff DeGrave, 2012

3.2.5.3 Tourism Era

As noted, village elites who helped steer the participatory mapping exercise received the initial benefits of microturbine ownership. But as tourism has steadily grown in Río Negro over the past 10 years, visitors from the Global North⁴⁰ have witnessed the extreme conditions of marginalization of many local residents, enabling two more marginalized households the opportunity to receive a microturbine.

Farmer to Farmer (F2F), a “small Wisconsin-based non-profit [organization] working in Guatemala and Honduras to support peace and cross cultural understanding” (Farmer to Farmer 2014, “Non-Profit Organization),” assists Río Negro in its tourism economy by offering guided tours of Río Negro. Farmer to Farmer earmarks portions of this revenue for reinvestment back into Río Negro. In 2012, these funds went for the purchase of a microturbine for the Zúñiga⁴¹ residence—marking the first, and thus far, only example of an installation funded by external sources. This intervention was provoked by the family’s dire economic situation. The household usually serves as the home of thirteen to twenty-one people, lies among the furthest from the carretera of all households in Río Negro, and can only be accessed on foot. As is seen in Figure 3.6, the dirt patio and external mud stove⁴² at the residence are but two reflections of the degree of

⁴⁰ Most tourists in Río Negro are from the United States, but an appreciable percentage also come from Canada and Western Europe.

⁴¹ This is not the actual family name. For more information, see footnote 72 (page 151).

⁴² More affluent households will frequently have a cement patio, an internal stove, or perhaps a second stove that is generally located outdoors and reserved for special occasions.

poverty at this residence. The family has long been among the most destitute in Río Negro for many years.

While the new microturbine was being constructed in 2012, the family received the original microturbine from 1998 that was no longer being utilized (see Table 3.1: Profile of Microturbine Ownership in Río Negro for an overview of the history



Figure 3.6: The Outdoor Kitchen at the Zúñiga Household
Source: Andrew Gaertner, 2014

of microturbine ownership in Río Negro). Once the new microturbine was installed, the family then passed down the old microturbine to one of her neighbors, MTO1c, who also lives a formidable distance from the *carretera*⁴³ and is not a member of the Río Negro elite. This sharing of the microturbine between two of the more marginalized members of the community revealed the existence of a parallel social and political network that provided its own form of empowerment to the more

⁴³ The word “carretera” literally translates to “highway.” However, the “highway” that cuts through the heart of Río Negro is a dirt road upon which one must drive through rivers in order to pass. Yet this “carretera” is unquestionably the principal (and only) “highway” that leads in and out of Río Negro. For this reason, I am leaving *carretera* untranslated as it captures the relative importance of the *carretera* to the community, without confusing it with the image of a typical “highway” in the United States.

marginalized members of society. As a result two of the more marginalized households within Río Negro were able to acquire a microturbine due to external intervention.

3.2.6 Building Social Capital

Since my initial trip to Río Negro in 2011, I have assembled a working network of contributors who offered their invaluable assistance with this research project. These contacts include Farmer to Farmer, COFEACOMA, two former Peace Corps



Figure 3.7: Farmer to Farmer Logo
Source: Jody Slocum, 2014

volunteers who served in and around Río Negro, several external consultants within Honduras, and the residents of Río Negro. Through these associations I received access to community records, documents, maps, reports, local oral histories, numerous anecdotal contributions, and intimate exposure to how “life happens” in and around Río Negro.

The research preparation for this project required several stages and a variety of steps. First, F2F introduced me to not only the coffee farmers, but the plurality of histories, perspectives, and experiences of every family in Río Negro. Because F2F serves as the conduit to bring external revenue to the coffee farmers of Río Negro, community members were eager to make my acquaintance.

Two former Peace Corps volunteers also provided me valuable assistance and further augmented my social capital within the village. Andrew Gaertner served in the Río Negro region during the early stages of the participatory mapping exercise while Gabriel Sidman was stationed in Río Negro from 2008 to 2010. Gaertner and Sidman were essential in gaining an understanding of the historical, political, and social contexts of participatory mapping within Río Negro. These “entrées” into the community provided me with instant credibility and I was able to speak with nearly every head of household⁴⁴ in Río Negro. For further discussion on informant bias, elite bias, and the bias of working with Peace Corps volunteers, see Section 5.3.2: Reliability of the Research.

3.2.7 Local Geographies of Power

The single most challenging component of this research project was gauging the intricacies within the social, political, and cultural power structures within Río Negro and how they shaped the participatory mapping exercise that took place 15 years ago. As with all participatory mapping projects, such undefinable, “invisible” forces have the propensity to furtively impact the direction and outcomes of this locally-driven methodology designed to be more democratic, inclusive, and egalitarian. These multifaceted and deeply intertwined intersections of power can and do affect more than what one may perceive.

The power structures in Río Negro merged over several decades through a plurality of historical geographies that became unmistakably evident during the

⁴⁴ For a clarification on what is meant by “head of household,” see Section 3.5.1.1: Internal Interview Subjects.

participatory mapping exercise and are still evident today. Understanding the relationships between people, place, and time in Río Negro was fundamental to contextualizing issues of marginalization and empowerment and how they may have impacted the participatory mapping exercise. These relationships continue to bear the legacies of enduring power dynamics through everyday life in Río Negro, and in all community-based activities. In the text that follows, I elucidate these complex intersections of marginalization and empowerment that not only influenced the participatory mapping exercise, but affected the outcomes of this research project, as well.

3.2.7.1 The Carretera

The first permanent residents of Río Negro arrived in 1950 and established their farmsteads along the main road from the metropole of Comayagua (Overmars, 2000). Even though no one in Río Negro actually “owns” his or her property, as virtually every resident is simply “occupying” a space within Comayagua Mountain National Park (see Figure 3.8), those who arrived first and claimed land decades ago have continued to enjoy significant political, economic, and cultural capital ever since. These families continue to occupy territories along the main road, now known as the Carretera de la Montaña de Comayagua (or the Comayagua Mountain Highway). The carretera bisects Río Negro (see Figure 3.11) and those with easy, direct access to the carretera enjoy a significantly more

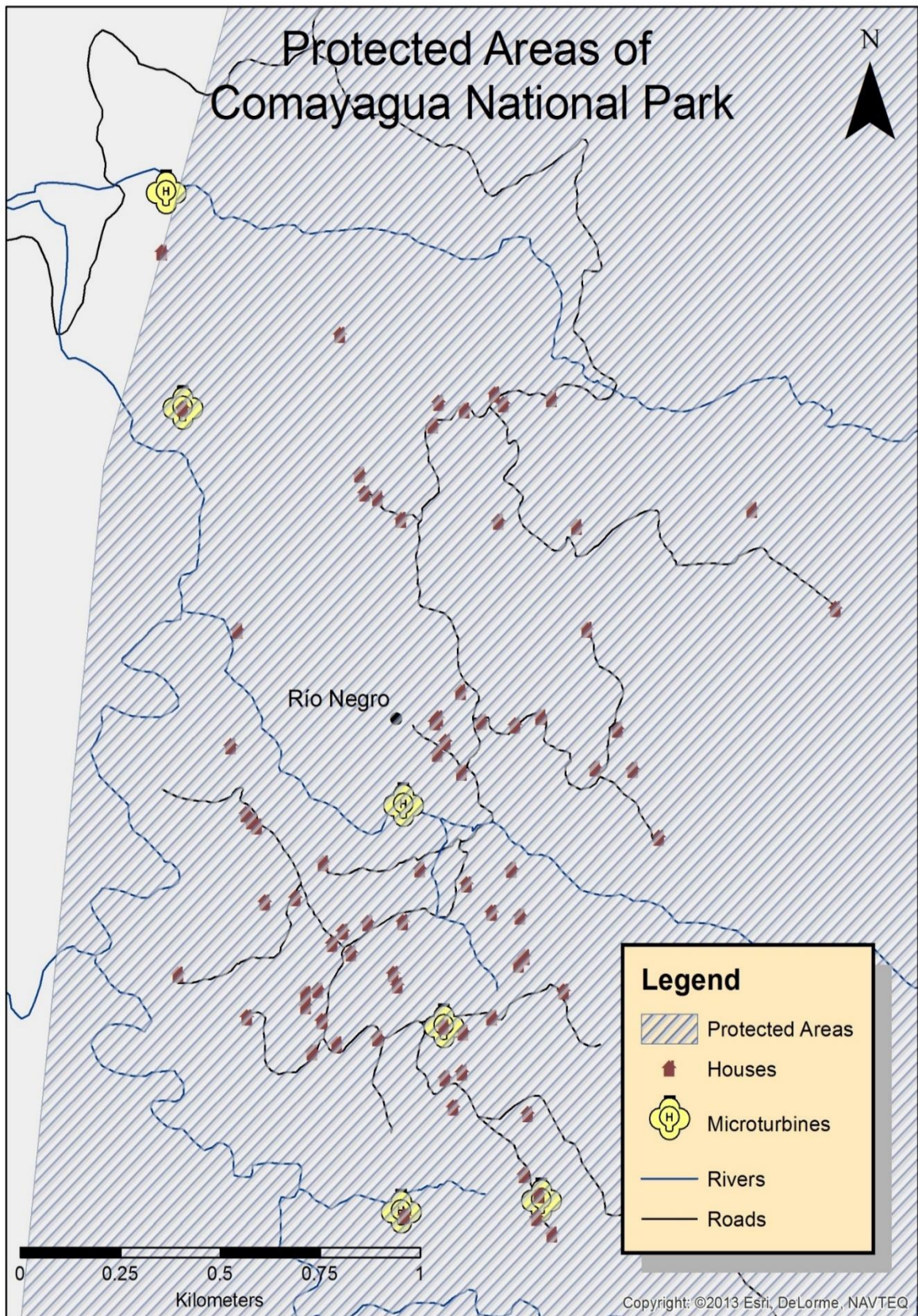


Figure 3.8: Río Negro Residences within Comayagua National Park
Map produced by Jeff DeGrave, 2014

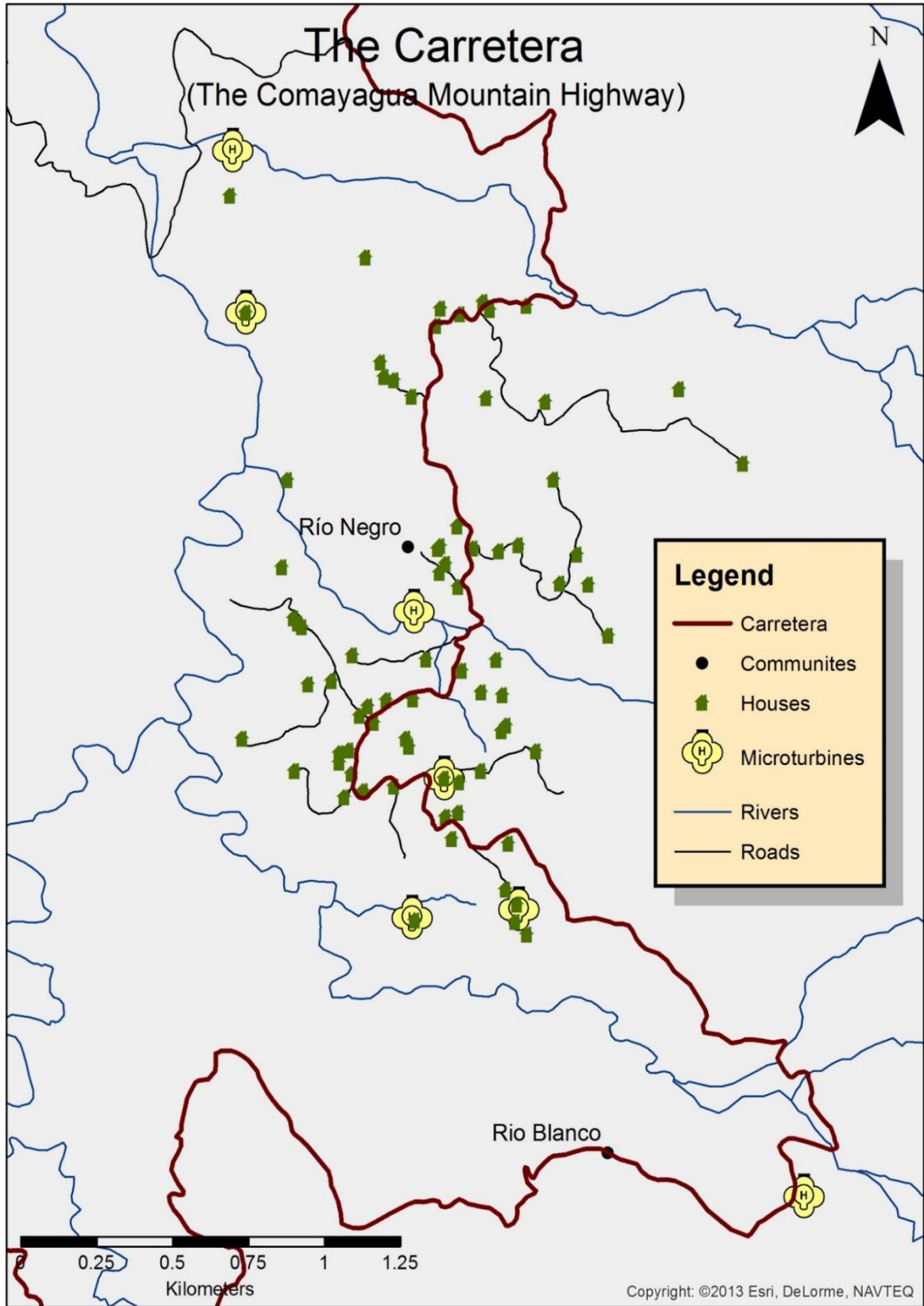


Figure 3.9: Map of the Carretera
Map produced by Jeff DeGrave, 2014

advantageous position of potential empowerment than those who live off the main road—generally accessible by only a dirt track or on foot.

In fact, all of the microturbine installations that resulted from the participatory mapping exercise—as well as the single microturbine in the neighboring village of Río Blanco—are located on or near the carretera. For those that do not live along the carretera, the prospects for networking, accessing tourism-related revenues, and obtaining political representation are also limited—further reinforcing existing conditions of marginalization and empowerment that participatory mapping was intended to address.



Figure 3.10: The Carretera (The Comayagua Mountain Highway)
Source: Jeff DeGrave, 2011

Furthermore, because Comayagua is located southwest of Río Negro (see Figure 1.1), initial settlements took place along the southern edge of the village. To this day the greatest population concentration in Río Negro lies south of the village center—including the four households that received microturbines directly following participatory mapping. Furthermore, a microturbine did not appear in the northern, more marginalized area of the community, until 2011. This north-south legacy of marginalization also becomes evident by the fact that six of the eight households that most strongly reflected the greatest degrees of marginalization are located north of the center of village while only two of the households that reflect stronger characteristics of marginalization lie south of the center. See Appendix 4: Río Negro Household Statistical Data for additional information.

3.2.7.2 Access to Water

The older families of Río Negro have also claimed most of the territories along waterways, as well. The combination of access to the carretera and a viable water source for electrical production creates a multiplier effect on the marginalization and empowerment of every household in Río Negro. For example, access to a sufficient water resource and to the carretera, allows for the depulping process to be mechanized, increasing efficiency and production. Such increased empowerment not only plays out economically through coffee revenues, but manifests itself socially and politically, as well—as became evident during the participatory mapping exercise.

3.2.7.3 External Political Forces

There is one additional influence that levies substantial impact on the conditions of marginalization and empowerment in Río Negro: external power structures. Such networks exist at any number of scales. But of particular interest to this study are the many linkages with the Global North that have also greatly impacted divisions of marginalization and empowerment in the community.

Perhaps most relevant to the participatory mapping exercise in Río Negro was the role of the HCC. If not for this external influence, it is likely that participatory mapping would have never occurred in Río Negro. In addition to the participatory mapping exercise, the HCC also funded the development of the tourist industry within the community (2002). Again resonating with issues of marginalization and



Figure 3.11: Río Negro Visitors Center Welcome Sign
Source: Jeff DeGrave, 2011

empowerment, the benefits of the tourism industry would mostly reach those along the carretera and those who received a microturbine—the same households that most directly benefitted from participatory mapping.

Similarly, the activities of the Peace Corps volunteers also tended to be centered along the carretera. Former Peace Corps volunteers have created lasting and financially-empowering relationships among the “old families” of the community by helping to further establish Río Negro as a tourist destination for “high schoolers, business people, gringos, teachers, and everyone” (Gaertner 2011b, “Honduras-Río Negro”). The already empowered families located along the carretera constructed a Visitors Center and several welcoming “eco-huts” on their properties to rent to tourists (Gaertner, 2011a)—facilitated by the microturbines that emerged through the participatory mapping exercise. This “eco-tourism” economy has continually gained momentum over several years and has been listed in the Honduras *Lonely Planet* travel guide since 2007 (Chandler and Prado, 2007). Río Negro annually attracts hundreds of visitors from the Global North (Velásquez, 2012). Participatory mapping has aided in creating economic opportunities, but only for certain members of the community. Most of the households that have benefitted from the tourism economy are located along the carretera with access to water. These were also the households that levied the greatest influences over the participatory mapping exercise, as well.

But perhaps the most poignant microcosm of the divisive forces of marginalization and empowerment through participatory mapping in Río Negro concerns the Visitors Center. Completed in 2011 (Gaertner, 2011a) through funding provided by the Municipality of Comayagua through ECOSIMCO (Partners of the Americas, 2002), the Visitors Center remains closed to this day. Several community members claim they were not invited to participate in its planning or construction, alleging that the “haves” continue to enjoy self-empowerment



Figure 3.12: The Río Negro Visitors Center
Source: Jeff DeGrave, 2011

through eco-tourism, while others remain excluded from its potential benefits—and microturbines. One community member, who has felt particularly excluded by the process—and did not benefit from participatory mapping, is in possession of the keys to the Visitors Center and refuses to surrender them as he believes opening

the (literal) door will only further the prosperity of the old families that have already benefitted tremendously—through participatory mapping and the microturbines they acquired during the process.⁴⁵

3.2.8 Understanding How Marginalization and Empowerment Act

Understanding how participatory mapping may have reinforced existing conditions of marginalization and empowerment in Río Negro is complex and multifaceted. Reflections of marginalization and empowerment in Río Negro may manifest themselves in any number of ways as noted in the preceding section. Likewise, a variety of metrics may be used to establish connections between marginalization, empowerment, and participatory mapping. But again, as noted in Section 2.3.7: Measuring Empowerment, “it is not at all important to measure power, or to attempt to locate it. The important question is how power acts and what it produces” (Sadan 2004, 63). This study follows Sadan’s idea in that it does not attempt to measure marginalization and empowerment, but to investigate how conditions of marginalization and empowerment were reinforced in Río Negro through participatory mapping examined through a specific set of geographically-based criteria. For more information on the criteria used in this study, see Section 4.3 Identifying Marginalization and Empowerment.

⁴⁵ Information obtained through several interviews with the resident who currently possesses the keys.

3.2.9 A Confluence of Complexities

Navigating these omnipresent power structures while serving as an obvious external influence carried its own liabilities, as well. For some, I represented the form of a “tourist”—paying for room and board, living in an eco-hut near the carretera, and therefore empowering the already empowered. While for others, I may well have represented yet another means of reinforcing preexisting conditions of marginalization and empowerment.

As observed by J.B. Harley in his work on cartography, geographic space cannot exist outside of cultural forces (Harley, 2001) and Río Negro is no exception. An intricacy of histories, geographies, and politics continue to reshape the cultural landscape of Río Negro—a complexity that is certainly evident in both the community’s attempts to manage microturbine locations through participatory mapping, as well as within my own research.

3.3 Empowerment and Marginalization through Participation: Triangulation

The multi-method approach I use in this study follows the participatory examples of Bourdieu, the World Bank, and the many scholars who have attempted to measure complex and elusive constructs such as marginalization and empowerment. As this study applies a postcolonial perspective for its intellectual foundation, employing a participatory methodology that ostensibly contests prevailing power structures is paramount. In other words, given that this study contains a postcolonial theoretical underpinning, it must recognize and include inputs and knowledge “from below” in order to empower its participants. This

methodological approach fits well with the history of participatory mapping, as well, as it draws on “earlier traditions of participatory action research which had been long established as an integral part of many grassroots organisations in the [Global] South” (Mayoux 2001, 4).

Furthermore, because marginalization and empowerment are “multidimensional concepts” there is a “need for a multi-method approach to understand” the complexities within them (Expert Group 2007, 6). A multi-method approach offers a richer, more comprehensive understanding of the various economic, political, historical, and cultural contexts within marginalization and empowerment from a variety of perspectives—including those whose knowledge is often disregarded. And, as with participatory mapping, the underlying goal of this more inclusive, multi-method approach to research is to reflect the depth of the many perspectives, histories, and experiences contained within the data.

The purpose of including a diverse array of resources is also “to overcome the problems that stem from studies relying upon a single theory, a single method, a single set of data [...] and from a single investigator” (Mikkelsen 2005, 96). Triangulation methodology is one of many poststructural and postcolonial strategies that seeks to counter and deconstruct prevailing “truths” and understandings by attempting to fill in the “gaps and fissures” of knowledge (Kimchi et al., 1991). Informational voids due to elite biases, memory lapses, political or social exclusion, and other potential “holes” in the data may be removed by introducing and combining multiple sources, methodologies, theoretical

constructs, researchers, and / or analytical methods (1991) within the same study (Thurmond, 2001).

Because triangulation does not acknowledge the existence of a single, dominant “truth” within its data sources (Mikkelsen, 2005), it more easily allows for the inclusion of “voices” of historically marginalized populations. Triangulation also exemplifies the ideas of French philosopher, Gilles Deleuze, as its “rhizomatic” approach seeks to create more pluralistic representations that are free of the hierarchical prioritizing of one informational source over another (Peet, 1998). With the inclusion of a greater number of sources, biases can be mollified. As participatory mapping does not function in a vacuum, triangulation helps navigate and negotiate the inevitable political, social, and cultural biases that exist within any society. As will be detailed in Section 3.5.1: Interviews, speaking with nearly every head of household in Río Negro ensures that the data comprises multiple opinions and points of view—perspectives that may have been remained outside of the original participatory mapping exercise due to elite biases on the part of community leaders, Partners of the Americas, the HCC, ECOSIMCO, and other entities that helped conduct the participatory mapping exercise. Furthermore, incorporating open-ended responses into the interviews creates additional contexts from which I can garner a greater understanding of the perspective of each individual. As noted previously, I also triangulated the responses of local elites with those of the marginalized residents of Río Negro.

This research project also incorporates significant *a posteriori*, phenomenological knowledge gained through experience and performance

(Rockmore, 2011). Reflecting the views of Orlando Fals Borda, this multi-method approach also serves to break the “scientific” hegemonic history of *a priori* knowledge production (1995). Knowledge created from a subordinate position contests the power structures “from above,” such as those retained within a local cultural hegemony, a government, or externally-driven technologies, as just a few examples. It is therefore imperative that this study endeavor to create an open forum through which these voices may be heard.

As part of maintaining this balance, triangulation methodology also allows the researcher to cross-check facts, figures, and perceptions between sources. For example, the survey I conducted inquired as to the number of residents in each household I visited. However, the question failed to offer a specific time period about which I was inquiring. The number of residents living in a given household varies according to the agricultural season, the academic calendar, and periodic migration. After receiving several irregular responses, through triangulation I was able to recognize the limitations of the question, verify the previous responses with other informants, and conduct future interviews with the understanding of this variability. Without the ability to crosscheck the responses (and the questions), my data would have been flawed, inconsistent, and largely unusable.

Yet informational contradictions between data sets may also be beneficial. Employing a variety of sources with different biases and strengths can be mutually complementary (Betsill and Corell, 2001) by filling in informational “voids” and ameliorating inconsistencies and biases within each data set. Employing multiple methods and a variety of data sources, such issues can be reanalyzed,

recontextualized, and reconciled through other methodologies which may be helpful in determining their impacts on the study (2001). Such contradictions may, in fact, require that the research questions or methodologies be re-evaluated (Johnson and Onwuegbuzie, 2004). But triangulation methodology is not charged to overtly resolve every apparent contradiction between the multiple “realities” that emerge, but to articulate these potentially distinct realities into a reasonable and “workable solution” (16). Contradictions within the data may also highlight the “fragmented and multi-faceted nature of human consciousness” (Brannen 2005, 18)—a “truth” that a single-source study might fail to capture.

3.4 Limitations to Triangulation Methodology

Although triangulation methodology may serve to break down prevailing historical and local power structures by facilitating a more pluralistic representation of multiple sources of knowledge, it is not without its own limitations. As with participatory mapping, triangulation methodology may not be able to live up its billing as an empowering, postcolonial, power contesting form of inquiry. Triangulation methodology offers “no guarantees” of success and may, in fact, create “aporia[s] for which there is no easy or clear solution” (Wainwright and Bryan 2009, 153).

For instance, in keeping with a postcolonial approach to this research project, I specifically sought Honduran geospatial information—as opposed to that collected by the Global North. As I elaborate further in Section 3.5.3, the government of Honduras as well as a number of mapping agencies were extremely

proprietary regarding access to spatial information that is publicly (and easily) available here in the United States. In addition to the Honduran government's "intentional neglect" and overt destruction of historical and geographical archival information (Soriano Ortiz 2013, "The National Archive of Honduras and State Irresponsibility), private mapping firms also made current spatial information nearly impossible to capture. Most of these firms required receipts of a bureaucracy-laden official "solicitation" before spatial information would be released. Overcoming the control and influence of such power structures was not entirely possible and clearly limited the opportunities for data collection. The principal challenges of triangulation frequently involve difficulties in negotiating between the perspectives of various power structures and the inevitable conflicts between them. This project is no exception.

The effectiveness of triangulation methodology may also be limited by the "potential disharmony based on investigator" (and informant) biases (Thurmond 2001, 256). The participatory nature of triangulation may help alleviate this "researcher myopia" (Gonzalez 2008, 327) by allowing the opportunity to include any number of informational resources. Researcher myopia involves the limited perspective and or biases of the research(er) which may lead to unintended omissions or exclusion of potential information or information sources (2008). Unless the researcher engages in "epistemic reflexivity" (Bourdieu and Wacquant, 1992, 36), researcher myopia may impede the effectiveness of the study. Engaging in epistemic reflexivity helps to ensure greater validity in the research by

recognizing, addressing, and offering self-critiques of one's methods, data, and conclusions (1992).

