Narrative Imaginaries:

A Transdisciplinary Approach to Mapping Sustainable Futures for the Cantareira System

by

Cody Bertrand Staats

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree
Masters of Science

Approved November 2019 by the
Graduate Supervisory Committee:

Mary Jane Parmentier, Chair
LaDawn Haglund
Michael Bennett

ARIZONA STATE UNIVERSITY

December 2019

ABSTRACT

Tucked peacefully into mountains just north of the City of São Paulo, the largest metropolitan area in South America, sits the Cantareira Reservoir System. This massive water catchment network received worldwide coverage in 2014 and 2015 as one of the worst droughts in a century hit the region, threatening to collapse the system. In the years since the peak of the drought, the media has changed its focus, the reservoirs have begun a slow recovery, but the people of the region have had to live with the consequences of this difficult period. Faced with an uncertain future, the people continue to grapple with the historic struggles of rural life, while being faced by new threats to the social, environmental, and technological order that has for a long time stabilized the region. My thesis explores the narrative imaginaries that individuals have pertaining to their personal future and that of the region. It delves into the identity of the Rural Producer, the battle to conserve and preserve native forest, issues surrounding the governance of common resources, and what actors perceive to be the biggest advantages and threats to the sustainable future of the region. Utilizing a set of twenty expert elicitation interviews, data was collected from a variety of actors representing a number of roles and positions within the system. My analysis connects disparate individual narratives, illuminating how they connect together with the narratives of other respondents, creating a regional narrative that illustrates a set of desired outcomes for the region. This paper does not attempt to operationalize solutions for the issues that face the region, it does however serve to provide a context for the historical and contemporary issues that exist, a means by which to consider how they may be approached, and ultimately as a tool for policy makers to make more informed decisions going forward.

ACKNOWLEDGEMENTS

I want to extend my gratitude to the many people who have accompanied me and assisted me in the completion of this thesis.

First, I would like to thank my committee, Dr. Mary Jane Parmentier for guiding me through the GTD program and keeping me on track despite many obstacles. Dr. LaDawn Haglund, thank you for guiding my work and being an advocate when I had nowhere else to go. Dr. Michael Bennett, thank you for being invested in my success and challenging me to think beyond my context.

To the whole team at the Center for Science and the Imagination, I cannot fully express how truly thankful I am for the support you have shown me during this journey. Ed and Ruth, thank you for being academic role models to me and for leading a mission of incredible value and importance at CSI. Nina, thank you for being my confidant and friend. Bob, I am grateful that you put up with me and for bringing excitement and humor to the office. Peter thank you for your wit and camaraderie. Joey, this really would not have been possible without your encouragement, counsel, and support; your constancy provided me with confidence when I doubted.

I am incredibly grateful to the Institute for Ecological Research for hosting me. Drs. Alexandre Uezu and Clinton Jenkins, thank you for your guidance, help, and advice during my fieldwork. Andrea, Luan, Cibele, thank you for allowing me to accompany your work and for the constant support you provided me.

To my companions in Brazil, Thomaz and Farah, thank you for all your hard work and dedication, for your creativity in academics, and flexibility in adversity. I want to extend

special thanks to Eurico, Natalia, Idalina, Aline, Cristina, Carlos, Maralice, thank you for coming to the rescue, welcoming me into your homes, and making me feel like family.

Finally, I want to express my love and appreciation for my family. Suegro, Suegra, Mom and Dad, thank you for rooting me on. Ryan and Cristina, thank you for always being there for me, for being my base, and for encouraging me to chase dreams. Nancy, I love you, thank you for supporting me, for struggling with me, for succeeding with me, for being my amazing wife.

TABLE OF CONTENTS

LIST OF ACRONYMS

ANA   Agência Nacional de Águas (National Water Agency)

APA   Áreas de Proteção Ambiental (Environmental Protection Areas - EPA)

APP   Áreas de Proteção Permanente (Permanently Protected Areas)

CATI   Coodenadoria de Assistência Técnica Integral (Coordinator of Comprehensive

             Technical Assistance)

CBH   Comitê de Bacia Hidrográfica (River Basin Committee)

CBH-PCJ   Comitê de Bacias Hidrográficas dos Rios Piracicaba, Capivari e Jundiaí

             (Piracicaba, Capivari, and Jundiaí River Basin Committee)

DS   Development Studies

FNDE   Fundo Nacional de Desenvolvimento da Educação (National Education

             Development Fund)

IAD   Institutional Analysis and Development Framework

IBGE   Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of

             Geography and Statistics)

ICMS   Imposto sobre Operações relativas à Circulação de Mercadorias e Prestação de

             Serviços de Transporte Interestadual e Intermunicipal e de Comunicação (Tax

             on the Operation and Circulation of Goods and Services from Interstate and

             Intermunicipal Transport and Communication)

IPÊ   Instituto de Pesquisas Ecológicas (Institute for Ecological Research)

RMSP   Região Metropolitana de São Paulo (São Paulo Metropolitan Area)

SABESP	Companhia de Saneamento Básico do Estado de São Paulo (State of São Paulo Basic Sanitation Company)
SEBRAE	Serviço Brasileiro de Apoio às Micro e Pequenas Empresas (Brazilian Micro and Small Enterprises' Support Service)
SENAR	O Serviço Nacional de Aprendizagem Rural (National Service for Rural Apprenticeships)
SES	Socio-ecological System
SETS	Socio-eco-technical System

LIST OF FIGURES

CHAPTER 1

INTRODUCTION TO THE CANTAREIRA

Nestled quietly in the rolling hills of the Brazilian Atlantic Forest, just to the north of São Paulo, South America's largest metropolitan area, the Sistema Cantareira (Cantareira Reservoir System) quietly performs its purpose daily. Its setting is idyllic, beautiful green stretching over rolling hills and rocky outcroppings. The forest rises to great heights and spreads across fertile lowlands, providing for some of the most biodiverse habitats in the whole world. The fauna is magnificent, the region a sight to behold. Yet amid this paradise of natural beauty there is a battle raging for control. Control of the plentiful resources in the region, control over what the future may bring. The scars of human civilization are tangible here amid the natural splendor. Massive groves of monoculture eucalyptus, grasping for sunlight and reaching deep for water, artificial stands planted with the intention of economic use as charcoal, furniture, or pulp. Degraded pastures where cattle once grazed and livelihoods generated, are now barren, succumbing to runaway erosion, which has removed fertile topsoil and left hillsides without beauty or economic use. The Cantareira System itself is a monument to the spread of civilization. Its pristine lakes of human design, whose clean waters are destined for consumption by the metropolis to the south, and the communities which predate it, all exist together in a careful balance of ecological, societal, and technical dependency.

The region, its people, the organizations and institutions at work here point to the long arc of human development, the effort and investment to achieve a desired future, one

that provides for needs and excels at delivering the wants of modern life. In this story, securing prosperity for great metropolitan centers, often enough leaves rural communities behind, its people forgotten, their livelihoods diminished, and their futures uncertain. The contemporary difficulties that face the sustainability of the system will place greater pressure on this neglected region and populous, exacerbating systemic issues and stressing existing institutions. The narrative is coming back around to them, and that is where the questions lie. As a new chapter unfolds, what future do they envision for themselves; how does their history inform their views and perspectives, their ambitions and fears, and will the region prosper as a whole or once again be plundered by external entities?

This thesis uses a transdisciplinary lens to explore the future imaginaries of actors and stakeholders within Cantareira System, as they interact with, rely upon, and contribute to it. No single area of study or academic discipline is the singular basis on the imaginaries present in this complex and vast system; therefore, transdisciplinary approaches are necessary to adequately describe the system. This research seeks to illuminate the personal perspectives and narratives imbedded in this community, as producers, guardians, and users of the precious waters of the region. These narratives were elicited through interviews, in an effort to explore how personal and communal meaning is constructed, by people with strong relationships to the System. Utilizing the Institutional Analysis and Development Framework as well as Narrative Analysis methods, the thesis outlines the hopes and dreams, doubts and fears, about the future, which are inherent to the nature of human embeddedness in socio-eco-technical systems. It will not attempt to prescribe solutions to past, present or future problems related to the

breaking down social norms, the battle for conservation, as well as economic and technological stressors; however it will describe the feelings, views, and visions of the individuals who feel their impact. These individuals, and the community that they make up, have had few opportunities to express their perspectives or preferences as they pertain to decision-making processes for the region. In analysis, this thesis uncovers themes and topics of importance to the actors of the region, in order to connect and express seemingly disparate ideas from the interviews as a means to inform decision makers about issues that are pertinent to the community. Drawing on already existing literature and guided by the work of many scholars before, the author most of all desires to relate the stories and amplify the voices of those who have had barely a platform through which to express themselves and their value.

History of the System

Conceived in the 1960's, the Cantareira System, a massive water catchment project, was implemented in two phases, beginning with the construction of the three southernmost reservoirs; the Cachoeira, Atibainha, and Paiva Castro. Following the completion of phase 1 in 1975, phase 2 of construction began, and continued until 1981, when the two northern reservoirs, the Jaguari and Jacarei were completed. The system resides within the jurisdiction of twelve municipalities[1] from the states of Minas Gerais and São Paulo, each with their unique cultures and histories. Today the Cantareira

---

[1] Municipalities in Minas Gerais: Camanducaia, Extrema, Itapeva and Sapucaí-Mirim. Municipalities in São Paulo: Bragança Paulista, Caieiras, Franco da Rocha, Joanópolis, Nazaré Paulista, Mairiporã, Piracaia, and Vargem.

services approximately 10 million residents, as well as businesses and industries in the Greater São Paulo Metropolitan Area (RMSP - Região Metropolitana de São Paulo), and it's existence has far reaching historical and contemporary implications on downstream ecosystems and the communities from which it draws its water (Atlas, 2017).

The RMSP is located in the hydrologic basin of the Alto Tiête, having grown up around the Tiête River as it flows from its source in the coastal hills to the east. By 1960, the cities of this basin quickly outgrew the water supply of these primarily tributary waters, resulting in the need to transpose water from another basin in order to sustain growth. With a population of approximately 4.8 million[2] exacerbating the need for more potable water, the solution was clear. Store the headwaters of the Piracicaba River, in a new and extensive catchment system, and divert them toward the RMSP. The technological feat is impressive. Using natural declination, the system relies on gravity to bring water from their highest points in the Serra da Mantiqueira (Mantiqueira Mountains) of southwestern Minas Gerais toward their final destination. After passing through a series of reservoirs, the waters enter the Paiva Castro reservoir, the lowest natural point of elevation in the system. It is from here that the water is pumped upward over the Serra da Cantareira (Cantareira Mountains), from which the system receives its name. Over 5km the waters rise 120 meters into the Águas Claras reservoir, the final holding point before descending into the basin of the Alto Tiête, where simply opening of

---

[2] The demographic similarities between the construction of the Cantareira System and the Catskills/Delaware System of New York State, USA are striking. 50 years earlier when the Catskill/Delaware was under construction, New York City had similar population constraints, having hit a population total of 4.8 million shortly after the 1910 census, and had exceeded its supply of potable water. The two systems are often juxtaposed in literature, planning, and in personal narrative, as differing examples of management success and cultural impacts.

the faucet provides the life sustaining liquid (Rodrigues; et all, 2015). This complicated

feat of engineering and its continued maintenance is supervised under the institutional

reins of SABESP (Companhia de Saneamento Básico do Estado de São Paulo), the State

of São Paulo Basic Sanitation Company, which manages, maintains, and administers the

system, providing sanitation services to 26.7 million customers in 363 municipalities.
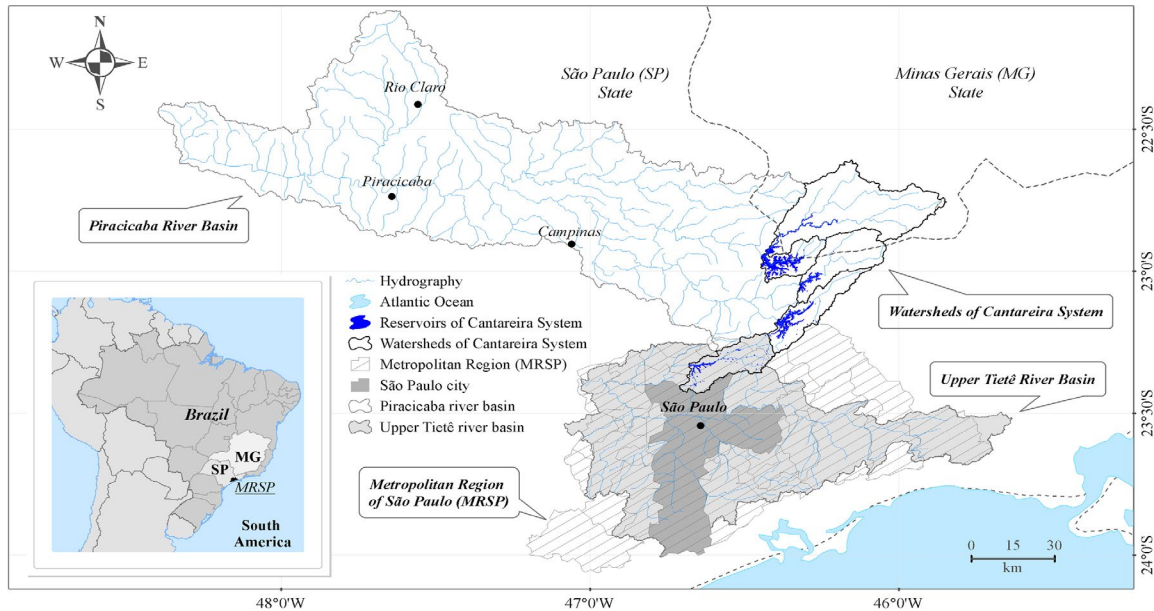
Figure 1 - Watershed map of the Cantareira System and the transfer of waters from the PCJ Basin to the Upper Tietê Basin for service of the Região Metropolitana de São Paulo.

The Crisis

It is a magnificent achievement, to create and manage a massive and complex

functioning system, which if not for the arrival of crisis, functioned so subtly in the minds

of the public, that its product is not contemplated despite its constant daily use. If not for

one of the worst droughts of the last 80 years (Nobre et al., 2016), the system might have

continued along without receiving massive news coverage. Beginning in the summer of

2013-14[3], southeastern Brazil entered a devastating drought, brought on by an atypically

weak rainy season. The rains, which normally begin in November, were late and

infrequent, and when the season ended, the deficit was evident. Analysis of water indices

in the Cantareira by Faro, Garcia, Oliveira, and Ramos show the dramatic early effects of

the weak rainy season. The Standard Precipitation Index, found in Figure 2 (Faro, Garcia,

Oliveira & Ramos, 2019) illustrates the rainfall totals as standard deviations away from
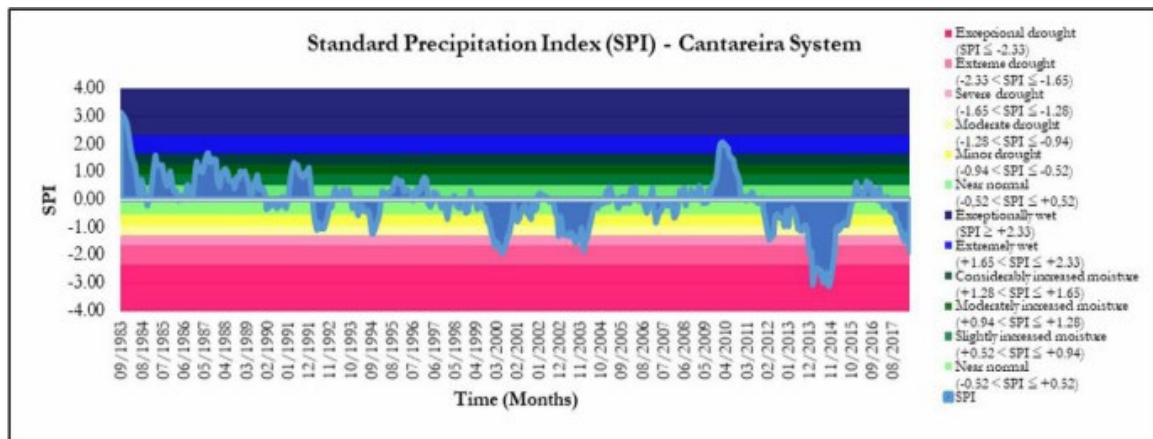
Graph 1. SPI, i = 12 months - Set for 12-month rainfall averages (moving average) - Cantareira System (September/83 to May/18).

the mean/average rainfall, and associates those deviations with the severity of the

conditions experienced, whether excessive or inadequate amounts of precipitation. It can

be seen that a lack of precipitation persisted from 2013 onward through the close of 2015,

with only a spare recovery during the 2016 wet season, but returning with force during

2017.

While the escalation of drought conditions due to the persistent lack of substantial

rainfall was no doubt a stressor that resulted in a terrible water shortage, Figure 3 (Faro et

---

[3]It is important to note that the Brazilian summer is the austral summer, corresponding with the
months of December, January, and February.
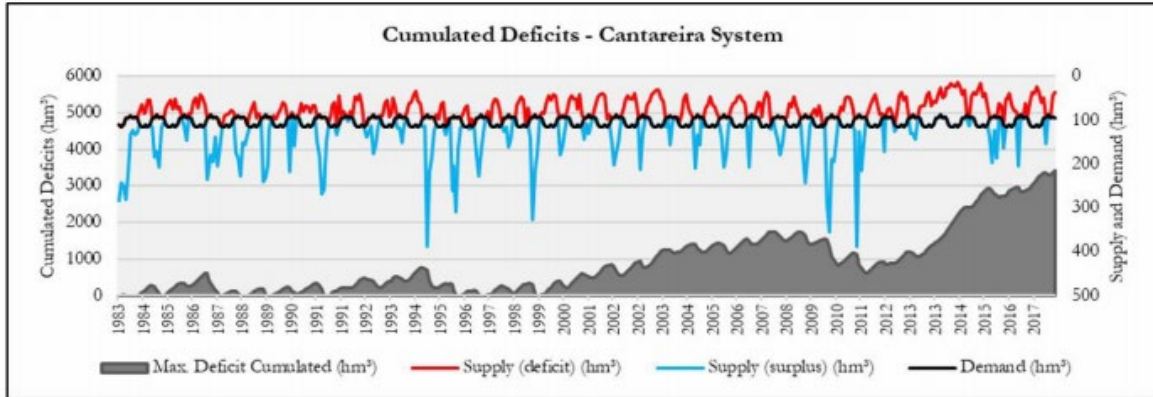
Graph 2. Main axis: Cantareira System's Cumulated Deficits. Secondary axis: Supply and Demand Volumes (monthly totals). Follow-up carried out from September/83 to May/18.

al., 2019) demonstrates the role which demand had in the crisis. The max cumulative

deficit is the relationship between the supply and demand, and from 2013-2017 the deficit

grew year over year. While demand did not grow, SABESP reported implementing

austerity controls to reduce consumption due to the drought (CHESS-SABESP, 2015).

Overall, the response was criticized for being late, limited, and biased (Phillips, 2014).