Researcher and informant biases reflect issues of both power and empowerment, as well. Not only may biases reinforce the disproportionate power of the researcher or particular informants, but, as Bourdieu attested, multiple "fields of power" exist in any "structured social space" (Johnson 1993, 9). Researchers, external sources, and local elites, can become drawn into an "elite bias," referring to the "favoring of the less poor and more influential" within the study (Özerdem and Bowd 2010, 24). Acquiring the input of a larger, more representative population of interviewees helps to increase validity while mollifying risks of reinforcing existing social power structures within the study (Fielding and Schreier, 2001).

But perhaps the greatest criticism of employing a triangulation methodology is the issue of credibility. Because triangulation methodology uses multiple approaches, the ability to repeat the investigation using other methods to re-create and reproduce its results may be limited. Despite this shortcoming, triangulation methodology remains one of seven techniques that have been endorsed by the Evaluation Research Society to help ensure credibility (Guba and Lincoln, 1989). Although the ability to repeat the results of a triangulated study may be open for critique, triangulation does provide a means of "cross-checking" the information to help ensure the validity of data (1989). Furthermore, triangulation may also "augment and illuminate data, [...] facilitate integration" of data and "capitalize on the putative synergistic effects of multimethods" (162). In other words, triangulation

lends itself to opportunities to corroborate one's data, revealing additional information about the data that may have never emerged without the ability to "cross-check" it.

Triangulation methodology has its limitations like any other scientific approach. But unlike "top down," *a priori*, positivist approaches to knowledge, triangulation methodology more effectively fits within postcolonial ideology as it seeks to represent and include multiple perspectives—echoing objectives similar to those of participatory mapping. Differing from empiricist formulations of the past, triangulation does not seek to provide a single, desired result from its inquiries, but to gain a broader understanding through a plurality of perspectives. Triangulation methodology's ability to serve as a more representative form of inquiry not only reflects the tenets of participatory mapping, but enables a more participatory, comprehensive, and inclusive form of investigation—particularly appropriate for a research project involving marginalized populations of the Global South.

3.5 Research Design and Methodology: A Multi-Method Participatory Approach

To avoid repeating participatory mapping's problematic tendency to reinforce existing conditions of marginalization and empowerment, this study utilizes a methodological approach that incorporates a variety of perspectives, inputs, and data sources. As explained above, triangulation methodology is well-suited for this purpose. Because triangulation methodology "consists of using various methods, such as interviews, observations, questionnaires, case studies and other secondary sources" in its data acquisition (Gaiha and Thapa 2006, 24), I have

been able to commingle a range of methodologies, resources, data sets, and analyses to strengthen and corroborate both the data collection processes as well as the results. In addition, this methodology allows for the participation and inclusion of multiple voices, perspectives, and data sources.

Triangulation methodology's comprehensive approach to research also fits neatly within the theoretical constructs of both participatory mapping and postcolonialism. For example, one component (the interviews) of the triangulation methodology I employ is participatory, which allows for locally-produced knowledge and incorporates a variety of inputs (Chambers, 1994; Rundstrom, 1995; Nietschmann, 1995; Weiner and Harris, 1998a; Elwood and Leitner, 1998; Kwan, 2002; Warren, 2005; and others). These interviews with local informants and the incorporation of data produced "from below" provide opportunity for the "subaltern to speak" through participation in this study.

The three methods of inquiry I have incorporated into this study are conducting interviews, reviewing governmental documentation, and employing geospatial technology to include various sources of statistical, spatial, and attribute data. These data sources include both qualitative and quantitative data to support and contest value-laden interpretations, positions, and perspectives that emerged in the data. The following subsections discuss the purposes, advantages, and challenges of each individual approach.

3.5.1 Interviews

As stated, in keeping with the foundational and ontological tenets of both participatory mapping and postcolonial approaches to knowledge creation, the interviews I conducted as part of this research project specifically allowed for the participation and representation of a collection of sources “from below.”⁴⁶ The locally-produced thoughts, experiences, and knowledge of both visitors and residents of Río Negro construct an integral component of this research project—represented in both qualitative and quantitative data. This multi-method approach offers a richer, more comprehensive understanding of the various economic, political, historical, and cultural contexts of the information from a variety of perspectives—including those of the marginalized and underrepresented. And, as with participatory mapping, the underlying goal of this more inclusive approach to research is to reflect the multiple perspectives, histories and experiences woven with the fabric of the Río Negro community—composed of perspectives internal and external to the community. Of course, despite all efforts to engage a more inclusive of method of inquiry, biases and inconsistencies are inevitable—and are discussed in-depth in Section 5.3.2: Reliability of the Research.

3.5.1.1 Internal Interview Subjects

Internal interview subjects of this study include over ninety-five percent of all current heads of household⁴⁷ in Río Negro. The questions were semi-structured

⁴⁶ For the formal list of questions asked during the interview processes, see Appendix 3: Interview Questions.

⁴⁷ As there is no commonly accepted definition of the term “head of household,” I am following cultural norms practiced throughout much of Latin America that frequently identify the oldest male income earner as the “head of household,” if one is present. Historically, culturally, and legally, “the notion of a household head has tended to be associated with that of a male provider” (United Nations 2004, 145).

as they sought to evoke specific responses while allowing for elaborations, anecdotes, explanations, and other offerings that many of the interviewees chose to contribute. In addition, each head of household provided her or his perspectives on the microturbines, the participatory exercise that was used to manage them, and the potential arrival of the electrical grid. Within this population of residents of Río Negro, I also acquired anecdotal information from those who experienced direct engagement with the participatory mapping exercise to further understand and complicate notions and understandings of what “participation” meant to residents. This “bottom up,” *a posteriori* knowledge of the local community provides practical examples and perspectives that fit within the larger theoretical contexts of participatory mapping.

3.5.1.2 External Interview Subjects

I also interviewed several external subjects, including two former Peace Corps volunteers, two Honduran consultants from outside of Río Negro whose knowledge of microturbines in the region is unparalleled, and one person from Partners of the Americas—the umbrella organization under which the HCC operated.⁴⁸

The responses of all internal interviewees of this case study are provided anonymously to protect individual opinions and identities. However, the two interviewees who primarily served as external experts were readily identified and engaged by community members during the research process. These two

⁴⁸ As noted earlier, the Honduras Conservation Corps no longer exists and I was unable to locate anyone with relevant expertise or experience with the HCC. Unfortunately, the representative of Partners of the Americas with whom I spoke was unfamiliar with the status HCC as it has remained inactive for several years. The most recent update to the Partners of the Americas: Vermont - Honduras webpage was in 2008 (Partners of the Americas, 2008).



Figure 3.13: Conducting an Interview in Río Negro
Source: Gabriel Sidman, 2012

subjects, Hector Oviedo and Adalid Zavala, live outside of Río Negro and, as stated, supplied specific historical, geographical, and technical information as they were the installers of nearly all of the microturbine in Río Negro and in the surrounding villages.

I also interviewed two Peace Corps volunteers who intermittently served in the region over the past three decades. First, Andrew Gaertner was stationed in Honduras from 1993-1996 and engaged in a number of participatory mapping exercises in Río Negro, including the construction of a 3-D model of the region (Gaertner, 2011c). Gaertner recently served as the president of Farmer to Farmer and annually leads small groups of tourists to Río Negro. His inside knowledge of

coffee farming in Río Negro and the surrounding region was critical to understanding the importance of the carretera, microturbines, and the issues faced by coffee farmers in the area. Because of his annual treks to Río Negro, Gaertner was also able to provide a longitudinal perspective on contemporary issues in Río Negro—particularly relating to the enduring legacies of participatory mapping and the microturbines.

Complementing Gaertner's experiences are those of the more recent Peace Corps volunteer, Gabriel Sidman. Sidman was exclusively stationed in Río Negro from 2008-2010. In addition to his vast local knowledge, Sidman was able to offer a greater familiarity with the contemporary aspects of the microturbines, recent problems relating to marginalization and empowerment, issues concerning the potential arrival of the power grid from the municipality of Comayagua, interpersonal conflicts and alliances, and other more community-centered topics. While serving as a volunteer, Sidman also created the first digital map of Río Negro—serving as the Río Negro basemap for this project.⁴⁹

3.5.2 Governmental Documentation

Oviedo and Zavala are also well-connected to mapping resources in the neighboring city of Comayagua, home to the largest collection of accessible governmentally-produced documents about Río Negro and the entire municipality of Comayagua. The governmental documentation I acquired for this research

⁴⁹ Sidman's original map contained the names of the head of household for each residence in Río Negro. I have removed the family names that were included on this map to retain the anonymity of the participants in this research project.

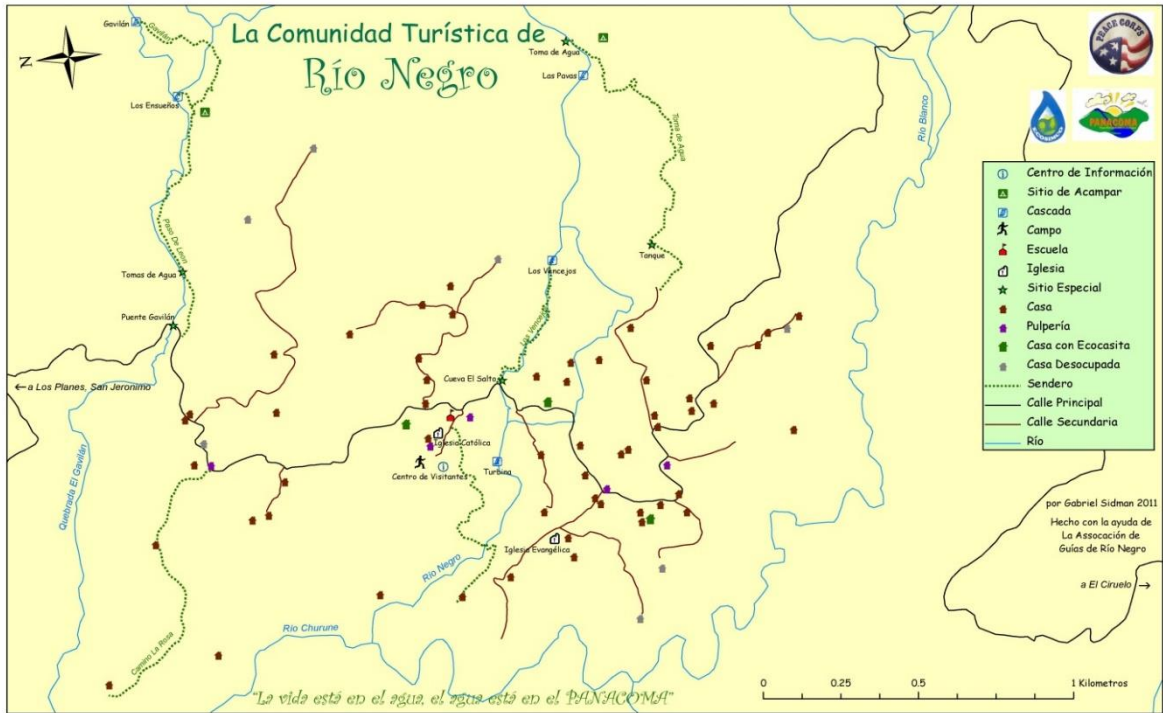


Figure 3.14: First Digital Map of Río Negro
 Source: Gabriel Sidman, 2011

project covers a wide range of forms and subjects—including Geographic Information Systems (GIS) maps, voting records, blueprints of the power grid that may be installed in Río Negro, among others. My original intent behind acquiring governmental documentation was to locate a collection of larger scale local and historical maps of Río Negro that may not be available here in the United States. These maps would, ideally, indicate changes over time in land ownership, parcel sizes, the built environment, land use, and other territorial issues. By analyzing these changes since the participatory mapping exercise, connections between microturbine access and marginalization and empowerment could perhaps be

drawn. However, publically available spatial information was extremely difficult to obtain or access.⁵⁰

These maps are extremely general and notably inaccurate as they were not produced for the purposes of identifying parcel ownership. Resultantly, this study relies on other resources that helped provide congruent contextual and circumstantial information to support the data that would have been provided by a contemporary cadaster.⁵¹

Compounding my inability to access geographic information was the fact that the maps made by the Honduran government (including those of Río Negro) were often relics from the 1950s and 1960s—most of which were produced by the U.S. Army Corps of Engineers or the CIA.⁵² Furthermore, due to the technology available at the time the maps were produced, the scale of the maps was far smaller (1:50,000) than what is currently available on ArcGIS. The only current maps I was able to procure were digital maps of Comayagua National Park and its buffer zone.⁵³ Hence, in what is an ironic postcolonial representation, most of the

⁵⁰ Innumerable explanations abound for the lack of publically available spatial information. Recent critiques suggest an intentional systemic failure—tying into issues of marginalization and empowerment on a national level. For example, Honduran historian Edgar Soriano Ortiz writes that “there has been an incredible decay of management of cultural institutions” across Honduras” (2013). In fact, he states that the “situation of the National Archive has becoming increasingly chaotic,” alleging intentional attempts by the Honduran government to destroy archival documents (2013). Concerning spatial information, specifically, Soriano Ortiz states that: “[a]rchival documents do offer a specific opportunity that may challenge power: land documents can be used to support legal claims when land has been alienated from communities or individuals marginalized in Honduran society, such as indigenous people or the Garifuna” (2013).

⁵¹ In 2013, the municipality of Comayagua began a new marketing campaign to encourage local residents to voluntarily submit spatial information in order to build and / or update the current cadastral inventory. This marketing campaign includes a website that explains that cadastral maps are important to the government in order to assess property values, update property tax values, coordinate public services with particular land uses, and to create legal land titles. The municipality has also created a comic book titled “El Cadastro” (“The Cadaster”) and its main character, “Cadastrito,” (loosely translated as “Little Cadasterman”) to help attract the attention and participation of its residents (Municipality of Comayagua, 2013)—many of whom are illiterate.

⁵² When I asked where I might find more recent maps, several agencies within the Honduran government recommended that I contact the CIA.

⁵³ As indicated previously, most residences in Río Negro are located within the buffer zone of Comayagua National Park.

maps used in this research project were not supplied by the local governments, but were externally produced in the Global North through ArcGIS or by the United States government.

Despite the paucity of Honduran-produced maps in this dissertation, I was able to secure other official documentation from the Honduran government. Among these documents include the 1999 *Monograph of Río Negro* (Velásquez et al., 1999)—a collaborative community needs assessment developed between the municipal government of Comayagua and the locally-organized “Communal Investigation Committee” of Río Negro.⁵⁴ I also acquired a copy of the *Proyecto Luz* study, which explored the viability of installing two large microturbines to supply electricity to the community (Overmars, 2000). Additionally, I received voting records of those who do and do not support the idea of connecting Río Negro to the power grid, a map of the proposed grid, among other related documents.

3.5.3 Geospatial Technologies

The capabilities of modern geospatial technologies complement other informational resources with its data storage and analytical capabilities—particularly concerning the large and diverse data sets I gathered as part of this study. One of these technical tools, GIS, is also highly functional for integrating a

⁵⁴ The monograph study coincided with the arrival of the first microturbine in Río Negro in 1998. However, the monograph also explored many needs of the community beyond simply electricity. Additional community issues that the monograph discussed included building a daycare center, addressing truancy, illiteracy, malnutrition, access to clean water, chemical contamination of the region, the use of pesticides, agricultural diseases, plant fungi, and other agricultural threats, the availability of social services, environmental conservation and protection, supporting community art fairs and events, tourism development, land tenure policies, and family planning, and increasing life expectancy (Velásquez et al., 1999).

wide range of data. For example, in order to obtain more current cartographic information on Río Negro, I combined Sidman's GIS basemap with a robust collection of Global Positioning System (GPS) readings that I recorded during the field research portion of this project. These GPS readings encompass an extensive spectrum of spatial data as they relate to electricity, marginalization, and empowerment within Río Negro. The GPS data include the location of every household, microturbine, and electrified residence⁵⁵ in Río Negro,⁵⁶ along with most major physical and cultural features such as rivers, roads, trails, and various points of interest.

The data gathered in Río Negro also includes dozens of attributes that supplied demographic, economic, and other household characteristics that were used to conduct the statistical analyses contained within this study. These attributes contain simple elemental attributes such as access to electricity, gender of the head of household, the square footage of the dwelling, family size, the number of residents who currently live within the household, and the distance to the nearest viable water source capable of powering a microturbine. These entries have been employed for simple analyses: observing potential relationships between access to electricity and gender, family size and electrical access, linkages between the size of the home and the gender of the head of household, among others. Such comparisons may help reveal observable tendencies between participatory

⁵⁵ The data include one microturbine that provides electricity to multiple residences.

⁵⁶ I also recorded GPS information in the neighboring village of Plan del Cedro for use in a future study. Plan de Cedro is located on the mountain face directly behind that of Río Negro. Dozens of hydro-microturbines power virtually every household in the community. In relative terms, Plan del Cedro is a far more prosperous community than Río Negro. Yet, perhaps due to this wealth, Plan del Cedro engages in extremely detrimental environmental practices, leaving the landscape barren or rife with garbage.

mapping, marginalization and empowerment, household characteristics, and access to electricity.

The attribute tables also contain data that uncover less apparent manifestations of marginalization and empowerment. For example, the presence of high-fidelity entertainment and communications equipment such as a television, CD player, stereo, or a cellular satellite dish all offer indications of empowerment—minimally through access to electricity. Further signs of modernity, such as an internal kitchen or indoor toilet facilities, also possess strong linkages to electrical access and, therefore, empowerment (For additional details on the presence of these symbols of empowerment in Río Negro, see Table 4.7: Symbols of Marginalization and Empowerment through Participatory Mapping). Additionally, the inclusion of an internal *pulpería*⁵⁷ (that often sell refrigerated products) also bears a strong association with empowerment and electrification. The presence or absence of such modernities within each household may reflect varying degrees of marginalization and empowerment, such as access to electricity—which may be a continuing legacy of the participatory mapping exercise.

Related, marginalization and empowerment may be visible in renovations and new structures outside of area homesteads, as well. Additions to houses, construction of new buildings, and other improvements to one's homestead also imply some degree of empowerment through the ability to initiate such changes. Specific examples in Río Negro include the new construction of coffee dryers,

⁵⁷ *Pulpería* is a word used in many Latin American countries that describes an extremely small “general store” that sells daily essentials much in the way one would think of a convenience mart here in the United States. The word “pulpería” derives from the Spanish word for octopus, *pulpo*, as these pulperías are tiny to the point where the clerk can reach all the available items in the store by simply extending her or his arms.



Figure 3.15: One of Several Eco-Huts Located along the Carretera in Río Negro
Source: Jeff DeGrave. 2011

installation or expansion of existing coffee drying patios, and the erection of “eco-huts” for tourists. All of these enhancements may serve to establish connections between those who are empowered to make changes that lead to increased income-generating opportunities, in part, through access to electricity. Contrarily, those who remain marginalized without electrical access are less able to self-empower and will likely be further marginalized with every new asset that the empowered are able to create for themselves.

This multi-method research approach is designed to include a variety of data sets, both quantitative and qualitative information, and numerous founts of resources. Combining this eclectic mix of data is intended to offer multiple forms

of knowledge, perspectives, and representations of spatially-related data. Through triangulation I have incorporated an array of complementary inputs to not only create a more robust dataset, but to help mediate any gaps that may have emerged within the data. This research project includes locally-produced ideas as well as “top-down” informational sources to ostensibly help create a well-balanced and inclusive set of results. However, like participatory mapping, it is important to note that the limitations of this participatory multi-method approach to research may also be at risk of reinforcing existing conditions of marginalization and empowerment of its sources—depending on how the information was interpreted, constructed, and utilized.

3.6 Chapter Summary

Río Negro still remains divided over electrical power despite the community’s efforts to employ participatory mapping to help more equitably distribute access to resources—including microturbine technology. Those in positions of power, with greater cultural capital, and greater access to electricity have been more enabled to exert their will over geographic space. Contrarily, the more disenfranchised members of the community continue to struggle to maintain an audible voice regarding their futures. The purpose behind employing triangulation methodology in this study is to illuminate these cultural forces of marginalization and empowerment by incorporating different forms of knowledge into the research—including the voices of the marginalized, the empowered, and those that occupy the liminal spaces in between—much like participatory mapping.

Quantitative and qualitative approaches to knowledge creation each have their limitations. But triangulation methodology, with its own limitations, allows for the inclusion of multiple perspectives and may be viewed as a postcolonial tool of discovery. Though it cannot guarantee a more effective evaluation of empowerment or marginalization from participatory mapping, triangulation methodology does recognize and incorporate bottom-up forms of knowledge production. Triangulation methodology also assists the researcher in crosschecking information in order to help create greater validity with the data and more verifiable results.

In spite of its drawbacks, triangulation methodology continues to be widely employed in participatory research—particularly concerning issues of empowerment (Chambers, 1994 and 1997; Malhotra, Schuler and Boender, 2002; Barahona and Levy, 2003; Whitehead and McNiff, 2006; Semu, 2011, and others). Innumerable international agencies and NGOs (Betsill and Corell, 2008), including the World Bank (World Bank, 2013b), advocate triangulation for its ability to cross-validate the results (Guba and Lincoln 1989), limit researcher bias (Betsill and Corell, 2008), and also because it is a participatory form of research—reflecting the ideas of PRA, PAR, and participatory mapping (Pinto et al., 2011).

Triangulation methodology can also be employed as an effective tool for combining and validating data obtained from a variety of informational resources (Gaiha and Thapa, 2006), an approach that fits well with the complexities and multidimensional nature of this postcolonial research project. The variability of the many data sources included in this study may be more effectively corroborated,

validated, and cross-checked through a triangulated approach, strengthening the analysis.

However, maintaining a delicate balance between possessing enough cultural capital to engage local populations and engender their participation without alienating one's sources of information through an elite bias is essential. As a significant portion of the data incorporated into this study was provided by sources outside of Río Negro, the participatory nature of this research project is open to many of the same criticisms that have been applied to participatory mapping. Nonetheless, every head of household (and other residents) in Río Negro had an opportunity to participate in this study. These perspectives compose a significant portion of this study and triangulation methodology has helped to identify and palliate some of the research challenges inherent to my role as the researcher and the implicit power dynamics my position assumes. The analysis in the next chapter examines the interplay of power structures, marginalization, and empowerment within Río Negro and the roles they role during and since the participatory mapping exercise.

CHAPTER 4: Analysis and Results

4.1 Overview

This section presents the empirical results of the Río Negro case study that reveal how participatory mapping did indeed reinforce preexisting conditions of marginalization and empowerment in Río Negro through its impacts on the development and distribution of microturbines. Since the completion of the participatory mapping exercise, the advantages of possessing a microturbine have further separated the marginalized and empowered residents of Río Negro. The people who acquired a microturbine through participatory mapping have benefitted far more compared to those who do not have access to electricity or those who received a microturbine long after the participatory mapping exercise was completed. In sum, no mechanisms were introduced during the participatory mapping exercise to ensure equal participation and those who received the benefits of microturbine technology were those that were already capially and politically enabled. This chapter employs empirical data collected in Río Negro to help assess the increased marginalization and empowerment that participatory mapping has engendered through microturbine ownership.

This analysis examines how historical settlement legacies, specific spatial advantages of household location, and the presiding social and political networks impacted the outcomes of the participatory mapping exercise and consequential acquisition of microturbines. All of these elements tie into past and present issues of marginalization and empowerment within the community, each having played significant roles in the participatory process, the distribution of the microturbines, access to electricity, and the resultant benefits. I then explore the relationship

between the participatory mapping exercise, the distribution of the microturbines, and how conditions of marginalization and empowerment have been further reinforced through the legacy of participatory mapping in Río Negro today.

Section 4.2 highlights the intentions and immediate impacts of the participatory mapping exercise in the community and offers perspective on the limited degree of participation that actually occurred during the exercise. Section 4.3 presents observable relationships between each of the three microturbine eras, participatory mapping, and the five criteria used in the analysis. Section 4.4 individually examines how each of these five variables demonstrate varying degrees of marginalization and empowerment in relation to the outcomes of the participatory mapping exercise and access to microturbines. Section 4.5 provides a multivariate radio graph analysis of these five criteria that visually reflects connections between participatory mapping, marginalization and empowerment in Río Negro while section 4.6 specifies how participatory mapping has continued to widen the gap between the more marginalized and empowered households over the long term. I also address whether or not participatory mapping was indeed the key factor in the reinforcement of conditions of marginalization and empowerment in Río Negro. Finally, Section 4.7 summarizes the chapter while setting up the conclusions of this study.

4.2 The Intent behind Participatory Mapping in Río Negro

As noted in the previous chapter, the participatory mapping project in Río Negro aspired to help level the playing field during the recovery from Hurricane Mitch, in

part, to help establish more equitable access to electricity. The goals of the NGOs involved in the re-creation of Río Negro paralleled those of participatory mapping: empowering the community, managing local resources (Granada, 2002), enabling a historically marginalized population to actively pursue and take ownership of the future direction of their village, and illuminating potential opportunities for economic development in the region (Partners of the Americas 2002, 1).

However, those with higher economic, political, and social status, more education, and longer legacies within the community clearly benefited the most from participatory mapping. Despite its purported facility to allow the voiceless to speak and creating a platform for disenfranchised members of the community to be heard, participatory mapping served as a means for village elites to solidify their already empowered positions. The forthcoming review highlights how participatory mapping immediately contributed to the continued marginalization of most of the community while adding to the empowerment of a select few in Río Negro.

4.2.1 Immediate Impacts of Participatory Mapping

Among the earliest impacts of the participatory mapping exercise was, ironically, not the production of a map, but the reestablishment of already empowered community leaders. Most notably is the Bosque household—home to a patriarch of the community and the father of MTO4. At the time of the participatory mapping exercise, the Bosques were “one of the main [coffee] producers” in the region, and MTO4 quickly gained cultural and political capital due to the prestige of his family, through his advanced horticultural skills, and his

familiarity with the natural environment (Partners of the Americas 2002, 10). MTO4's homestead was also centrally located and one of the largest within Río Negro, allowing MTO4 to become the fulcrum of the participatory mapping exercise.⁵⁸ Still today many community meetings are held at his family's residence. The HCC describes MTO4's growing sense of empowerment within the community by stating:

[MTO4] had a new dream: to make the mountain of Comayagua a beautiful place where locals and foreigners alike could visit and enjoys its beauty. His dream slowly came true. He found some business associates and people who shared his vision. HCC was one of the best solutions for [MTO4] and it became one of the propulsions of the program and through various camps, his dreams came true. The people listened to him more now that his leadership qualities have improved, and business partnerships like the Comayagua Mountain Ecosystem Foundation (ECOSIMCO) and the Municipality of Comayagua are constructing the first Visitors Center for the Comayagua National Park (PAPACOMA⁵⁹) in [MTO4's] community, Río Negro (Partners of the Americas 2002, 10-11).

Considering that MTO4's father was one of the patriarchs (perhaps oligarchs, as well) of Río Negro and one the village's most successful farmers, MTO4's family had long been established as part of the community elite. With MTO4's household becoming the *de facto* headquarters of the participatory mapping exercise, the direction of the endeavor would, in part, be a reflection of his "dream" to bring tourism (aided through access to electricity) to Río Negro (2002). The passage also notes the gradual empowerment of MTO4 and how his voice became dominant in terms of the direction of the proceedings. MTO4 and the HCC were

⁵⁸ The participatory map (Figure 1.6: Sketch Map of Río Negro continues to remain mounted on an exterior wall of the Iglesias homestead.

⁵⁹ It is unclear to me if this acronym contains a typographical error or if the acronym has been changed. What is written as PAPACOMA above is now known as PANACOMA.

successfully able to utilize one another's support of microturbines through participatory mapping and this intention was eventually carried out with the assistance of additional NGOs, as described above.

However, the rise of MTO4's standing within the community and the participatory mapping exercise also, in part, led to political divisions within Río Negro. As many members of society did not feel their "participatory" input was considered on an even par with those of village elites, Río Negro continues to be divided over this and other "participatory" endeavors—such as the construction of the Visitors Center.⁶⁰ As noted in the above passage, MTO4 "found some business associates and people who shared his vision" in order to further the microturbine agenda that he strongly supported during the participatory mapping process and continues to this day. These "business associates and people" included local elites who supported microturbine technology, those associated with the NGOs, international support, government officials, and other external participants who would be considered as elites relative to most residents of Río Negro. Though most locals did, in fact, partake in the participatory mapping exercise, the voices of the politically connected, the economically elite, and those with the greatest social capital appear to have spoken "more loudly" to the leaders of the participatory mapping exercise than "other" voices, again raising the question of what "participation" actually meant during this exercise.

⁶⁰ Information obtained through anonymous interview responses as part of this study.

4.2.2 Observations on the Participatory Mapping Exercise

The impacts of MTO4's stewardship on the direction of the mapping are unmistakable. The recipients of the first two microturbines installed as a result of the participatory mapping exercise were close business associates of MTO4. And, as noted, by 2008, MTO4 built a microturbine to power his own residence as well as the residences of two family members, all of his seasonal workers, the elementary school, the church, and the Visitors Center (Figure 4.1). Shortly thereafter his cousin, MTO5, also built and installed a microturbine in his own home.

It is important to note, however, that the results of the participatory mapping exercise are not a judgment against the character of MTO4. MTO4 was equipped with the knowledge, technical abilities, ingenuity, motivation, and opportunity to support the microturbine agenda. Moreover, because of his social and political network, he also had access to participants who were willing to embrace an alternative form of electrical production.

MTO4 attempted (and continues to try) to convince others within the community that investment in a microturbine is a worthwhile endeavor. But financial limitations and uneasiness with an unfamiliar form of electrical power⁶¹ have kept most of Río Negro from engaging with microturbine technology. In addition, as noted in Chapter 3, most members of the community did not feel that the mapping exercise truly allowed for "full" participation as indicated by MTO4 and other village elites. Those who did not occupy elevated political positions within the community

⁶¹ Most residents of Río Negro make regular visits to Comayagua and are familiar with modern electrical systems. Information obtained through anonymous interview responses as part of this study.

eventually dropped out of the participatory mapping process as village elites ultimately took control of the direction of the proceedings—and the outcomes.

As noted, Partners of the Americas and the HCC philosophically (and operationally) orient their participatory international development projects through community elites (Kestenbaum 2002, 165) and institutions (Partners of the Americas, 2014b). For example, the HCC engaged in what may be viewed as an elite bias by “favouring the...more influential” (Özdem and Bowd 2010, 24) as the Bosque family had been among the most empowered clans within the community since the 1950s and were perhaps more comfortable in engaging with external parties such as the HCC. Further evidence of this elite bias appears in the 2002 “Honduras Conservation Corps Evaluation” as the only residents of Río Negro referenced in the document are two members of the Bosque / Iglesias family (2002). For this reason, participatory mapping appears to have reinforced preexisting conditions of marginalization and empowerment in Río Negro. This reconfirmation of power structures through participatory mapping exercise continues to limit the benefits of microturbine technology for most residents of Río Negro today.

Spatial analysis of the territory controlled by the Bosque / Iglesias family further emphasizes how participatory mapping led to the empowerment of the “already empowered” in Río Negro. Figure 4.1 reveals the advantages of the significant political, cultural, and economic clout that the family holds through its long history and resultant large landholdings. In addition to administering electricity to the households of family members and seasonal workers, under the family’s *territorial*

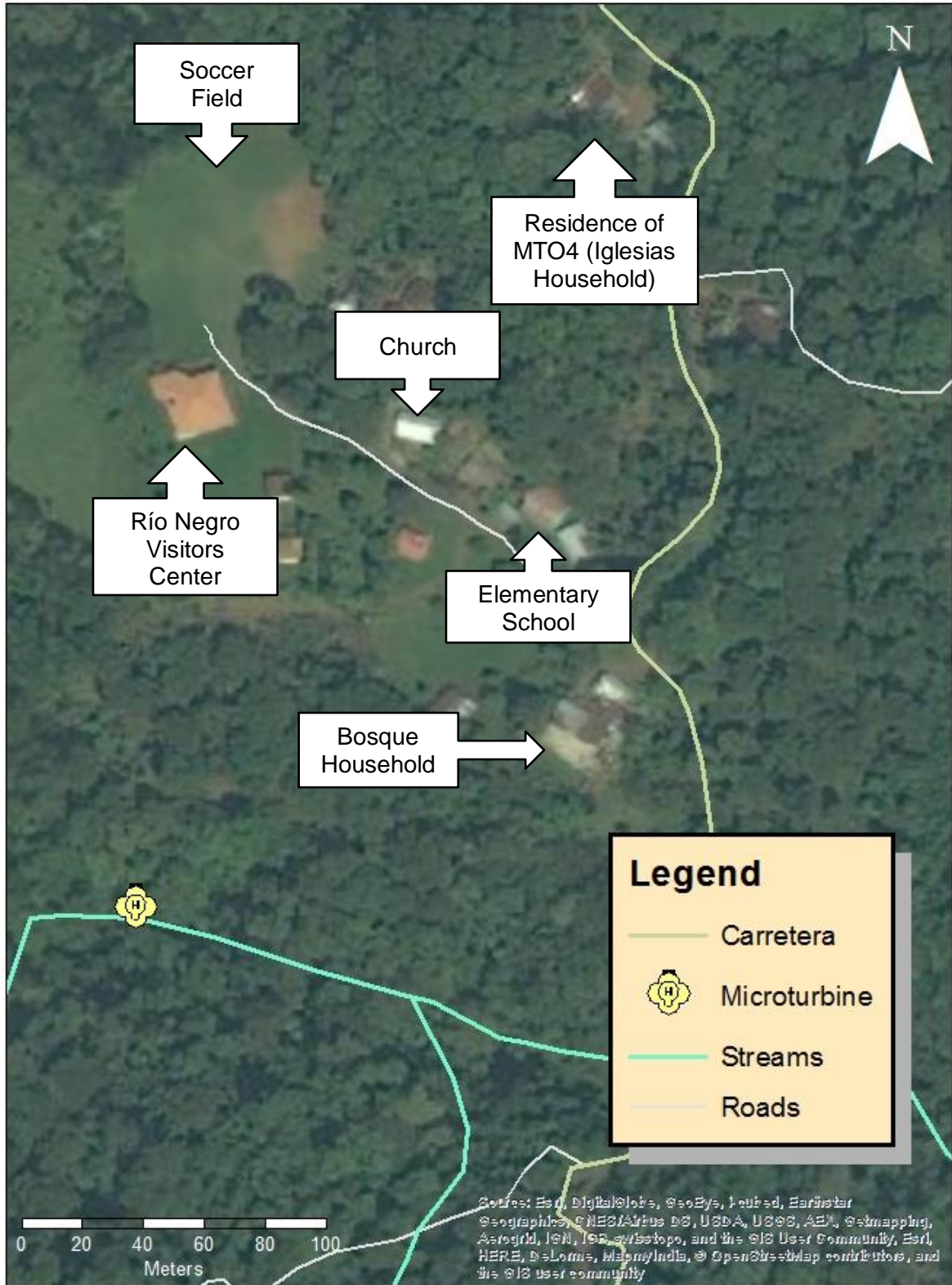


Figure 4.1:

The microturbine belonging to MTO4 powers multiple residences as well as the cultural core of Río Negro.

Map produced by Jeff DeGrave, 2014

authority lies the *de facto* cultural center of Río Negro. This “third space” (Bhabha, 1994) contains the school, church, Visitor’s Center, and soccer field—all of which are under the electrical, political, and territorial control of the Bosque / Iglesias family.

4.3 Identifying Marginalization and Empowerment

Although participatory mapping clearly aided the politically and socially elite in the short-term, the heart of this investigation lies in the long-term analysis of its impacts. This assessment of the long-term legacies of participatory mapping first begins with a brief profile of the current microturbine owners in Río Negro—comparing and contrasting them with those who do not have access to electricity. Microturbine ownership is broken down into the three distinct time intervals identified in Chapter 3:

- Era I: the Pioneer Era;
- Era II: the Revival Era; and
- Era III: the Tourism Era.

Eras I and II were led by local elites who directed the participatory mapping exercise, while the Tourism era exists external to the influence of the participatory mapping exercise and the initial distribution of microturbines to village elites. In this analysis I group Eras I and II together as both eras are inextricably linked to the results of participatory mapping. I then use these categories to make comparisons and differentiations between those who benefitted from the participatory mapping exercise and those who did not. This section provides foundational demographic information to help uncover the role that participatory mapping played in reinforcing

the ongoing cultural partitioning of the community through the distribution of electricity.

The demographic data used in this analysis derives from interviews of over 90% of all heads of households in Río Negro. This data was entered into a GIS for further analysis to look for trends, tendencies, and patterns. As stated previously, among my first observations were that the elites who greatly influenced the participatory mapping exercise tended to live along the carretera in Río Negro, enjoying the legacies of previous generations of settlers who occupied the first, and most serviceable, tracts of land on the mountain. This empowerment is also evidenced by the size of their homes, their relative ease in accessing a water source, their participation in the tourist economy, and the smaller sizes of their families. On the other hand, more marginalized households—those who played limited roles in the participatory mapping exercise—generally occupied land away from the carretera, further from a water source, had larger families, and did not have access to electricity. Hence, the five primary statistics incorporated into this study to establish the relationship between participatory mapping, marginalization, and empowerment for each household in Río Negro are as follows:⁶²

- Average Dwelling Size (in square meters)
- Average Number of Residents per Household
- Domestic Space per Person⁶³
- Average Distance to the Carretera
- Average Distance to the Nearest Waterway

⁶² To view the raw data used in this analysis, see Appendix D: Río Negro Household Statistical Data. If the head of household was unavailable, I interviewed an available adult who was knowledgeable of the family and the homestead. I did not include any vacant or seasonal quarters for use in this analysis.

⁶³ Specific household economic data was not available. Therefore, by calculating the amount of square footage available to each resident of each home, one may interpret this figure as the relative economic well-being of a family. Additionally, very little hard currency is used in Río Negro, thereby further undermining the effectiveness of using income to overtly measure *economic* social class.

4.4 Quantitative Analysis of Microturbine Ownership: The Haves and Have-Nots

Only 10.8% of all residences in Río Negro currently have access to electricity—all of which is derived from microturbines.⁶⁴ Most of these microturbines were installed at the residences of village elites during Eras I and II as the result of participatory mapping. Questions continue to remain as to the role participatory mapping still plays in the representations of marginalization and empowerment that microturbines engender—in addition to access to electricity. This section conducts a number of statistical analyses to reveal connections between the outcomes of the participatory mapping exercise and contemporary reflections of marginalization and empowerment in the households of Río Negro. The three population cohorts represented in these analyses are:

- Era I and II Households with a Microturbine
- Era III Households with a Microturbine
- Households without a Microturbine

I follow this quantitative study with a cross-analysis of two geographic variables, Average Distance to the Carretera and Average Distance to the Nearest Waterway with Domestic Space per Person. Because Domestic Space per Person derives from the combination of Average Dwelling Size and Average Number of Residents per Household, Domestic Space per Person captures the significance of these two variables. The purpose behind this cross-analysis to determine if notable relationships exist between households located along the carretera or near a waterway and the amount of domestic space per person. I conclude the analysis

⁶⁴ Based on survey responses as part of this study.

by presenting the values for each descriptive statistic and variable incorporated into this study.⁶⁵

4.4.1 Average Dwelling Size

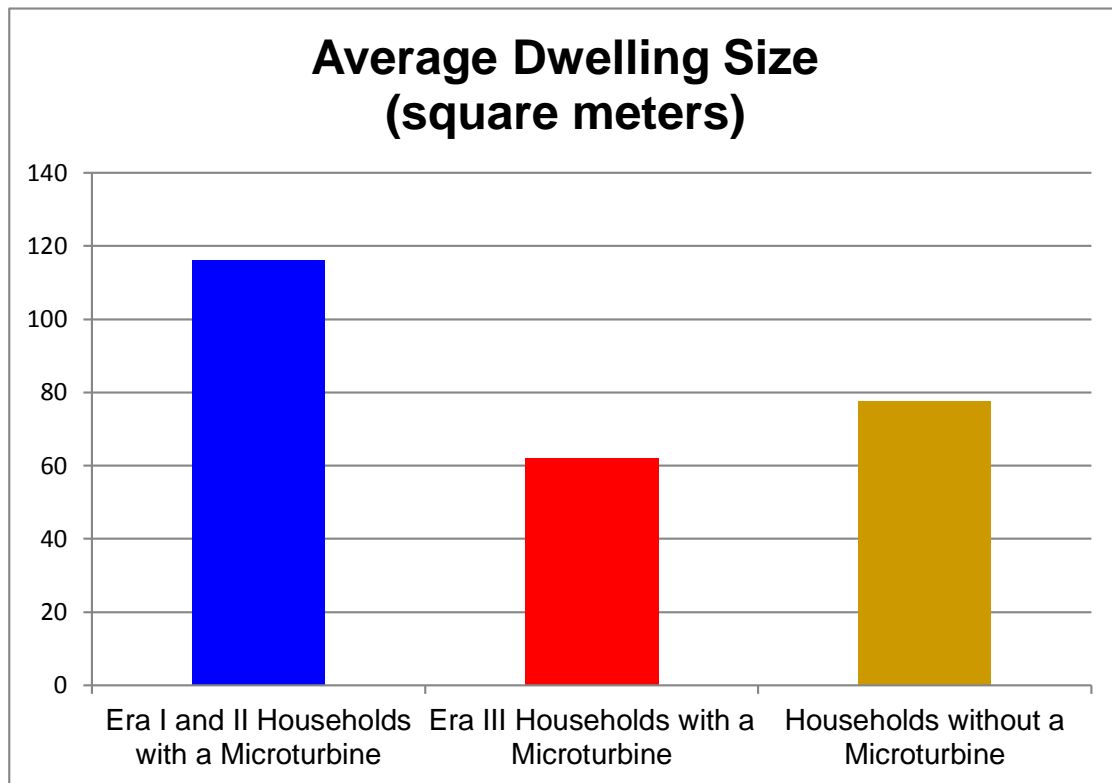


Table 4.1: Average Dwelling Size in Río Negro
Source: Jeff DeGrave, 2012

As indicated in Table 4.1, households that received a microturbine through participatory mapping are, on average, are nearly twice as large as the households that received a microturbine during Era III. This graph also reveals the marginalization experienced by the Era III households. Era III homes only average 62.1 square meters while the average size of households without a microturbine is over 20% larger at 77.6 square meters. This metric may be used as surrogate for

⁶⁵ For further analysis of marginalization, empowerment, and microturbine ownership see Appendix G: Box-and-Whisker Graphs for Each Variable vis-à-vis Microturbine Ownership Status

economic class as those with larger dwellings are likely to possess greater economic means in order to maintain the residence. However, a larger dwelling may simply be reflective of a larger family living in that residence. Section 4.4, Radio Graph Analysis: Marginalization and Empowerment by Household, more specifically addresses this question. Nonetheless, the data in Table 4.1 suggest that those who received a microturbine through participatory mapping are also those with largest homes in Río Negro.

4.4.2 Average Number of Residents per Household

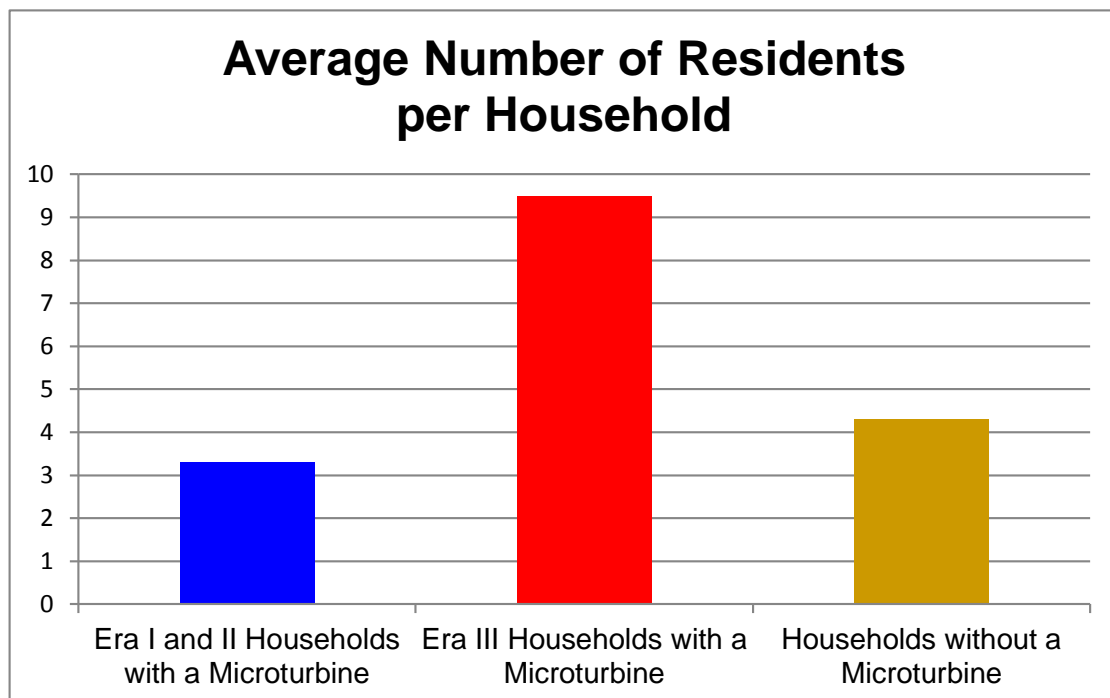


Table 4.2: Average Number of Residents per Household
Source: Jeff DeGrave, 2012

Coupled with Table 4.1, Table 4.2 provides strong evidence that the elites who significantly influenced the participatory mapping exercise not only tend to have larger houses, but fewer residents in their dwellings. Era I and II microturbine

owners average only 3.3 residents per household while Era III microturbine owners average a whopping 9.5 residents per household—largely because the home of MTO6 regularly contains between 11 and 18 occupants on a regular basis.⁶⁶ And, should the participatory mapping have been conducted with the “greatest need” in mind, certainly MTO6 should have garnered significant consideration for a microturbine. MTO6 did receive a microturbine until 2011—13 years after the participatory mapping exercise was completed.

4.4.3 Domestic Space per Person

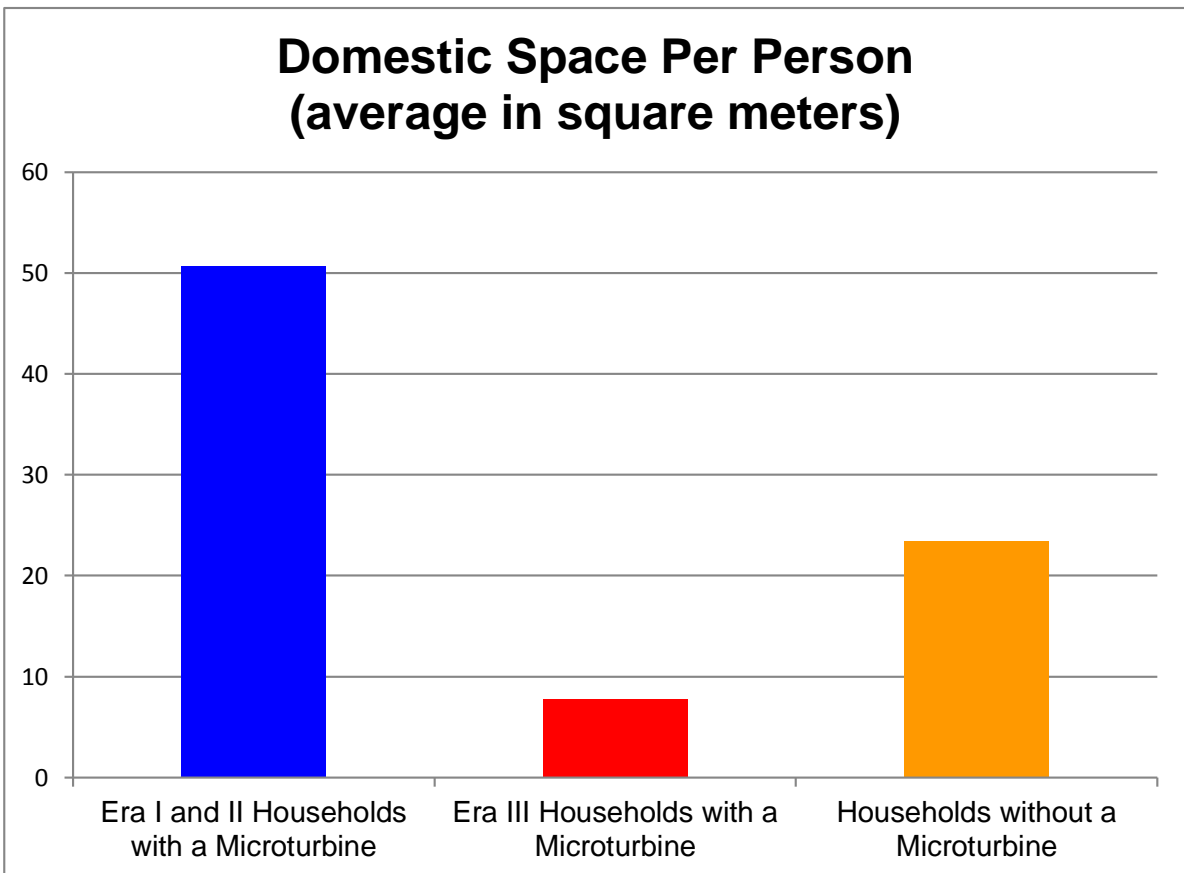


Table 4.3: Domestic Space per Person
Source: Jeff DeGrave, 2012

⁶⁶ For the purposes of consistency, I am using the figure of 13 for the number of residents in the Zúñiga household as 13 people were present the day I conducted my interview at the household.

Combining the two preceding variables offers another perspective on existing corollaries between participatory mapping, dwelling size, and household size. This metric is calculated by dividing the total square footage of the dwelling by the number of persons who occupy that dwelling to measure of the average amount of domestic space for each resident within the household. Table 4.3 reveals a rather extreme disparity in household space between village elites who received microturbines during Era I and II and the remainder of the population. Era I and II microturbine owners average over 50 square meters per person of domestic space. While those who are marginalized from access to electricity tend to live in notably confined spaces, averaging only 23.4 square meters per person. Again, the households that received microturbines outside of the participatory mapping exercise reveal extreme living conditions of large families existing in incredibly limited spaces. In fact, the domestic space at the MTO6 household is the lowest in Río Negro at 4.3 square meters per person.

4.4.4 Average Distance to the Carretera⁶⁷

Many local elites also continue to enjoy the empowerment gained from being among the first to claim territory in Río Negro. As noted, the earliest settlers tended to occupy spaces nearest to the carretera and with the most arable land. Therefore, a strong connection between receiving a microturbine through participatory mapping and residing a relatively short distance to the carretera

⁶⁷ This measurement was not calculated in simple linear distance. Since Río Negro is dominated by rugged mountainous terrain, the most appropriate measure of distance is by following the most direct trail or a roadway. For this reason, the calculated distances used in this metric may be significantly longer than how they may appear on a map.