Service interruptions and cuts were aimed at lower income communities and the urban

poor, with little to no warning. As such, attempts to curb the deficit ultimately came

down to the supply and not reduction in demand. This drought resulted in a variety of

issues, and affected the lives of people in the Cantareira region in different ways from

those issues faced by the end users of water resources downstream in Sao Paulo. These

lived experiences, in times of water crisis, contribute to the future visioning narrative of

these individuals as they pursue their own endeavors and livelihoods, engage with other

actors in the community, and plan for what is to come.
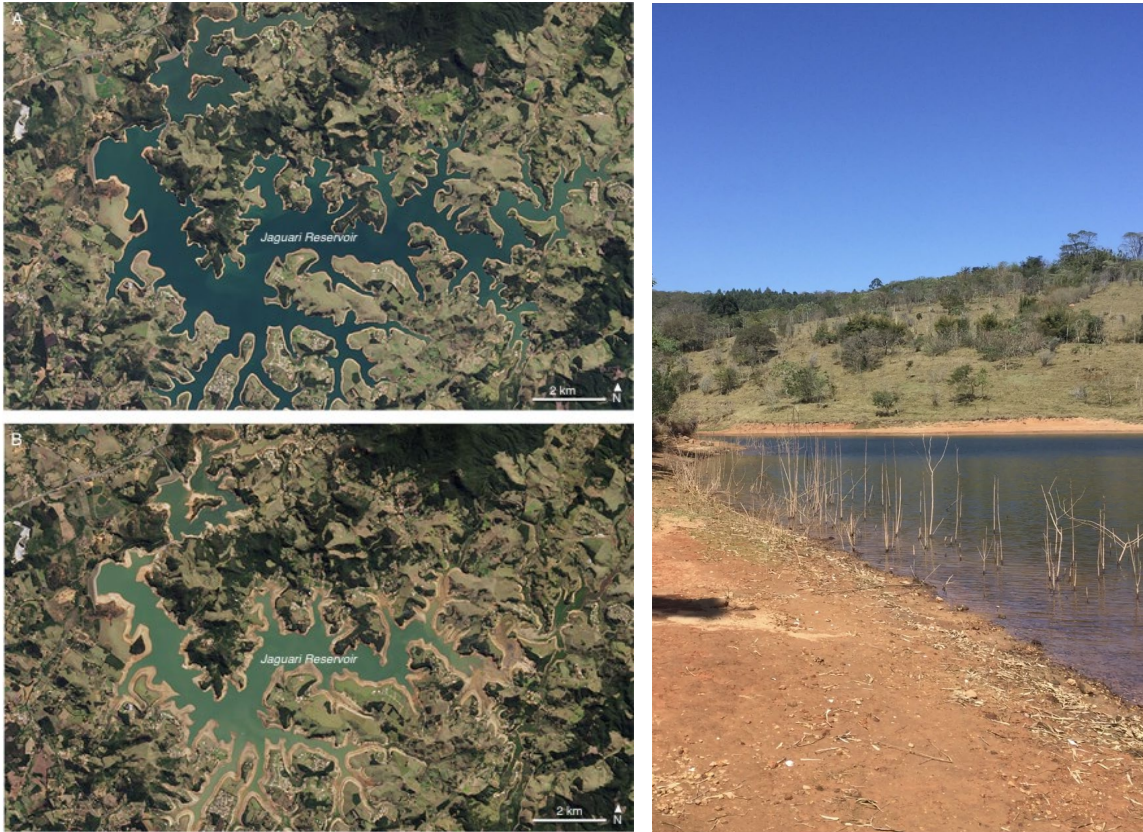
Left- Satellite images of the Jaguari Reservoir in August 2013(A) and August 2014 (B) illustrating the effects of the drought (Dobrovolski, 2015). Right - On the ground photo of the Atibainha Reservoir in August of 2018, water level is still well below normal levels

Water shortages are a contemporary topic of growing relevance for many metropolitan areas, indeed many regions of the planet[4], which for centuries or millennia have hosted the growth of human civilization, are now reaching points where they will be incapable of sustaining future growth. In reaction to the crisis created by water shortages, researchers and professionals from many different fields have taken up the charge to

---

[4] See: Recent droughts in the Western United States, Cape Town, South Africa, Late and Weaker Monsoons in India

prepare for future droughts, through the analysis of water catchment systems; supply, demand, and waste usage; as well as through ecosystem restoration, planning, and engineering.

This research delves into the manner in which individuals and social actors within the Cantareira System envision the future of their region, from a purely personal standpoint to macro level perspectives. The real human cost of actions taken in the call to save cities and regions from resource collapse, more often than naught, relies on the compliance and subservience of rural regions from which resources can be gathered to service this economic and societal fuel. It suggests that the voices of those actors, the people in the regions whose resources and efforts contribute to the longevity of more developed areas, must be heard in the discourse of creating the future, and that development initiative must be accountable to the actors. This acknowledgement is not only necessary, but also overdue, in that in many ways, the people of the Cantareira have silently adhered to the changing tides of governmental changes, made do with what they received from societal institutions, and worked through the struggles of life that came their way. They should be seen as shareholders in the greater system and have their voices heard.

CHAPTER 2

THE CANTAREIRA: A LIVING SYSTEM

Development

Humanity has progressively developed greater knowledge regarding the world in which it lives, and applied that knowledge to implement technological and societal interventions, in hopes of achieving a varied but vast set of goals. This process is called development. Development is not achieved through a singular overarching approach, and it effects do not fit within a closed and concise set of borders. The broad spectrum of human interaction with its environment means that development is core to the very basis of human society and the institutions that humanity has created to elaborate on its own desires and wishes. Development as a study and practice began in earnest in the post WW2 era, though its historical roots date back to the beginnings of human civilization. This section will discuss the changes that development studies underwent as a result of practical application, changing political landscapes, new theoretical frameworks, and advancing science technologies.

The Cantareira System is a living example of the evolution of development theory and practice. From its conception and construction to the present day, the paradigm of development studies has shifted substantially. Social and political scientists, economists, and environmentalists approach novel problems in areas such as institutional and economic growth, resource security, sustainability, and education in a very different manner than they did in the past. Perceptions on the role of development; its theory,

methods, and practice have all evolved as experience has dictated new thought and led to deeper investigation of the world we live in and the spaces we share. Each phase of this process toward modern development paradigms has affected the Cantareira System, through the actions taken by governments, NGO's, and individuals, in order to ensure its longevity. In the era of its construction, prevailing theories regarding international development were focused on Sovereign Order (Williams, ch1). At the end of the Second World War, many countries began to gain their independence from colonial powers. With newfound autonomy, these nations began to experiment with the political, social, and economic tools of the time. Brazil, despite being independent of its colonial ties since 1822, proceeded through the period of Sovereign Order under the governance of an authoritarian military regime, which began on the 1st of April, 1964 and came to an end on the 15th of March 1985. This fact is inextricably tied to the style and scope of development projects, which were planned for, initiated, or completed within the country during this era. The Cantareira System is an example of the development policies of the dictatorship, being planned, constructed, and coming into operation during the rule of the military.

In particular, there were four key thematic drivers to the practice of development during the 1960's and early 1970's. The first being Embedded Liberalism, which Williams defines as the role of "economic orders were ones in which the 'market' and economic relations were subordinate to and expressions of broader social and political goals" (Williams, 20). This is to say that the economy would function on the premise that free trade is essential to growth and that political/governmental institutions should intervene on behalf of the economy to maintain social institutions and full employment.

The Brazilian military regime utilized command style economic policies to subjugate the economy, aggregate power, and dictate the use of the means of production, through major projects, which focused on the sustenance of large population centers. Self-determination and the extension of sovereign power was the second theme. For all developing nations this meant that their sovereignty should be reinforced through development efforts and that, the path forward should be decided by each nation individually. This theme was of particular benefit to military and authoritarian regimes, as this strengthened the case for limited external interference. The third theme was overwhelming optimism in the aptly named "Golden Age of Capitalism". Growth was seen as inevitable and resources for development were treated as such. All economic processes could be deployed in ever-increasing methods of efficiency. While most military regimes did not function under the tenets of capitalism, this same optimism was mirrored in the "Brazilian Miracle", under which the dictatorship propped up growth rates of approximately 10% GDP during the late 1960's and early 1970's (Giambiagi, Castro, Hermann & Villela, 2016). Finally, the fourth theme was the political landscape of global hegemony, in particular the struggle for influence between the US and USSR. It is in this theme, that development served to further extend the influence and power structure of the two great superpowers of the time. This is why, at times, sovereign self-determination was cast aside in favor of global, resource, or political security; the latter implying forced development toward westernized democratic governmental institutions, which were seen as superior.

Another popular theoretical approach from the growing field of development studies during the construction of the Cantareira System was "development economics". Development economics also had a set of four thematic characteristics, which defined the

way in which it was employed in projects around the globe. It is well known for its focus on large infrastructure projects and interventions meant to provide resource security and stability. This plays into the first theme of development economics, which is the belief that the structure and institutions created by the global economy were already sufficiently capable of development without modification, while acknowledging summarily that development under current conditions was not an inevitable outcome, but was in fact highly unlikely. This uncertainty surrounding whether or not development would occur led to some assumptions about market equilibriums and trade policies being barriers to development, but ultimately was deemed to not be a primary barrier to development. While not inevitable, the second and third themes are dictated the idea that development was mutually beneficial to all parties globally and in particular required the process of industrialization (Rosenstein-Rodan, 1943). Some influential economists of the time paired these two elements of the theoretical framework into a single theme; however, it is worth noting that they are not exclusively linked in the mind of Williams and other contemporary social scientists (ie. Michael P. Todaro, Stephen C. Smith). Finally, the fourth theme was centered on developing nations and their reliance on external assistance to achieve growth, whether that be in capital and resources or via expertise and knowledge. According to the theory, nations did not necessarily require this assistance; however, it was seen as advisable to acquire help from developed nation(s) so as to assure a greater chance of success. In Brazil, these themes and their policy implications are known as import substitution industrialization (ISI), for their insistence on reducing economic dependence on the production of primary commodities and reducing reliance

on the import of finished goods produced externally, through the mobilization of domestic industrial potential (Evans, 1995).

Due to the delayed level of modernization Brazil had reached during the 1950's and 60's, the themes discussed earlier in this section regarding development theory and its application in rural areas, as well as its practice, very much still held true for the country and specifically the Cantareira region. As noted by Ellis and Biggs (2001) "While it is superficially neat to characterise the 1960s as modernisation, the 1970s as state intervention, the 1980s as market liberalisation, and the 1990s as participation and empowerment, popular ideas and their practical effects on rural policies did not, indeed, undergo these transitions in such an uncluttered manner" (pp. 437). Summarily, the theoretical proposition of new methods to employ rural development practices often served as a decadal or multi-decadal precursor to its implementation and spread. So while the worldwide trend of development could be generalized and then categorized neatly, cases such as that of Brazil, were often delayed by political and social movements particular to the nation, which can be attributed to control of the military regime and its goals. In some cases, it would take many years for new development practices to gain traction and have wide effect. It is notable, in the context of this thesis, that the theory of development economics as well as the overarching themes of the era of sovereign order were not particularly focused on the cultural and social characteristics of developing communities or on enhancing capabilities and human development, rather the interventions focused on monetarily driven hard fixes for economic problems. Import substitution industrialization policies involved the implementation of large-scale infrastructure projects, industrial investment, and monetary assistance. In urban settings,

industrialization and public works were the answer to underdevelopment. While in rural settings, modernization of techniques and technology via transfer from more developed areas was the standard for attempting to develop communities left behind by the growth of urban centers and resource reallocation practices. It was this intellectual and practical development paradigm in which the Cantareira was built, a massive project meant to sustain the RMSP, at great expense to the PCJ river basin and the municipalities at the headwaters of the Cantareira.

Environmental and Water Policy in Brazil

Among the forces that most influence the daily lives of actors in the Cantareira system, and thus influence the narratives they tell and the futures they envision, are the environmental and water protection laws. The political and management paradigm was very different in 1973 when the first of the reservoirs were flooded under the auspices of the military dictatorship. Private water rights still existed and environmental protections had not yet come to the forefront of concern, and the implantation of the system resulted in severe displacement and limited remuneration. "Because it was unusual, in the 1960s, for the population to participate in decision-making processes concerning water resources (Braga 2001), no compensatory measures were established for riparian users when the Sistema Cantareira was designed" (Rodrigues; et all, 2015, p.3). This fact was substantiated in the historical backdrop of several actors who were interviewed, as was the "magoa" or bitterness still present in the present day where communities were heavily impinged upon by the reservoirs flooding homesteads, farms, and towns. An article written in 1970 by Ludtke and Burdge about the displacement of individuals in Kentucky

15

and Ohio due to reservoir construction offered a contemporary solution that might have helped to mitigate the feelings of resentment and the physical effects of economic and social displacement. In this case, "Rather than spending funds on large information programs the Corps of Engineers might develop vehicles for the orderly relocation of people. Much of the hostility presently directed to the Corp might be if such resettlement procedures were made available" (pp. 129). However, this was not the case during this era, as already noted by Rodrigues, and the effects were long lasting. The headwaters transposed to the basin of the Alto Tiête siphoned off much of the annual flow that supported the communities in the interior of the state, and it took years for recognition of this damage to reach a place where the situation could even be discussed in earnest.

In 1988 the Brazilian Constitution eliminated all remaining private rights pertaining to "water resources, thereby characterizing all waters to be public goods belonging either to the union or to the states, in accordance with river basin boundaries" (Rodrigues; et all, 2015, p. 2). This was a major step toward a new set of goals for the country in its conservation efforts. The system became participatory; shareholders from a variety of different organizations and profiles were able to advocate for their rights to water usage and compensation at a state level. This led to the emergence of Comitê de Bacias Hidrográficas (River Basin Committees), prominent among these for the Cantareira being the Comitê de Bacias Hidrográficas dos Rios Piracicaba, Capivari e Jundiaí (Piracicaba, Capivari, and Jundiaí River Basin Committee - hereafter CBH-PCJ). The CBH-PCJ comprises constituents of the downriver communities whose tributary rivers were diverted for the purpose of the Cantareira system. In order to secure more control and garner some revenue from the supply of water that remained for its rapidly

growing population and industries, this committee has struggled to get proper treatment and recognition in lieu of the circumstances it was dealt. "However, Brazilian law makes no provision for cases where water is transferred from one basin to another, and consequently, no management practices are stipulated for this situation, which tends to generate conflicts of interest among users," (Rodrigues; et all, 2015, p .3). This lacuna in the legal code complicates the interaction between self-governing basin committees and governmental entities such as SABESP, and leads to friction as well as a sense of inability to shape the future of water policy and security as it affects the region.

There already exists a great deal of literature regarding the system, its impacts and outcomes, which focus on a variety of themes from Payments for Ecosystem Services(PES), to the ecological impacts of APP (Áreas de Proteção Permanente) and their governance, discussions on land-use reclamation and revitalization, as well as the supply and demand needs for the greater RMSP. It is not the intent of this thesis to delve into the complexities of these topics, instead the author would refer you to articles[5] by authors who have discussed at length the intricacies of environmental restrictions and payments to rural producers for their participation in conservation efforts.

There is public engagement and PES are being implemented in the Cantareira region; however, the general feeling both academically and publicly is that not enough is being done to incentivize conservation efforts, mobilize producers toward sustainable forms of production, or create a sense of inclusivity in a participatory model of

---

[5] Seixas, S. R., Höeffel, J. L., Renk, M., & Silva, B. N. (2012); Chiodi, R. E., Sarcinelle, O., & Uezu, A. (2013); Richards, R.C., J. Rerolle, J. Aronson, P.H. Pereira, H. Gonçalves, P.H.S. Brancalion. (2015); Richards, R. C., Kennedy, C. J., Lovejoy, T. E., & Brancalion, P. H. (2017); and Ruggiero, P. G., Metzger, J. P., Tambosi, L. R., & Nichols, E. (2019).

governance for these resources. For the purpose of this research, acknowledging the weak role these environmental management tactics play at the current moment, contextualizes the decision making process of individual actors in evaluating buy-in to incentivized conservation activities. Both hope and despair are present in these undertakings due to the historical backdrop, political landscape, and social setting. Within the context of this paper, APPs serve as a geographic boundary object, providing a physical constraint from within which data can be gathered, and with which to contextualize the expertise of the participants, based on their relationships through socio-geographical connections.

<center>Socio-eco-technical Systems – SETS</center>

As discussed at the beginning of this chapter, the origin of development as a field of study stems from economic development, a social imperative to provide a greater quantity of goods and services that increase the quality of life in measurable way. Historically, this approach was not focused on externalities and viewed system complexity as a hindrance to efficiency or a cost to be dealt with. Thus human interaction with ecosystems, the environment as a whole, was controlled and manipulated by a vast set of technological tools, in order to achieve greater economic efficiency, without great regard for the numerous intricate elements that interact in a tender balance that affords humanity sustenance. In the 1940's, Eric Trist, Ken Bramforth, and Fred Emery, whose research was based on the social psychology of work crews in the coal mines of Longwall, brought to life a new conceptual model for understanding this development phenomenon, socio-technical systems. Their studies took steps to outline the reciprocal relationship of technology and social systems. This is to say technical systems and social

<center>18</center>

system do not function independently of each other rather that they operate in a state of component exchange. On a basic level, social systems provide task and process structures, while technical systems provide tools, services, and products for utilization. Ideas such as labor utilization, human capital, and social investment were part of the new system approach to understanding the interplay of elements, which were once considered disparate pieces of individual models and fields of study. From this starting point a greater understanding of system complexity arose, which would finally consider allocating proper importance to the human interaction with ecosystems and its use of a vast set of technological tools to shape nature for its use.

Parallel to the strides being taken in Development Studies (DS) a new field of study was emerging. Early Socio-Ecological System (SES) theories began to gain traction, spawning a number of different subfields that focused on contemporary topics of the time, including but not limited to: ecological economics, or the connection of the two classic areas of study; common property, an area of study focused on the conventional tragedy of the commons; and political ecology, which viewed cultural and political interaction by its ecological footprint. Each began to view the system as something more complex and yet related, until works by Elinor Ostrom established the prevailing framework for the field, which is still being built upon today.

The IAD, or Institutional Analysis and Development Framework, which Ostrom (2009) presented, relies on a system view that utilized a "multilevel, nested framework for analyzing outcomes achieved in SESs" (pp. 420), which amplified the ability of the theories and models generated to encapsulate the ongoing interaction between society and the environment. As a framework the IAD assists "scholars and policymakers interested

in issues related to how different governance systems enable individuals to solve problems democratically, the IAD framework helps to organize diagnostic, analytical, and prescriptive capabilities. It also aids in the accumulation of knowledge from empirical studies and in the assessment of past efforts at reforms" (Ostrom, 2011, p. 9). For this thesis, the IAD will be serve as a descriptive output, uniting the elicited narratives of actors from different parts of society, and providing context to the current paradigm of system interaction. A description of these framework elements is provided below:

Internal Structure – Action Situations

Action Situation - The social spaces where actors interact, conduct economic activities, engage each other in social settings, develop social hierarchies through action and inaction, and otherwise participate in community. This list is not all-inclusive, but rather an explanatory.

Actor - An individual or entity (NGO, Corporation, Governing Body), which takes action in some way within the situation, whether explicit or implicit.

Rules - The common understanding among actors, which defines the actions that may be taken at any time as, restricted by physical, social, economic, or legal constraints. It is important here to note "Information search is costly, and the information-processing capabilities of human beings are limited. Individuals therefore often must make choices based on incomplete knowledge of all possible alternatives and their likely outcomes"

(Ostrom, 2011, p. 14). Therefore, a common understanding of restrictions is not necessarily homogeneous across all actors.

This thesis explores the question of imagined futures created by actors within an action situation that is directly tied to the Cantareira System and is thus tied to a classic commons dilemma. Initially pursued academically as a "tragedy of the commons", a situation occurs in which the management of a common resource is dictated only by personal desire and limited knowledge, leading to resource depletion. It was a traditional approach to thinking about situations in which shared resources must be maintained for the sustainability of public use; however, the assumption that resource depletion is the only explicable end point has been replaced with different approaches to management solutions. The water and land-use restrictions in place in the Cantareira watershed have a widespread effect on the narrative of the actors as well as the actions that can be taken by individuals. The collective conflict, between the interests of long term small and medium size producers/land owners, NGO's, governmental bodies, organized industry such as tourism, and new speculative investors creates the landscape for the dilemma faced in managing the future of the region. To this effect, rules within the IAD assist the researcher in codifying the actions, which actors may take while pursuing their daily efforts, as well as short-term and long-term goals.

Types of Rules

Boundary Rules - What limits are placed on the appropriation of shared resources, due to ethnographic labels, legal designations, social or economic norms.

Position Rules - Describing the necessary process of becoming a member of the group or progressing into control positions with specialized tasks.

Scope Rules – The way resource appropriation is limited by physical constraints

Choice Rules - Are there alternative methods, preferential methods, forbidden methods, etc. of exercising one's agency to act

Aggregation Rules - Do group dynamics dictate the manner in which resources are appropriated, requiring acceptance, permission, or mandate

Information Rules - Whether information is public domain or secret, based on privacy, security, personal preference, etc.

Payoff Rules - The results of positive actions and the ramifications of negative actions, their monitoring and the exercise of authority or power to safeguard resources and punish bad actors or reward proper conduct in usage, preservation, or protection of the resources

---

In order to arrive from SES to SETS, it is important to emphasize the technological element at play. Drawing on the work of Grabowski et.all, the role of technology is not simply a social or ecological element, but requires its own discussion as an integral part of system theory. Technologies according to Grabowski et.all; are those large scale infrastructure projects that are distinguished by their built environment, including transportation, power generation and distribution, food production and processing, manufacturing, water delivery, and waste treatment. All possess social and ecological inputs and outputs, thus they were typically grouped in with those respective pieces of the SES format. "As part of thinking about the true costs and benefits of infrastructure, infrastructure systems science requires a more equitable process for

articulating infrastructure's goals and design considerations" (Grabowski, et.all, 2017, p. 2).

Reservoirs, like the Cantareira, are constructed with the primary purpose of storage and providing a constant, reliable source of water to large metropolitan areas. Secondary purposes can include in some cases the generation of hydroelectric power and providing for flood control measures. This technological intervention has been utilized at various scales for almost 5,000 years, however despite the freedoms and prosperity that might have been generated by these technological implementations, the process of arriving at an equitable and democratic solution for socio-eco-technical problems which was largely missing from these early projects. For equitable solutions to come about steps must be taken "The first involves the integration of different forms of expertise, shifting the emphasis in infrastructure research away from academically siloed or specialist-led programs to one engaging the infrastructure design, implementation, management, and research communities to frame problems and solutions collaboratively. Secondly, the authors emphasize the need for better process integration, whereby design, implementation, and management processes integrate technological systems with social and ecological systems" (Grabowski et. all, 2017, p. 2). While this thesis will not alter the design, implementation, or management process of the Cantareira, it does illuminate the existing sentiment toward social-eco-technical systems; their design, implementation, and management, providing a data set that may be useful in consideration of future infrastructure projects.