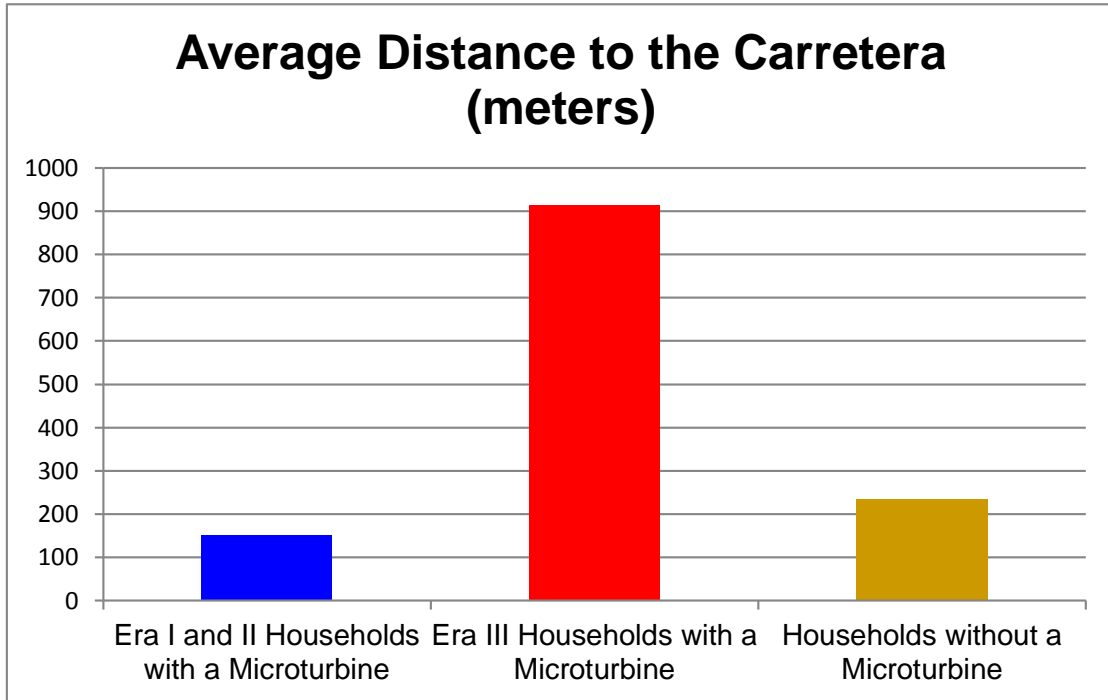


Table 4.4: Average Distance to the Carretera
 Source: Jeff DeGrave, 2012

should emerge in the data for Era I and II microturbine owners. Table 4.4 reveals that the dwellings of Era I and II microturbines owners average approximately 150 meters in distance from the residence to the carretera. For those who received a microturbine through the donations of tourists during Era III, nearly 915 meters lie between their household and the carretera, on average. Even in comparison to those without a microturbine, Era III households are far more marginalized in terms of access to the main road. Again, the mean for the Era III households is largely influenced by the fact that MTO6 lives over one kilometer from the Comayagua Mountain Highway, and is the most remote residence in Río Negro. And as evident in the previous graphs, those households at the greatest geographic disadvantage in terms of access to the main road were unaided by the use of participatory

mapping. Furthermore, those who were able to settle nearest to the carretera were the prime beneficiaries of the mapping exercise.

4.4.5 Average Distance to the Nearest Waterway⁶⁸

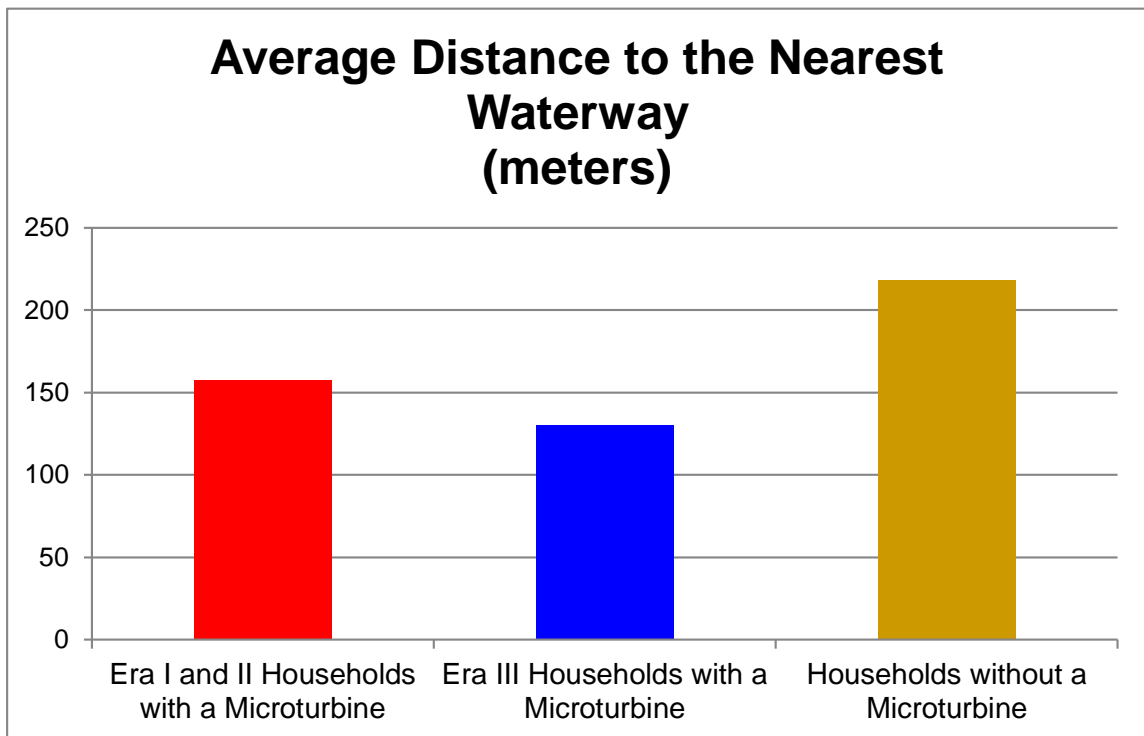


Table 4.5: Average Distance to the Nearest Waterway
Source: Jeff DeGrave, 2012

The chart reveals a rather complex relationships between participatory mapping, microturbines, and the distance to the nearest waterway. First, it is perhaps no surprise to see that those who live farthest from a river do not have access to microturbine-generated electricity. The microturbine hydropower system requires a series of PVC pipes to bring the water from the river to the microturbine

⁶⁸ This distance was calculated in direct linear distance. When the PVC pipe is routed between a river and the microturbine, following a trail or roadway is neither required nor preferred. In order to save costs, the PVC pipe is routed as directly as possible to and from the water source. For this reason, this metric was calculated using the shortest distance between the dwelling and the nearest waterway. However, microturbine installers often encounter any number of physical and legal obstacles that may warrant a more indirect route to the waterway and therefore require additional PVC tubing.

and back into the river. Therefore, the amount of necessary PVC pipe is a function of the distance between the microturbine and the waterway. For this reason, those who live closest to a useable waterway will generally find the installation of microturbine tubing to be far less difficult and a much less costly proposition than those who live a significant distance from a river or stream. For this reason, given the experimental nature of microturbines during Eras I and II, perhaps those with easier access to a waterway were prioritized over all other considerations. And, generally speaking, those with easier access to a waterway were the earliest settlers of Río Negro—the very same elites who gained significant influence over the participatory mapping proceedings. However, it should also be noted that the household belonging to the microturbine recipients in Era III are located, on average, over 25 meters closer to a waterway than those who received a microturbine through participatory mapping. This contradiction suggests that distance from a waterway was not an overriding determinant in microturbine distribution through participatory mapping.

4.4.6 Quantitative Analysis Summary

These analyses illustrate a number of tendencies of how participatory mapping reinforced existing conditions of marginalization and empowerment in Río Negro. In sum, those who benefitted from the participatory mapping exercise and through access to microturbine-generated electricity (Eras I and II) tend to live relatively near to water, have larger homes, fewer inhabitants within those homes, and therefore greater domestic space per person. These households also tend to be

	Era I and II Residences with a Microturbine	Era III Residences with a Microturbine	Residences without a Microturbine
<i>n</i>	4	2	64
Average Dwelling Size (m²)	116.25	62.13	77.64
Average Number of Residents per Household	3.25	9.5	4.29
Domestic Space per Person (m²)	50.73	7.83	23.43
Average Distance to the Carretera (m)	151.31	914.66	235.93
Average Distance to the Nearest Waterway (m)	157.77	130.38	218.47

Table 4.6: Sample Cohorts Compared against Common Variables
Source: Jeff DeGrave, 2012

the homes to descendants of the earliest settlers in Río Negro. For these reasons, these households were clearly not among the most marginalized based on the five variables tested. In addition, the first four residences that received a microturbine contained a male head of household at the time, as well.

This demographic snapshot again raises questions as to the increased inequities created by participatory mapping. Until a microturbine was externally donated by Farmer to Farmer in 2011, none of the more marginalized residents—those away from the main road, in smaller houses, and with larger families—received access to electricity. Although more residents of Río Negro currently have access to electricity than ever before, an external force needed to insert itself into the microturbine distribution equation before anyone outside the socially, politically, and economically empowered network received access to electricity. Participatory mapping is, of course, designed to empower disenfranchised populations, offer a voice to the unheard members of society, and create a more democratic system of decision making. However, as those households with the greatest apparent need in Río Negro did not receive access to electricity, participatory mapping only exacerbated prevailing conditions of marginalization for some while enhancing the empowerment of the already empowered.

It should be pointed out, however, that participatory mapping is not the only factor that has impacted past and current conditions of marginalization and empowerment in Río Negro. For example, remittances play an enormous role in the national, regional, and local economies of Latin America—particularly in small, rural, and comparatively disadvantaged communities such as Río Negro. Although

migrants have traveled from Honduras to the United States for decades, large-scale emigration from Honduras to the United States is a relatively recent phenomenon—largely provoked by the aftermath of Hurricane Mitch (Reichman, 2013).⁶⁹ Many former and current residents have migrated to the United States and the impacts of remittances in Río Negro are palpable. Home repairs, new clothes, and the omnipresence of small household appliances represent but a few of the changes that remittances have brought to Río Negro. But major impacts such as building additions, the acquisition of an automobile, or even the installation of a microturbine generally remain beyond a realistic possibility—even with the economic power of remittances. Regardless of the external influences that may have impacted the degrees of marginalization and empowerment experienced in Río Negro, participatory mapping was unable to meet its theoretical objectives of empowering the voiceless, more marginalized members of the community.

4.5 Radio Graph Analyses: Marginalization and Empowerment by Household

As illustrated in Table 4.6, those who received microturbines via participatory mapping tended to possess, on average, larger dwellings, smaller families, more domestic space per resident of each household, and easier access to the carretera than the averages for Era III recipients of microturbines as well as those without a microturbine. In addition, those who received a microturbine through the participatory mapping exercise also tended to live relatively short distances from

⁶⁹ Río Negro experienced a similar emigration pattern; but those who left the community after Mitch have returned to their families. However, many of Río Negro's young adult population have since gone to the United States. Currently, teenagers are contemplating their own possibilities for migration—some looking to reunite with parents that have not returned for years (Yanes, 2012).

the nearest waterway as compared to those who did not benefit from the participatory mapping in terms of access to electricity.

The five variables incorporated into this study suggest a compelling relationship between those who benefitted from the participatory mapping exercise and a preexisting, more empowered, elite status within the community. Therefore, analyzing these same five variables on a per household basis will offer additional insight into the varying degrees of marginalization and empowerment exhibited throughout Río Negro. By identifying the levels of marginalization and empowerment reflected by each household based on the five variables tested above, generalizations may be made as to whether or not participatory mapping reinforced existing conditions of marginalization and empowerment within the community.

To compare and contrast these same five variables I employ a radio graph analysis. Each radio graph examines (moving in a clockwise manner from the top of each graph), the Dwelling Size, the Number of Residents in Each Household (Residents), the Domestic Space per Person, the Distance to (the) Carretera, and the Distance to (the nearest) Water(way). Examining not only the values, but the resultant patterns of the values displayed on each radio graph creates a visual representation of marginalization and empowerment on a per household basis in Río Negro—based on the five variables used in the previous analysis. With these radio graphs one can make assessments as to whether or not participatory mapping empowered the more marginalized or already empowered households

within the community. To view the radio graphs of each household in Río Negro, see Appendix 5: Radio Graphs of Each Household in Río Negro.

First, in order to establish points of relativity regarding the degrees to which participatory mapping reinforced existing conditions of marginalization and empowerment, I have created a radio graph containing the average values for each of the five variables for all of Río Negro. Figure 4.2 reveals a relatively non-descript pattern as it contains only the mean averages⁷⁰ for each of the five variables for the entire community.

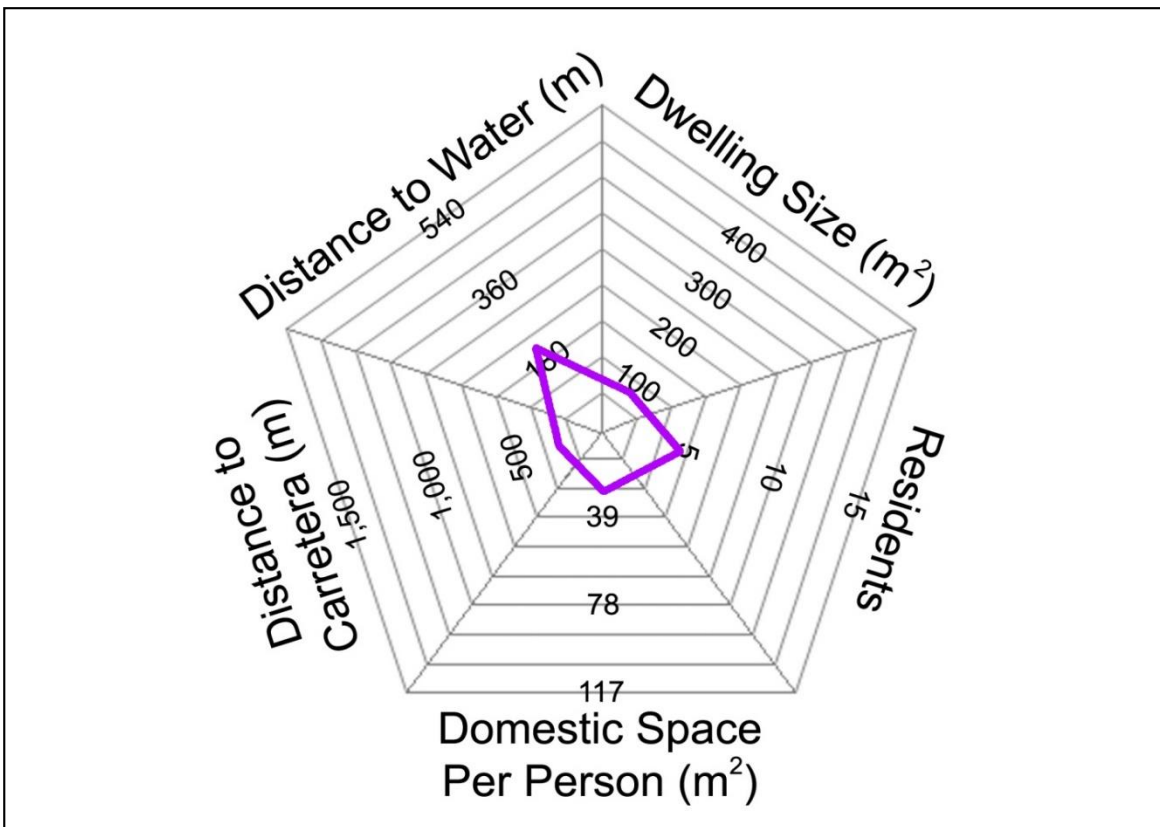


Figure 4.2: Averages for All Residences of Río Negro
Source: Jeff DeGrave, 2012

⁷⁰ See Appendix F: Mean Averages, Central Tendency, and Mode Analysis Calculations for the Five Variables Tested by Era for further statistical analysis

Secondly, to determine if all recipients of microturbines were already among the more empowered members of the community, Figure 4.3 provides a visual comparison of the average values of each of the five variables for all residences that do and do not contain a microturbine. The radio graphs reveal fairly similar patterns. Although differences can be noticed, no striking dissimilarities become apparent. This general similarity implies that not all recipients of microturbines shared a common status as either extremely empowered or extremely marginalized—according to the five variables tested. Therefore, further analysis of those who currently possess a microturbine is necessary to determine if those who received a microturbine during the participatory mapping exercise (Eras I and II) reflected notably different conditions of marginalization and empowerment when

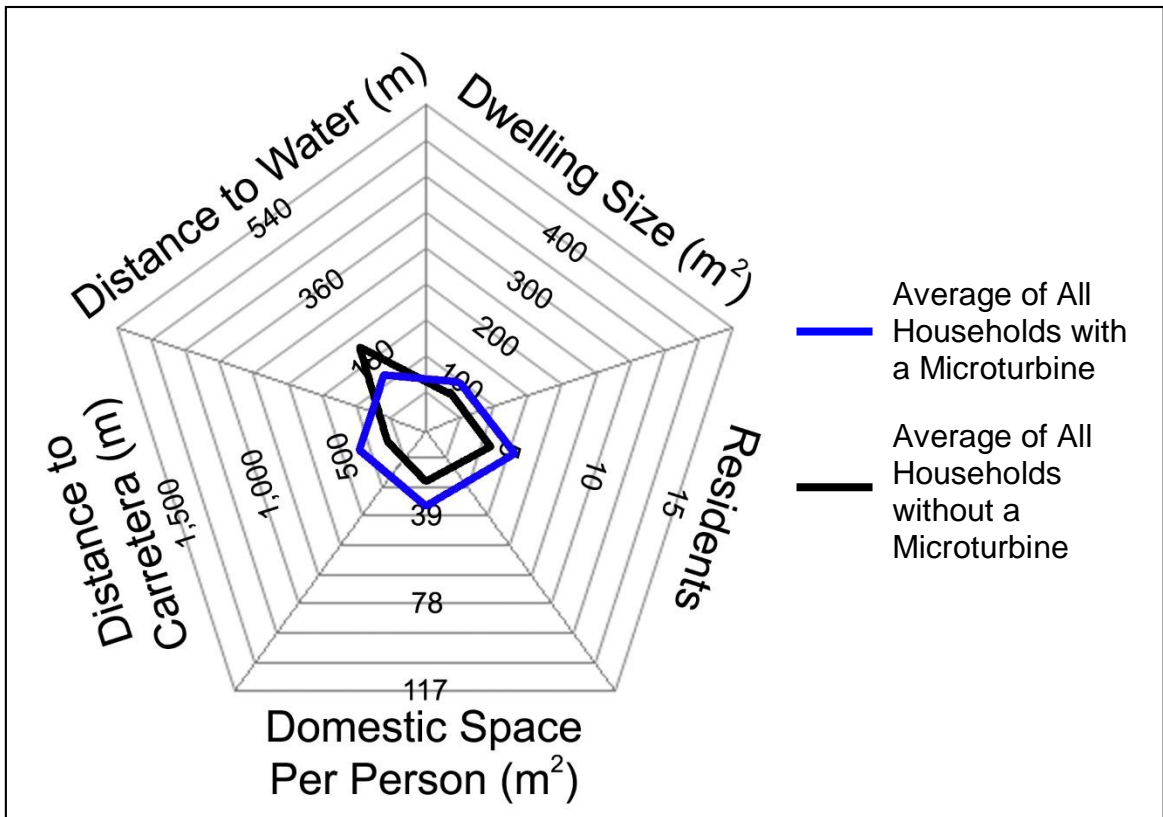


Figure 4.3: Averages for All Residences With and Without a Microturbine
 Source: Jeff DeGrave, 2012

compared to those who did not receive a microturbine through the participatory mapping exercise (Era III).

However, when I apply the averages of those households that received a microturbine through participatory mapping during Eras I and II, Era III, and those who did not receive a microturbine at all (Figure 4.4), striking patterns emerge. First, households without a microturbine reveal a pattern notably similar to that of the averages for all residences in Río Negro as seen in Figure 4.2. This similarity is not surprising since roughly 90% of all households in Río Negro do not possess a microturbine. Of greater note, vast differences emerge between the patterns exhibited by Era I and II households and those of Era III.

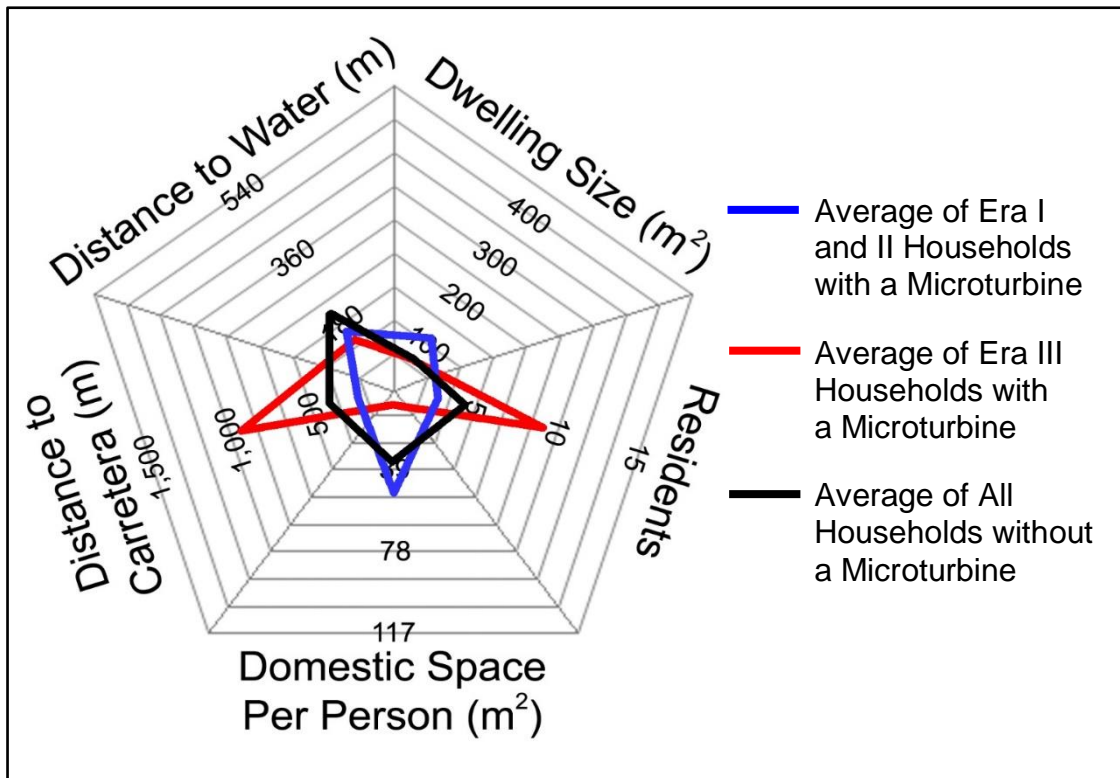


Figure 4.4: Averages for Era I and II Households with a Microturbine, Era III Households with a Microturbine, and Households without a Microturbine
Source: Jeff DeGrave, 2012

Perhaps most apparent are the extremes: the large sizes of families and relatively large distances from the carretera for Era III microturbine recipients as well as the notably larger value for Domestic Space per Person for those households that received microturbines through participatory mapping. This radio graph again reflects indications of greater empowerment—such as the relative proximity to the carretera, greater amounts of domestic space per person, and larger dwellings—for those that received a microturbine through participatory mapping. Contrarily, those with larger families, smaller homes, and greater distances to the carretera continue(d) to remain more marginalized—despite the use of participatory mapping. If not for direct mediation by tourists during Era III, two of the most marginalized households in Río Negro would likely have never

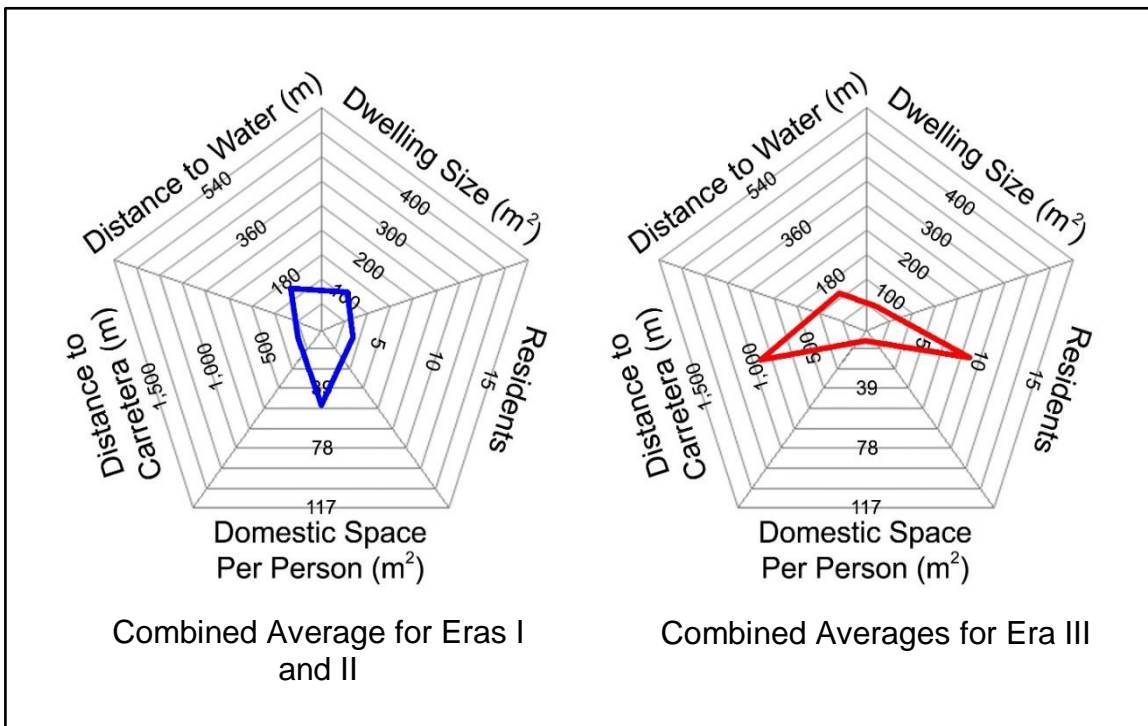


Figure 4.5: Radio Graph Analysis:
Averages of Households with Microturbines by Era
Source: Jeff DeGrave, 2012

received a microturbine. Figure 4.5 offers yet another revealing perspective on these same averages through a side-by-side comparison of those who received microturbines during Eras I and II with Era III.

Although these averages provide a general portrayal of how participatory mapping simultaneously reinforced conditions of marginalization and empowerment in Río Negro, refocusing this analysis on household scale offers even greater insight into this phenomenon. Figure 4.6 presents the individual radio graphs for each household that possesses a microturbine. Contrasting the households from Era I and II with Era III again highlights vast differences in degrees of marginalization and empowerment—according to the five variables tested.

The radio graphs consistently reveal the empowerment of those households who received microturbines through participatory mapping. These families also tend to live closer to the carretera, have fewer children, live in larger homes, and have more domestic space per person. The left-to-right orientation of the Era III radio graphs helps reveal the extreme conditions of marginalization that MTO6 and MTO1c continually endure: living nearly 1,000 meters from the carretera with less than 12 square meters per person of domestic living space. In contrast. MTO5 enjoys over 100 square meters of domestic space per person and resides less than 50 meters from the main road.

Following the examples provided in Figures 4.4, 4.5, and 4.6, I have applied this analysis to every household to help create insight as to which households in Río Negro suggest the greatest degrees of most marginalized and empowered-- according to the same five variables. The purpose of this analysis is to further support the notion that participatory mapping reinforced conditions of marginalization and empowerment in Río Negro. By noting which households reflect the greatest degrees of marginalization and empowerment, generalizations can be made about whether or not participatory mapping was able to live up to its purported abilities in countering dominant discourses of power including multiple voices, (Taylor-Lovell, 2007) and helping to “solve problems in specific sectors of society” (Aberley and Sieber, 2002).

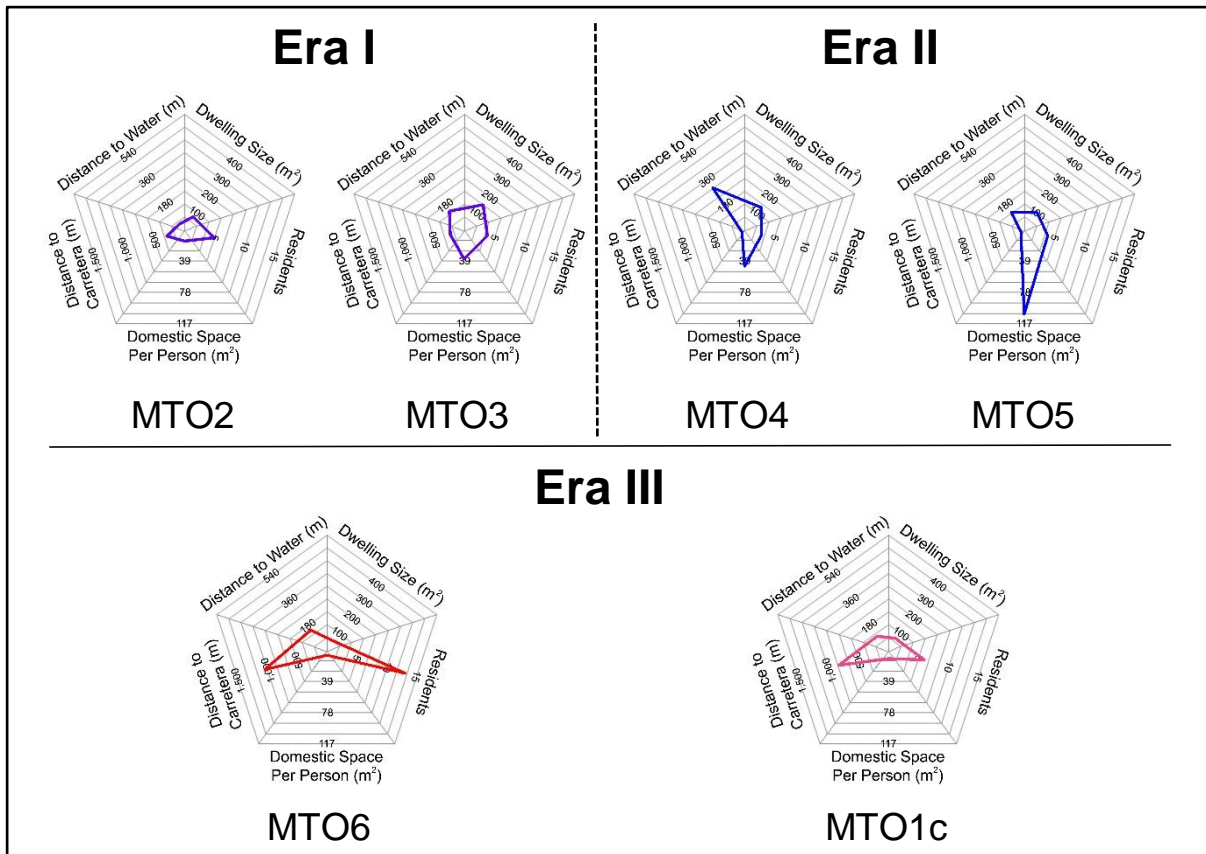


Figure 4.6: Radio Graph Analysis: Individual Households with Microturbines by Era
Source: Jeff DeGrave, 2012

First, I entered the numerical data for each of the five variables. I then applied a non-weighted ordinal ranking of all fully occupied 68 residences in Río Negro. I ranked these residences between 1 and 68 to determine each household's degree of marginalization and empowerment relative to all other households in Río Negro. For example, the residence with the shortest distance to the carretera received a 1 for this variable. On the other hand, the household that was located furthest from the carretera received a ranking of 68. I then averaged the rankings for each household to create a tool to assess the relative degree of marginalization and empowerment for each household based on the five variables.⁷¹ Finally, I submitted these values for GIS analysis to physically locate which households and the extent to which they reflect marginalization and empowerment within the community.⁷²

Figures 4.7 and 4.8 provide the results of this ordinal ranking analysis. These two figures display the most extreme representations of marginalization and empowerment among households in Río Negro according to the ordinal ranking system analysis of the five variables. As there are 68 households in Río Negro, I

⁷¹ It is important to note that the purpose of averaging these values is not to dictate, quantify, or define the degree of marginalization and empowerment for each household in Río Negro. This value is simply a reflection of existing conditions of marginalization and empowerment within each household based on the five variables included in this study. As was discussed in Section 3.3: Empowerment and Marginalization through Participation: Triangulation, triangulation methodology presents its own limitations in terms of which data sources are included and excluded and the unlikely repeatability of the results. Therefore, a different triangulated approach to assessing marginalization and empowerment may incorporate alternate variables which may produce differing results. But, again, the purpose of this study is not to define, measure, or locate what *is* marginalization and empowerment. Returning to Elisheva Sadan's quote in Section 3.2.8: Understanding How Marginalization and Empowerment Act, "The important question is how power acts and what it produces" (Sadan, 2004).

⁷² Related to the previous footnote, I am not including this map as part of this dissertation in order to maintain the anonymity of the respondents. However, I will make this map available for analysis during my dissertation defense.

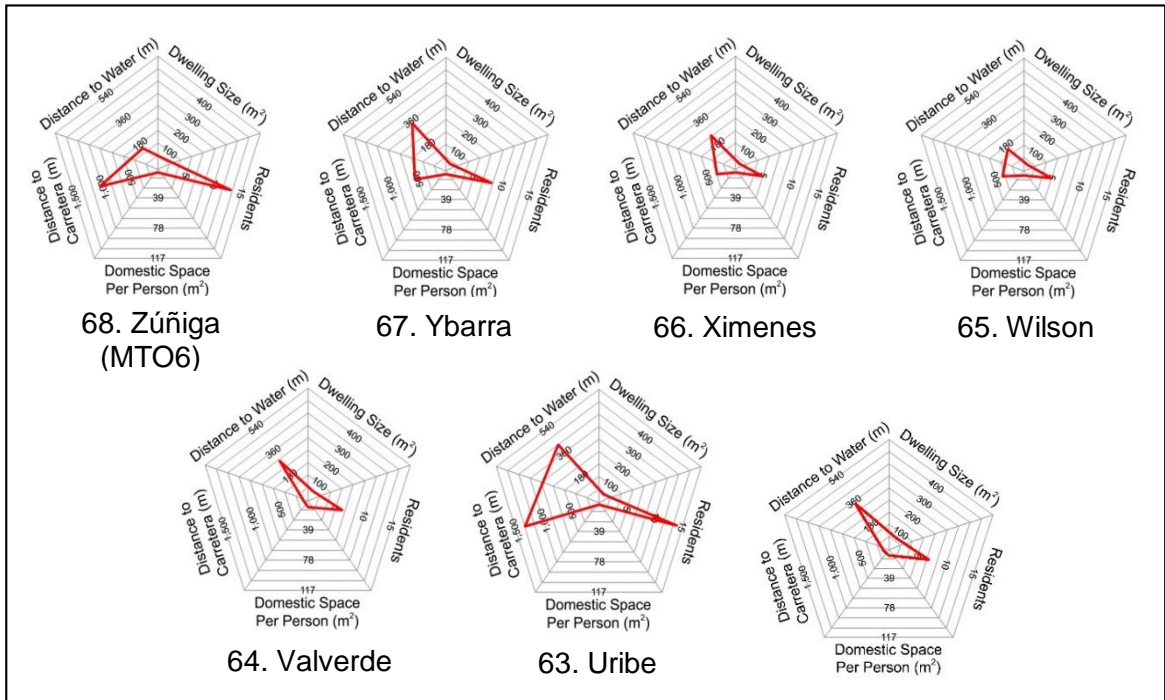


Figure 4.7: Radio Graph Analysis: Households that Reflect Extreme Conditions of Marginalization in Río Negro According to the Five Variables Tested
Source: Jeff DeGrave, 2012

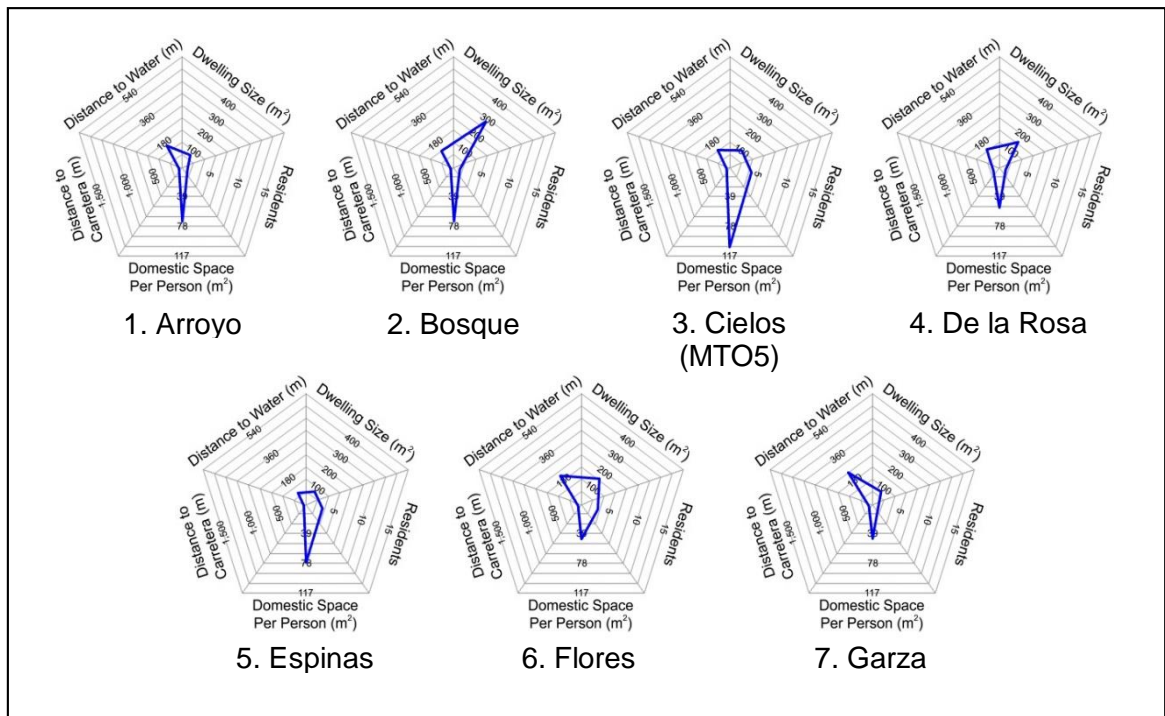


Figure 4.8: Radio Graph Analysis of Households that Reflect Extreme Conditions of Empowerment in Río Negro According to the Five Variables Tested
Source: Jeff DeGrave, 2012

present the residences that fell into the 90th percentile on both ends of the scale. The ranking is listed before each head of household.⁷³

As expected, the radio graphs for the most extreme individual households reflect patterns of marginalization and empowerment found in Era III, and Eras I and II, respectively. For example, MTO6 appears in both the Era III set of radio graphs as well as in Figure 4.7 (as the Zúñiga residence) that identifies those households that exhibit the most extreme conditions of marginalization in Río Negro according to the five variables tested. Similarly, Figure 4.8 suggests which households emit the strongest indications of empowerment in the community, including MTO4—one of the village elites who received a microturbine through the participatory mapping exercise. Therefore, within the context of promoting “redistributive” and “geographic” justice, the results of the participatory mapping exercise should have generally corresponded to the results of the above analysis. In other words, as discussed in Chapter 2, participatory mapping is founded on the ideals of empowerment, inclusion, social justice, challenging dominant discourse, and allowing the voices of the marginalized to be heard, the participatory mapping exercise in Río Negro should have not enabled the most empowered households in the community to augment their empowerment by receiving microturbines over the more marginalized members of the village. This outcome, of course, serves as a reminder of the very foundation of this research project: did participatory mapping

⁷³ For reasons of anonymity, once again, I have changed the names of the 10% most marginalized and empowered households. The names I have chosen are surnames commonly found in Honduras and, whenever possible, also identify a feature of Río Negro. In addition, the marginalization and empowerment ranking of each household is reflected by the first letter of the surname, as well. Therefore, the Arroyo household reflects the conditions of being the most empowered residence in Río Negro while the Zúñiga household reflects the most extreme conditions of marginalization—according to the five variables tested.

reinforce existing conditions of marginalization and empowerment within in Río Negro? The ensuing sections of this chapter will weigh the outcomes of the participatory mapping exercise against the marginalization and empowerment analysis illustrated above.

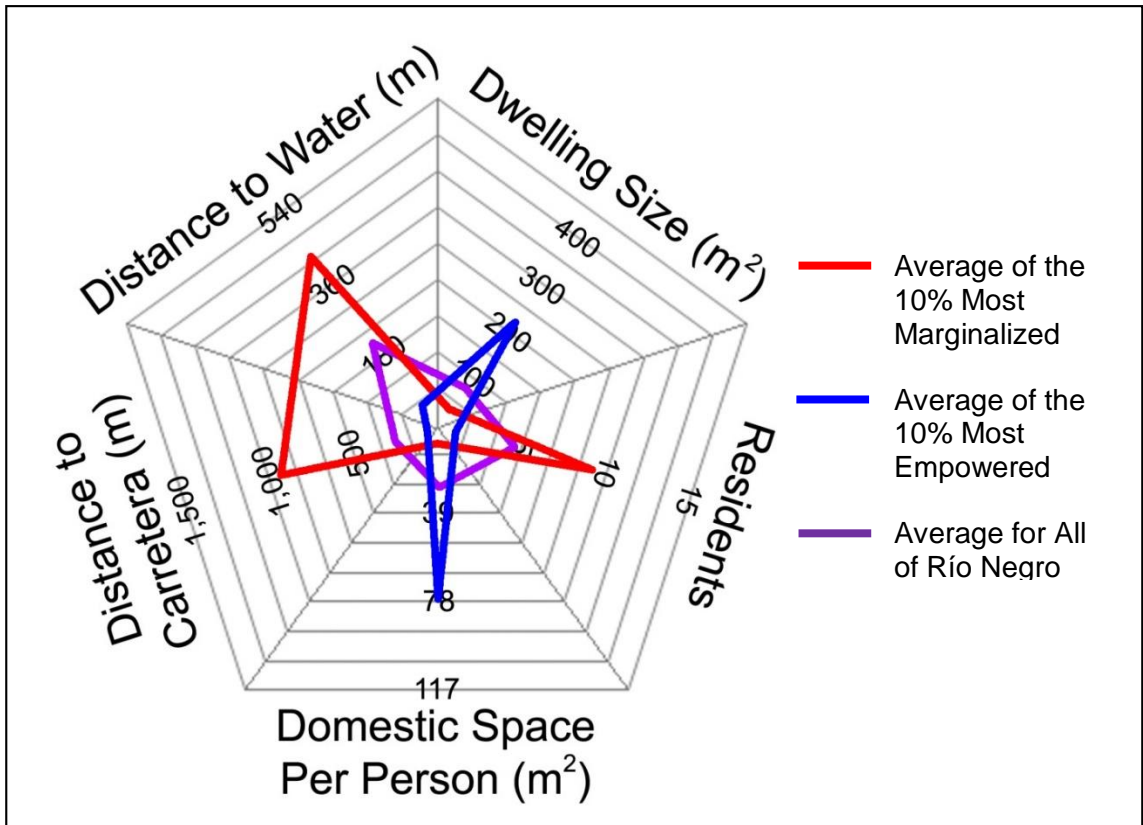


Figure 4.9: Averages for the 10% Most Extremely Marginalized and Empowered Residences in Río Negro Overlaid on the Average for the Entire Community
Source: Jeff DeGrave, 2012

First, to offer a general point of comparison, Figure 4.9 compares the community average to the averages of the households that reflect the 10% most extreme conditions of marginalization and empowerment. Though much more dramatic, the patterns created in the radio graph of the most extreme households noticeably parallel the patterns found in Figure 4.4: Averages for Era I and II

Households with a Microturbine, Era III Households with a Microturbine, and Households without a microturbine. The similarities between these two radio graphs reveal that the patterns for households that received a microturbine through participatory mapping (during Eras I and II) bear a notable resemblance with those households that reflect conditions of greater empowerment. Similarly, those households that did not receive a microturbine through participatory mapping tend to reflect conditions of marginalization. Furthermore, the radio graph representing the household of MTO5—a recipient of a microturbine through the participatory mapping exercise—is among the more extreme reflections of empowerment. In fact, two households that receive electricity through microturbines appear among those households that reflect greater empowerment—the Bosque residence (who receives electricity from his son, MTO4) and the Cielos residence (MTO5). Incidentally, MTO4, (who is a member of the Iglesias household) is ranked ninth in terms of those households that offer the strongest indications of empowerment in Río Negro. Incidentally, the household that reflects the most extreme conditions of empowerment in Río Negro, the Arroyo residence, has since been vacated (Sidman, 2014)—perhaps symbolizing empowerment through their ability to leave.

On the other hand, the household of MTO6 reflects the most extreme conditions of marginalization, a household that did not receive a microturbine through participatory mapping. More poignantly, however, is that none of the households that reflect the most extreme conditions of marginalization received a microturbine through participatory mapping. In effect, three households (Bosque, Cielos, and Iglesias) that exhibit extensive manifestations of empowerment

received a microturbine during Era I and II, while those households that did not contain members of the community elite did not see any benefits from the participatory mapping exercise.

4.6 Long-Term Impacts of Participatory Mapping in Río Negro

The depth of the enhanced empowerment of the elite of Río Negro due to participatory mapping becomes heightened when examining the long-term residual effects. Greater economic opportunities and increased cultural capital realized through the electrification that arrived via participatory mapping continue to widen the gap between the marginalized and the empowered within Río Negro. Increased coffee production, access to economic opportunities in the tourism market, and the ability to offer fee-based electrical services provide increased financial stability to those with microturbines. While, simultaneously, the more marginalized members of the community struggle to make ends meet with few opportunities to improve their economic standing. The following subsections explore a number of means by which the elite have extended their empowerment through participatory mapping.

4.6.1 Increased Coffee Revenues

The Bosque / Iglesias clan remains one of the largest coffee producing families in Río Negro. As beneficiaries of the participatory mapping exercise, they have since mechanized their depulping processes (as seen in Figure 3.1), increasing efficiency and allowing more coffee to be harvested, processed, and sold in any

given season. Already a major coffee producer, participatory mapping has enabled the Bosque and Iglesias households to further empower themselves through increased returns. At the same time, those families that did not receive a microturbine through the participatory mapping exercise continue to depulp coffee by hand (Figure 3.2). Era I beneficiaries of participatory mapping, MTO2 and MTO3, have enjoyed increased coffee production and the added revenues of automated coffee depulping for nearly 15 years—ever since the completion of the participatory mapping exercise.

4.6.2 Alternate Revenue Generation

Participatory mapping has also allowed microturbine owners to create revenue streams beyond coffee production, illustrated in Table 3.1: Profile of Microturbine Ownership. For example, with the microturbine he received through participatory mapping, MTO5 is able to create additional income through battery charging.⁷⁴ Not only do clients without access to electricity come to recharge automobile batteries for longer term energy storage (Figure 4.10), customers will also pay to have their cell phones and other electronic devices recharged (Figure 4.11). In this scenario, participatory mapping has furthered existing divisions in marginalization and empowerment within Río Negro through three related activities. First, revenues associated with battery charging are only available to microturbine owners—of which most belong to the elite class of Río Negran society. Second, microturbine

⁷⁴ Charging stations are extremely popular in Río Negro and other remote villages near Comayagua Mountain. Prior to the arrival of microturbines, area residents would ride several hours into Comayagua to charge their phones. Because most rural denizens of Honduras do not own any form of transportation, they would not be able to recharge their phones until a driver could take them to Comayagua.

owners will often combine battery charging services with other business ventures to gain additional income. Several microturbine owners in Río Negro operate a pulpería out of their home where customers can purchase and consume coffee, snacks, candy, or other items while waiting for their batteries to be charged. Third, these revenues are extracted from the more marginalized members of the community who did not receive a microturbine through participatory mapping—continually widening the gap between the more marginalization and empowerment members of the community.



Figure 4.10: Using a Microturbine to Charge Automobile Batteries
Source: Jeff DeGrave, 2012

One final example of how the legacy of the participatory mapping exercise in Río Negro continues to create greater divisions between the more marginalized

and empowered in Río Negro is tourism. Most tourists that visit Río Negro live in the Global North and carry certain expectations in their travels, such as access to electricity and running water. Therefore, those members of the community that received a microturbine through participatory mapping can also enjoy the benefits of the influx of foreign



Figure 4.11: A Microturbine-Powered Cell Phone Charging Station
Source: Jeff DeGrave, 2011

currencies through tourism. For example, the Iglesias household (MTO4) also serves as one of the hubs of tourism in Río Negro. Because of easy access to electricity through participatory mapping, the Iglesias residence is able to fully capitalize on tourist revenues.

4.6.3 Increased Cultural Capital

Participatory mapping not only created electrical and economic empowerment through the distribution of microturbines, but also the empowerment of increased cultural capital. Through the increased revenues highlighted above, microturbine

owners are able to acquire what may be viewed as “luxury items” in Río Negro. For example, most windows in Río Negro are simply wooden panels mounted on hinges. However, the households belonging to MTO3, MTO4, and MTO5 (all beneficiaries of Eras I and II) are equipped with glass windows. These glass windows emerge as a status symbol, adding to the cultural capital of those who can afford them. The presence of such “luxury items” is also an indication of



Figure 4.12:
Glass Windows Indicate Empowerment
Source: Jeff DeGrave, 2012

disposable income—an advantage rarely experienced by residents of rural Honduras. MTO3 and MTO4 also possess a collection of audio-visual electronic equipment that includes televisions, stereos, and computers (Figure 4.13). Of course, those who were not prioritized to have a microturbine through participatory mapping have no use for such items as they do not have access to electricity. Other indicators of enhanced cultural capital for households most commonly associated with microturbine owners are indoor kitchens, indoor bathrooms, automobile ownership, satellite receivers for cell phones and televisions, and the presence of a garage, among others.

4.6.4 Individual Cases of Empowerment through Participatory Mapping

Perhaps inferred from the previous subsections, participatory mapping has also led to greater upward mobility for those who were already the most empowered within the community. This section presents a portrait of each of the Era I and II



Figure 4.13: Electronic Equipment also Indicates Empowerment

Source: Jeff DeGrave. 2011

beneficiaries of participatory mapping through the distribution of microturbines. These profiles offer further indications of how participatory mapping continues to increase the separation between marginalized and empowered populations within Río Negro.

4.6.4.1 MTO2

MTO2 was the first recipient of a microturbine following the participatory mapping exercise. He immediately replaced his hand-powered coffee depulping machine with a mechanized system—leading to increased coffee production. But for MTO2, this form of empowerment gained through participatory mapping became far less valuable than the cultural capital he acquired through and after the participatory process.

MTO2's experience in installing the first microturbine in Río Negro has enabled him to become a microturbine salesman, installer, and serviceman for existing microturbines in nearly every village around Comayagua Mountain. MTO2 has since purchased a home and moved his family to Comayagua where his children



Figure 4.14: The Abandoned Microturbine at the House of MTO2
Source: Jeff DeGrave, 2012

are able to further their education beyond elementary school. The empowerment he gained from the participatory mapping exercise is now being passed down to his children, allowing them to escape the cycle of marginalization and poverty commonly experienced in rural Honduras. MTO2 now employs seasonal laborers to process his coffee since he no longer permanently resides in the community (Zavala, 2012). His homestead in Río Negro is now virtually abandoned and is only used as a shelter during coffee harvest. Similarly, the microturbine that brought him such empowerment following the participatory mapping exercise has remained in a state of disrepair for several years (Figure 4.14).

4.6.4.2 MTO3

As the second household to receive greater empowerment through the participatory mapping exercise, MTO3 has become one of the leading coffee producers in Río Negro. This success has allowed her to operate her business independently from the local coffee cooperative (Sidman, 2012). MTO3 continues to prosper in Río Negro and remains among society's elite—with his home calculated as the fifth most empowered residence in Río Negro. She, along with the Bosque, Cielos, Iglesias, and Espinas households, are the only residents of the community that own an automobile.

MTO3's economic success, due in part to 16 years of increased empowerment through participatory mapping, has garnered her significant cultural capital—as she continues to serve as a leader of the Manos Divinas women's cooperative in Río Negro. In fact, MTO3 noted during a 2012 interview that because of the

microturbine she acquired through participatory mapping, she is able to host meetings of the women's cooperative during the day or night. MTO3 also felt that the cooperative is stronger and better organized due to this added flexibility, increasing women's agency and ability to negotiate, control, and influence the economic and political structures that impact their lives.