Boundary Objects

Setting a reasonable framework for this thesis, when discussing the broad set of implications brought about from inheriting the diverse disciplines that come together to form SETs theory, requires a few of boundary objects. Star and Griesemer (1989) define boundary objects as: "objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Hertz and Schülter, 2015, p. 13). So, where does the SETS end? It is tempting to follow the path of rising complexity along a winding network of causal interactions and functional connections, both strong and weak, until the system, being analyzed reaches a truly enormous scale. Boundary objects are necessary to properly define the extent of the study, placing exacting constraints with the breadth of the complex system, through which a meaningful interpretation of data can yield some results. Boundary objects for this thesis consist of the aforementioned IAD, methodological considerations including Snowball Sampling and Grounded Theory, geographical and political constraints such as the watershed of the Cantareira, the corresponding APP and APA areas and the municipalities that surround the reservoirs.

Understanding the existing literature regarding socio-eco-technical systems and the role it plays within the context of this thesis is key, as it serves to frame the interaction of social constructs, technological interventions, and the ecological system present in the Cantareira. As noted the nature of commons dilemma unites the actors interviewed within a system framework, in which IAD rules can be determined and coded for an understanding of what it means to live within the SET system. Snowball sampling

bounds the research by connecting the researchers organically with other actors through mutual contacts and share action with the system, while relying on a saturation of results, themes, and constructs created by narrative overlaps and inconsistencies among individuals. In order to reach a point of confidence in the reliability of the data collected, saturation had to be considered. Grounded theory ties the expert narratives together by removing initial assumptions and providing for live interpretation of that data, as it is forthcoming, which permits the researcher to code responses together with limited starting biases. Finally geographic constraints place a boundary on the respondents, relying primarily on individuals with the network of the Cantareira watershed, including actors with ties to many functions within the region including the municipalities of Bragança Paulista, Nazaré Paulista, Joanópolis, Atibaia, Piracaia, and Camanducaia.

Imagination and Narrative

Imagination is invention, it is clever, it seeks solutions. It wants to tell stories, big and small, about the world as it is, as it may have been, as it can or will be. It is fundamental to progress, because it can inform the decision-making process, encourages the would-be intrepid adventurer to see beyond the veil of the present, and seek a path forward. Synonymous at times with hopes and dreams, it is the means to an end, an escape from the now; it is what its crafter wills it to be. It can however be lost, taken or hidden by the trials of life, the system as it is can quench it, and the world may see it as fruitless. Development draws on the visions that only imagination can illuminate. A malleable world, capable of change. In fact, development can be loosely defined, as any sort of change, but there exists in its meaning a certain innate desire to frame it as change,

which is purely positive in nature. This is not necessarily bad, as perhaps it alludes to the intent behind the changes, which are occurring, however it can be considered naive to assume that all changes within the complex socio-eco-technical system in which humanity resides would be positive. It is worth being wary of this fact, but "the future is not unimaginable. Hence, the possible results of decision-making come from the imagination. Decision-makers must imagine the future in order to choose; what is missing does not exist and must be imagined" (Almeida, Curado, 2019, p. 18). In this way, the imagination is based on the ability of individuals to tell stories and create narratives, which will be grounded in the reality they perceive, constrained by real factors, but unlimited by their willingness to look beyond those things a see better outcomes. "Similar to oftentimes less explicit sociotechnical imaginaries, narratives of change create a shared sense of belonging and a community identity that structure actions and meaning based on a common outlook on social reality and a desired future" (Wittmayer, et all, 2019, p. 4). Narratives form a communal connection through their shared features, but all illustrate the unique facets of individual life and struggles.

There is a classic Brazilian quote is, "A esperança é a última que morre", which to a certain degree means While There is Life, There is Hope, yet at times is closer to despair or "Hope is the last thing to die." It expresses both the tenacity of the Brazilian to overcome any adversity, and the hopelessness that accompanies what appears to be consistent ill fortune brought on by the struggles of systemic stagnation and governmental gridlock. An overarching narrative describes both the resilience and tenacity of the people. There is imagination and drive encapsulated in its use, and a willingness to achieve and strive to the very end. As argued by Beatty (2017), "We need

a way of representing and explaining the world one event at a time, because we often don't know, on the basis of the laws of nature and initial conditions, what comes next. We need to be told. Narratives tell us, and sometimes in a manner that not only represents the world but makes sense of it" (pp. 41). The stories told by each actor interviewed are human stories, they are not just data, they are sacred, meaningful, and worthy of proper consideration as the narrative of a people.

CHAPTER 3

METHODOLOGY

Research for this thesis was conducted as part of a Global Development Research

fellowship, with financial support from the USAID Global Development Laboratory,

from June until August of 2018. IRB exemption was granted on the 6th of June 2018, with

IRB ID: STUDY00008324. Data for this thesis is based on 20 semi-structured interviews,

which were modeled a qualitative expert elicitation approach (Hagerman 2010, Usher and

Strachan 2013). The interviews relied on constructivist grounded theory. This is to say

that each individual is the primary expert based on their membership in the community,

regarding his or her personal role in the complex network that is the Cantareira. Their

perspectives and narrative visions of the past, present, and future shape the way in which

they view the system, its future, and their place within it. In addition to the groundwork

in expert elicitation, the USAID Key Informant Interview format served as a guiding

document for the formulation of interview prompts (USAID, 1996). A set of interview

questions were developed with four categories in mind: Contextual, Narrative,

Behavioral, and Structural/Knowledge-Based. These categories stem from previously

explored methodologies within other studies that rely on expert elicitation, including;

Hoffman (1995 & 2006), Haggerman (2010), Usher, W., & Strachan, N. (2013).

Contextual questions served as a foundational anchor for the discussion of future visions

by developing an understanding of the actors' background, history in the region, as well

as the roles and daily activities in which they are involved. In this way, the actor connects

themselves with the questions in a meaningful way, noting that their past roles le d to

future participation in the region, which prepares them for the following questions. "A narrative's configuration is best "grasped" by reflecting back on it" (Beatty, 2017, p. 37). Narrative questions helped to illuminate the individual's ideals, opinions, perspectives, and views on topics surrounding the future of the region and their part in that future. These questions probe the ambitions, beliefs, opinions, and views of the actor to delve into subjective visions for the future of the region and the community. Having established the unique personal narratives of the actor, behavioral questions and structural/knowledge-based questions further illuminate how these narratives were constructed. This is achieved through discussion of societal structures and institutions, knowledge gaps, obstacles, and points of success and optimism.

The questions[6] are purposefully open-ended, which allows for participants to discuss their thoughts, while mitigating the frequency of instances that might lead to "guided answers". An open-ended format also allowed follow-up questions to be proffered, based on participant responses, which required clarification or introduced interesting concepts and themes, as well as allowing for a certain amount of control in co-creating a fluid and thoughtful conversation. A number of the prompts utilized are found below, in category by subject matter. While not limited to these questions in practice, the interviewer and interviewee were able to speak freely, which allowed a flowing conversation to generate observable topics while limiting the occurrence of leading responses.

---

[6] Found in Appendix A

The interviews were conducted in a variety of field sites and settings, all with the paramount concern being the willing participation and comfort of the actors being interviewed. This included doing interviews on family farms, at places of business and office spaces, during workshops in collaborative spaces, at local cafés, and over the phone. The interviews were often scheduled ahead of time, varying in length from 15 minutes to just over an hour, though a number of interviews were solicited on the spot, during outreach workshops with local producers, according to the interest of the conversation as topics arose in discussion. Recordings were taken of the content of the interviews, omitting records or information that may be used as a personal identifier, and transcribed for coding of themes and rules post project. The 20 written transcriptions, 19 of which are in Portuguese, with one being conducted in English, serve as the data set for this thesis.

Expert Elicitation

Expert elicitation is methodological approach to data collection that utilizes the collective responses of individuals, who are experts in the subject being investigated, to develop an explicit data set, where the data is difficult to obtain for logistical, financial, or physical reasons. The method typically relies on semi-structured interviews to gather data, allowing the expert to elaborate on a number of subjective or difficult topics according to prompts or questions, which are established to set boundaries for the conversation. The answers proffered help to inform the investigator about the links between theoretical formulations and the empirical or measurable world (Charmaz,

2008). In the context of this project, semi-structured interviews provided an approach that was stylized to match the cultural acceptance of open conversation. Developing a relationship of trust and respect with each actor was necessary in order to achieve a level of communication that yielded quality data. In planning for the interviews, it was noted that there was a potential for deeply insightful information to come forward, while also the potential for wild deviation from the intended data goal. In order to maintain a certain amount of control over the process of eliciting answers, incorporating some structure into the interviews became necessary. "Unstructured interviews gained early acceptance as a means of simultaneously "bootstrapping" the researcher's knowledge of the domain, and establishing rapport between the researcher and the expert... Interviews could get their structure from pre-planned probe questions, from archived test cases, and so forth" (Hoffman & Lintern, 2006, p. 205).

Some detractors view expert elicitation as a lesser form of research, one that requires less rigor and less effort. Morgan (2014) notes that there are ways to introduce rigor, such as using the setting to minimize expert fallacies, interviewing a wide range of experts to check saturation, and analyzing data combinations with a wary disposition. Other ways in which to increase rigor include iterative adjustments and drafts protocols. While the first suggestions were easier to implement as interviews were conducted at locations of comfort for the actors, homesteads, offices, and in public. This allowed the individual to set the stage and select a location, so that they were not worried about logistics or visiting a place they had never been before. Additionally, data analysis following the grounded theory, which provided for theme to emerge organically while viewing the data from a variety of perspectives. It was however difficult to utilize the

suggestion to produce various iterative adjustments. Interactions were quick in succession; however, each interview was discussed in length upon completion, to improve communication and clarity of responses. The protocol was then reviewed, for execution as well as efficacy, in order to better access the knowledge of each expert. Subsequent interviews then incorporated this gained knowledge to better reach the individual and to prevent difficulties in communication with future interviewees.

<div align="center">Experts</div>

Methodological disagreements arise regarding the quality and reliability of data produced through expert elicitation. Among these dissents is the question of whether or not experts actually exist. While the definition of what an expert is has long been debated and in many cases is extremely fungible, this thesis makes an effort to expound upon the reasoning behind what an expert is, in the context of future visions of the Cantareira System. Experts are very much human, and are thus subject to the many frailties that come along with the quality. Morgan (2014) raises a number of concerns regarding the efficacy of relying on experts to provide predictive insight that can be considered relevant assessments on the future of a topic or field. Primary among these concerns are the intrinsically human characteristics of a fallible view of probability, cognitive heuristics and biases, and overconfidence. In regards to probability, experts are susceptible to personal beliefs and what information they have present when making "subjective probabilistic assessments of the present or future value of uncertain quantities, the state of the world, or the nature of processes that govern the world" (Morgan, 2014, p. 7176). In order to control for this, experts were not asked to provide empirical research or data

<div align="center">32</div>

based assessments, but were not restricted from doing so, if they offered in the course of the conversation. In order to control for probability biases, the study firmly relies on qualitative interpretations of the language used and narrative portrayed, while not eliciting specific empirical results or statistical data points.

Due to the constructivist epistemology, which this study follows, I argue that an expert does not necessarily need perfect knowledge of the complete system as it is, but rather their inherent expertise on the subject of life within the system and their roles as an actor with it informs their ability to define a future visioning for the system. Each individual interviewed assists in constructing a meaningful model, through their distinct life experiences at the ground level, imbue the model with a portion of their reality. Earlier constructivist researchers have also engaged in studies wherein the definition of experts was defined more openly. "Studies spanned a wide gamut of topics, some of which seem more traditional to academia (e.g., physics problem solving), but many that would traditionally not be fair game for the academic experimental psychologist (e.g., expertise in manufacturing engineering, medical diagnosis, taxicab driving, bird watching, grocery shopping, natural navigation)" (Hoffman & Lintern, 2006, p. 205). It is this determination, to define expert analysis, as the perspective of an actor based on experience and connection to the subject matter, here being the Cantareira System, rather than limiting the respondents to only those who possess formal or professional expertise in the subject matter. This led to interviews with those actors who were impacted most heavily by the drought and whose continued livelihoods in the region are most connected to its success. "It is always important to remember that science is not a matter of majority

vote. Sometimes it is the minority outlier who ultimately turns out to have been correct"

(Morgan, 2014, p. 7183).

<div align="center">Participant Selection</div>

In order to develop a sample group, a great deal of reliance was placed on generating initial contacts solicited from faculty, associates, and staff from the Institute for Ecological Research (IPÊ), in Nazare Paulista. These contacts were acquired via first person introductions, at events hosted by IPÊ, and through external events in which IPÊ associates participated. Initial contact was made with actors centered on the conservation and restoration work, which IPÊ engages in, forming a group of participatory individuals and facilitating contact with a wider network of individuals with connections to the institute and the Cantareira system. The network of contacts was further extended through the use of the snowball method, soliciting each actor who had participated in the interview process, as well as individuals who had declined due to a variety of potential reasons, to indicate other actors who may be inclined to participate. While this method seems simple in most terms, as it serves to expand the potential of data collection, it also provided a means through which to transverse social barriers that may have prevented further data collection. Rural communities place a great deal of social capital on the traditions they hold and their time is precious. One of the best means through which to access these actors is through personal referral and indication. A personal referral can metaphorically and literally open doors in rural communities that might otherwise be tense or unwilling to work with the researcher. As Atkinson and Flint(2001) note, "While some may seek to characterise the topics for which snowball strategies have been used as

being trivial or obscure, the main value of snowball sampling is as a method for obtaining respondents where they are few in number or where some degree of trust is required to initiate contact" (pp. 2). Trust was ultimately fundamental to the quality of the research, as individuals were prompted to share their story, thoughts, dreams, and visions for the future, all of which are of great personal value. Additionally, the data being collected informed how the snowball method was utilized, as when certain data points became saturated, snowballing allowed for a flexible request to expand the network not only to like minded actors, be made it possible to find those who were differing opinions. Tight knit community centered referrals were a reliable means through which to find actors whose experiences and perspectives differed from those who had been interviewed before, as personal, social, and civil disagreements exist between members of the community. Recording dissenting opinions to those expressed by prior interviewees, further strengthens the conceptual linkage between individuals, and helps to highlight data points that might have been overlooked were counterarguments ignored.

Grounded Theory

First conceived and published by Barney G. Glasser and Anselm L. Strauss (1967), grounded theory was derived from their backgrounds in sociology, with inspiration from positivist traditions and the study of symbolic interactionism. The theory gave new life to qualitative research and inquiry, breaking away from the increasingly quantitative dominant approach to social research at the time. It suggested that there was value in approaching social processes and complexity with inductive inquiry, leading to probable assertions of evidence, rather than definitive truth statements. This is in

accordance with the perspective of Glaser and Strauss (1967) who "argued that qualitative research could generate theory and qualitative methodologists could close the gap between theory and the empirical world" (Charmaz, 2015, p. 1). In suggesting the use of this new method, a greater value was placed on the ever-changing nature of social systems, and in particular to this thesis, the socio-eco-technical systems at play in the world.

Grounded theory provided several core benefits as the anchor through which the data was interpreted. First, grounded theory proposes that throughout the "research process, the researcher codes the data, compares data and codes, and identifies analytic leads and tentative categories to develop through further data collection" (Charmaz, 2015, p. 1). Therefore, the method permitted concurrent primary analysis of the data as it was being acquired through in-person interviews, via journaling, notes, and memos. This benefited the content of the interviews and guided the proper use of prompts to fill in gaps and access deeper insights that might have been left untouched. Additionally, it provided an opportunity to initiate the data collection quickly, as time was short, and there was finite time to complete the project and fieldwork. Second, owing to a lack of primary literature review, the data collection was initiated with a limited number of preconceived ideas about the state of the system. Though this was a challenge to utilize, confidence was found in the idea that to "Glaser and Strauss, and particularly Glaser (1978, 1992, 1998, 2001), theory construction was and is an emergent process accomplished through systematic engagement with data. Both Glaser and Strauss viewed knowledge of earlier theories and research as leading to forcing preconceived ideas on the data, instead of analyzing them afresh. Therefore, they advocated delaying the

literature review to avoid relying on extant ideas" (Charmaz, 2015, p. 1). Due to the aforementioned obstacles, it ended up being of substantial benefit to the researcher, during the course of the project, and in the subsequent period afterward, which culminated in the writing of this thesis, that the literature could be digested under conditions that permitted a thorough review of the events. Proper reflection on the data collected and analysis of the narrative constructed by the individual interviews as they apply to the situation in the Cantareira became a more reasonable task within this format.

CHAPTER 4

EXPERT NARRATIVES AND FINDINGS

Profile of Interviewees

Interviewees were drawn from the communities of Atibaia, Bragança Paulista, Camanducaia, Nazaré Paulista, Piracaia, with a number of candidates performing roles and being actors in more than one of the municipalities in the region. Those who have activities in multiple municipalities are labeled as having more than a single municipal affiliation in the data set. Each municipality corresponds directly with elements of the Cantareira System, from the headwaters to the reservoirs themselves and ultimately to its runoff. As such, the respondents have also been categorized based on their relationship with the waters of the system, at the point in which their roles interact with the process from catchment to delivery. The corresponding designations are to the Headwaters, Jaguari/Jacarei, Atibainha, and Down-River Communities that are part of the CBH-PCJ. Additionally, two other criteria were evaluated in primary analysis of the data, one being the level of connection to IPÊ and the other being the role that each individual actor plays within the region based on their position within the community.

IPÊ formed the nexus of this research endeavor and participants were selected and recruited in large part due to the initial referential contacts and opportunities created through outreach programs. As such, each interview is assigned a tag denoting the degree of separation the respondent has from IPÊ. Respondents who were in direct contact with IPÊ and its affiliates, employees, and senior staff, are tagged as 1st degree contacts.

Those who were connected to IPÊ through a 1st Degree contact, but do not have direct association with the organization are 2nd Degree contacts; and those who have no direct contact with IPÊ or its 1st Degree associations are tagged as a 3rd degree contact. According to these criteria, a single interview was conducted with a member of IPÊ, 11 were conducted with 1st degree contacts, 6 were conducted with 2nd degree contacts, and 2 were conducted with 3rd degree contacts.

As actors within the region, each interviewee can play a number of roles or occupy a variety of positions. In order to analyze comparative and contrasting narratives, where specific perspectives were connected to position related assumptions, five core roles were designated. These are Rural Producers and Small Business Owners[7], Landowners, Big Business, Academics and NGOs, and Government. The primary difference between rural producers and landowners is the manner in which their land is used. Landowners do not utilize the land for commercial purposes, rather it is held as primary housing, recreation, or for preservation.

Elicitation of expert opinions that make up the data analyzed in this thesis are reported anonymously, however excerpts of the interviews will be denoted by parenthesis prior to the quote, indicating from which interview the quote was taken. The original quote, in Portuguese will be followed by the translation to English.

---

[7] (Small Business Owners in this case is not a direct correlation to the same distinction referred to in common discourse in the United States, in fact it is more closely related to subsistence farming, but rather than cut out other business operations that are typical to the region, it refers to individuals who utilize their land to conduct a variety of commercial endeavors, in order to sustain their livelihood

My findings are organized into a format that connects thematic similarities, which emerged during the interviews, pairing them to most relevant elements of the Social, Ecological, and Technological structure of the system. It is not fully possible to disentangle these elements, therefore in order to express the data in a meaningful way; the themes are categorized by their primary implication. As an example, ideas expressed regarding the weakening of traditional social ties due to new urban arrivals might also have bearing ecological or technological function system, by means of their economic or political influence.

Social Themes

4.1.1 - Relationships and Respect

The communities and municipalities around the Cantareira System have grown slowly since its implementation, maintaining much of their rural profile. With this comes a number of traditional values, social insights and modes of operation for navigating the relationships that actors have with each other. This order is under stress from a number of forces, external and internal. In recent years, the population growth rate to the more urban municipalities of the region has led to a steadily changing urban/rural distribution[8]. When responding to the influx of new actors in the region, there is a struggle for the role that

---

[8] Bragança Paulista, Atibaia, and Extrema, located on the Fernão Dias highway, which links the RMSP to the interior regions of the state, have seen the most drastic growth in the last few decades, outpacing national growth. These areas have become increasingly urban, while municipalities such as Nazaré Paulista, Joanópolis, and Piracaia have had much slower growth rates, far below the national average (IBGE, 2019).

traditionally rural farmers and producers play in the community. Several of the

interviewees, who have roots in the rural zones, express this.

(9) Eu acho que o próprio reconhecimento do pequeno produtor. Porque a gente tem visto aí, tipo
multinacionais as grandes indústrias, que vem atropelando todo mundo, e eu acho que tem que
valorizar o pequeno produtor e agricultura familiar, que é a base de tudo, agricultura familiar de
subsistência, é a base de tudo. Se você tem alimento na nossas mesas é por conta deles.

I think that the small producers need recognition. We've seen, multinationals, the big industries,
which have been running over everyone, and I think we have to place value in the small producer
and family farming, which is the basis of everything. Subsistence family farming, is the basis of
everything. If you have food on our tables, it's because of them.