4.6.4.3 MTO4

Though already empowered through familial prestige within Río Negro, MTO4 has been able to economically, socially, and politically capitalize through his leadership that developed during the participatory mapping exercise. Ironically, the Bosque household—that also receives electricity from MTO4—would prefer to receive electricity from the (potential) grid rather than the microturbine. As previously noted, this residence is the home of one of the most socially, politically, and economically empowered patriarchs of Río Negro. Despite the advantages the Bosque household through the benefits of electricity access gained through the participatory mapping exercise, during an interview the Bosque residence informed me that they want to be able to “stabilize” the energy they receive. They believe the grid would provide continual, regulated amounts of energy--whereas the electricity supplied by any microturbine is variable, depending on the season, the amount of rainfall, the degree of maintenance performed on the system to unclog pipes, clean filters of debris that slow the flow of water, and to ensure solid electrical connectivity. In essence, the Bosque residence seeks greater

empowerment despite their relative position of power as one of the few homes in Río Negro already with access to electricity.



Figure 4.15: Quonset-Style Coffee Drying Hut
Source: Andrew Gaertner. 2014

Nonetheless, as one of the key figures in both the participatory mapping exercise and during Era II: the Revival Era, MOT4 has been able to modernize his coffee production operations. Instead of using large outdoor cement patios to dry his coffee, MTO4 has recently constructed translucent Quonset-style drying huts, as seen in Figure 4.15. These enclosed huts prevent rain from undermining the drying process and also keep the coffee relatively free of detritus, thereby preventing loss and increasing coffee revenues. These coffee drying huts can also be employed to gain additional revenue through tourism, offering an exotic

sleeping quarters for guests (Figure 4.16). Without the empowerment gained during the participatory mapping process through the acquisition of a microturbine, it is likely that MTO4 would not have had the opportunity to expand coffee production or effectively participate in the tourism economy.



Figure 4.16: A Coffee Drying Hut “Hotel” for Tourists
Source: Corrin Turkowitch, 2014

4.6.4.4 MTO5

As part of the Revival Era, MTO5 installed his own microturbine based on the perceived empowerment gained by the beneficiaries of Era I through participatory mapping. As seen in Figure 3.5, MTO5 developed a portable microturbine to use for electrification as well as for a demonstration model to entice others in and around Comayagua Mountain to hire his services in building, installing, and

maintaining microturbines. As stated, MTO5's household is one of the few that contains glass-paned windows as well as an automobile.

4.6.5 Empowerment in Río Negro through Participatory Mapping

Individual empowerment that arose through participatory mapping via the installation of microturbines remains directly visible in Río Negro today. The households that exerted the greatest influence over the direction over the participatory mapping exercise continue to exert their increased empowerment economically, politically, and socially.

Symbol of Empowerment Present within Household	Households With Access to Electricity (Eras I and II)	Households With Access to Electricity (Era III)	Households Without Access to Electricity (<i>n</i> = 62)
Television and / or Stereo System	4	1	1
Indoor Bathroom	4	0	1
Car	4	0	0
Glass Windows	3	0	0
Pulpería	3	1	1
Eco-Hut	2	0	1
Refrigerator	2	0	0

Table 4.7: Symbols of Marginalization and Empowerment through Participatory Mapping
Source: Jeff DeGrave, 2013

To illustrate the depth of how participatory mapping and access to electricity have aggravated disparities in marginalization and empowerment in Río Negro, Table 4.7 reveals a discernable connection between those who have benefitted

from participatory mapping during Eras I and II, those who are struggling to gain empowerment during Era III, and those who remain marginalized from the benefits that participatory mapping was purported to deliver. None of the symbols of empowerment identified in the left column existed prior to the participatory mapping exercise—again reinforcing the notion that participatory mapping further reinforced conditions of marginalization and empowerment within Río Negro.

4.6.6 Empowerment in Río Negro without Participatory Mapping?

One could easily assume that with every year that passes in Río Negro that the impacts and influences of the participatory mapping exercise from 1998 continually diminish. Yet the presence of microturbines—and access to electricity for a limited few—within the community expand its long term impacts. The microturbines and the energy available to a select number of households offer constant reminders of the gap between the most and least empowered residences in Río Negro that was greatly expanded through participatory mapping.

The legacy of participatory mapping in Río Negro has never been more topical than it is today. Surely those without access to electricity experience a constant sense of marginalization that participatory mapping and microturbines have engendered. In fact, when interviewed, all but six households in Río Negro stated they would like a microturbine. Yet it was the participatory mapping exercise that allowed residents to understand the concept and see the potential benefits of microturbine-powered electricity.



Figure 4.17: The “Club” at the Zúñiga Residence
Source: Jeff DeGrave, 2012

For this reason, even the microturbines installed during the Tourism Era are indirectly a result of participatory mapping to a certain degree. Though these households were largely excluded from the participatory process, the existing microturbines that came into use through participatory mapping were available to tourists—ultimately leading to the empowerment of two of the most marginalized households in Río Negro through this external connection. Although

there was no direct connection between the sketch map drawn in 1998 and the installation of a microturbine at either of the households identified as part of the Tourism Era, the legacy of the utilization of participatory mapping to help place microturbines in Río Negro remains apparent to this day within every existing microturbine in the village.

To this point, although participatory mapping may have magnified existing conditions of marginalization and empowerment in Río Negro, certain forms of empowerment have emerged for even the marginalized. For example, the Zúñiga household (the household of MTO6), which reflects the least amount of

empowerment in Río Negro according to the preceding analyses, is in the process of morphing from a remote island of disenfranchisement to what may become a new “third space” in Río Negro—largely due to electrical access. Because of her microturbine, MOT6 is steadily gaining not only economic, but cultural capital within the community. As stated in an interview with MTO6 four months after receiving electricity for the first time, her life has been “transformed” since the installation of her microturbine. MTO6 has recently combined coffee farming, battery charging, operating a pulpería, and opening a “club” (Figure 4.17) within her home to create additional income. Through microturbine-powered electric lighting, the “remoteness” of her homestead has been reduced. The illumination of her property now attracts travelers to her residence, allowing opportunities for additional income through these auxiliary enterprises.

MTO6 is gaining additional cultural capital through her children, as well. They now attend school on a more regular basis as the depulping process has become less labor intensive due to automation via the microturbine. Furthermore, because of the presence of electric lights, her children may now study at night more easily since candlelight is no longer required. The utilization of the microturbine is providing an opportunity for her empower herself and her family to break the cycle of poverty from which many rural Honduras will never escape.

4.7 Chapter Summary

This chapter provided an assessment of how participatory mapping has reinforced conditions of marginalization and empowerment over the course of 16

years through its influence on the distribution of microturbines. The intention to create greater equity and inclusivity through participatory mapping remains unfulfilled to this day. The link between the power held by elites that was used to influence the outcomes of the participatory mapping exercise and those who have access to electricity in Río Negro today is inescapable. Possession of a microturbine through participatory mapping has empowered the households of the historical elite by supplying not only electricity, but by using this electricity to create additional economic opportunities for themselves.

The examinations conducted in this chapter illustrate the many forms of marginalization and empowerment that participatory mapping fostered through microturbine ownership. But it is important to note that marginalization and empowerment are not just factors of participatory mapping. Those who were empowered in the participatory mapping exercise steered the direction of the proceedings toward their own interests have continued to capitalize on the opportunities that access to electricity provide. Meanwhile, most of those who were left out of the participatory process continue to struggle—economically, politically, and socially. Only through the intercession of tourists did electrical access reach the more marginalized members of the community—an objective that was, ostensibly, to be realized through participatory mapping, as noted in Chapter 1.

This analysis also utilized triangulation methodology to help holistically elucidate the role that participatory mapping played in the marginalization and empowerment of its users. Employing the interviews of community residents, official documentation, and GIS data, helped create a more comprehensive body

of information from which conclusions about participatory mapping's tendency to reinforce conditions of marginalization and empowerment in Río Negro were drawn. The data support the empirically grounded analysis to identify the relationships between participatory mapping, access to electricity, and marginalization and empowerment.

CHAPTER 5: Conclusions

5.1 Overview

Did participatory mapping reinforce existing conditions of marginalization and empowerment over the long term? The outcomes of this dissertation research project illustrate how prevailing power structures can affect the trajectory of a participatory mapping exercise and enhance both marginalization and empowerment among its users. Despite participatory mapping's objectives of empowerment, democratic decision-making, political agency, and alternative knowledge creation for voiceless populations, prevailing systems of dominance, control, and power within Río Negro undermined the participatory nature of the exercise and reinforced existing conditions of marginalization and empowerment within the community over time.

In this final chapter I summarize how participatory mapping indeed reinforced existing conditions of marginalization and empowerment within the community of Río Negro. I further reflect on how attributes such as geography, economic and social class, gender, political capital, and social networks all played significant roles in undermining the potential "democratization" of data (Aitken and Michel 1995; Pickles 1995; Sheppard 1995; Elwood and Leitner, 1998) through participatory mapping. Historical legacies of marginalization and empowerment based on proximity to the main road or a waterway also created power structures that further undermined the mapping exercise, causing failures in the delivery of participatory mapping's primary objectives: participation, bottom-up knowledge production, and offering a voice to historically marginalized populations. These

powerful social and political networks undermined the participatory mapping exercise, furthering the gap between the marginalized and empowered within Río Negro.

Section 5.2 revisits the results of the primary research question of this dissertation: “How did participatory mapping reinforce preexisting conditions of marginalization and empowerment in Río Negro?” by summarizing the findings of this project. This section also explores the consequences of the participatory mapping exercise in Río Negro—and the impacts of this research project on the local community. Section 5.3 offers observations on the collision of participatory mapping theory and practice and the various manifestations of power that undermined the objectives of the participatory mapping exercise—including the degree of participation. Section 5.4 explores the notion that perhaps using participatory mapping for the distribution of individual benefits may lend itself to issues of competition between members of society, undermining the more collective, community-oriented nature of most participatory mapping exercises. Section 5.5. discusses the methodological limitations of triangulated research while Section 5.6 presents observations and reflections on participatory mapping, identifying the need for more long-term assessments of participatory mapping projects as well as possibilities for further research in Río Negro. This paper ultimately concludes with Section 5.7, offering final thoughts on the future of participatory mapping, marginalization, and empowerment in Honduras.

5.2 How Did Participatory Mapping Reinforce Preexisting Conditions of Marginalization and Empowerment in Río Negro?

Microturbine allocation through participatory mapping in Río Negro was strongly impacted by the intersection of local geographic, historical, economic, social and political forces. Those with the greatest amount of cultural capital were able to influence the direction of the participatory mapping exercise in Río Negro to support their own interests. Microturbines first appeared in the southern half the village and close to the carretera—reflecting the patriarchal and territorial legacies of those who first settled in Río Negro in the 1950s. This uneven playing field in access to electricity remained evident until a different set of external forces (through tourism) exerted themselves in 2012. Although these influences ultimately enabled two of the most marginalized households in the village to acquire microturbines, the community's elite along the carretera remain the core of empowerment in Río Negro.

Several other factors have aided in expanding of the gap between the more marginalized and empowered in Río Negro, as well. Owners of microturbines have parlayed their access to electricity into increased coffee production and a number of revenue-generating microenterprises. These industries are primarily centered on the carretera as it allows clients easier access to necessary ancillary services such as transportation to Comayagua, access to phone charging stations, and information about community affairs. Among the many amenities available near the main road include tourism-related hospitality packages, battery charging, cell phone charging, and pulperías. This “empowerment inertia” is not only maintained

through access to electricity, but for most microturbine owners in Río Negro, it is also the same reason they ultimately received access to electricity.

Despite its design to serve as a more equitable, redistributive, and justice-oriented form of knowledge creation, participatory mapping reinforced existing conditions of marginalization and empowerment within Río Negro through the distribution of microturbines—a division that continues to intensify through microturbine-powered electrical access today.

5.2.1 Consequences of Participatory Mapping

Perhaps the greatest long-term impact of the participatory mapping project was to generate awareness of the possibilities for electrification for even the most marginalized members of the community. The participatory mapping exercise helped to promote the use of an indigenous technology, microturbines, although not necessarily in a democratic manner. But perhaps no community in the region would have access to electricity today if not for the discussion about microturbine-powered electricity originating in the participatory mapping exercise. Although Río Negro has not been able to embrace this technology for its electrical needs, other mountain villages like neighboring Plan del Cedro are virtually 100% electrified through microturbines (Oviedo and Zavala, 2012).

The consequences of participatory mapping also include several less tangible impacts. For example, political, social, and economic divisions in the community became more established through the process. The continual closure of the Visitors Center is but one example of the ongoing rifts in the social fabric of the Río

Negro. Resentment, jealousies, and bitterness over the participatory process that led to disparate access to electricity—and therefore economic opportunity—still fester in the community. These feelings of inequity undoubtedly represent for many the primary motivation to connect to the power grid.

5.2.2 Impacts of the Research on Río Negro

The impacts of my multi-method “bottom up” research on the community of Río Negro remain uncertain. My external status as a researcher limits my knowledge of the long-term impacts of the research. Cultural hegemonies within the community existed prior to my arrival and will likely continue for the foreseeable future. Yet short-term impacts were certainly evident. Contributing additional revenues for room and board, transportation, and other hospitality services added to the income of many households—though frequently only for the most empowered populations. Also, visiting the majority of households in Río Negro allowed locals the opportunity to provide their opinions on matters from which they are frequently excluded. Simply expressing interest in obtaining their input was a “reward” to many as a number of informants explained at length how they were often left out of important conversations such as participatory mapping procedures and access to electricity. In fact, several residents inquired if I would be able to bring electricity to Río Negro as a result of my questions pertaining to microturbines and the power grid.

Unfortunately, false hope is likely an impact that requires much self-reflection. The mere presence of a visitor from the Global North creates (unrealistic)

expectations in the minds of many of the least empowered in the community—such as my ability to bring electricity to Río Negro. I unavoidably represented wealth and opportunity to many residents in the community. But the performativity of my presence in Río Negro was unintentionally misleading, offering more hope and opportunity than a single individual could ever possibly deliver. Of course, similar to their interactions with the HCC, the Peace Corps, Farmer to Farmer, and tourists, the residents of Río Negro were likely aware of my ephemeral existence in the community. However, though local residents may be fully cognizant of my short-term investment into the community, hope for greater opportunity through associations with the North will inevitably persist.

5.3 The Question of Participation, Marginalization, and Empowerment

Many of the issues concerning the effectiveness of participatory mapping that were raised earlier in this dissertation were realized in the Río Negro project. Among these limitations to its success included whether or not participation “necessarily equate[d] to power” (Aitken and Michel, 1995), the degree to which “participation” actually occurred (Dunn, 2007), the unequal influences of various “power relations” (Weiner, Harris, and Craig, 2001), the questionable degree to which power shifts actually occurred (Kyem, 2001), and ultimately the “simultaneous empowerment and marginalization of people and communities” (Weiner, Harris, and Craig, 2001), the “differential inclusion” of those with less cultural capital in terms of their electrical needs (Wainwright and Bryan, 2009), among others.

Despite the apparent inclusion of multiple perspectives and the enabling of the “subaltern to speak,” issues of power, inequity, and representation during the participatory mapping exercise in Río Negro raise doubts as to the degree of empowerment gained by its users. Though nearly every community member agreed that most people “participated” in the mapping process, “participatory mapping” carried different meanings and understandings for different members of the community. Participation occurred, but to what degree—and for which cohorts of the community? Perhaps most importantly, why did most of the residents of Río Negro chose to remove themselves from the participatory process if participatory mapping was the bottom-up, more inclusive form of decision-making that it purports to be? These questions raise significant challenges to the use of participatory mapping as a viable, truly “bottom-up” geographic technique to empower disaffected populations over the long term.

5.3.1 The Role of Gender

For example, elite males were self-empowered to administer the proceedings in a manner that reflected their personal interests. By forwarding the microturbine agenda, these leaders gained additional empowerment as they possessed the technical knowhow to sell, install, and regularly maintain the microturbine system. Even though the mapping meetings were “participatory” in name, the participation of community gradually waned and eventually ceased. This limited degree of participation follows what Harris and Weiner identify as “*participation as*

legitimization” (Harris and Weiner 2002, 248), used to support the pro-microturbine platform of elites.

Furthermore, meetings were held at the household of one of the more outspoken microturbine supporters (also a male), again serving to buttress the direction of the proceedings. As such, the outcomes of the Río Negro experience only magnified ongoing divisions of marginalization and empowerment by rerouting the prioritization of the microturbines toward community elites. The opportunity for the Zúñiga family—the most marginalized household in Río Negro as suggested by this study—to obtain a microturbine was only made possible by financial contributions originating in the Global North. Perhaps not coincidental, the head of household at the Zúñiga household was also a woman. As noted in Dunn et al., 1997; Kyem, 2001; and Chapin, Lamb, and Threlkeld, 2005; an external force is often critical to the “success” of many participatory mapping projects—particularly in the Global South. But in the case of Río Negro, participatory mapping was employed to develop a more equitable distribution of access to electricity; but this form of “bottom up” knowledge production did not directly assist any historically marginalized members of the community by empowering them with a microturbine.

5.3.2 Empowerment, Marginalization, Participatory Mapping, and Tourism

Another consideration of the participatory mapping exercise is the development of a tourist industry in the community. As noted above, tourism and microturbines frequently share a symbiotic relationship: households attract tourists with Western amenities powered by microturbines; and the microturbines, themselves, have

become a point of interest for tourists. These points of interest are generally located on or near the carretera, therefore offering the greatest benefits from tourism receipts to those who live on or near the main road. The distribution of microturbines through participatory mapping had initially only empowered households nearest to the carretera. These are also the same households that were in the most ideal positions to benefit from tourism—as well as the same households that significantly influenced the direction of the participatory proceedings.

5.3.3 Did Participatory Mapping Impact the Distribution of Microturbines?

The overwhelming domination of the politically elite throughout the participatory mapping exercise raises yet another question: did participatory mapping actually influence the placement of the microturbines? Based on the results of the exercise it seems likely that the distribution of microturbines was perhaps a foregone conclusion. They were going to be distributed according to the will of the empowered—regardless of the participatory process. Participatory mapping was perhaps simply a vehicle by which decisions could be made through the rhetoric of participation. Had participatory mapping actually delivered results according to its ideological foundations, the resultant microturbine distribution would have ostensibly paralleled the results of the radio graph analyses used in this study that identified clear distinctions between the most marginalized and empowered members of the community.

For these and other reasons, most residents of Río Negro view both participatory mapping and microturbines as tools of the empowered. Likewise, most residents of the village see real empowerment through the power grid of the ENEE. In fact, Río Negro held a referendum in April of 2012 to determine the preferred form of electricity for the community. 64 of the 68 permanent households in Río Negro voted in favor of connecting to the grid—including several microturbine owners (Departamento de Comayagua, 2012). Yet, when surveyed, 62 of the community's 68 permanent households said they would like to have a microturbine.⁷⁵ Río Negrans have seen the potential for empowerment through access to electricity—regardless of the mechanism that provides it. But after waiting 16 years since the participatory mapping project terminated, most residents only see the greatest opportunity for actual empowerment through the external interventions of the ENEE.

5.4 “Common Interests” versus Individual Motivations

Another consideration to factor into the outcomes of the participatory mapping exercise is the individualistic nature of access to electricity through microturbines. Aside from *Proyecto Luz* that studied the viability of installing two microturbines to create energy for most of the community, residents have viewed access to electricity through microturbine technology a per household basis in Río Negro. Therefore the participatory mapping exercise was implicitly driven by individual desires and perspectives. As a result of this (Western-inspired) prioritizing of the

⁷⁵ Based on survey responses as part of this study.

individual over the community, individuals were ultimately competing for electrical access, thereby undermining the cooperative and public participatory objectives of participatory mapping. This same individualistic orientation also became evident in the limited access to tourism revenues.

Contrarily, more communal interests such as addressing erosional risk zones, infrastructural repairs, and contaminated waterways, may have been more effectively served through participatory mapping than determining locations for microturbines. The communal interests inherent to resolving issues of unstable terrain and non-potable water would have perhaps outweighed personal interests due to the gravity of the circumstances surrounding the recovery efforts from Hurricane Mitch.

Although measuring the “success” of any participatory mapping exercise is certainly a subjective endeavor, a number of participatory mapping projects have shown promise in their results—many of which are communally-oriented in their goals. For example, Bjørn Sletto has collaborated for over ten years with the Penom indigenous tribe in the *Gran Sabana* of Columbia to construct participatory maps (Sletto and Rodríguez 2013) to help maintain a “proscriptive burning system designed to keep savanna grasses from accumulating and savanna fires from raging out of control” (Sletto 2005, 8). Though Sletto does state that this participatory project is “fraught with challenges because of contrasting views on the role of fire and the practices of prescribed burning between indigenous and state fire managers” (Sletto and Rodríguez 2013, 155), the indigenous members of the community have a common interest as well as a uniting counter-perspective

to dominant non-indigenous discourse and philosophies regarding fire control (156).

But for Río Negro, many of the underlying principles of participatory mapping were not upheld during the participatory processes. Due to gender roles, individual desires, historical, political, social, and economic divisions, and a host of intertwining interpersonal forces within the community, the participatory mapping exercise did not live up to its theoretical and ideological charges. As noted in Chapter 2, participatory mapping is intentioned to bring greater equity to its users, engender inclusiveness, incorporate multiple voices, and impact “other segments of society that are traditionally marginalized from decision making processes” (Aberley and Sieber 2002, “Public Participation GIS (PPGIS) Guiding Principles”).

Though the HCC did achieve many of its development initiatives, the notion that the participatory mapping exercise was indeed *participatory* and was successful in empowering disenfranchised members of the community is unsubstantiable. The use of participatory mapping in Río Negro only served to reinforce prevailing power structures and did not reach its objectives in allowing greater voice for more marginalized members of the community, effectively representing disaffected voices of the village, or enabling greater political agency for less empowered members of society. Palpable long-term impacts of participatory mapping within Río Negro reflect a history of increased empowerment for village elites and further marginalization for those who were less able to ensure their voices were heard during the participatory mapping exercise.

5.5 Methodological Reflections on the Research

Although the triangulation of GIS data, interviews, and other resources provided a useful benchmark to which the results of the participatory mapping exercise may be compared, it is important to note that a similar study is not likely to produce these exact results. As noted in Chapter 3, the (potential) unrepeatability of a triangulated study does not render it useless—for its insights are valuable. However, several considerations need to be made regarding the outcomes of the research.

First, allowing for the representations and inputs of a large collection of individuals increases the opportunity for informant bias. Although triangulation helps cross-validate the information provided by multiple informants, the opportunity for greater variability in the responses increases with each interview. Related to information responses, although most residents of Río Negro appeared eager to “help with the research,” their motivations may have existed outside the research interests. Community members may have attempted to manipulate the research in order to obtain perceived additional benefits, such as receiving rents by offering accommodation, meals, or transportation services—or perhaps receiving a microturbine.

Another potential for informant bias involves Gaertner and Sidman—the two former Peace Corps volunteers. Given their intimacy with the region and the community, much of my research was steered by their experiences and relationships within Río Negro. As stated in the preceding chapter, most of the Peace Corps activities tended to take place on or near the carretera (Gaertner,

2011a). And, of course, households along the carretera tended to be home to village elites—those who significantly influenced and benefitted from the participatory mapping exercise. I relied heavily on residents along the carretera for their inputs. Many of the families who settled along the main road were intimately familiar with the six decades of Río Negro history. These households were also able to provide services such as room, board, and transportation that were essential to my research. Other helpful benefits to staying along the main road included access to households who specifically chlorinated their drinking water for me, offered tours of the area during my initial visits to Río Negro, and provided access to written documentation—as most of the residents along the carretera were literate. For these reasons, my perspective was inevitably shaped by residents along the carretera—those who benefitted most from the participatory mapping exercise—through relationships created with the Peace Corps volunteers. Therefore, in addition to potential informant biases affecting this research, the impacts of elite biases in this study may be palpable, as well.

5.6 Future Research Possibilities and Recommendations

This research project focused on a unique opportunity to assess the impacts of a participatory mapping project over 15 years after its completion. Further explorations of the long-term intersections and consequences of marginalization, empowerment, and participatory mapping would provide much needed contrasts and comparisons with this study. Although the findings of this research project support existing scholarly work on the limitations of participatory mapping,

additional examples of the long-term impacts of participatory mapping would help to confirm or challenge the results of this single case study.

5.6.1 Further Additional Long-Term Participatory Mapping Studies

For example, future assessments of the impacts of participatory mapping should include an audit of its long term residual effects. As noted, the World Bank and many other international development agencies have conducted an endless array of short-term, more immediate audits of hundreds of participatory mapping projects (World Bank, 1996, 2005b, and others; USAID, 2008, 2011, and others; IFAD, 2009, 2011b, and others). Scholars have also examined the immediate impacts of participatory mapping (Rundstrom, 1995; Weiner and Harris, 1998a; Elwood and Leitner, 1998; Kwan, 2002; Warren, 2005; and others). With additional longitudinal studies of participatory mapping, issues concerning how and why participatory mapping tends to reinforce existing conditions of marginalization and empowerment may become more visible. In addition, the ongoing debate over the touted utility of participatory mapping to empower may offer greater resolution through a collection of long term analyses.

5.6.2 Further Research in Río Negro

Returning to Río Negro for continued research may assist in more effectively gauging the impacts on marginalization and empowerment within the community after the connection to the power grid is complete. But many new questions will surface should Río Negro be connected to the grid. Will electrification of the

community through the power grid diminish the ever-widening chasm of marginalization and empowerment between residents? Will complete electrification virtually negate the impacts of the participatory mapping exercise? Will village electrification simply lead to other manifestations of marginalization and empowerment? Will those residents who are excluded from the grid choose to employ participatory mapping once again for access to electricity through microturbine technology? Would participatory mapping be more effective for this purpose as village elites would likely not participate as they would already have electrical access through the grid? Or would such an exercise necessitate the input of an external “expert” to help steer the project—and lead to similar issues of marginalization and empowerment as were experienced in the 1998 participatory mapping exercise?

5.7 Final Thoughts

Following the conclusions of Wiener, Harris, Kyem, Kwan, and many others, participatory mapping has again revealed its inability to deliver the empowerment and voice to disaffected populations that proponents of this alternative methodology and approach to knowledge production purport. The data and results of this study reveal how village elites were able to effectively influence and redirect the participatory mapping exercise to further enhance their control of community affairs and buttress their positions of privilege over the long term. Although international development institutions like the World Bank may embrace such approaches with the hope of bringing more democratic, locally-produced perspectives into decision making processes, prevailing power structures—

internal or external to the community—will inevitably bear undue influence over its direction and outcomes and frequently subvert its objectives.