Rural producers play an integral role in providing foodstuffs to the local market.

Among the Rural Producers and Small Business Owners who were interviewed, five of

the seven provide their goods directly to the local market through Farmer's Markets, sales

to a local Atacadista[9], or via direct sales of raw production to a larger industrial entity[10].

In attempting to work with rural producers on a variety of tasks, such as implementing

new agricultural practices, adhering to and entering into compliance with new

environmental laws, or providing technical assistance, the relationship that the technician,

specialist or auditor has with the individual is of paramount importance. In the rural zone,

social currency such as a positive working relationship is instrumental to effectiveness

and is tied directly to the respect shown.

(3) Você não pode chegar para agricultor, e falar para ele, Aí esse jeito que você faz está errado,
tem que fazer assim. Não pode fazer isso. Tem que chegar, olha, tem uma outra forma de fazer
também, porque você não experimentar, aí você consegue cativar né. Porque ele está arraigado

---

[9] Atacadista - Is a wholesaler, functioning as supermarket to the public, which will buy
agricultural commodities directly from local producers in bulk. While this makes for easy reliable
money on the part of the Rural Producer, it does remove the ability commercialize and capture
additional potential revenue.
[10] Some commodities, including beef, poultry, milk, and coffee, are dominated by large
companies that process the raw product purchased from Rural Producers, before sending it to
market.

com aquilo que o avô que o pai fazia. Se você dizer que aquilo tudo tá errado. Não vai virar. E não vai transformar nada. Você vai aliar alguma coisa que você traz para ele experimentar também para e ele ver. Aí ele si próprio convence que aquilo pode ser interessante começa a mudar também. Isso é bacana, a relação. E você demora para ganhar a confiança desse homem do campo, mas quando você ganha, tudo flui muito bem. Eles têm uma empatia muito grande né. Muitas vezes tem que chegar lá tomar café com ele, dá uma atenção especial para ele, não só chegar com a parte técnica na mão dizendo como que tem que ser. Ele gostou desse contato, desse você entre aspas perde. A gente que é de cidade grande se acha que perder tempo, mas não, esse tempo é importante pra ele. Ele tem que te conhecer e sentir confiança em você. Por isso o trabalho de extensão rural e assistência técnica é um trabalho super importante. O técnico das Casas de Agricultura, um cara que desempenha papel fundamental ele fica amigo das famílias e consegue introduzir novas técnicas, novas formas.

You can't get to a farmer, and tell him, "so this way you do it is wrong. You have to do it that way." You can't do that. You have to arrive [and say], "look, there's another way to do it too, why not give this a try?" This way you can catch their attention, because he is rooted in what his grandfather and his father did. If you say that everything is wrong, nothing will change, and it will not transform anything. You go to combine something that you bring with you for him to experiment with and he will see. Then he will convince himself that it may be an interesting thing to do, so he begins to change as well. That's cool, the relationship. And it takes you awhile to earn the confidence of this countryman, but when you win it, everything goes very well. They have a great deal of empathy. Often you have to get there, have coffee with him, pay special attention to him, not just get straight to the technical part, telling how it has to be. He liked this contact, that time you "lose". Those of us from a big city think they waste time, but no, this time is important to them. He has to know you and feel confidence in you. This is why extension work and technical assistance is a super important job. The agriculture department technician, a person who plays this key role, he befriends families and can introduce new techniques, new ways of doing things.

(11) Então o meu saber na universidade, como mestre, lá, e não sei que, é uma coisa, mas chega conversa em casa, as vezes ele te ensina 90 por cento e você só ensina 10 pra ele diz. Então existem saberes diferentes na sua vida. Não é nem mais nem menos. São diferentes e juntou gente agrega então se você chega com esse pensamento pra você conversar com o produtor rural você já sai ganhando. Assim sai ganhando que eu falo, já sai com seu trabalho e ganhando no seu trabalho né. Você já sai feliz porque é pra mostrar pra ele que é igual pra igual.

My knowledge from the university, as a master, it's one thing, but when you arrive for a consultation in house, sometimes the rural producer teaches you 90 percent and you only teach 10 to him. There are different types of knowledge in life. It is neither more nor less. They are different and when we bring people together, arriving with this thought to talk to the farmer, you already win. It is a win, that is what I am saying, the work you do will be successful. You end up leaving happy because it is a meeting with the rural producer as equals.

As these quotes from individuals who work with rural actors on a regular basis indicate, someone who wants to enact change on an individual level would be aided greatly by understanding tradition and generational tendencies. Engagement with Rural Producers is a collaborative endeavor, wherein knowledge transfer should not be treated linear from technician to farmer, but is best understood as circular. In order to assist the rural area and its community, it is essential to understand that for many people, their lived experiences are the only truth they have, and that the situation they face may be clouded by biases due to being an external actor.

(13) Eu vou pouco para área mais rural, porque eu fui professora de área rural na época que eu estava ainda fazendo a faculdade de artes, ali eu comecei a ver mais que que é a verdade de Nazaré. Quando você está frequentando só essa área urbana, você não enxerga a verdade. A verdade está na área rural, que é a grande maioria. Então, o acesso que eu tenho aqui dentro da área urbana aumentou bastante, as questões estão sendo mais discutidas.

I don't really go to the rural areas anymore, I was a professor for the rural area back when I was completing my university studies, that is where I began to see the truth about Nazaré. When all you are experiencing is urban life, you don't see the truth. The truth is in the rural areas, which is actually the largest part. The access I have here, inside of the urban area has grown a lot, and questions of growth are being discussed.

Among the respondents, every Rural Producer interviewed expressed ideals that derive from personal character traits such as resilience, determination, and perseverance. This isn't unexpected, as life as a Rural Producer is fraught with systemic difficulties, as society tends toward urbanization. Interview 16 illustrates these shared personal qualities, as a reflection of the constant struggle to bind social order together, amid struggles for recognition.

(16) As pessoas têm que acreditar. Mas acreditar tentando imaginar. Tem vários obstáculos, porque essas coisas são formadas por pessoas. Então as pessoas têm que se respeitar. A hora que você der uma sugestão, respeita; se ela é boa ou é ruim, tem que respeitar, entendeu? Então as

pessoas têm que acreditar, então é ter o respeito pela opinião de cada um, saber até onde ele pode ir, o empresário pode ir, a Prefeitura pode ir. Quer dizer, eu acho que é isso, e tem muito trabalho, tem que ter muita vontade, porque às vezes pode ser que um grande queira uma coisa, a Prefeitura queira, mas o restante não quer, então tem que ter pessoas preparadas. Às vezes a pessoa não vai ganhar, mas só o fato de estar participando socialmente…..Ele vai ganhar ajudando socialmente o município, que ele vai poder estar envolvido, as pessoas que vão trabalhar com ele vão estar mais informadas, vai ter um público mais treinado com o tempo. Então são essas coisas que tem que fazer; é acreditar. Tem que acreditar, tem que fazer as reuniões e unir a turma. Tem que unir, tem que ter mais união.

People have to believe, believing and trying to imagine. There are many obstacles because these things are created by people. People need to respect each other. When a suggestion is given, show respect, if it's a good or bad one, show respect, right? People need to believe, they need to have respect for each opinion, need to know where things lead, for the business or the city. What I'm trying to say is, I think that this takes a lot of work and willpower, because sometimes there is a big need for something, something the city wants, but their are going to be people who don't want it, so you have to be ready for that. Sometimes, people won't win, but the fact is they are participating in society….. They win by participating in society, the city, in being evolved, the people will work and will be informed, and the public will end up being better trained in time. These are things we can do, it is believing. Believing that together we can do things, if we unite. We have to unite, become more unified.

4.1.2 - Collaborative Work and Social Order

Collaborative work is another element of rural life that contributes to the social order that exists in the rural zone. Many elements of environmental and agricultural management require reliance on neighbors. This can vary in scope from clearing and maintaining roadways where governance fails, setting up informal agreements for usage of waterways, shared grazing, and ensuring neighborhood security. These social contracts are established for the good of rural land owners, as public power and the services that come with it often have a difficult time extending beyond the edges of the urban frontier. All seven of the interviewees engage in collaborative work and social exchanges for the

stability of their livelihoods and the area as a whole. These are some examples of this in action.

(6) Não, É complicado. É um ou outro vizinho só que, se eu precisar dele... Geralmente quem está me ajudando no negócio da água é o vizinho que ele precisa de tanque também, porque se ele não me ajudar o que acontece? Ele não me ajuda, mas manda um funcionário dele. Quando uma vaca estoura a água, fica sem água, eu falo, "Vamos arrumar a água lá, para você levar, encher uns vinte sacos de terra", ele tem trator, eu encho o saco de terra aqui, ele pega o trator e levá la, coloca no lugar que está vazando, uma parede. Então está dando certo, mas tem outros vizinhos que antigamente dava certo, hoje já não está dando, porque ele acha que o homem é muito rico, ele acha que o homem que tem obrigação. E está errado, se ele usa ele tem que ajudar também

No, it's complicated. It's just I rely on my neighbors... Usually the person who is helping me with questions about water is the neighbors, he needs the resource too, if he doesn't help me what happens? He doesn't help me, but if he sends an employee of his. When a cow breaks the canal, runs out of water, I say, "Let's get the water there, so you can take it, fill some twenty earth bags," he has a tractor. I fill the earth bag here, he picks up the tractor and take it there, put in the place that is leaking, a levy. So it's working, but there are other neighbors that used to work, but today they're not working anymore, because they think they are very rich. And it's wrong, if he uses it(the water), he has to help too.

(10) And then these guys come over here in the rural area. And say "okay, this is paradise." Fine, okay, build my house here, but then they still adopt the same culture, the same style, living standard. They don't talk to the neighbors. It keeps them, remain isolated. They don't know anybody and then they start building big walls, big fences, electrocuted you know like electric wires, high tension wires to keep out strangers and neighbors. They you know they remain isolated. You know nobody talks to anybody. I maintain some kind of relationship here with some of my neighbors here. I interact with them but I mean it could be done in a much uh richer way, if really I had neighbors. And another thing that some of you know a good portion of these neighbors are doing, that they're not really, I mean their main social and economic activity is kind of directed to the urban centers. Like, you know, with our urban center here is Nazare Paulista which is about 15 minutes away by car. Which is by car considered close, nearby, but if you go by foot, I mean that'll take you know a good two or three hours to get to Nazare by foot. That could be rough, but by car okay. I mean 10 to 15 minutes, I mean, is just you know, they're just going from from one neighborhood to another in a big city like São Paulo. People don't think you know, two seconds about going and doing that.

While traditional norms are actively enabling behavior that supports the system, both quotes illustrate the stress being placed on the social order by new arrivals from outside the region, who bring with them a different set of ideals and perspectives about

who should carry the burden of work. As noted in interview 10, new arrivals will often leave the rural area for commercialization opportunities in urban centers, rather than looking to their neighbors and surroundings for solutions, as this is familiar and comfortable. They engage in this behavior while also isolating themselves from their neighbors via common urban security measures, such as high walls and electric fences, which are unusual in the rural zone.

One method for improving maintenance that does not rely on informal social contracts is to enhance the role of governance in these areas. Committees, Cooperatives, and Associations are common terminologies within the Cantareira region. Committees such as the CBH-PCJ, receive federal and state funding to operate and manage water resources, providing for a meeting place of ideas, interests, and debates. As noted by Interviewee 12, who participates actively in the committee, it is an opportunity to bring about cultural changes.

(12) Sim então é, o que pensando no comitê de bacias se tem um braço que é muito interessante que é esse onde todo mundo vem e coloca seus interesses, suas eixos, e onde um enxergo o outro faz que isso no meu ponto de ver, depois dessa vivência de longo prazo. Acho que isso ajuda, ajudou a transformar cultura e ajuda ainda, há alguns testes grandes lá na parte de saneamento.

From my point of view, one of the interesting qualities of the basin committee is the collaboration that allows everyone to bring forward their interests, their perspective, their point of view and see what others do. I think this helps, and helped in transforming the culture, as there have been a number of big challenges in the area of sanitation

Once again, the importance of understanding perspectives and the point of view of participants is fundamental to making meaningful changes. The interviewee continues.

(12) Mas essa cultura de juntar os município, juntar a sociedade, juntar as indústrias e o estado, para tentar achar um futuro melhor, é que eu acho que é a grande vantagem que a gente tem aí… Não se esquecendo quer dizer, porque se você mudar a mentalidade de gestores municipais, dentro do comitê de bacias, é levar conhecimento. Então esse cara esse representante lá, ele vai lá

para dentro do município ou o prefeito que representa o município que está dentro do fórum maior do plenário dos comitês de bacias. Esses caras, você vai transformar dessa cultura.

This culture of connecting municipalities, bringing in civil society, industries, and the state, to try to find a better future, I think it's the big advantage we have here. Being sure not to forget, because if you change the mindset of municipal managers, within the basin committee, it transmits knowledge. So this guy, this representative, he goes back to his municipality or the mayor who represents the municipality within the largest forum of the basin committee. With these people, you will transform culture.

These committees allow more vertical access to officials in government who can potentially be points of leverage to change policy and culture. It is optimistic, however it stands in contrast to the typical sentiment surrounding government in Brazil, which is entrenched in gridlock due to legislative friction that causes both over action and lack of action to counterbalance each other. The desire for legislative agendas that assist in environmental conservation, through proper monitoring and oversight are highly desired, and over half of the interviews contain ideas surrounding what role social order should employ when paired with political power. Interview 5 reveals some of facets at play when trying to bring the two together.

(5) Com relação à essa parte ambiental, seria caminhar junto. A parte da sociedade civil que seria os proprietários e o poder público. Políticas públicas voltadas para que entre num equilíbrio. Tem as políticas que favoreçam a conservação do meio ambiente… São áreas públicas que estão nas áreas privadas e que da mesma forma a pessoa tem em contrapartida um rendimento daquela área que seriam principalmente no pagamento de serviços ambientais. Hoje os mecanismos de legislação estão caminhando para isso. Só que eu vejo aí o descaso essa questão da prorrogação. Aí você vê que não tem, falta um pouco da questão de fiscalização também. Fiscalização daí acaba porque uma vez que tenha alguém seja multado serve de exemplo para outros botarem. Então a parte punitiva tem que caminhar juntos também porque no Brasil a cultura do brasileiro é um pouco difícil. Tem, acha que vai dando jeitinho para tudo, e isso acaba atrapalhando muito.

Regarding this environmental part, it would be to work collaboratively. The part of civil society that would be the owners and producers and the government. Public policies aimed at creating balance. There are policies that favor the conservation of the environment... These are public spaces that are in private areas and similarly the person has in return an income from that area

that would be mainly in the form of payment of environmental services. Today the legislative mechanisms are moving towards this. But I see neglect in the continuity of this measure. You can see that there is a lack of supervision and enforcement. Inspection occurs and once someone has been fined, it serves as an example for others. So the punitive part has to go together with benefit, because in Brazil the Brazilian culture is a bit difficult. Yeah, the culture is that there is always a way around the issue, and it ends up causing lots of problems.

4.1.3 - Cooperatives and Associations in Social Order

Cooperatives and associations bring together Rural Producers and Small Business Owners of similar vocations, who form a member-owned and operated entity, in an effort to address any number of needs brought on by economic, social, and political occurrences. It can allow for increased bargaining power, a means by which to share knowledge and techniques, and a way to stay connected and reinforce the informal contracts of rural life. Perhaps somewhat surprisingly, cooperatives have had a difficult time gaining a foothold in the region, particularly in Bragança Paulista and Nazaré Paulista. Therefore, while informal contracts have historically worked well for Rural Producers, the opinion of cooperatives in the aforementioned municipalities is laden with negative feelings and suspicion. Interviews 3 and 5, both of which are actors involved in rural assistance, reveal some of the historical reasons for distrust of cooperatives in the region.

(3) Cooperativa é uma coisa muito bacana, mas Bragança tem estigma com cooperativismo muito grande. Porque nós tínhamos aqui uma cooperativa de café e uma cooperativa de leite muito fortes, e essas duas eram muito fortes, e elas praticamente quebraram além a cooperativa. Então muitas vezes você fala para o produtor aqui sobre cooperativismo, ele foge que nem o demônio foge da cruz, ele não quer saber. Muita gente teve prejuízo aqui, teve uma cooperativa de crédito, que quebrou também, levou o dinheiro de muita gente, então aqui em Bragança cooperativismo é meio complicado de você aplicar.

Cooperatives are a really cool thing, but Bragança has a huge stigma against cooperatives. We used to have very powerful cooperatives for Coffee and Milk, the two were extremely strong, and

they almost destroyed everything. So sometimes you get to talking to a producer about cooperatives and he runs away like a demony from the cross, he doesn't want to hear about it. Lots of people were hurt here. There was also a cooperative for lending and that failed as well, took people's money, so for Bragança cooperatives are a complicated thing to establish.

(5) Então, aqui na nossa região, nessa questão de associativismo e cooperativismo. O pessoal tem muito receio, eles não acreditam nessa forma de trabalho coletivo… Então eu vejo muita questão cultural. Então se numa região com a cultura aí do trabalho coletivo, ela não está empregada assim já é bem difícil.

Here in our region the question associations and cooperatives, people have a lot of fear, they don't believe in this type of collective work. I see it as a cultural thing. If the region doesn't have a culture of collective work, where it isn't employed, it is difficult to get going.

Even where cooperatives do spring up in the region, there is a challenge in overcoming social ills that can drive members away and cause the organization to fall apart. In the case of interview 6, the actor participated in an association that left him disappointed and offended, because instead of action, the leadership just wanted to glory of being the leader.

(6)A união dos produtores. Não foi para frente. Não conseguimos dar andamento nisso, porque às vezes um já tem a cabeça do que é um cooperativo, eles já querem que o nome dele apareça...

The producers union didn't continue to function. We couldn't get any forward progress, because sometimes there is a leader of the cooperative, and he just wants to be the big name and see his name in lights.

It is not simply enough to deploy a charter and start a cooperative, it requires social investment and individuals who are able to separate personal ego from productive collaboration. Even so, while there exists a great deal of mistrust surrounding the operation, leadership, and benefit of cooperatives and associations in the region, this does not mean that there isn't optimism present as well. Two respondents reported excitement regarding their cooperative work that they were involved in. Respondent 1 had founded a cooperative to assist members with agricultural activities, and Respondent 18 was excited

about the start of a brand new organization for honey producers in the municipality of

Piracaia.

(18) Essa turminha que acabou de fazer o curso, para a gente fazer a associação só do mel. Aí, no caso, se a gente não achar ajuda de ninguém que queira ajudar, a gente faz o seguinte, a gente compra uma peça, aí paga entre todo mundo. Aí, depois, nós compramos mais uma peça.

Our little group just completed a course, so that we can start a Honey Producers Association. If we can't find anyone else to help, our group will put money together and get machinery together. Then we can go on to buy another machine.

4.1.4 - Rural Exodus

Another way in which the social order of the Cantareira region is changing is related to

Rural Producers leaving their lands, referred to here as a rural exodus. Rural exodus is a

hallmark of development, as the population moves toward urban centers in order to

pursue employment and a higher standard of living. This phenomenon is exacerbated

around the Cantareira due to its close proximity to the RMSP, but is also occurring on a

smaller scale within the system itself as municipalities such as Atibaia and Bragança

Paulista have grown increasingly urban. Therefore, while some Rural Producers may be

leaving for the capital region, others might remain within the region but relinquish the

rural land in favor of a city dwelling. Among Rural Producers, there is a negative

connotation pertaining to the exodus, as expressed by respondent 18. According to them,

a rural producer who had traded in city life for the farm, it is about whether or not the

person is capable of hard, quality work.

(18) Então acontece o seguinte, a maioria dos jovens que moram lá para aquela região, eles mexem com lenha, carvão, eucalipto. E daí aqueles que se adaptam, que já estão adaptados naquilo ficam. Porque quando o cara é bom de serviço, ele continua, dá para ele ganhar dinheiro. Mas quando ele acha que aquilo não é bom, eles saem fora e vai para cidade grande.

What happens is the following, the majority of youth that live in the region, they work with firewood, charcoal, and eucalyptus. The ones that adapt to changes, and are adapting to stay. When a young person is good at working, he continues to work and makes money, but when he isn't good, he takes off and goes to the big city.

The stigma also exists, that those leaving the rural area are going to suffer, become sickly and weak from their time in urban spaces. Interviewee 10 observed this change, as his family moved into the urban zone, where they have become sick and troubled.

(10) I mean if you know originally I raised a family here, my family was living here over the past 30 years. How did they raise their children. They never went to the pharmacy. They never went to the doctor. They raised their children. You see, you can see the children, four healthy adults and doing well. They're very healthy but unfortunately they're living now in the downtown, but their kids are not healthy. Look at the their kids that they're raising now they're not healthy, all the time they're having health problems, having to go to the doctor and even to the hospital and losing time at the school. It's crazy. And what is their life expectancy. The way, they're fat they don't look healthy and they don't exercise enough. They breathe in pollution and all this you know all these problems. Well what, I mean if they were to stay here, I think you know, the national life expectancy would be far far greater. You know that we lead a healthier life, socially more, also healthier because downtown once again, you know, they live in apartments or whatever small tight living quarters.

While these narrative statements may be subjectively driven, by pains of separation, relativistic morality, or other personal framer work, making it difficult to disassociate feelings from the reality, this construct belies the pain felt by those who continue to battle for livelihoods in the rural zone. They perceive benefits to this work; peace, tranquility, health and longevity, value in the struggle, which lends itself to mental and physical fortitude. I encourage further research to be conducted on the qualities of resilience that these actors possess, as a means of understanding system stability.

A number of governmental bodies are working directly on addressing rural exodus, which provided an opportunity to elicit plan, ideas, and methods through which

this problem is being addressed. Much of the effort is focused on three fronts, technical assistance, providing public services and subsidization, and working with the youth to promote rural culture. Interviews 3 and 9 highlight some of the work being done by these bodies.

(3) Tem outras coisas. Se você der uma condição de serviços públicos básicos na área rural, saúde, educação, segurança. Você consegue fomentar muito mais isso. Porque hoje as escolas estão cada vez mais difíceis de manter porque não tem criança na zona rural. Antigamente nascia uma criança. Hoje nasce menos. As escolas vão fechando, e o que é que o poder público faz, pega transporte de aluno, passando pela zona rural e levando para alguns pontos. Então qual que é o sonho da criança hoje, é vir para cidade. A professora é da cidade. Ela vai até a área rural da aula, qual que é a impressão que ela passa pelos alunos. Os exemplos que ela usa são urbanos, não são rurais. O sonho daquela criança na escola, é ir para a cidade. A gente debateu muito isso já aqui, para ter uma educação que fosse do professores do bairro, formadas lá no bairro, que dessem aula lá. Preparadas para dar aula com exemplos e com cartilhas rurais. Com exemplos de meio ambiente, produção agropecuária, tudo isso. Porque se você leva a cultura da cidade para lá, é óbvio que ela vai plantar a cultura dela essa professora. Vai despertar a vontade daquela criança de ir para cidade.

There are other things. If you create a condition for basic utilities in the rural area, health, education, safety. You can foster it much more. Today schools are increasingly difficult to maintain, because there are no children in the countryside. Formerly a child was born. Today children are born less. The schools are closing, and what does the government do, takes and transports the student, passing through the countryside and taking them to different stops(urban). So what is the dream of a child today? It is to come to town. The teacher is from the city. She could even go to the rural areas to teach the class, but what is the impression she gives to the students. The examples she uses are urban, not rural. That child's dream at school is to go to the city. We have discussed this a lot here, to have an education by teachers from the rural neighborhood, trained there in the neighborhood, to teach there. Prepared to teach with examples and rural concepts. With examples of the environment, agricultural production, all that. Because if you take the culture of the city there, it is obvious that she will pass on her own culture. It will arouse that child's desire to go to town.

(9) Então a gente dá, nesse curso, oferece noções básicas para que esse jovem, ele possa continuar no campo, ele possa tomar gosto pela atividade do campo, mas com acesso à tecnologia, ao acesso a outras informações, que ele não teria se estivesse preso somente no campo e na escola básica... A gente tem que dá subsídio para o homem do campo ficar no campo, nos fornecendo alimento. O agronegócio do Brasil tem sustentado o país, tem sustentado a balança comercial do país, isso é muito importante pra gente, então nós temos que da condições do homem do campo continuar a desenvolver nas atividades do campo, e aqui pra região especificamente nosso temos

sobre fomentado isso, valorizando a agricultura familiar, o pequeno produtor. Que é quem no todo soma ao trabalho é apresentado.

We give courses, offer a basic understanding for the youth, so that they can continue in the field, so that he can gain an appreciation for rural activities, with access to technology, access to other information, so that he doesn't feel trapped in the field or in school… We have to give subsidies to the workers in the field, who are providing us with food. Brazil's Agribusiness has sustained the country, sustained the commercial balance of the country, this is very important to us, because we have to give the farmer the necessary conditions to continue to develop his activities in the field, and specifically here in this region we have done something about this, giving value to family agriculture, to the small producer.

None of the Rural Producers interviewed had backup plans, none had contemplated leaving the rural zone. Regardless of difficulty, being a Rural Producer is a core element of identity of these actors, not just a vocation.

4.1.5 - Urban Exodus

As mentioned above, a wave of new arrivals to the rural zones of the Cantareira have placed stress on the traditional social order. Those new arrivals may choose to establish residencies in the rural zone, but do not identify with or take on the role of Rural Producer. However, among the new arrivals, there are individuals who are fed up with urban life, and seek out a rural lifestyle, willingly assuming the role of Rural Producer. Interviewee 18 moved away from the RMSP chasing the dream of being a rural producer some 10 years prior, and Interviewee 4 had only recently made the transition. In describing the reasoning behind this change in vocation, and specifically the desire to become a Rural Producer, the respondent stated the following.

(4) E assim, a questão do sítio né. Porque o sítio? Porque era uma intenção da gente de morar na zona rural. Eu falei, eu brincava e falava que eu vou ser vou me tornar um produtor rural, quando eu me aposentar né. O que acontece eu falei quero começar trabalhar com coisas no campo. E aí eu já meio incomodado sabe quando estava uma empresa naquele fim de casamento, sabe, quando a empresa não me aguenta e não aguentou a empresa mais não estava dando mais. E aí eu

cheguei, eu pensei o seguinte, para que eu precisar esperar aposentar para me tornar produtor rural. Vou embora já.

Why the farm? Because it was our intention to live in the countryside. I said, I joked and said I'm gonna become a farmer when I retire. I said I want to start working with things in the field. And then I began to feel restless, bothered, you know at a company, similar to being at the end of marriage, when the company can't stand me and I couldn't stand the company, I wasn't having it anymore. And then it hit me, I thought, I don't need to wait to retire to become a farmer. I'm leaving now.

There appears to be a certain optimism that comes from being in control of one's own productivity instead of being subject to the trends of urban life. Respondent 20 had established rural roots thirty-eight years prior, purchasing the land and beginning to producer goods, while splitting time between an urban occupation, having only within the last five years decided to complete the transition. It is revealing that this actor's perspective is one of worries for those that remain behind, while being at peace because in the rural zone, personal needs are all accounted for.

(20) Eu pessoalmente não tenho receio porque eu já estou saindo do meio urbano para viver aqui, e aqui é a coisa bem. Então aqui eu tenho boa água, tem bom clima, tem um ambiente tranquilo, tem alimentos. Preocupo com os outros, com os outros. Com as pessoas que não pensam dessa forma. Chega um momento que não vão ter como beber como comer, porque é muito queimado e não respeita a água. Então eu acho que esse dano continua esse dano está crescente. Ele não foi freado ainda, não acho que encontramos um caminho de diminuir esse dano.

I don't personally have any fears about the future, because I am already leaving the urban crush to live here, where things are good. I have good water here, good weather, a calm environment, food. I worry about others, with others. With people who don't think this way. Eventually a moment will come when they don't have anything to eat or drink, because they've burnt it all and don't respect the water. I think that the destruction is continuing to grow. It hasn't been slowed down, and I don't think we've found a path to stop the damage.

4.1.6 - Governance

As the population chances and the social order adjusts to the inflow of new actors taking on roles within the community, another concern among the individuals interviewed is the role of governance in providing for change. Governance is a sore issue in the region, as discussed in Chapter 2, as the decision making for the region was dictated by the military regime, with little consideration for those who would be negatively impacted by the system.

(1) Houve uma falha de não aparelhar a quem estava morando no local. E a água também, água de não tão boa qualidade, tem municípios aí aqui não tem tratamento… Depois com a demanda de veio várias organizações vieram. "Olha não pode fazer, é assim que faz né." E aí, porque as pessoas elas aceitam bem essas coisas. Entendeu? Tanto que agora você vai vendo que as pessoas vão tomando consciência. A comunidade vai tomando consciência, só que isso poderia ter sido feito há quase 50 anos atrás quando eu nasci.

There was a lack of effort made in preparing the local population(for the reservoirs). The water as well, was not left in the best of quality, and there are municipalities without sanitation treatment… After demand rose, a number of organizations came. "Look, you can't do that, it goes this way." People accept good things, right? Now you can see that people are becoming aware of things. The community is becoming knowledgeable, but this could have been done 50 years ago when I was born.

Many changes could have been made earlier on, as suggested by Interviewee 1, who was born in the era of the system's creation and has accompanied its evolution. There was minimal effort to provide capability training or develop environmental awareness and education, which left the residents behind, requiring them to catch up when demands arose for preservation and conservation practices. A lack of proactive or retroactive assessment of adverse impacts and successful implementations does little to improve future projects (Wang, 2012). From the viewpoint of over half the respondents, the

following should be occurring, and should have occurred at an earlier point in the history

of the Cantareira System.

(13) Eu acho que deveria ter uma mobilização maior, um trabalho de mobilização, de
conscientização do cidadão mesmo. Isso é um desejo que eu gostaria no Brasil todo, mais
participativo mesmo, o cidadão participando das questões de gestão, mais mobilizado.

I think there should be a great mobilization, a program to mobilize, to raise public awareness.
This is something I wish all of Brazil had, something participatory, with citizens participating in
the question of management, more active.

The shifting political climate of the country often prevents this vision of united

mobilization between the citizenry and government for the management of key resources.

Four of the interviewees expressed doubt about the capability of government to achieve

anything due to a national political climate of corruption, while three expressed a general

feeling that government at all levels was unable to solve these problems, and two

expressed doubt in local governance officials and their ability or desire to work on these

issues. The political climate of distrust can be attributed to many different sources from

reminiscent authoritarian rule, to the lavo jato[11], to the election of 2018, which was

arriving as these interviews were conducted. On a local level, Interviewee 3 highlighted a

reason which public policies of interest to the rural zone have a difficult time getting

introduced, much less approved.

(3) São políticas públicas direcionadas a esse público rural, porque o que acontece. Hoje, eu não
sei qual que deu o censo mais aproximadamente 10 a 15 por cento da população moradora da
zona rural. Moradora, não trabalhador. Tem gente que mora lá, mas trabalha aqui, e vice versa. A
gente pode dizer que de 10 a 15 por cento mora na área rural. O que o político pensa, se eu
investir em política pública na minha campanha voltando ao rural, eu atingir 10 por cento dos
votos, então esquece isso. Deixa pra trás, não vale a pena você investir. A área rural tem 10 a 15

---

[11] Lavo Jato - Operation Car Wash, the major corruption and bribery scandal involving members
of the Workers Party, including former presidents Luiz Inácio Lula da Silva and Dilma Rousseff.

por cento numa área muito maior. Então ele faz campanha na cidade, que é muito mais fácil. A efetividade da campanha dele é muito maior. Não se pensa em área rural.

Public policies directed at the rural community(is needed), because what happens? I am not sure what the census came back with, but approximately 10 to 15 percent of the population lives in the rural area. Lives, not works. There are people that live there and work in the city, and vice versa. We can say that 10 to 15 percent live in the rural area. The politician things, if I invest in public policy during my campaign that is directed at the rural area, I'll get 10% of the vote, so forget them. The rural area gets left behind, it doesn't matter to invest in. The campaign is for the city, and that is much easier. The effect of the campaign is greater, if they don't think of the rural area.

Rural administration is no less important to the municipalities of the Cantareira, despite representation by population; in fact, it is worth arguing that the rural zone is actually of greater importance to the overall system and especially to the RMSP, due to its role in producing potable water. This importance is even recognized by rural landowners, as with Interviewee 13, whose land is not used for primary sources of income.

(13) Tem as questões de ambientais que são fundamentais para Nazaré, porque traz um crescimento organizado. Para ter um crescimento onde traga, vamos dizer, divisas que traga emprego, que traga investimento para cidade, a meu ver, o grande potencial da cidade é a questão ambiental. É onde você tem os atrativos naturais. E isso todos sabem.

There are many questions about the environment that are fundamental to Nazaré, because they bring organized growth. In order to bring that growth, which brings employment and investment to the city, from my point of view, the cities biggest potential is the environment. There are many natural attractions. Everyone knows this.

The interviews established that rural actors are cognizant and proud of the natural bounty of the region. This idea will be discussed at greater length in connection to the ecological themes of narrative, later in this chapter.

In recognizing the importance of the stability of social order in the region, there is space for external actors to assist in mending the rift between the citizens and political entities in the region. No single individual, entity, or governmental body can succeed, or

bring about positive change for the system without embracing the social norms, political

landscape, historical struggles, and contemporary stressors at play in the region.

(16) Porque como é uma conscientização, de toda a política, todos os municípios, e a gente não consegue fazer nada sozinho, mesmo para eles buscarem recursos no governo, então o que têm? Pode ser uma ONG, uma associação, eu não sei se ainda existe a unicidade, que é uma organização ainda da região, que une tanto o poder público como o poder privado.

Because this is awareness, for all policy, for all cities, we can't do anything alone, especially getting resources from the government(federal). So what do we do? Maybe an NGO, an association, I'm not sure if the entity already exists, that an organization from the region, can unify public and private power.

4.1.7 - Personal Power and Self Determination

Another theme emerged when discussing the aspects of collaborative work and

social order with the respondents, the amount of power each actor had over their status

within and effect on system. Seven of the respondents, from every employ except for Big

Business, felt that their positions lacked power to change the system as a whole; however,

there was confidence that their role could still possess potential for change. Ten

interviews mentioned the capacity to assist others with knowledge, providing technical,

function, or environmental guidance to those who did not have it, which was the most

common way in which actors could best employ their position for positive change.

(11) Eu acho que a gente tem um poder pequeno de fazer a extensão rural. Naquele, não de criar políticas, nada disso, não acredito que eu tenha esse poder na minha função. O que tenho, o poder que eu tenho, é chegar nas propriedades que eu vou atender e conscientizar os produtores. Porque na verdade, a gente precisa conscientizá-los dessa produção da água. Então esse é o poder da extensão rural eu tenho. Agora um poder maior de criar políticas públicas daí eu já acho que são instâncias superiores e pessoas realmente mais, que nem eu falei, especializadas na parte, aí seria mais ambiental mesmo. Entendeu. Mas assim da conscientização do dia a dia para os produtores que dou assistência, eu acho que eu consigo.

I think that we have very little power to do rural extension. Not to create policy, nothing like that, I don't believe I have that power in my role. What I do have, is the power to go to properties and

attend to producers and bring them awareness. In truth, we need to provide awareness about producing water. This is the power I have in rural extension work. However, a higher power to create public policies, that's something I think belongs to people higher up, specialized in that thing, then they could be environmental. I think that in the day to day work of building awareness with producers that I give support to, I can succeed.

(7) Não. Não tenho poder. A gente é assim, eu tenho dois momentos aqui, um momento na minha ocupação, na minha responsabilidade, que a gente procuro desenvolver um esforço de articulação de produtores, que aqui vocês estão participando, que é um desses momentos. De conscientização técnico, de pessoal que atua na linha de frente junto produtor rural. Mas infelizmente é muito pouco dentro do contexto governamental que a gente pode fazer. Você tem de seguir uma política ou a falta de uma política. E aí vocês na verdade ficam tapando buraco, em vez de resolver as questões que poderiam está sendo trabalhado.

No, no I don't have power. It works this way, I have two instances here, one within my occupation, my responsibility, which I try to develop through articulated effort with producers, which you are seeing, that is one role. Technical training, for people who work on the front lines with rural producers. Unfortunately there is very little I can do within the governmental sphere. You have to follow the policies, or lack of policies. You end up in truth just patching up things, instead of resolving issues that could actually be worked out.

Both of the above quotes, from interviews 11 and 7, a government official and an academic, indicate a worrying lack of ability to inform policy change or exercise a great deal of power in that regard. It is notable that despite this, employing one's personal efforts is emphasized. Instead of letting the inability to change legislation or enact policy result in discouragement and inaction, it pushes individual actors to do more with what they have.

When presented the opportunity to discuss the most pressing personal struggles and issues facing the region, the barriers to success were often external rigors; such as the government, the economy, or the climate. There was limited acknowledgement of the personal role in coming up short on goals or outright failure. Yet the responses did not signal an air of invincibility, rather they point to the belief that with hard work, which is inextricably tied to the identity of actors in the region, anything is possible. Therefore,

59

while many factors may stack up against Rural Producers, Land Owners, Academics, Government Representatives, and Big Business Employees, it can be expected that they will not desist, that they will attempt to succeed until they cannot anymore. When success arrives though, it is not just a personal victory; it is a victory for their circles, for those relationships that are built through common struggle.

Many of the social element discussed above have bearing on the ecological and technological sections to follow, as actors employ social constructs to address environmental and development issues.

Ecological Themes

4.2.1 - Theory vs. Practice

Ecological preservation and conservation is logically a worthy cause, an absolute necessity to future generations. Many of the interviewees are employed in the service of these endeavors, from technicians, to academics, and from landowners to consultants. That is to say, that it is easy to say pleasant things about nature, without ever doing anything to address the existing problems or engage with conservation practices and education in a meaningful way.

(13) Porque na prática, a teoria é outra. A gente fica na teoria. Eu venho de uma história acadêmica, eu sou cheia de teorias também e adoro. É isso que me faz ter processos de criação, de elaboração de ideias. Mas eu sou uma pessoa contemporânea que venho de uma cultura diferente. Não é esse processo que acontece aqui. Aqui existe um processo opressor mesmo, de não validar a ideia que venha do outro. Então, você pode teorizar como acadêmico, ter boas ideias, mas na prática não acontece, por quê? Porque não foi processual, não veio da própria comunidade que vai se beneficiar disso, dessas ideias, de tudo isso. Ela não participou do processo

Theory and Practice are two different things. We lean toward theory. I come from an academic background, I am full of theories and I love them. It is this that helps me with the process of creation and to elaborate ideas. But I am a modern person who comes from a different culture. This process does not happen here. Here, there is a really oppressive process of not validating the ideas of others. So you can theorize as an academic, come up with good ideas, but in practice it doesn't happen, why? Because it wasn't procedural, it didn't come from the community itself that will benefit from it, these ideas, all that, they did not participate in the process

(14) Então as vezes fica muito só no falar. "Ai tem que fazer isso porque isso é bom", mas na hora de fazer uma ação de fato que precise, fazer um movimento que seja, vamos fazer algo, desenvolver um projeto, fazer um movimento para o meio ambiente para que a gente consiga melhorar. Aí eu vejo que a falta de cultura do povo e a desmotivação isso fica só no papel. Então é por isso que a gente enfrenta muitas coisas assim, obstáculos que a gente não consegue alcançar muito, em questão de cultura e no meio ambiente, porque fica muito só em conversa em assunto e não tem ação ali pra resolver.

Sometimes things are said but not done. "We have to do these things because they are good" but when the hour arrives to put things into action as needed, start a movement or whatever it maybe, let's do something, develop a project, for the environment that we can better. That's when I see the lack of culture from the people, the lack of motivation, so it just stays an idea. This is something we come up against on a lot of issues, obstacles that we don't manage to overcome, because of culture and the environment, because things often are just discussion about a topic, without any action to resolve it.

Conservation is difficult to practice when it comes into direct conflict with the processes that already exist for economic sustenance. In order for it to be enacted, it must be operationalized in such a way as to encourage individual actors and the population at large to participate.

4.2.2 - Challenges

Described below are a number of the challenges that exist in regards to sustainable development, conservation practices, and maintaining the natural vocation of the Cantareira System, providing water for the region.

(9) Ah desafios tem, a gente tem todo dia, a gente trabalha nessas desenvolvimento sustentável. Porque de fato é muito difícil atrelar o desenvolvimento a essa questão da preservação ambiental.

Enfim essas diversas questões ao lado do negócio, porque é que nem exemplo básico, a gente tem essas caixas de embalagem de agrotóxico a gente tem que fazer um trabalho de conscientização do produtor, porque se ele descartar essas embalagens próximos a nascentes ele pode poluir e acabar com tudo, e é uma coisa besta uma coisa simples. Os desafios a gente tem todo dia só que é um trabalho não só pratica ou técnicas como também de conscientização dessas pessoas.

There are challenges, we have them every day, because we work with sustainable development. In fact is very important to slow down the development with respect to environmental preservation. There are many questions in regards to business, some of which are so simple. We have these boxes that are containers for agrotoxins and there is work going on to help inform the producer, because if they throw away this packaging near springs they can end up polluting and destroy it all, it is such a simple thing. We have difficulties every day, but that is the work, not just in practice or in techniques, but in terms of bringing awareness to people.

(7) E você tem o momento atual que continua a ocupação imobiliária, da especulação… você já viu uma série de propriedades virando condomínios, isso aí não para na região toda. Com uma crise econômica que afetou as propriedades aí por exemplo, leite tá lá em baixo, a suína cultura quase acabou, café desaparecendo, você não tem mão de obra, para muita as culturas você não tem mais mão de obra. Existe um desafio, de um redesenho da parte produtivo rural, para aqueles que ficarem, sobrevivem aí. Como é que isso vai ser feito. Isso é um desafio do poder público de olhar isso, se é que tem interesse, até porque como a região tem a importância que ela tem, na questão da água. Isso na verdade deveria tá sendo prioridade.