For Honduras, even if participatory mapping were to regularly fulfill its lofty charges, the support for such international development initiatives into Honduras has recently vanished because it is now one of the most corrupt and violent countries on Earth (Rama, 2014). In fact, United States removed all Peace Corps volunteers from the country in 2012 (Peace Corps, 2012) due to increased levels of violence. Additionally, the Honduras Conservation Corps chapter is no longer active (Partners of the Americas, 2014c)—the very agency that spearheaded the participatory mapping project in Río Negro over 15 years ago.

These global-scale decisions to discontinue such programs in Honduras reflect similar issues of marginalization and empowerment that arose during the participatory mapping exercise: top-down decision-making by elites, the influences of an external management body, and further alienation of the least empowered. Unfortunately, most Hondurans will continue to remain disenfranchised, marginalized, and unable to participate in the many major decision-making processes that significantly impact their lives.

Despite the wealth of research that has revealed participatory mapping's inability to deliver on its promises of empowerment to voiceless populations over both the long and short term, international financial institutions and development organizations like the World Bank, USAID, and IFAD continue to embrace its ideological motives and mobilize its application (World Bank, 2015a and 2015b; USAID, 2015; IFAD, 2015; and others). Numerous scholars, activists, and

governmental agencies—mostly based in the Global North—have also furthered the propagation of participatory mapping projects across the globe. Such projects are frequently initiated under “empowerment-related” labels such as “national security” (Bryan, 2013), “maintaining peace, resolving conflicts, and providing humanitarian assistance worldwide” (Herlihy, et al, 2008). But as noted above, the power structures that undermine participatory mapping’s ability to deliver a more democratic, bottom-up, and empowering form of knowledge creation also seem, fittingly, to be the greatest proponents of its usage.

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Appendices

Appendix A: Pico Hydro Power System

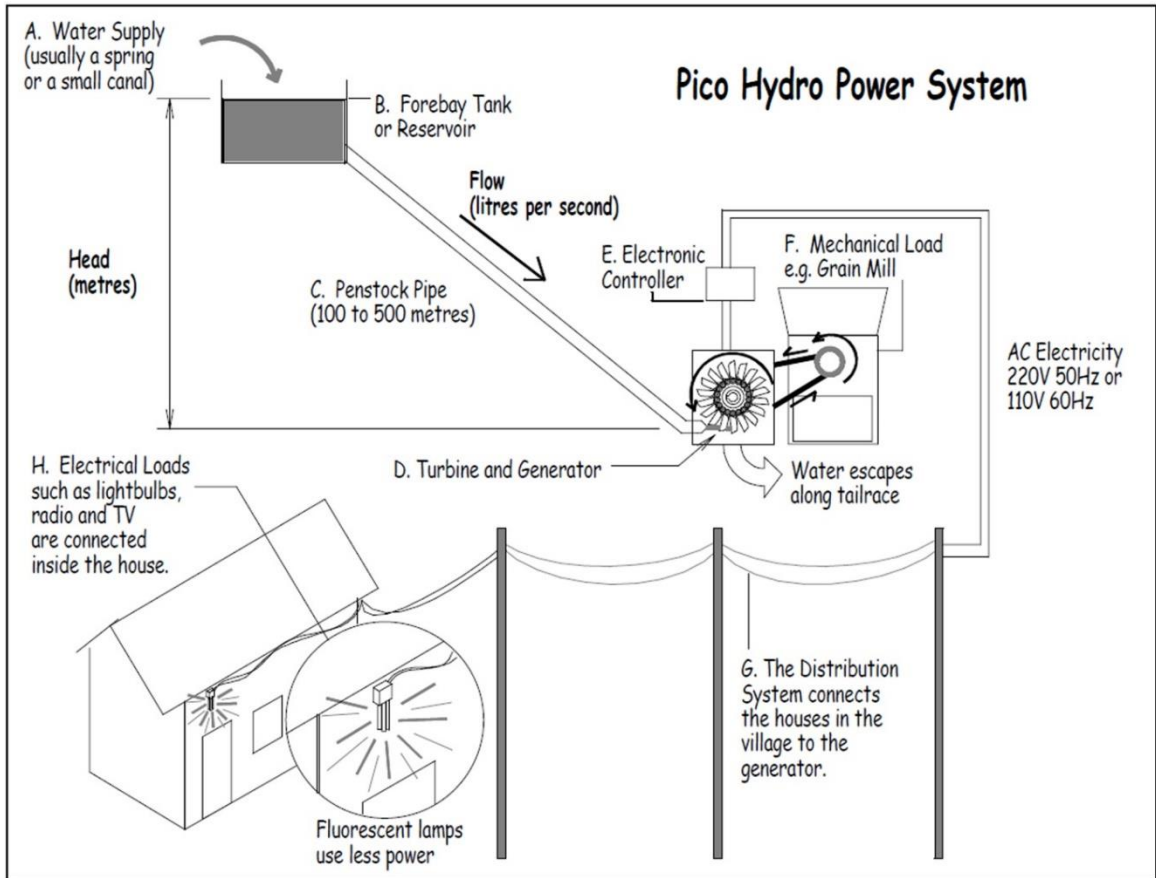


Figure A1: Schematic of a Pico-Hydro Electrical System

Source: Maher and Smith, 2001

The microturbines in Río Negro would generally be classified as a pico-hydro systems due to their minimal electrical output,⁷⁶ generally residing between 300 and 1,000 watts.⁷⁷

CLASSIFICATION	SIZE	CHARACTERISTICS
Large-hydro	> 100mW	usually feeds into a large electrical grid
Medium-hydro	15 – 100mW	usually feeds into a large electrical grid
Small-hydro	1 – 15mW	usually feeds into a large electrical grid
Mini-hydro	100kW – 1mW	stands alone or feeds an electrical grid
Micro-hydro	5kW – 100kW	for small community / industry, off grid
Pico-hydro	< 5kW	individual household

Table A1: Classification of Hydro-Powered Electrical Systems

Source: Doig, 2001

⁷⁶ Generally speaking, electrical production over 15MW is not considered “small-hydro” (Doig, 2001).

⁷⁷ No universal standard exists that defines specific ranges and categories for each electrical production classification contained in the chart. Such classifications vary from country to country and region to region.

Appendix B: Complete Pico-Hydro Electrical System

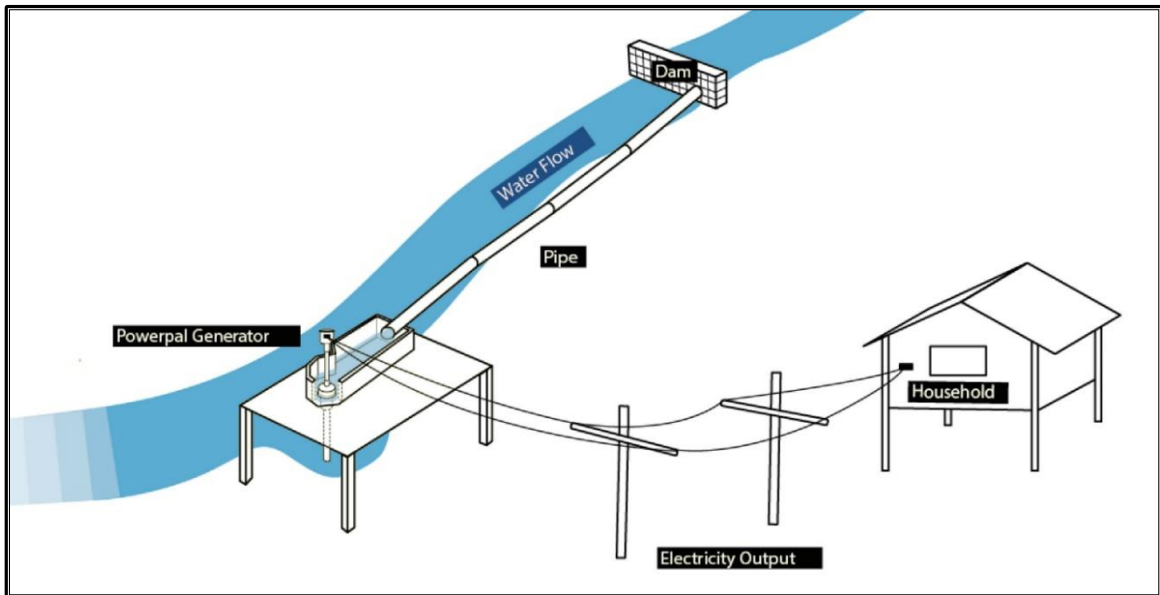


Figure B1: Pico-Hydro Power System Set within the Landscape
Source: Sustainable Generation, 2013

Appendix C: Interview Questions

Each head of household in Río Negro was asked the following questions:

- 1) Do you currently have access to electricity?
- 2) What form of access do you have?
- 3) If you currently have no access to electricity, would you like a microturbine?
- 4) If you currently have no access to electricity, what has prevented you from acquiring a microturbine?
- 5) If you currently have no access to electricity, what would be the primary functions for which you would use your microturbine?
- 6) How many people live at this residence?
- 7) What is the square footage of your dwelling?
- 8) Is there anything else you would like to add regarding the microturbines and / or your life situation?

Appendix D: Río Negro Household Statistical Data

Households highlighted in gold possess a microturbine

* Does not possess a microturbine, but receives electrical power from the microturbine of another resident

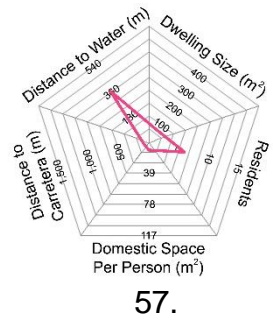
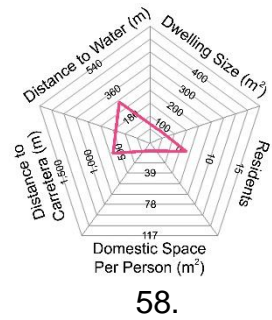
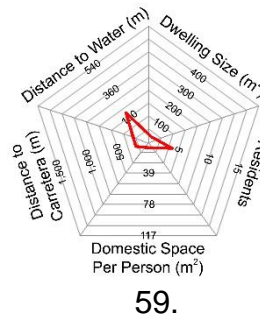
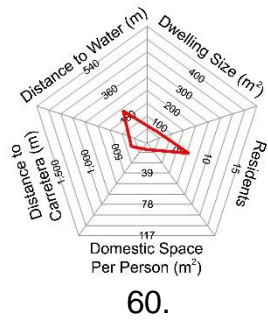
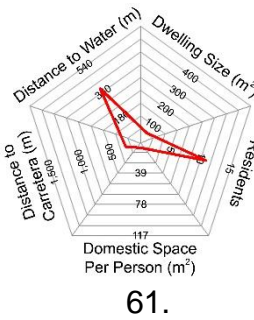
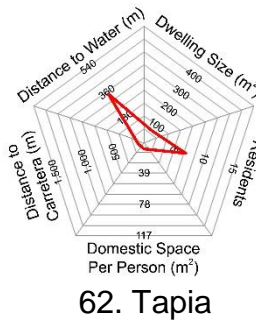
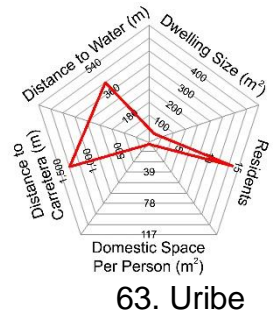
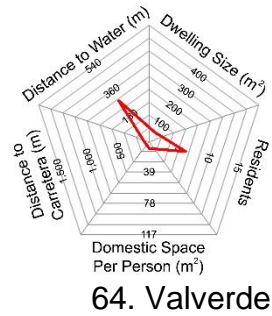
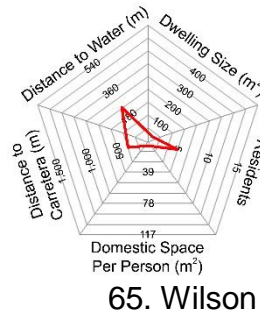
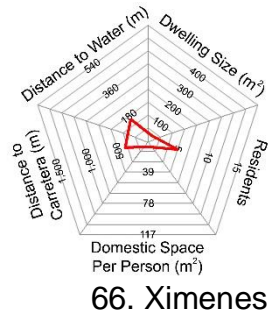
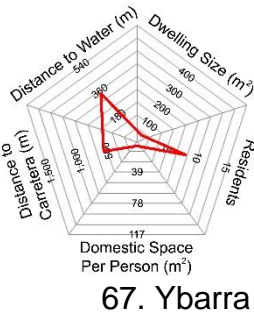
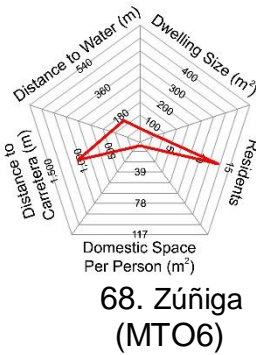
Rank No.	Dwelling Size (m ²)	Dwelling Rank	No. of Residents	Res Rank	Domestic Space Per Person (m ²)	Domestic Space Rank	Distance to Carretera (m)	Distance to Carretera Rank	Distance to Flowing Water Source (m)	Distance to Flowing Water Source Rank	Average Rank
68	56.25	43	13	68	4.33	68	1011.02	66	157.24	26	54.2
67	33	61	4	26	8.25	57	541.87	59	329.91	55	51.6
66	25	63	5	41	5	64	393.87	56	161.48	27	50.2
65	20	66	4	26	5	64	332.56	49	247.92	46	50.2
64	51	46	8	65	6.38	61	40.1	21	295.81	51	48.4
63	42	58	3	12	14	39	1363.47	68	420.81	65	48.4
62	63	38	7	61	9	56	51.33	25	350.34	60	48
61	54	45	5	41	10.8	49	215.09	43	383.84	62	48
60	68	31	7	61	9.71	54	246.62	45	223.3	41	46.4
59	20	66	4	26	5	64	189.42	39	212.72	36	46.2
58	72	23	6	50	12	46	617.28	61	290.06	50	46
57	60	39	6	50	10	52	53.66	26	366.79	61	45.6
56	49	47	6	50	8.17	58	96.42	31	185.47	34	44
55	36	60	5	41	7.2	60	11.6	4	305.61	54	43.8
54	49	47	3	12	16.33	27	926	65	512.24	68	43.8
53	24	65	4	26	6	62	34.89	19	228.33	42	42.8
52	25	63	2	7	12.5	41	130.99	34	422.37	66	42.2
51	64	34	6	50	10.67	50	417.43	57	131.49	19	42
50	56	44	7	61	8	59	89.27	28	104.59	13	41
49	68	31	6	50	11.33	48	818.3	63	103.53	12	40.8
48	100	15	7	61	14.29	38	330.03	47	215.85	37	39.6
47	100	15	11	67	9.09	55	10.77	3	344.75	58	39.6
46	49	47	9	66	5.44	63	22.32	12	81.66	9	39.4
45	58.5	42	6	50	9.75	53	20.02	8	223.1	39	38.4
44	72	23	5	41	14.4	35	211.97	42	275.56	49	38
43	49	47	4	26	12.25	42	883.94	64	85.53	10	37.8
42	49	47	4	26	12.25	42	1182.1	67	21.76	1	36.6
41	30.25	62	3	12	10.08	51	369.5	51	67.04	6	36.4

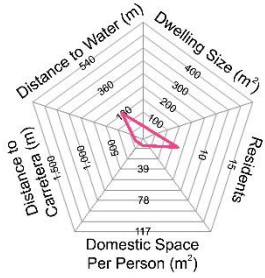
40	72	23	5	41	14.4	35	200.45	41	223.16	40	36
39	144	7	6	50	24	20	548	60	239.46	43	36
38	49	47	3	12	16.33	27	54.39	27	481.76	67	36
37	390	1	6	50	65	8	392.28	55	404.14	64	35.6
36	49	47	4	26	12.25	42	44.82	23	175.97	33	34.2
35	20	66	4	26	5	64	9.66	1	94.34	11	33.6
34	49	47	4	26	12.25	42	30.93	17	212.02	35	33.4
33	64	34	4	26	16	29	373.08	52	142.48	23	32.8
32	60	39	5	41	12	46	17	6	166.72	30	32.4
31	64	34	4	26	16	29	472.28	58	110.84	15	32.4
30	60	39	4	26	15	33	20.39	9	300.38	52	31.8
29	121	11	3	12	40.33	15	674.41	62	346.71	59	31.8
28	42	58	3	12	14	39	178.62	38	64.27	5	30.4
27	105	13	6	50	17.5	26	189.42	39	147.37	24	30.4
26	95	17	6	50	15.83	32	18.17	7	243.35	45	30.2
25	72	23	5	41	14.4	35	295.63	46	41.02	3	29.6
24	64	34	3	12	21.33	24	390.29	54	137.99	21	29.0
23	162.5	3	6	50	27.08	18	385.54	53	117.28	16	28.0
22	45	56	3	12	15	33	113.88	32	53.68	4	27.4
21	120	12	5	41	24	20	117.66	33	169.46	31	27.4
20	90	18	2	7	45	13	169.16	36	391.23	63	27.4
19	48	55	3	12	16	29	95.97	30	75.42	8	26.8
18	45	56	2	7	22.5	23	21.4	11	163.9	28	25.0
17	76.5	20	4	26	19.13	25	178.13	37	106.42	14	24.4
16	72	23	2	7	36	17	25.37	14	341.97	57	23.6
15	150	6	4	26	37.5	16	237.68	44	132.11	20	22.4
14	81	19	2	7	40.5	14	333.43	50	138.2	22	22.4
13	126.5	10	5	41	25.3	19	147.72	35	28.48	2	21.4
12	68	31	1	1	68	7	38.7	20	259.4	47	21.2
11	76.5	20	1	1	76.5	2	332.31	48	173.04	32	20.6
10	72	23	1	1	72	4	42.42	22	267.94	48	19.6
9	138	8	3	12	46	11	24.71	13	301.9	53	19.4
8	138	8	3	12	46	11	12.4	5	331.92	56	18.4
7	76.5	20	1	1	76.5	2	29.71	16	241.06	44	16.6
6	162.5	3	3	12	54.17	9	34.41	18	217.57	38	16.0
5	72	23	3	12	24	20	27.2	15	73.96	7	15.4
4	162.5	3	3	12	54.17	9	94.46	29	128.89	18	14.2
3	105	13	1	1	105	1	47.21	24	156.06	25	12.8
2*	280.5	2	4	26	70.13	6	20.5	10	120.7	17	12.2
1	72	23	1	1	72	4	10.75	2	165.56	29	11.8

Table D1: Río Negro Household Statistical Data
Source: Jeff DeGrave, 2014

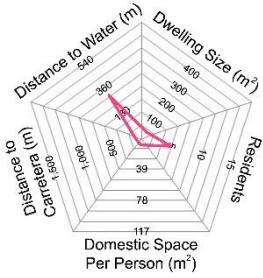
Appendix E: Radio Graphs of Each Household in Río Negro

The following set of radio graphs contains the data measured for each household in Río Negro. These variables include: Dwelling Size, Number of Residents per Household, Domestic Space per Person, Average Distance to the Carretera, and Average Distance to the Nearest Body of Water. These radio graphs contain the same data as seen in the radio graphs in Figures 4.7 and 4.8. The radio graphs are arranged in ascending order according to the overall marginalization and empowerment ranking averages listed in Appendix D.

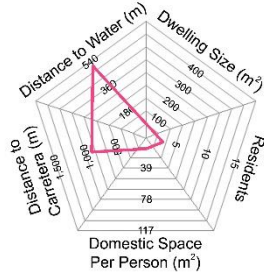




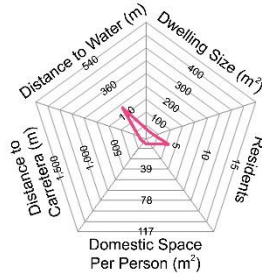
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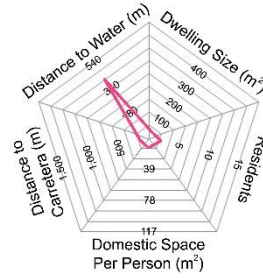
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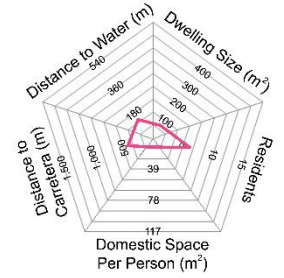
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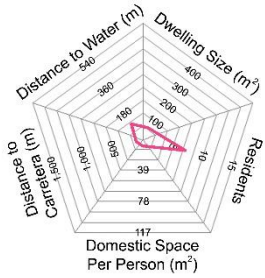
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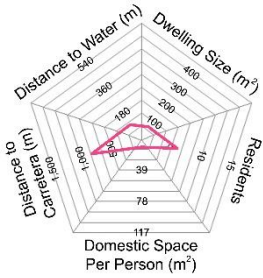
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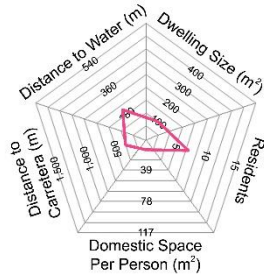
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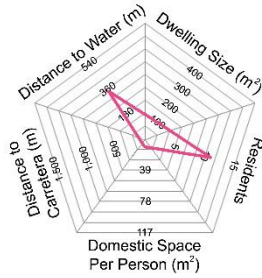
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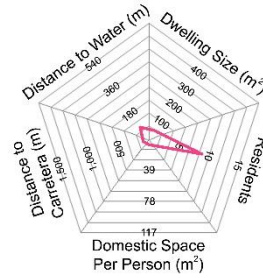
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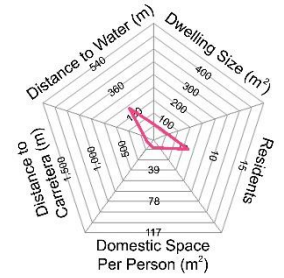
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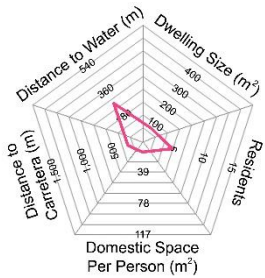
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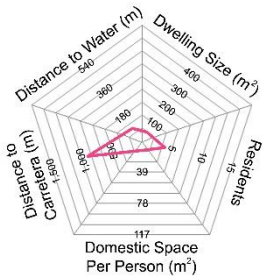
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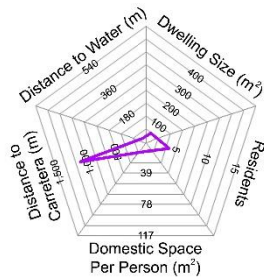
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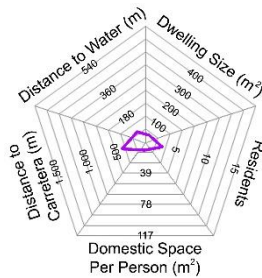
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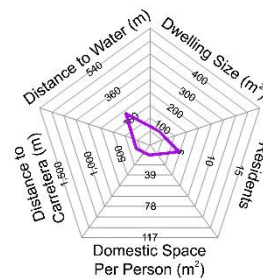
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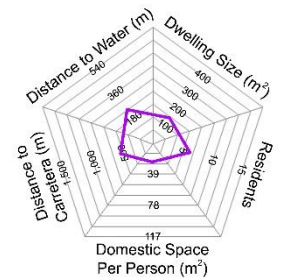
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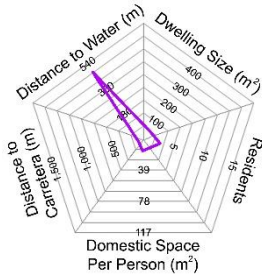
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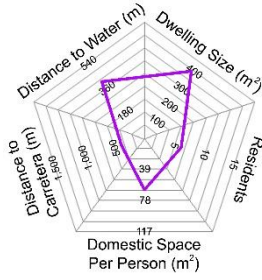
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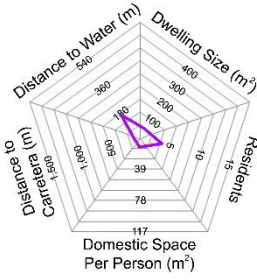
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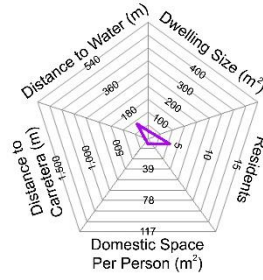
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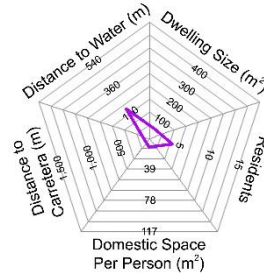
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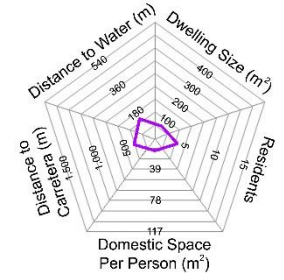
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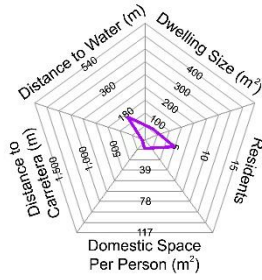
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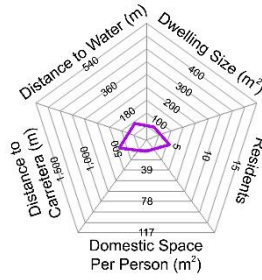
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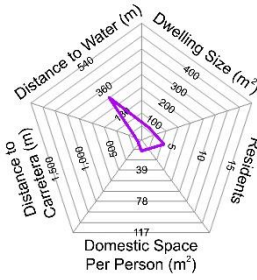
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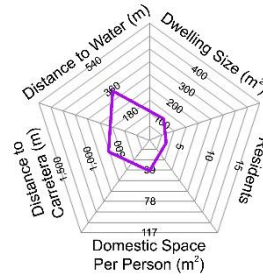
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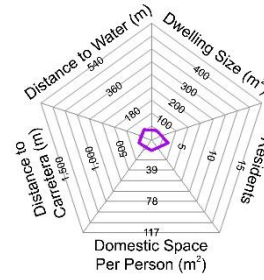
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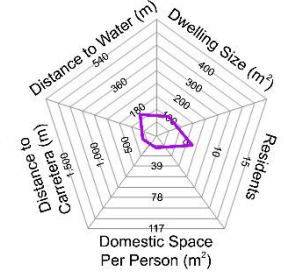
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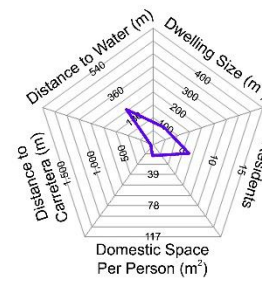
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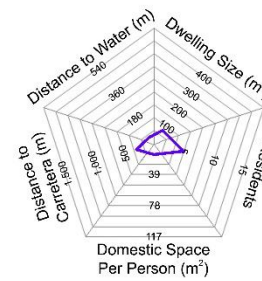
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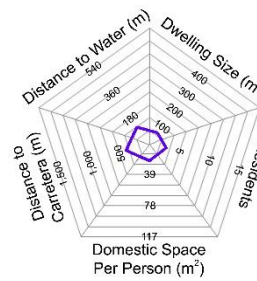
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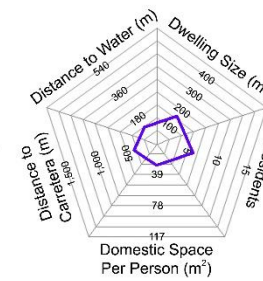
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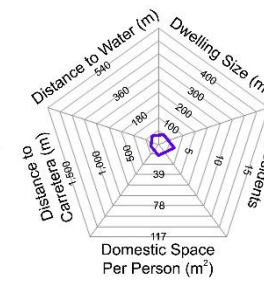
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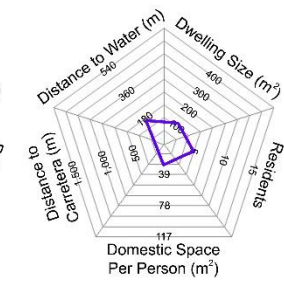
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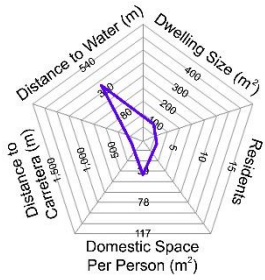
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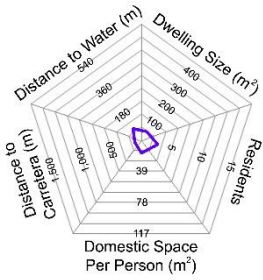
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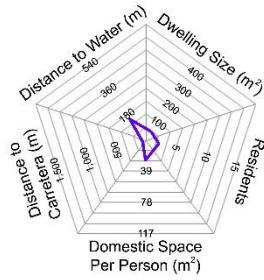
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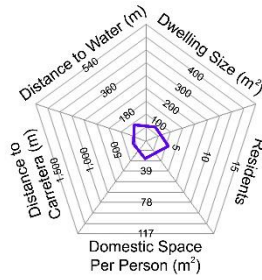
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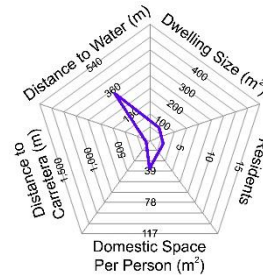
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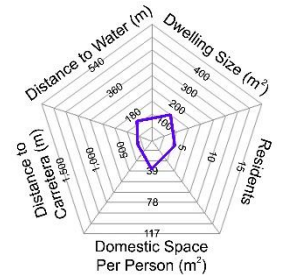
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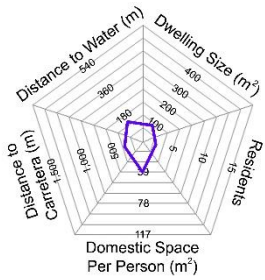
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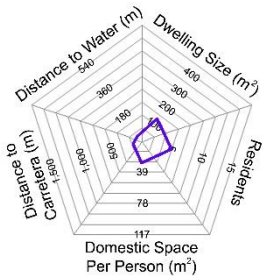
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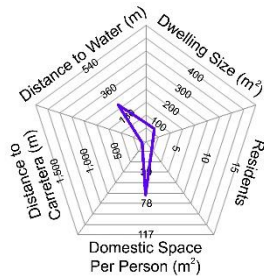
15.
(MTO 3)