In the current moment there is growth of housing occupation, of speculation. You can already see a variety of properties turning into condominiums[12], this does not stop, in the whole region. With the economic crisis that affected the properties, for example, the price of milk is low, pig farming has almost ended, coffee is disappearing, there aren't any laborers, for many of the agricultural products there aren't anymore laborers. There is a challenge, from redesigning rural productivity, for those who remain, continue to live here. How this will be done. This is the issue that governance will have to look into, if they are even interested, because of how important a role this region plays in regards to water. In truth, this should be a priority.

(20) Hoje o grande inimigo da vegetação é o pecuarista. Porque ele precisa de grandes extensões para plantar capim para engordar e vender o boi para virar carne. O carnê é um alimento que o mundo inteiro precisa de carne. É que a gente exporta muita carne, e para isso precisa de pasto um pasto que não vinga debaixo de arvoré.

---

[12] Condomínios - translated as condominiums or gated communities, refers to a practice in Brazil of building a highly secured compound, typically with tall walls, electrified or razor wire, and 24 hours security, for residents from the middle and upper middle class.

The biggest enemy to vegetation is the rancher. He needs huge tracts of land to plant feed to fatten up and sell his cattle to become beef. Beef is a foodstock the whole world needs. We export a lot of beef, and to do this you need pastures, pastures that are not under the trees.

Land speculation and the expansion of real estate is a highly visible challenge to the sustainability and future of the system. Giant scars are taken out of hills, where native forest or used pasture is tilled for the express purpose of building a gated condominium. While some companies do engage in responsible practices, building gated communities to the highest standard of the law, as was discussed with Interviewee 8, the speed at which these developments are built is staggering. It bring impermeable land that does little to recharge the aquifers, destroys or manipulates springs and waterways for the purpose of sanitation, and removes the ability to protect or restore native forest which changes the climate profile of the region by altering the surface albedo and removing vegetation fundamental to transpiration.

Another threat to the conservation is that of ranching. The Atlantic Forest, home to the Cantareira System, is threatened in much the same way as the Amazon by the expansion of pastoral lands through burns and deforestation. Economic emphasis on the consumption and export beef is the primary driver behind this practice. Ongoing projects, such as Semeando Água(Sowing Water), one of the flagship projects of IPÊ, are reclaiming degraded fields and cleared land for reforestation. This process takes time because in this very hilly region, erosion quickly reduces soil quality, resulting in less fertile pastures, and driving the need to clear more land to successfully feed herds. Just as with the installation of condominiums, filtration and the ability to recharge aquifers is

reduced, harming the water cycle, which is fundamental to the longevity and stability of

the reservoirs.

(5) Porque hoje e se fosse a água daqui abastece mais de 8 milhões de pessoas. Eu acredito que essa população, elas não têm a mínima idéia do que é o sistema. Como que é aqui pra cima. Porque eles são beneficiados por isso, essa população não. Então na crise e até acabam achando culpados. Então quando faltou água isso e aquilo "então conserva área de APP conserva!" Acaba acontecendo isso.

Today and if it were just the water here, it supplies more than 8 million people. I believe that this population, has no idea what the system is. It's up here. They benefit from it, this population here does not. So in the crisis they even find themselves being seen as guilty. So when water was missing then "you start conserving APP area", "save water"! This is what happens.

The most recent water crisis also resulted in greater scrutiny about the ways in

which the region manages it water resources. As Interviewee 8 states, much of the blame

for the crisis was placed on the heads of the residents of the region, despite the fact that

they receive little to no benefit from the water produced in the region. Therefore, while

much is being done at different levels, the external perception of events is negative.

Every interview contains references to water or the reservoir[13] system as a key resource,

despite none of the prompts or questions asked mentioning water, until the respondent

had offered some insight into the topic, opening up the line of discussion. Interviewee 4

notes that there are many difficulties for the region, but describes water as the primary

issue, due to its importance.

(4) Eu diria que são vários os desafios da região. Um deles, eu acho que talvez mais importante é que a região de Bragança tem uma importância muito grande no contexto de abastecimento de água no Estado de São Paulo. Então não somente a questão agrícola nele tem sim uma importância essa grande a relação à agricultura, considerando a distância de São Paulo é muito próximo de São Paulo e você tem aqui hoje produções... Mas se você pensar em outros produtos Bragança é relativamente importante, na produção de como que chama, frango. Por exemplo hoje

---

[13] Water and reservoir could carry the same connotation at times based on context; however, every interview had at least a single reference to water.

você tem uma produção importante aqui você tem a produção de milho mas, o que acontece, é que eu vejo que quando o mais importante da região é a produção de água, ou seja o fornecimento de água para as grandes cidades. Campinas e São Paulo

I would say that there are several challenges in the region. One of them, I think perhaps the most important is that the region of Bragança has a great importance in the context of water supply for the state of Sao Paulo. So it is not only the agricultural issues, it has a great importance in relation to agriculture, considering the distance from Sao Paulo, it is very close to Sao Paulo, and there are today a number important (regional) products... But if you think about other products Bragança is relatively important for, the production of chicken, for example… here you have the production of corn, but I see that the most important product from the region is the production of water, or providing the water supply to the big cities. Campinas and São Paulo

4.2.3 - Conservation

When discussing what obstacles or challenges might influence the future of individual actors and the region, half of the respondents replied that a lack of emphasis on conservation and preservation was a major barrier to success. In order to address this issue, Interviewee 1 suggested the following.

(1) Porque é que eu acho que tinha que se explicar é, que a gente tem que se sacrificar um pouco, cada um tem que sacrificar um pouco para o outro também poder viver e então, quem pode, cuida da água ou pelo menos um pouquinho.

Gradually, I think we have to explain that we have to sacrifice a little, each of us has to sacrifice a little so that the other can live, then, whoever can, takes care of the water, even if a little.

If everyone is willing to sacrifice a little bit to take care of the water, it will continue to support the region. Though no specifics were offered, the social narrative of collaboration and community permeates the way ecological preservation is envisioned. In order to achieve a sustainable future for the system, involvement with sustainable practices must be widely accepted and inclusively participatory.

(13) É de cima para baixo. Nada que é de cima para baixo funciona direito. Tem que ser processual. As pessoas têm que participar, tem que entender por que que aquilo está acontecendo,

tem que questionar, tem que trazer a sua realidade para que o processo até sofra algumas alterações em função disso.

From top to bottom. Nothing that is only top to bottom works properly. There has to be a process. People have to participate, they have to understand why thing are happening, they have to question it, they have to bring their reality to the process and suffer through some changes for this to function.

Another conservation problem that is present in the narratives of the interviewees is pollution. Deep into the drought, SABESP authorized the use of the Cantareira's dead volume, waters that sit at the bottom of the reservoir, below the elevation at which the system is designed for withdrawal. This required massive pumps, and revealed the once submerged bottom of the reservoir, which had not been seen for over 40 years. Among the population, this drew attention to the oil and sewage, which had collected in the depths. Interviewee 10 suggests that the limit for recreational use has been reached, as well as the growing population centers gathering on the banks of the reservoir. While Interviewee 18 affirms that if the water were treated with respect, it would not run out.

(10) Yeah, once again. There's a limit to that, and it's serious. I think we've all read it, already reached the limit. We can't do any more than that because you're on your own, it becomes dangerous to sort of you know, to pollute all that water distract people. How are you going to control the sewage of all this big population that starts encroaching on you on the reservoir there. Well there's no pollution for the boats, throwing oil and diesel and what have you. That's the big danger. Serious limit to that. Can't go much further than that. Then what's being done now.

(18) Então isso é muito errado, a pessoa pollute aquele represa. A pessoa tinha que se conscientizar que não pode fazer isso. Se todo mundo pensar igual, então aquela água não ia acabar.

It is extremely wrong for a person to pollute the water. The person needs to become aware of things and what they can't do. If everyone thought the same, the water would be safe and for everyone.

The Crisis also dredged up memories of homes, places of business, centers of worship that were submerged, and signaling a potential end in which the system no longer exists.

66

Today the reservoirs are a symbol of the region, a feature that is ever present, one from which pride is derived. Interviewee 17, a landowner who has lived in the region since the beginning of the system relates the feelings of the populace during the height of the drought.

(17) Está poluindo, não é? Por causa de diesel, de combustível. Acho que sim. Porque as pessoas estão vendo a importância. Quando baixou de verdade a água da represa, ficou só terra. Aí todo mundo lamentou. A gente até pensou que fosse acabar a represa, porque baixou muito. Depois quando começou a chover de novo, todo mundo comemorou.

It's polluted it isn't it, with the diesel and gas. I think so. People don't show the reservoir respect. When it was low, in reality the reservoir became just earth. Everyone was devastated. If we think about the death of the reservoir, it was so low. Afterward, when it started to rain again, everyone celebrated.

At only 5% of the volume of the system remaining at its lowest (Porto et al., 2014), residents felt like the end of the system was near. While many of the respondents were able to describe their visions of the future, one of the academics interviewed was adamant is affirming that their time was best thinking about current issues, within the realm of possibility.

(2) Mas não quero pensar nisso, quero pensar só no planeta hoje, como que ele está, reciclar o que é possível e manter as nossas matas a nossa produção agrícola de forma adequada. Acredito que aí a gente consegue mesmo período de seca que é quatro, cinco mezes seco. Acredito que aí a gente consegue mesmo período de seca que é quatro, cinco mezes seco. Não tem problema. Perdemos água, não perdemos água no escorrega.

I don't want to think about it, I just want to think about the planet today, as it is, recycle what we can and maintain our forests and our agricultural production in a proper manner. I believe that if we have another period of drought, that is four, five months. No problem. Did we lose water? No we didn't lose water on runoff.

This response illustrates that there is pushback against the tendency to waste time dreaming of possibilities, paralyzing action, while projects can be executed in the present. It shows that there is a belief in current action, to create the future.

67

To endow actors within the community with a sense of personal agency and responsibility in the system, the conceptual role of Water Producer has been introduced into the regional conservation narrative. This designation helps to establish an identity, from which character traits can be derived, in a similar manner to how the role of Rural Producer carries with it implicit values. It frames one's role in conservation as an agent of change, defying the blame unduly placed on the region, by building up a sentiment of ownership.

(20) Eu ajudo São Paulo, além de eu servir dela, ela(a água) vai o acesso e vai desce e vai na represa. Despeja na represa.

I help São Paulo, besides me serving the city, the water goes from the first point and goes down to the reservoir. It ends up in the reservoir.

Without outside help and comprehension about the role that water consumers downriver play in the sustainability of the system, this ideal of ownership and responsibility will be difficult to instill.

4.2.4 - Awareness and Education

Responsible ownership of the system requires actors, Water Producers, who are aware of their position, educated on its potential, and capable of engaging in conservation practices. Interviewee 15, who works with Rural Producers as an educator, raising awareness about conservation shared thoughts on how to assist the public in becoming conservationists.

(15) Uma solução seria um incentivo maior do nosso poder público, por exemplo incentivar em mais campanhas de educação ambiental. Por exemplo aqui faz projetos de campanha ele dar curso e não é por incentivo público. É que a gente é patrocinado por uma assim é público também mas não da Prefeitura de Nazaré, é difícil entender essa parte. No caso que é um que é público, é um órgão público, eles têm compensação ambiental esse projeto mas é um âmbito federal sabe,

68

nacional. Nazaré é uma cidade pequena com pouco recurso. Então tem esse problema financeiro também. Mas uma solução seria o incentivo público maior participação da população. Não sei colocar brilho nos olhos as pessoas, entender que da forma que a gente está indo assim não vai ter mais planeta para gente né. A gente está aqui no berço da água e a gente já viu essa represa aqui seca já e vai ver de novo se o pessoal continua com as mesmas práticas.

One solution would be for the government to offer a greater incentive, for example, incentivize more environmental education campaigns. For example, currently here courses are given in a campaign, but not with public funding. We are sponsored by another entity, it is public, but not local to Nazaré. In the case of public, it is a public institution, and they are doing this project as compensation for environmental use, but it is federal. Nazaré is a small city with limited resources, so of course there is a financial problem as well. However, a solution would be to incentivize the public, the population to participate. I don't know how to make people passionate about the planet, because the path we are going on now won't leave us with one. We are the birthplace of water and we already saw the reservoir here dry and we'll see it that way again if we continue with the same practices.

Much of the current environmental awareness work in the region is done under the auspices of private funding. While public money is engaged in the oversight and management of conserved resources, more could be done to incentive public buy-in to the practice.

Many of the respondents expressed frustration with the lack of understanding and awareness of their fellow citizens. Nine of the interviewees described the lack of effort to conserve as a gap in their knowledge about the subject, with only two of those nine describing the gap as negligence or being willfully misinformed. Both of the following quotes come from academics who work with capacity building and environmental education.

(2) Não existe a consciência. Muito muito gente não tem consciência. E é muito difícil fazer é muito difícil fazer conscientizar as pessoas. Tem de começar por onde, pela escola pela educação, tem de começar pela escola pela educação. Mas às vezes a escola e educação tem que ver também coisas… Se as escolas, todas elas, tivessem, as escolas municipais, tivessem coleta das águas do telhado o reaproveitamento da água, isso aí gera uma consciência muito maior no aluno do que simplesmente dizer precisamos de preservar água e não fazemos nada e não fazemos nada. Eu fico assim preocupado.

Being conscientious (of conservation) doesn't exist. People are unaware. It is really difficult to make people aware. You have to start somewhere, from schooling from education; it has to start at school during education, but sometimes school and education need to see things as well… If the schools, all of them, the municipal schools, had collection systems on the roof to capture and reuse rainfall, this would create greater understanding in the student, more than just saying that we need to preserve water and not doing anything. This is what I am worried.

(15) Existe o que a gente pode chamar também de analfabeto funcional, aquele que não é analfabeto, um cara que sabe ler sabe escrever mas não se interessa pelas coisas, às vezes está estagnado numa área, então por exemplo às vezes é um cara realmente tem gente estudante, ou formado em Gestão Administrativa, administração, só que tem é só olhar ambiental e nunca se interessou pelo tema. Então é difícil teria que atingir esse tipo de público também….. Acredito que o treinamento, qualificado no caso, seria por um analfabeto funcional por exemplo, é você tem mais ferramentas ainda para ajudar para levar informação para essas pessoas.

There are a lot of people that are functionally illiterate, not actually illiterate, they know how to read and write, but they are not interested in things, they are stagnant in an area. As an example, they may have been a student and graduated in Administrative Management, but they don't ever look at environmental issues, the theme doesn't interest them. It is difficult to reach this type of public…. I believe that training, qualified training, would be for the functionally illiterate, with more tools you can help to deliver these people the necessary information.

It can certainly be difficult to bring awareness to people, particularly in that awareness alone is not necessarily enough to change one's actions or day-to-day life. Interviewee 15 notes that a degree of education, such as a bachelor's degree, does not always indicate a personal commitment to conservation activities. The perspective of individuals being well educated, but functionally illiterate is an interesting distinction. Ideally, this education would allow them to become stronger actors in the movement for conservation and preservation, but desire has to be aligned with the knowledge gained.

Two Rural Producers regarding their perception that humanity does not care enough for nature and the environment offered some very poignant thoughts. From their point of view, the glut and resources required to satisfy the life of an urbanite is

unseemly. It is worth considering what is required from built systems to ensure individual standards of living.

(18) Porque não ajuda, não ajuda no bem estar. Então como o mundo vai para frente se eu quero o bem e você quer o mal? Então era assim, se alguém pudesse fazer com que esse povo compreenda que precisa preservar, não é destruir.

It doesn't help the greater good. How does the world go forward if I want good and someone else wants bad. We need someone to make the people understand that we need to preserve and not destroy.

(6) É. O Ser humano é complicado. Qualquer país eu acho que é tudo a mesma coisa. Ser humano é muito egoísta.

Human beings are complicated, difficult. I think this is the same in any country. Human beings are very selfish.

Interviewee 5 battles back against the idea that many Rural Producers are unaware of conservation practices.

(5) Mas no geral o produtor rural essa questão do desmatamento assim isso aí já muitos deles têm a consciência de fazer. Mas é mais essa questão do respeito das áreas de APP. Mas no geral, o produtor tem essa consciência ambiental. O que falta um pouco é a questão do programa que é algo de serviços ambientais e o pagamento por serviços ambientais. Porquê da área que ele tem lá é uma área ativa porque ele poderia cultivar e ter um retorno econômico para aquela área.

In general the farmer understands this issue of deforestation so many of them already have an awareness of what to do. But this is more a matter of respecting the areas of APP. Overall, the producer has this environmental awareness. What is missing is the issue of a program, which is about environmental services and the payment for environmental services. Because the area he has there is an active area, he could cultivate it, and have an economic return for that area.

According to this perspective, the way they practice conservation is not perfect, but they do have the knowledge. It seems easy to assume that actors are either willfully ignorant of conservation practices or do not care to employ them, but that does not always reflect the tougher issues behind the visible symptoms. Economically viable and lower cost alternatives are often available, whereas environmentally conscious products and

activities can be a burden to the actor with limited resources, moving their decision away from potential conservation payoffs in the long run.

(20) Investimento do Estado na parte cultural e os exemplos que dei, como essa para aproveitar a água da chuva. Tudo isso é para esticar mais para frente o causa, porque um dia a gente vai chegar no momento em que falar que acabou. Agora é só para adiar porque nós não vamos conseguir educar unidade completa.

State investment is needed for the cultural change, like the examples I gave, like utilizing rainfall. This is all to push the cause forward, because one day the moment will arrive the things end. For now, it is just to push things forward, because we won't be able to educate the whole community.

The local, state, and federal government may be able to play a part in bringing about a situation in which long term preservation goals and conservation activities are not the opportunity cost, but rather the optimal choice.

4.2.5 - Roles and Assistance

In much the same way as Interviewees 7 and 11 expressed their ability to teach and assist individuals in navigating social issues with their communities, Interviewees 1 and 15, have a similar feeling toward environmental awareness and education.

(15) Meu papel, ele é pequeno e grande ao mesmo tempo, porque ele pode ser pequeno mas se eu puder levar a informação que eu conheço para uma, para duas, para 10, para 100, para 300 pessoas isso é muito boas. Ainda, por exemplo se eu, vocês me acompanharam no viveiro, alí eu estou conversando. Dependendo do tema eu falo sobre reciclagem por exemplo, tem gente que não gosta de reciclar, tem gente que não quer reciclar. Agora vamos supor que estou falando com dez pessoas, dessas dez que não reciclam estou conversando com elas, duas passam a reciclar depois eu conversei e consegui convencer. Isso aqui já é muito para mim. Apesar duas pessoas a não ser nada, se essas duas convencem outras duas roda.

My role is a small and large at the same time, because it can be little but I can take information and knowledge to one two people, to 10 to 100 to 300 people, this is very good. You've seen my work at the nursery, where I'm instructing. Depending on the theme, let's say recycling, there will be people there that don't recycle, and people that don't want to recycle. Now, let's suppose that I am speaking to 10 people, of these 10 who I'm speaking to and don't recycle, if two start

recycling after our conversation, I've succeeded. Even though it's only 2 people, it isn't nothing, these 2 can convince two more in their circle.

(1) "A gente transformou a nossa propriedade orgânica. Quem precisa de ajuda a gente ajuda ensinar. A gente fundou uma cooperativa de produtores. Fazendo implantação de agroflorestas nas propriedades da gente tentar espalhar este conhecimento que chega a nós para os outros."

We turned our property organic. Anyone that needs help, we help teach. We founded a cooperative for producers. We are working to establish agroforests on our properties as we try to spread the knowledge, which came to us, onto others.

None of the interviews revealed grand plans, with the majority of respondents having discussed their power to enact change as something that can be best achieved through their professional and social roles. These seemingly small acts carry with them the belief that changes at scale can come about through social networks, which magnify proper practices and methods.

4.2.6 - Governance

As with the earlier section on governance in the social context, governance in the ecological context is subject to a number of difficulties. Legislatively, the federal government has offered robust legal guidance about land and water use within the Cantareira, designating Permanent Protection Areas and establishing a process for registering these spaces, CAR (Cadastro Ambiental Rural). The difficulty lies in the oversight, enforcement, and management of these areas. The Cantareira straddles the border between states of Minas Gerais and São Paulo. Headwaters from both sides are part of the hydrologic contribution to the system; however, state laws differ, as does the question of oversight. Interviewee 12, an active member if the CBH-PCJ spoke on the

issues that the system creates, and how it lacks a simple solution due to the variety of

shareholders represented by its expanse.

(12) Eu estou falando bastante do sistema, não do Cantareira. Como que lidar com o conflito que o Cantareira traz. Isso eu estava falando bastante. Eu acho que na verdade, o que eu penso é que é uma região, é uma região de cabeceiras e é uma região que precisa ser preservada, porque o abastecimento público de uma população imensa, depende dessa da conservação dessa área para a manutenção dessa vazão. Aí eu acho que, o que tem acontecido à industrialização de algumas bacias que drenam para o sistema Cantareira do lado mineiro principalmente, onde as regras são diferentes do Estado de São Paulo e o conhecimento histórico de qualidade de água é menor do que nós temos no Estado de São Paulo. Não quer que seja perfeito mas a gente tem uma que está mais avançada nesse sentido.