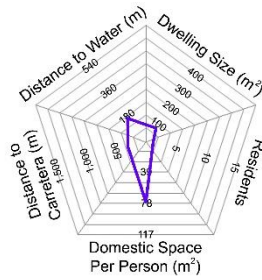
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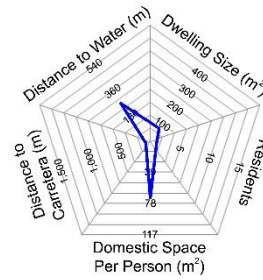
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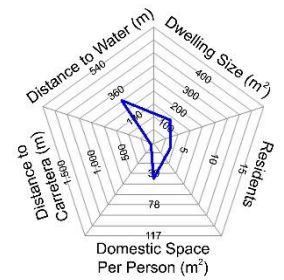
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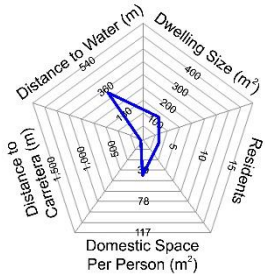
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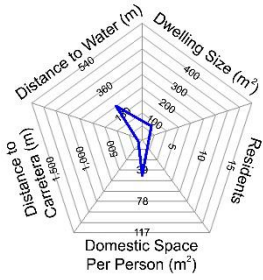
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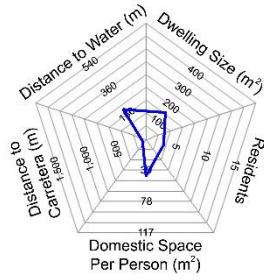
9.
(MTO4)



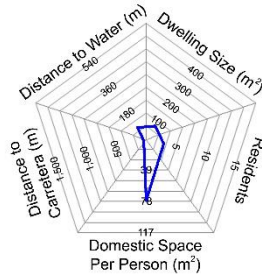
8.



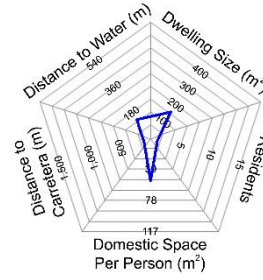
7. Garza



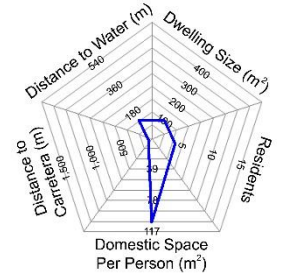
6. Flores



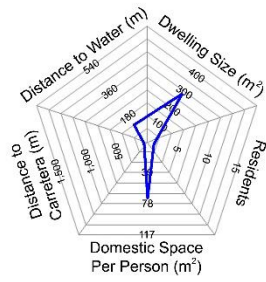
5. Espinas



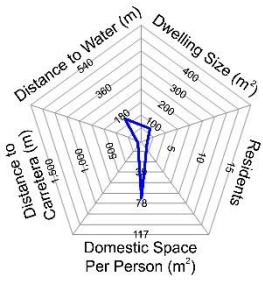
4. De la Rosa



3. Cielos
(MTO5)



2. Bosque*



1. Arroyo

* Receives microturbine generated electricity from 9. MTO4

Figure E1: Radio Graphs of Each Household in Río Negro
Source: Jeff DeGrave, 2015

Appendix F: Mean Averages, Median, and Mode Calculations for the Five Variables Tested by Era

The following table contains the averages for each era in order to offer additional insight how participatory mapping reinforced preexisting conditions of marginalization and empowerment within Río Negro.

Mean Averages:

Variable	Entire Community	Era I and II	Era III	No Microturbine
Dwelling Size	79.46 m ²	116.25 m ²	62.13 m ²	77.64 m ²
Number of Residents per Household	4.4	3.25	9.50	4.29
Domestic Space per Person	24.58 m ²	50.73 m ²	7.83 m ²	23.43 m ²
Average Distance to the Carretera	250.92 m	151.31 m	914.66 m	235.93 m
Average Distance to Nearest Waterway	212.31 m ²	157.77 m	130.39 m	218.47 m

Table F1: Mean Averages
Source: Jeff DeGrave, 2014

Central Tendency (Median):

Variable	Entire Community	Era I and II	Era III	No Microturbine
Dwelling Size	64.0 m ²	144.0 m ²	62.13 m ²	49.0 m ²
Number of Residents per Household	4.0	3.5	9.5	4.0
Domestic Space per Person	14.4 m ²	41.75 m ²	7.83 m ²	14.4 m ²
Average Distance to the Carretera	117.66 m	137.45 m	914.66 m	117.66 m
Average Distance to Nearest Waterway	175.97 m	144.09 m	130.39 m	212.72 m

Table F2: Central Tendency
Source: Jeff DeGrave, 2014

Mode Analysis:

Variable	Entire Community	Era I and II	Era III	No Microturbine
Dwelling Size	49.0 m ²	N/A	N/A	49.0 m ²
Number of Residents per Household	4.0	N/A	N/A	4.0
Domestic Space per Person	5 m ² ; 12.25	N/A	N/A	5 m ² ; 12.25
Average Distance to the Carretera	N/A	N/A	N/A	N/A
Average Distance to Nearest Waterway	N/A	N/A	N/A	N/A

Table F3: Mode Analysis
Source: Jeff DeGrave, 2014

Appendix G: Box-and-Whisker Graphs for Each Variable vis-à-vis Microturbine Ownership Status

The following box-and-whisker graphs offer visual representations of the variance and the ranges of the data for each of the five variables used in this study. The following key identifies the specific cohort for each box-and-whisker graphic representation:

TOTAL POP:	All households in Río Negro
W / O Mt:	All households in Río Negro without a microturbine
W Mt:	All households in Río Negro with a microturbine
Era I:	All households in Río Negro that received a microturbine during Era I
Era II:	All households in Río Negro that received a microturbine during Era II
Era I + II:	All households in Río Negro that received a microturbine during Era I and Era II combined
Era III:	All households in Río Negro that received a microturbine during Era III

G1. Dwelling Size (m²)

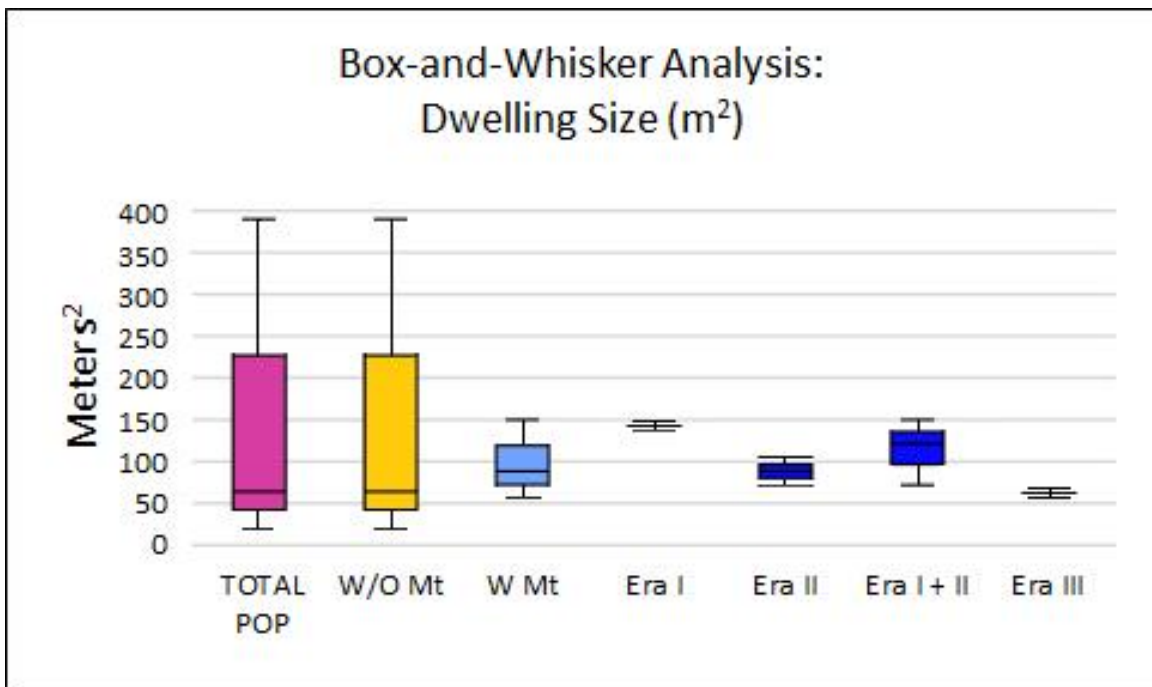


Figure G1: Dwelling Size
Source: Jeff DeGrave, 2015

G2. Number of Residents per Household

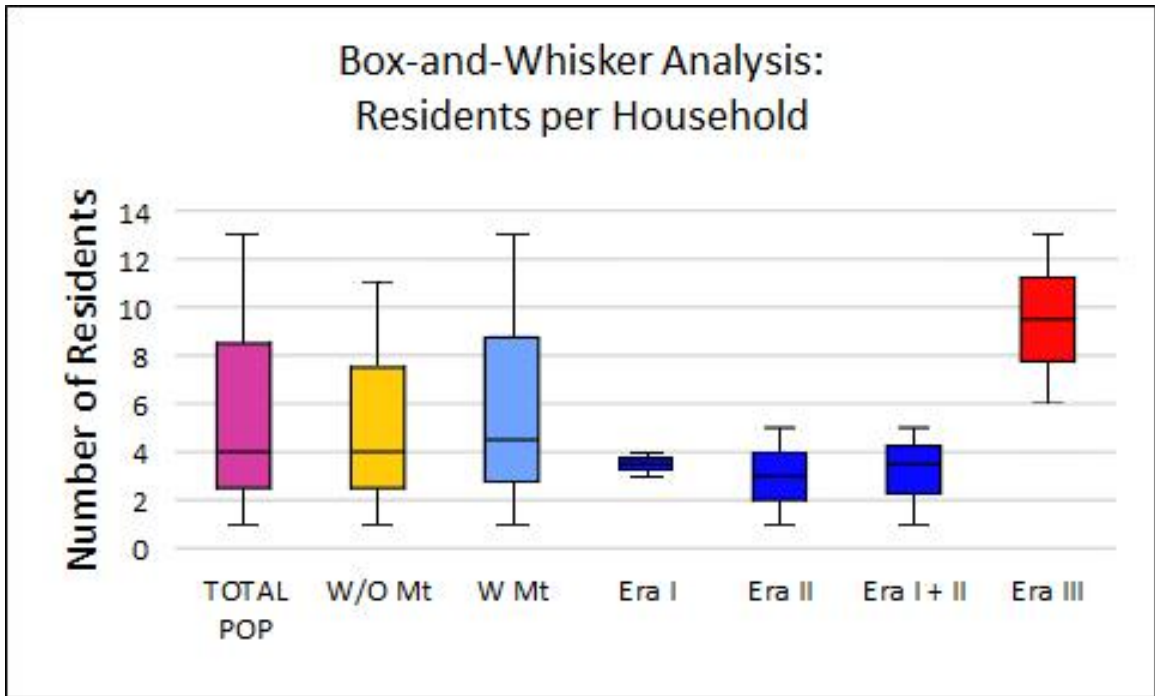


Figure G2: Number of Residents per Household
Source: Jeff DeGrave, 2015

G3. Domestic Space per Person (m²)

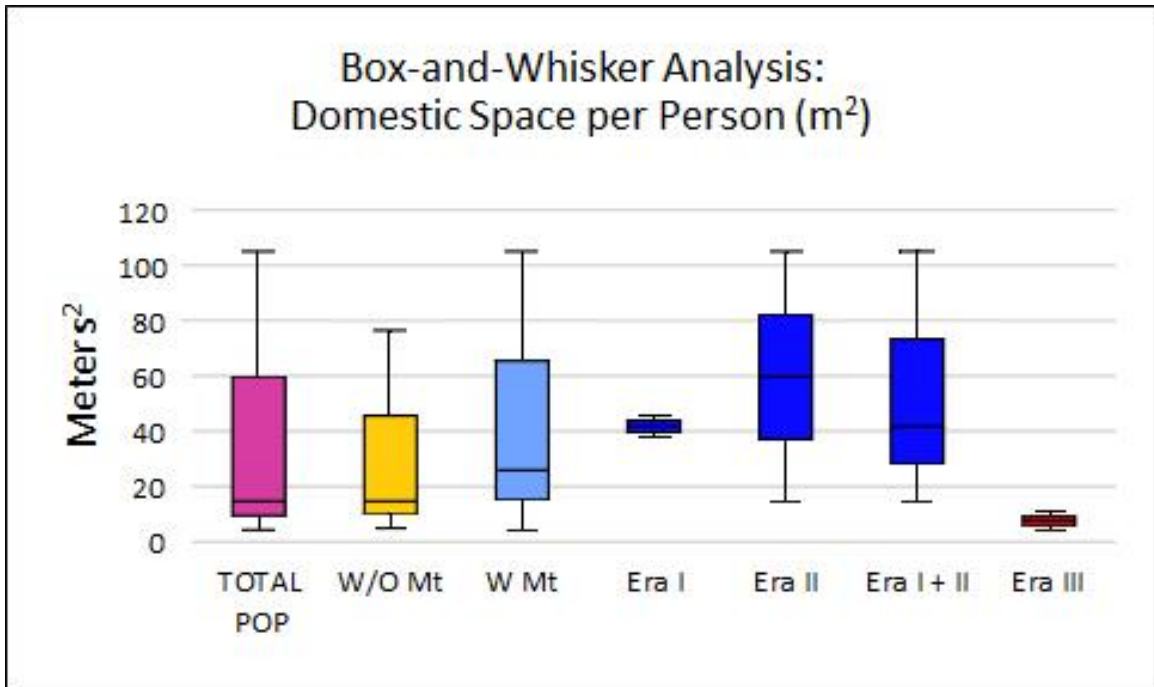


Figure G3: Domestic Space per Person
Source: Jeff DeGrave, 2015

G4. Average Distance to the Carretera (m)

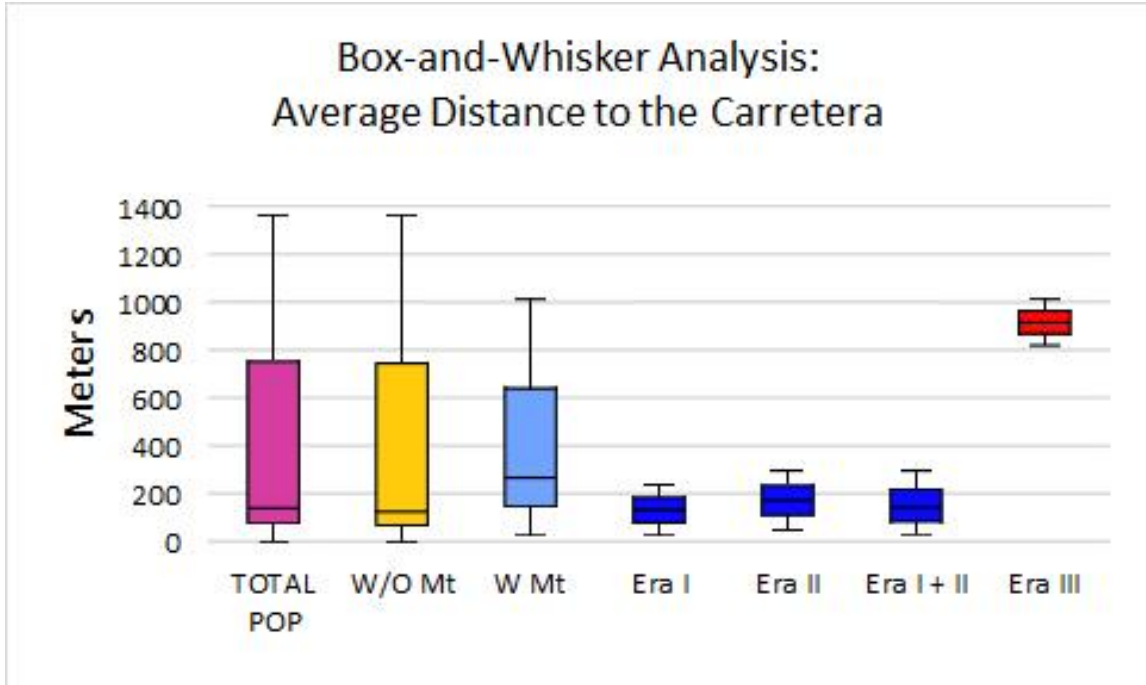


Figure G4: Average Distance to the Carretera
Source: Jeff DeGrave, 2015

G5. Average Distance to the Nearest Waterway (m)

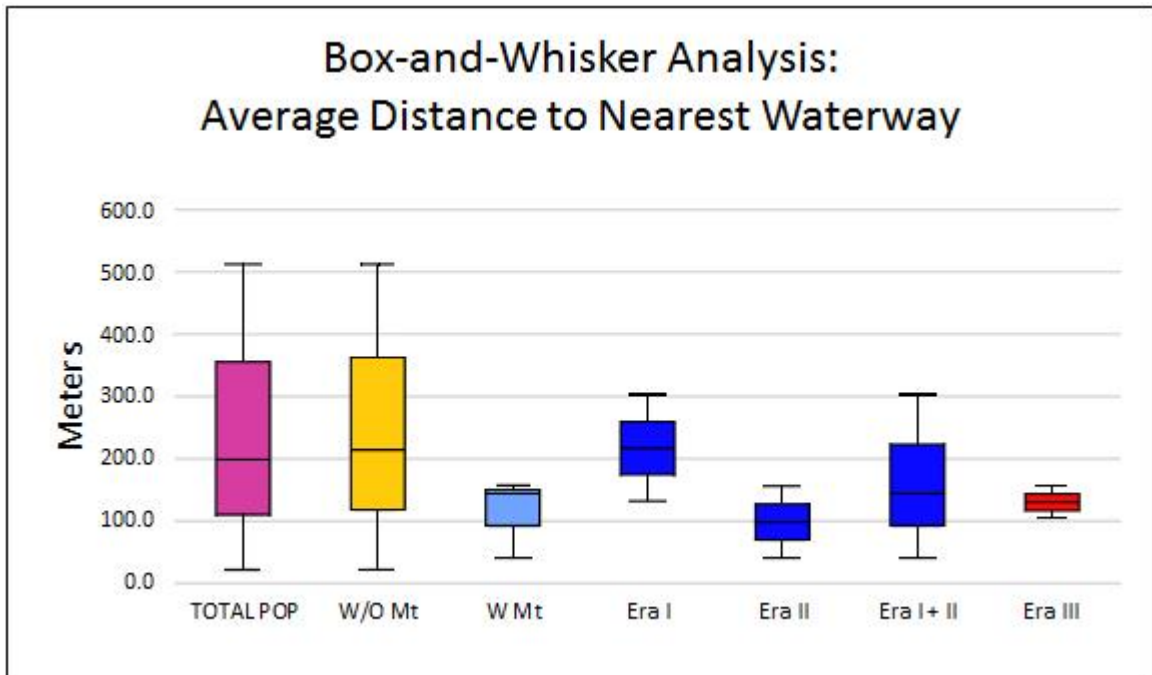


Figure G5: Average Distance to the Nearest Waterway
Source: Jeff DeGrave, 2015

G6. Average Marginalization and Empowerment Ranking by Household for the Five Variables Tested⁷⁸

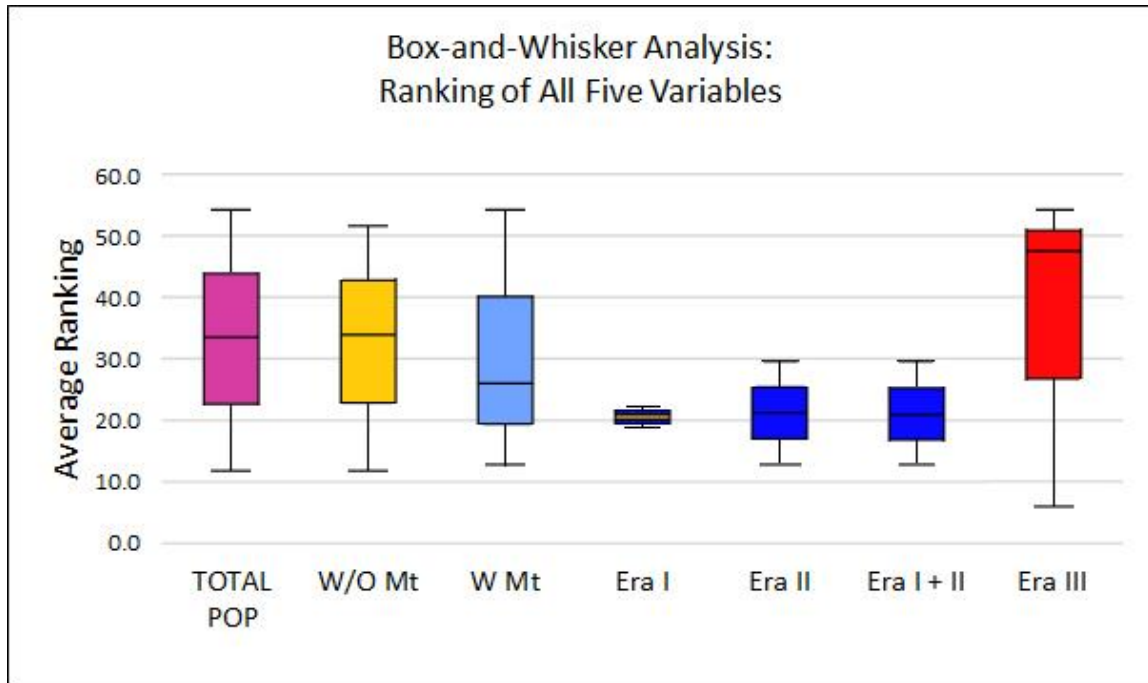


Figure G6: Ranking of All Five Variables
Source: Jeff DeGrave, 2015

⁷⁸ A higher average value for the five variables tested more strongly reflects conditions of marginalization while a lower average ranking tends to reflect a greater degree of empowerment for the five variables tested.