I am speaking a lot about the system, not the Cantareira. How to deal with the conflict that the Cantareira brings. This is what I have been discussing. I think, in truth, that this is a region of headwaters that must be preserved, because it is the public water supply for a massive population, which depends on the conservation of this area and the maintenance of the output. That's why I think that what has happened is the industrialization of the basins that drain into the Cantareira System, mainly from the Mineiro side of the border, where the rules are different from the state of Sao Paulo and historical knowledge of water quality is less than what we have in Sao Paulo. This doesn't mean ours is perfect, but we do better in this sense.

According to the quote above, São Paulo has a better system of governance, oversight,

and investment, which provides for higher water quality. On the Minas Gerais side of the

border, a representative from government office whose role is conservation and

preservation of natural and water resources noted that is not due to a lack of desire that

the water quality is worse.

(19) Não temos muito que reclamar, pois a vida por aqui é tranquila, esperamos para o futuro mais investimentos em saneamento básico, quando digo saneamento estou me referindo as ocupações que acontecem em locais sem infraestrutura que consequentemente acaba poluindo nossos rios e diminuindo a qualidade da água.

We don't have anything to complain about, because life here is calm, and we hope for a future where there is more investment in basic sanitation, and when I talk about sanitation, I am referring to the housing that goes up and locations without current infrastructure which end up polluting our rivers and hurting the quality of the water.

The municipalities in Minas Gerais that contribute to the headwaters of the Cantareira System, with the exception of Extrema, are significantly smaller, more rural, and less well funded. State or federally funded infrastructure projects in the region could provide a means through which to greatly improve the water quality.

In line with the question of corruption hampering the progress of social changes, the sense that the law could simply be altered based on flippant political trends is a major worry for actors. Without firm legislative guidance, which is expected to be enforced for a meaningful period of time, actors have to be cautious in their decision making progress, or risk financial or personal ruin.

(7) Os códigos existem, as restrições existem, têm uma série de coisas. O problema é que os códigos não valem. Porque quando começa criar problema os políticos mudam, muda lei, facilita. Agora tem uma palavra bonita no país quer flexibilizar legislação, eu nunca vi isso. É ou não é. Agora flexibilizar a legislação é brincadeira.

Codes exist, restrictions exist, there is a list of things. The problem is that the codes don't matter. Because when it starts to cause trouble, politicians change, and the laws change, to make it easier. Recently there has been some frivolous talk the country about making legislation flexible, I have never seen anything like it. Is it(the law) or is not. Making legislation flexible is a joke.

(17) Não sei se funciona. Porque as pessoas têm medo. Eu não tenho medo porque eu não faço nada de errado. Tem que ter. Porque falta mesmo órgãos competentes que saibam mexer com isso. A terra acaba. O mato acaba.

I don't know if it functions. People are afraid. I am not afraid, I don't do anything wrong, but we have to have laws. What we lack are oversight organizations that are competent and know how to work, or else the earth ends, the forest is gone.

Beyond being preoccupied with potential corruption and ever-shifting laws, several interviews spoke of the fear they have about breaking laws that were unknown to them. Due to shifting laws that may or may not be enforced vigilantly, actors are scared to be fined and cited, so it is better to simply remain in limbo, continuing to pursue traditional

production. Obviously, this has the potential to limit progress. Interviewee 5, who engages with rural actors through work in capacity building, explained how to best bring conservation and environmental reform to the system.

(5) Eu vejo que por esse caminho seria muito mais vantajoso que uma reforma que não é punitiva. Uma reforma educativa e dando o benefício ambiental, e acaba em benefício sistemático.

I think that along this path, the most beneficial reforms are non-punitive. Educational reform and giving environmental benefits and payments, ends up in systematic benefit.

To this point, the questions of governance have been reactive, adjusting to issues created during the past. Another argument is presented by Interviewee 7, a proactive approach to more comprehensive governance in order to slow down environmental degradation caused by the expansion of real estate. This can be accomplished through stronger enforcement and oversight that is more intensive. The real estate industry moves very quickly, which according to the quote below should force government to respond with greater agility. At the moment, policy directed to rural zones is not enough, being slower and weaker than is expedient.

(7) Esse crescimento desordenado, ele é muito mais rápido do que as ações que se contrapõem a isso. Qualquer projeto que você vai desenvolver, você demora dois, três, quatro, cinco anos para ter um resultado em pequena escala. Um loteador que compra uma propriedade, seja lá que tamanho, ele deu uma mês, alí já fez um estrago que ele não deveria fazer. É muito difícil se você não tiver uma política oficial forte, direcionada por uma questão de importância da região ou não. Aquilo é importante, dizer, está no papel que é uma região de extrema importância, mas na realidade, não se vê isso ser aplicado, inclusive nas políticas de desenvolvimento dos municípios.

This disorganized growth, is far faster than the actions taken against it. Whatever project you come up with, takes two, three, four, five years to have any results at scale. A construction company buys a property, whatever the size may be, given a month, more damage is done than should have been done. It is really difficult without strong policies directed at the issues of importance to the region. This is important(nature and agriculture), it is a role of extreme importance to the region, but in reality, you won't see this applied, even in the development plans for the municipality.

Ecologically, the Cantareira System relies completely on the sustained performance of the Atlantic Forest, its lush vegetation and bountiful waters in order to have a successful future. Those actors, Water Producers, and the millions of end users downstream rely on the system in continuity, these are a few of the ways that a successful future can be achieved, where consideration is given to the complexity of the problem. Starting to address the ecological status of the system in relationship to the narrative of its actors, while attempting to understand how they view the environment currently and as a factor in their future is a challenge. It is fairly simply to elicit answers to the affirmative regarding conservation; about the beauty of nature, but in order to understand the true relationship that an individual has with nature, observation would likely prove to be methodology that is far more relevant. As far as the narrative goes, conservation is well regarded, and there were no responses that denied its importance among the respondents. Knowing this, adoption would likely not rely on convincing actors of the value that preservationist actions would have on the system, but rather the personal value received from taking action.

Technological Themes

Tying together the regional narrative of futures for the region requires a look at the elements of the Cantareira System that are technological in nature. Development, the pressures of Urban Expansion, the rise of Real Estate Speculation, the prevalence of Clandestine Housing, and the other regionally applicable vocational aptitudes such as Tourism all play a role in the future of the system. Thematically, some of the topics are extremely contemporary issues across the board, being discussed in great length in many

different circles, while others are only now becoming part of the discussion on sustainable futures for the region.

4.3.1 - Tourism

In initial discussions with members of the academic community and government in the region, tourism was not discussed a major threat or benefit to the region, in fact it went mostly unaddressed. Early in the course of interviewing the respondents for this research, it became apparent that tourism was a theme with great importance to the future of the region, in terms of economic, social, and environmental values. Ten of the twenty respondents, from every occupation except Big Business and from every municipality with the exception of Camanducaia, offered thoughts on the role of tourism in the region. Eight of the interviewees were highly positive about its potential, while two were rather conflicted about the outcomes derived from increased activity by the industry in the region, offering both positives and negatives.

Interviewees 4 and 16 leverage tourism as Small Business Owners, operating in Bragança Paulista and Nazaré Paulista respectively. Both have a desire to see their industry receive recognition from local government, through investment in recreation and attractive tourism, as well as promotion and advertisement in external markets.

(4) Eu espero que a desenvolve, consiga alavancar isso de novo, porque para mim vai ser ótimo e o que eu espero que eu consiga desenvolver bem em cima disso. Mas como que isso aconteceria porque seria recreativo e atrativo. Bragança e aldeia tem a represa que ela é legal, mas são coisas que por si não tem um potencial suficiente, mas a Bragança tem essa característica rural que próxima de São Paulo isso é uma atrativa e tanto. Sabe eu fico imaginando se as pessoas não viriam para cá para ver uma galinha de verdade para ver um boi. Eu imagino, olha eu vivia em São Paulo para um quais mais de vinte anos, viria, sem dúvida alguma. Eu e a família viria para Bragança, estamos menos de cem quilômetros de São Paulo com pouco menos de 100 kilómetros uma família sairia de lá para passar o fim de semana aqui para ver galinha para ver vaca, sabe

para ver como é que é uma colheita de alguma coisa para providenciar, como que é hoje, o turismo e experienciar. Viver as experiências. As pessoas viriam viver a experiência da vida rural aqui tranquilamente e para isso nós poderíamos desenvolver isso muito facilmente. Muito fácilmente, seria, nós temos tudo para conseguir fazer isso. O que eu espero que Bragança faça isso tem propriedades hoje com um potencial gigantesco por isso, tem várias propriedades que eu conheço, inclusive a minha, claro, que a minha talvez nem tanto, tem outras muito melhores também e que poderia fazer esse tipo de coisa.

I hope it develops, that we can leverage it, because for me it will be great and I hope I can develop well on top of that. How that would happen would be through recreational and attractive(tourism). Bragança and the surrounding area have the reservoir, which it is cool, but these are things that do not have enough potential per se, However, Bragança has this rural characteristic, near São Paulo, this attracts. I wonder if people would come here to see a real chicken to see an ox. I imagine, look I lived in Sao Paulo, for over twenty years, they would undoubtedly come. Me and the family would come to Bragança, we are less than 100 kilometers from Sao Paulo, and with just under 100 kilometers a family could leave there to spend the weekend here to see chickens and cows, you know to see what a harvest is like, things to provide, as it is today, experiencential tourism. Live the experiences. People would come to live the experience of rural life here, quiet and peaceful, and we could develop it very easily. It could be done very easily, we have everything to be able to do it. What I hope Bragança does this, it has properties with huge potential today, there are many properties that I know, including mine, of course, though maybe not so much mine, there are much better ones, that could do that kind of thing.

(16) Acho que o turismo, além dessa parte aí de... ele tem que ter algumas atrações, alguns atrativos para poder divulgar e as pessoas se... por exemplo, tem que ter atrações... Ele tem os atrativos, mas ainda não tem os produtos, então a gente está cheio de coisas por aí para serem trabalhadas. É, uma coisa que a pessoa possa... explorar. um pacote exclusivo de (coisa) É mais tem algo aqui, tem um pedaço aqui.. Teria que juntar tudo isso aí. Falta alguém chegar e... Isso. Um trabalho de sensibilização, que é o primeiro caminho, eu acho.

I think that tourism has to have some sorts of attractions, that we can publicize, and people need attraction… Our market has attractions but doesn't have outcomes, we have tons of opportunities to be leveraged. It's something that needs to be discussed, an exclusive package of things to do. Something like what we are doing here, offering a variety of things together to do. I think it requires a little awareness that is the first step.

According to Interviewees 9 and 10, it is the allure of rural life that is driving the market.

While the RMSP continues to burgeon, the walls seemingly close in around the people

and can be suffocating. Respondents 4 and 15 also shared similar feelings regarding the

urban crush that incentivizes rural tourism to recover and recuperate energies.

(9) Eu acho um atividade bastante crescente, que envolve bastante o homem do campo é o turismo rural, porque a gente tem visto a crescente procura de, dos cidadãos dos grandes centros, que chega ao final de semana eles querem ir para a zona rural, querem tipo espalhar e desestressar e eles têm procurado a gente e têm procurada atividades na zona rural mesmo.

An activity that is growing recently, which puts the rural producer in focus is rural tourism. We have seen growing demand from the citizens of the big cities, that come out on the weekend. They want to go to the countryside, they want to spread out and de-stress, and they have been looking to us and seeking activities in the countryside.

(10) You know that's been something, an activity that's becoming more and more popular, with other properties of this type. Sort of are selling their nature. If you're looking at the sites of these places that are offering rural tourism, places if you looked really down to it. What they're really offering is there's not much. Not exactly what I have here, it's much much less than I can offer here in terms of nature, but they're selling that as nature. With, always with some kind of swimming pool of some sort. You know together.

Locals from around the banks of the Atibainha, Jacarei, and Jaguari are less likely to

utilize the reservoirs for recreation or relaxation, as noted in the following quote from

Interviewee 16.

(16) Porque essa represa aí é interessante, ela atinge uma boa área do nosso território, só que quem curte essa represa, quem está na represa, são pessoas de fora, de outros municípios: Atibaia, São Paulo, Campinas, por quê? O pessoal de Nazaré, poucos têm embarcação; eles curtem pouco em cima de barco. Então o negócio deles é cavalo, é área rural mesmo, mas eles têm um potencial grande para festas, então tem muito produto aí, tem muita festa, teria que fazer um pacote, tem esse trabalho de divulgação. É da obra aí.

The reservoir is an interesting commodity, it covers a large part of our territory here, but the only ones who use it for leisure are people from other cities, Atibaia, São Paulo, Campinas. The people of Nazare, very few have boats, they don't really use it. The issue is that their life is survival, but what we have is potential as a product to produce parties here, make it our business to produce events for those people who come here. That is the work happening.

This same idea was expressed in Interview 17, lending to the idea that there is some gap,

quite possibly income, which proves to be a barrier to local recreational usage, while the

number of resorts and marinas around the reservoir expand. With increased usage, comes the risks of damage to the reservoir as a water supply systems, as was noted in section 4.2.3. Contamination by gasoline, oil, and sewage negatively affects the water quality as well as the pristine nature of the reservoir as an attractive recreational magnet. Tourism will bring employment and wealth to the region, however, in direct contrast to the wealth generated is the degradation of the system in service of recreation.

4.3.2 - Development

Natural geographic features have restricted the spread of large-scale industry in proximity to the Cantareira, with Bragança Paulista and Extrema having the greatest concentration of industrialization. However, in recent years, as highways have been completed and populations have swelled, modernizing development has begun to take hold. The theme expressed a highly positive connotation among all the respondents, but in the face of past development paradigms removing any agency from actors in the region, a few distinct suggestions arose as to how to better address the issue.

(17) Ah, acho que sim. Porque quando chega o desenvolvimento muda muito. E aí vem mais pessoas, atrai mais. Isso é muito bom para a cidade. Mas esses desafios vão ter que mudar muita coisa. No trânsito, no comércio, na estrutura da cidade. Precisa de uma estrutura boa para receber essas pessoas. O turismo já cresceu bastante.

When development arrives, things change, then more people come and attract more. This is good for the city. There are a lot of challenges when things change. The transit, business, the structure of the city. We need to have a good structure in place to receive people. Tourism has grown a lot.

(1) Vamos perguntar, sabe? Perguntar primeiro, sabe coloca as organizações que são preparadas para isso. Para levantar isso e em cima disso faz um plano. Não precisa ser muito mirabolante. É o primeiro passo começa de então… Junta com o que eu acho que eu preciso com o que você acha que eu preciso. Aí a gente conversa e chega no plano porque às vezes quem está de fora também enxerga melhor.

Let's ask? Ask first, approach the organizations that are prepared for it. Raise the question, make a plan. It doesn't have to be very exciting, it is the first step that starts the journey.. Bring together what I think I need and what you think I need. Then we can talk and come up with the plan, because sometimes the person on the outside can have a better perspective.

Modern development studies paradigms have become more adept at incorporating human capabilities and rights, though it would be extremely disingenuous to say that it has reached a point of perfect comprehension of individual challenges in systemic conflict. DS are more closely aligned with the qualities described in interviews 1 and 17. Structural and infrastructure considerations as well as human impact and input, are more widely used in development today, though on a local level, these academically siloed principals may not prove to be used. Gathering a consensus or using public input data can be perceived tedious to attain, difficult to reconcile, or nearly impossible to implement, however it is worth ample consideration as development will inherently impact human lives. As Interviewee 8, who works for a Big Business, states in the following quote, it takes considerable financial investment to bring about the best practices when pursuing development, but issues of great importance deserve this treatment.

(8) É a parte económica, ela afeta bastante porque a maioria das boas práticas envolve custos né, é difícil fazer prática sem custos, até dá mas nem tanto. Então é, aqui onde a gente trabalha especificamente, graças a Deus, os recursos que a gente está precisando estão vindo. Em alguns momentos a gente tem que aguardar um pouco, isso é normal, faz parte de um planejamento, então tem que entrar tudo num planejamento, como todo, mas a gente vai conquistando na medida do possível. Dificilmente alguma coisa que realmente tudo o que é relevante seja implantada rapidamente e as melhorias que vão sendo complementares vão entrando num processo de planejamento e vão sendo implantadas conforme for andando esses planos.

The economic situation (of the region), has a major effect on best practices, because they involve costs, and it's difficult to practice without costs, it can be done, but not well. Luckily, where I work specifically, the resources are available and keep coming. Sometimes we have to wait a little bit, but this is normal, it is part of planning, because everything has to enter into a plan, but we do the best we can with what we are given. It is difficult to find something of great importance

that is implemented quickly and betterment has to come through a process of steady planning and implementation.

4.3.3 - Urban Expansion

Connected to the theme of development is the expansion of urban spaces. Many of the municipalities in the region are experiencing urban growth, extending services such as pavement and basic sanitation to regions further from the city center. This brings with it a number of challenges, but is also of great interest to Rural Producers. Outside of the urban core, road quality quickly deteriorates from pavement to gravel compact, to dirt and eventually to tracks. Much of the maintenance of these roadways deeper into the rural zone is placed on the Rural Producers in the area. Interviewee 13 questions whether the services are being allocated in the correct way.

(13) O que eu tenho visto é que está tendo uma expansão urbana natural e então está tendo uma melhoria na estrada e já estão trocando postes, já está fazendo uma iluminação melhor, a água encanada já está chegando em alguns lugares que era bem inacessíveis. Então, o poder público está chegando nessas áreas. Mas como está chegando, a forma como é feito isso, quando eu escuto alguma coisa, eu não sei se é a forma mais adequada, mas está chegando.

What I have seen occuring is a natural expansion of the urban area, road improvements, new signage and modern utility posts, better street lighting, running water is arriving in some places that were really inaccessible. So public services are reaching these areas. The question is how it is arriving, in what way it is done, and when I hear something, I don't know if this is the best way, but it is arriving.

This connects to the experience of Interviewee 6, who as a Rural Producer far from the urban core doubts the equity and efficiency of resource allocation for the rural zone. There was a perceived improvement in the manner in which issues were being dealt with, mostly due to the work of a past mayor, however these positive changes fell off after a while.

(6) De uns tempos para cá deram uma mexidinha, deu uma melhoradinha. Mas foi por quê? Foi prefeito estar cutucando-o para ele fazer alguma coisa. Vai falar para mim que é falta de verba. Então é assim, sempre a mesma coisa, sempre reclamam que não tem condição, é aquela coisa toda. Para pintar uma casa, quanto custa para pintar uma casa? Custa mil reais? Tem dez funcionários? Cem reais cada um já paga… Agora, não querer abrir mão de onde está morando, como faz? Eu sei que vai ser meio difícil. Agora se eles não conseguem fazer isso, eu tenho certeza que tem dinheiro lá para eles trazerem, porque quando a gente precisa de dinheiro para arrumar a estrada aqui eu assino um documento os caras mandam dinheiro para vir arrumar estrada aqui.

A little while back they made some small tweaks, and there was a little improvement. But why was that? It was the mayor bothering them to do something. He'll tell me, it's a lack of funds. It's like this, always the same thing, always complain that there is no funding available, it's that whole thing. But to paint the (department building) house, how much does it cost to paint a house? Does it cost a thousand reais? Do you have ten employees? One hundred reais each, already paid... Now, what about helping those who live in the region, what do we do, where are our funds? I know it is kind of hard. Now if they can't achieve this, I'm sure there is money there for them to offer, because when we need money to repair the road, I sign a document, and the guys send money to come fix the road.

4.3.4 - Speculation, Land-Use Issues, and Clandestine Ownership

As discussed urban expansion around the banks of the reservoirs and within the municipalities of the Cantareira places stress on the catchment system, jeopardizing the water supply and quality. Over the last few decades, land valuation in the region was primarily tied to the economic viability of traditional agricultural activities, namely the production of beef, pork, and milk, charcoal and wood, or in other agricultural outputs such as fruits and vegetables. In recent years however, the valuation has become skewed by valuation places on proximity to the RMSP and its viability for relaxation and recreation, as well as a means by which to invest wealth. As the price of land has increased, it has driven more construction. This has caused affordable housing to become scarce and labor costs to skyrocket. New construction offers employment at a higher

wage than other comparative positions, causing workers to forgo agricultural labor. As Interviewee 5 indicates, due to weaker margins, market forces pressure Rural Producers to pursue other methods of earning a livelihood.

(5) O mercado interno está em recessão...Mão de obra também devida nos últimos anos o salário teve um aumento fora da inflação foi o maior, salário foi maior. Então hoje a mão de obra e insumos está pesando muito, no custo da produção e o valor de mercado ele não tem como controlar e colocar o preço no seu produto. Então essa margem que seria o lucro que está cada vez menor. Então ele não está tendo uma rentabilidade adequada e alguns estão até deixando de produzir porque não tem retorno econômico da atividade. Daí junto a isso nesses últimos anos tem entrando na questão do Sistema Cantareira, teve a crise hídrica. Então alguns passaram por dificuldade que todos têm dependência da irrigação. A irrigação deles poucos utilizam a captação da água da chuva todos dependem do Rio e do manancial. Então eles tiveram sérias dificuldades aí com a questão da irrigação das culturas.

The internal market is in recession… Although laborers in recent years have received wage rate increases in recent years, regardless of inflation, wage increases have been higher. This means that today the cost for labor weighs heavily on the cost of production and the market value has no way to control in, passing the cost onto products. So margins have been getting smaller and smaller. This results in inadequate returns in terms of profit, so that some producers are giving up on production because of the lack of economic return for their activity. Together with this, during recent years the Cantareira System went through a water crisis. So some people passed through difficult where there is dependence on irrigation. Very few used water capture from rainfall for irrigation, and depend fully on rivers and springs. They came under severe difficulties due to this irrigation paradigm.

One of the prime ways of doing so is to sell the land at a high price, and move to housing in the city, where low skill labor jobs are more abundant. This causes a change in the occupation of the land, shifting away from traditional agriculture toward condominiums and segmented personal recreational resorts. Interviewees 5 and 13 worry about the occupation of these areas close to the reservoirs, and potential damages caused to the system.

(13) A questão da degradação ambiental é inerente a questão da urbanização e dessa chegada do poder público. Algumas coisas estão sendo desmatadas, estão sendo ocupadas. Eu não sei de que forma estão sendo ocupadas essas áreas.

The issue of environmental degradation is inherent to the question of urbanization and the arrival of public services. Forests are being cleared, and people are moving in. I don't know how, or in what way they are occupying these areas.

(5) Quando foi concebido o sistema eram áreas de fazendas e áreas rurais. Quando foi desapropriada as para a construção dos reservatórios. Não existia o que tem hoje com condomínios, loteamentos irregulares. Então isso acaba afetando na qualidade da água e na quantidade. Que áreas que teriam que ter uma área de preservação o solo está compactado em impermeabilização. Não tem uma recarga então acaba afetando na quantidade e qualidade. Acaba tendo, gera uma poluição. Então isso tudo é política.

When the system was first drawn up, the area was farms and rural areas, when it was condemned for the construction of the reservoirs. The condominiums, the unregulated lots that are there today didn't exist. This ends up affecting the quality of the water and the quantity. What should have been areas that are protected the soil is impermeable and compacted, making it waterproof. There ends up being no recharge, which also hurts quality and quantity. It ends up creating pollution. This is all political.

A common theme in the expansion of urban spaces is the arrival of political power, however it is not just services provided that pertain to governance, it is also enforcement legal frameworks. As mentioned earlier, the government does not have the current capacity or capability to keep up with the speed of private construction companies, which results in damage being done due to lack of oversight. Interviewee 7 notes that there is a regional narrative being implanted by some unknown element, perhaps big business or political elements, in order to convince individuals that the changes, particularly damages done to the environment and water are for the benefit of the region, when in reality this is just a narrative in service of the RMSP.

(7) Então a gente perceber de alguma maneira isso ser trabalhado, como é que regionalmente essa visão está sendo implantada e por quem. Vamos ver que é o mesmo grupo político que acaba sendo do grupo imobiliário, ou é imobiliario uma hora e é político na outra hora e que vai trabalhando a mudança dessa região. Estruturada nesse forte vetor aí que é o crescimento, a qualquer custo, tendo em vista o grande mercado que se tem aqui encostado em São Paulo.

We realize that by some method a regional vision is being created or implanted and who is behind it. It is the same political element that also represents real estate interests, it is real estate interests one minute and acting on a political level the next which is working to change the region. It is structured in this way, where growth, at any cost, is driven by the large market that exists next door in São Paulo.

Individuals from all positions and occupations in the region are baffled by the expansion, with little understanding of whether or not the new condominiums are being built under legal guidance and to code. It seems that the information is either not easily accessible, or that the narrative presented above, that the development is positive, has worked to an effect of dissuading investigation or answer seeking.

(13) Abrindo muito condominio. Eu não sei quais são as condições desse condomínio, se estão legais ou não, porque o meu foco não é esse, eu só observo, mas eu vejo que está abrindo condomínios, áreas sendo abertas por tratores, depois vem uma chuva, assorea tudo, joga tudo para onde estava organizado, urbanisticamente e eu não sei o que que é feito, se existe uma fiscalização. Eu não sei.

A lot of closed of communities are opening. I don't know what the conditions of these gated communities is, whether they are legally constructed, because my focus is not on this, but I see it happening, areas being cleared by tractors, then the rain comes, everything gets washed away into where the urban neighborhood was being organized, and I don't know if enough oversight is being done.

The other side of this real estate boom is clandestine housing, which involves the installation of homes on land that is not allocated for residential development. Much of the land directly around the banks of the reservoirs is dedicated to Permanent Protection Areas, and should be protected. Interviewee 12 discusses this topic below.

(12) Por outro lado eu acho que você tem também uma ocupação grande do entorno do Cantareira de pouca renda também que invadiu muitos APPs que tem muitos décadas e que eu não sei se o estado mexe com essa áreas por exemplo, então eu acho que essa era uma questão que poderia ser trabalhada pelo Estado. Onde tiver uma APP a ser guardada, essa devia ser cobrado. Imagino eu que com o novo código florestal essa situação lentamente vai acabar em áreas rurais, vai acabar havendo uma adequação, que mais. Eu acho que as tensões de que foi falado no encontro seria a questão de áreas pela SABESP, compreender o sistema como é. Porque a gente tem uma cultura que é mandar água para gente sem preocupar, qualquer água. E pra você manter a qualidade de

água, a vegetação é importante, a ocupação, como a prática agrícola se dá, quantidade de nutrientes se joga, ainda mais em reservatórios. Enfim tudo interfere na qualidade da água.

On the other hand, there is also a great deal of occupied space surrounding the reservoir, particularly low income housing, which invaded many of the Permanent Protection Areas over the last few decades, and I don't know how the state can work with these areas, so I believe this is a big issue that can be worked out by the state. Wherever there are Permanent Protection Areas to be preserved, this should be dealt with. I imagine that the new forest code should slowly deal with this situation in rural areas, and will end up changes. I think the tensions that were discussed at the meeting would be issues for SABESP, understanding the system as it is. We have a culture that is to send water downstream, without worrying about the water, any water. In order to maintain water quality, the vegetation is important, the housing, agricultural practices employed, the quality of nutrients we toss in, and of course the reservoirs. All of this interferes with the water quality.

New laws about the use and protection of forested areas are slowly rooting out issues and correcting improper use of the land, and optimistically Interviewee 12, who works for big business, believes that in time the issue of clandestine housing will be resolved by the regional culture as well as government management and oversight. Interviewee 7 proposes a more active role in resolving the issue of clandestine housing, finding ways to make the growth of housing compatible with the natural role of the region in the production of water.

(7) O mais provável por aquilo que se desenha hoje é compatibilizar esse crescimento que é alguns setores quer, os setores fortes querem. Vamos dizer numa linha do pensamento, lotear a região porque isso é um mercado de terra fortíssimo encostado com São Paulo e valorizado pela água, pela paisagem, pelo acesso facilitado e tudo mais... Então (a solução) compatibilizar isso com aquilo(o crescimento) que é colocado como vocação da região, é uma região produtora de água, uma região de importância ambiental muita grande e tudo mais.

What is most likely is that what is being designed today matches the growth that some sectors want, the strong sectors. Let's say that is a line of thinking, sub-divide the region, because of the incredibly strong real estate market adjacent to São Paulo and overly valued by water, by the landscape, and by the easy access, all of it. So (the solution) is to make the (growth) compatible with the natural roles of the region, as a region that produces water, a region of great natural importance.

What form this might take was not discussed, however one can imagine that this means

building communities that are integrated into the natural environment with the

implementation of green technology as the backbone of the development. This however

is speculation, seeing as the region is ultimately still developing, and would lack the

resources and funding to implement the most modern green technologies. Interviewee 15

provides a more drastic plan to protect the reservoirs and the system.

(15) O ideal por exemplo seria ter um incentivo público para essas pessoas que estão à margem da represa por exemplo e colocar elas em outro lugar, vai pagar para elas um valor razoável da região. Vai cercar e vai fazer isso aqui uma área de preservação, não vai ter jet ski, não vai ter esse tipo de coisa porque isso também contamina. Se você o fundo do sistema da Cantareira, a parte do volume morto, que a gente teve que retirar na crise hídrica, aquela área totalmente contaminada de combustível de jet ski por exemplo porque diluí, vai para final da água. Então uma área de preservação, não se vocês se chama lá, é de Preservação Permanente, APP hídrica.

The ideal, for example, would be public incentive for the people who are on the banks of the reservoir to move to other locations, paid at a reasonable rate for the region. Then fence off and turn the whole area into a preserve, no jet skis, no more of these things that contaminate. At the bottom of the Cantareira System, in the dead volume area, that we had to take for the water crisis, that area is completely contaminated by fuel from jet skis because it dilutes. It goes to the bottom of the water. So a preservation area, permanent preservation area for the water, if that's what you all call it.

This plan, to cordon off the land, purchasing the land from the current occupants,

regardless of claim, or potentially evicting those that have no claim to the land, is an

analog to the Catskill/Delaware reservoir systems of New York. The Catskill/Delaware

system is highly protected, possessing a natural barrier of forest around its banks, and has

limited recreational and economic use, such as bans on the use of motor boats. This form

of preservation would environmentally speaking be best for the natural ecological state of

the system, however it would have the highest immediate human cost. If this were to be

the route taken, could the planners behind the projects and the government itself learn

from past errors, providing not only payment for the land but offering capacity building courses, relocation assistance, and other programs?

(7) A gente imagina que deveria existir uma política direcionada específica para a região. Uma política de valorização dos produtos daqui com um selo de origem. A questão da Pagamentos por Serviços Ambientais e pagamento realmente, não esmola como se faz hoje, que é uma piada. Uma política de conservação hídrica, solo, uma série de coisas para barra o que está acontecendo em termos de expansão imobiliária.

We imagine that there should be a policy in place directed specifically at the region. A policy for product valorization with a stamp of origin. The issue of Payments for Environmental Services, and I mean real payments, not these pity payments that are given today, which is a joke. A policy of water conservation, soil conservation, a number of things to impede what is happening in terms of real estate expansion.

Politically, the actors of the region, despite doubts and misgivings with corruption and governmental action, know what they want from their politicians and legislators. The hope would be that Water Producers, those who conserve, would be given a fair cut, something that would aid them in pushing back against the tide of real estate expansion. These boons come in a variety of methods, as spoken to by Interviewee 7. Payments for Ecosystem Services, regional product valorization, subsidies for Rural Producers, and government sponsored conservation funding all offer assistance to the current social order, which feels generally threatened by the changes that are occurring.

4.3.5 - Ideal Future

In attempting to express the future imaginaries present in the narratives of the actors who call the Cantareira Region their home, a variety of thematically notable topics have been explored. Describing the ideal future is directly tied to the historical and contemporary issues that inform individual and collective morale, define personal identity, and create a setting for system dynamics to be addressed. All respondents were

90

prompted to discuss their ideal future and the ideal future of the region. Interviewee 1 emphasized how to arrive at the ideal future, that it requires on the input of every community, and that it is not a unilateral decision.

(1) É, eu acho que isso dá para desenhar o futuro ideal, quando se levantar as demandas de cada comunidade sabe porque cada comunidade tem uma necessidade... O que não dá é alguém ficar lá em cima, pensando e fala assim, eu acho que você precisa disso.

I think you can only design the ideal future, when you bring up the demands of each community, because each community has a need… What doesn't work is someone above you, thinking and telling you, "I think you need this".

If all voices are considered, the hope is that the voices express their sincere desire, and individually the hope is that those expressions of thought are of a positive nature. The next generation is the focus of many questions about the future. There is a prevalent concept that emerges when eliciting future imaginaries, one that desires the world to still be habitable and sustainable place for their posterity, indeed better than it is today.

(14) A gente está formando cidadãos para que dê essa continuidade e não é fácil. Não é fácil você conscientizar para que isso é importante, porque isso faz parte pra gente ter um futuro melhor(uma cultura de simpatia). É difícil.

We are creating the citizens that will continue our legacy, and it's not easy. It is not easy to teach them that this is important, because this is what will make the future better(a culture of caring). It is difficult.

(18) Porque não ajuda, não ajuda no bem estar. Então como o mundo vai para frente se eu quero o bem e você quer o mal? Então era assim, se alguém pudesse fazer com que esse povo compreenda que precisa preservar, não é destruir.

It doesn't help the greater good. How does the world go forward if I want good and someone else wants bad. We need someone to make the people understand that we need to preserve and not destroy.

Unfortunately, in some cases the future just seems out of reach. If the struggles of today require so much effort to overcome that any sort of planning beyond the immediate

situation is impossible, the future will arrive without anticipation. It is painful to know that for some of the respondents, the future is just making it to tomorrow, and that nothing beyond that is yet reality, so its importance is not yet pertinent nor worth the effort in consideration.

(7) Não tenho como imaginar. Se não está na pele do produtor, tudo o que você falar, você está falando fora da realidade.

I can't imagine it(the future). If you're not in the shoes of the producer, whatever you say, it is speaking about impossible things.

The future will be setup by the constraints that are placed upon it, through negligence, through poor planning, through active engagement, through ambitious endeavors, whatever humanity decides to do and nature decides to cosign. Experience has dictated a future vision for Interviewee 14, which is based on realistic and reasonable goal setting, acknowledging that the loftiest dreams are not necessarily achievable. Setting expectations can provide for an imaginary that is procedural and operational.

(14) O ideal a gente sonho, o ideal seria isso né. Pra gente desenvolver isso. Só que o real, a gente trabalha muito com o real ali dentro da possibilidade que a gente consegue, mais que a gente gostaria que fosse de uma outra forma. A gente depende de terceiros, e que muitas coisas ali hoje, eu entendo porque é assim quando a gente está iniciando, ou quando a gente vê de fora. Eu vou fazer isso isso isso. Só que muitas coisas que você quer fazer, não depende só de você. É uma rede, é um grupo, e a gente não pode pensar só ali naquele local ali, a gente tem que pensar no todo, em esse todo para gente atender não é fácil. Então a gente tem isso em mente que aos poucos a gente vai adquirindo e que nem tudo o que a gente sonha e que acha que é o ideal a gente consegue também. Mas a gente consegue realizar muita coisa dentro do que a gente procura.

The ideal that we dream of, the ideal that would be right for us, is for us to develop. We work a lot with reality, with what is possible inside of real constraints, but we would like it to be another way. We depend on others for many things today, because that is how things start, when looking out of our space. I do many things, but many of the things you do don't rely on you. It's a network, it's a group, you can't just think of your space, you have to think about the whole thing, and taking care of everyone is not easy. We are getting better at doing this, gaining this skill, and

knowing that not everything we dream or think is ideal is something we can achieve. We can accomplish lots of things within the constraints we have if we keep trying.

(19) Espero que as pessoas tomem mais consciência da importante que tem nossos recursos hídricos e preservem as nascentes, rios e cursos d'água para que não faltem para as futuras gerações. Um futuro onde as pessoas entendam o papel que a natureza exerce em nosso planeta e aprendam a respeitá-lo, mas por enquanto falta mais conscientização, trabalho e dedicação das pessoas.

I hope that people will become more aware of the importance of water resources and the preservation of springs, streams, and rivers, so that they are around for future generations. A future where people understand the role that nature plays on our planet and learn to respect it, but for now people lack awareness, work, and dedication.

Ultimately the hope is that everyone will adopt a stance that shows due importance to the ecological system humanity lives within, by adapting technology and social institutions to meet the sustainable needs of this complex system. What does that future look like? It is one where the greater good is based on thoughtful consideration about the ramifications of technological implementation, where individual behavior is motivated by societal norms that place explicit value on capabilities and human rights, and where the sustainability of the planet is of greater value than accumulated wealth. In action, it is one where government is honest and manages resources efficiently, where the market does not disenfranchise people, where the environment is not overlooked or mistreated. It is not utopia, it is just attainable.

Institution Analysis and Development Framework

This section, focused on the IAD, will serve as an overview or description of the Cantareira SETS, one that highlights larger concepts and provides a basic map for

understanding how interactions occur between the social, ecological, and technological facets of the system, when rules are applied to the action situation.

The Commons Dilemma

Conflicting uses for water resources dictated by individual management of springs and waterways as well as questions of land-use are the root cause of the commons dilemma around the reservoirs. Governmental bodies and non-governmental organizations are attempting to mitigate land-use conflicts through educational and technical training aimed at improving conservation practices among rural producers. This work helps to reinforce the social contracts that have been developed as a traditional means of resources management in rural communities, prior to periods of oversight and top-down governance.

Inefficient land-use and agricultural practices in light of recent drought conditions has led to environmental degradation that threatens the productivity of subsistence farming and Rural Producers. Paired with increased labor costs, margins on agricultural products have dropped significantly. Additionally, land-use restrictions from more robust codes on environmental management are reserving productive lands for Permanent Preservation Areas (APPs), without compensation in the form of Payments for Ecosystem Services (PES). These issues have increased the incidence of rural flight, causing a drain on youth populations in the rural zone, further straining available labor supplies while damaging the capacity of the region to replenish its population in continuity.

Traditional land-use is tied to family farming, aided by the creation of communal relationships for collaborative work, which lent to the creation of organic social contracts

meant to provide assistance in the case of knowledge or labor deficits. These contracts enabled Rural Producers by creating a channel by which to communicate about and actively manage common-pool resources (CPR). The traditional social order that created this collective landscape is threatened by the fragmentation of familial lands through inheritance, by increasingly disparate types of habitation due to real estate speculation, and by the expansion of urban sprawl into rural zones. Land valuation has skyrocketed, resulting in a booming real estate industry, which can operate with almost complete autonomy due to a vacuum of oversight and enforcement in the legal apparatus. The system functions as a norm without intensive top-down management from governmental agencies, however it must be noted that in times of crisis, the informal social order than maintains the system will be completely disregarded in favor of direct management by SABESP, as evidenced by actions taken during the drought. So while informal social contracts dictate the day-to-day, power over the system itself is leased out based on governmental action or inaction.

Rules

Boundary Rules: Hydrographically, the Cantareira System is bounded by the extent of its tributaries within the upper watershed of the Piracicaba River. It is also bounded by the collective boundaries of the 2 states and 12 municipalities in which it resides. Additional boundary considerations needs to be made for questions of land-use, as land dedicated to the purpose of APPs creates a legislative set of restrictions and permissions.

Position Rules:

- Leadership roles within governmental bodies, including ministers of agribusiness, environment, and municipal development dictate the public funding of capacitation programs, product subsidization, and the focus of outreach initiatives, having been selected either from open elections or as representatives of the elected party.

- Leaders with traditional academic training that engage with the community through employment or research roles at NGOs or with federal and state bodies, and provide connections to external collaborators and information

- Landowners who do not utilize their land for economic activity, but participate in social and cultural interactions with the community, providing value through relationships and respect

- Rural Producers and Small Business Owners, who participate in capacitation workshops, develop informal social contracts with neighbors to manage resources, and who may assist in the creation of formalized social infrastructure such as cooperatives or associations.

- Unknown operators who are replacing traditional land-use and social structures with external values from isolationism to disregard for social norms

Scope Rules: Recovery from the drought has not replenished the reservoirs to the level that they were at pre-drought. Management of natural resources through oversight and enforcement is not agile enough to prevent clandestine housing on the banks of the reservoirs, land fragmentation due to the development of condominiums, or the tilling of

new land for pasture; all of which place strain on the ecological processes that replenish the system (Ditt, 2008).

Choice Rules: On a micro level, decisions made on private land by Rural Producers are dictated by the National Water Act as well as Native Vegetation Protection Laws, but also by the poor or non-existent remuneration provided for adhering to this legislation. Barring these restrictions, other choices are influenced by market factors, such as the increased cost of labor, opportunity costs on the valuation of land sales, as well as the non-subsidized cost of implementing conservation technology.

Aggregation Rules: Wide varieties of positions collaborate in workshops in which strategies are devised and plans are laid out for the deployment of sustainable practices. Certain positions are more likely to voice their opinions, silencing dissent by dominating the conversation. In settings where feedback is acquired through discourse and then through consensus voting, this impedes the viewpoint of certain positions, namely Rural Producers, from being adequately expressed. As a result, strategies and plans may run into struggles with adoption, implementation, or continuance due to a known problem that may have been revealed to the committee if vocalized. While some plans may be formalized by a signed document at the end of the workshop, the majority of these documents are symbolic in nature and legally non-binding. As such, signatures are freely given, despite minimal efforts by the organizing body to maintain this focal point for its signatories beyond the meeting itself.

Information Rules: Engagement with participatory governance is an optional role that any member of the community can engage in. Workshops, committee and community meetings serve as gathering points for the discussion of pertinent topics to agricultural and conservation practices. Individual Rural Producers with extensive knowledge become hubs for information transfer, being the nexus social networks that rely on experience and wisdom to mediate difficulties. Generational landowners and Rural Producers also employ informal social networks via working relationships as means by which to share news, events, and changes that may affect the area. The informal networks for the transfer of knowledge are threatened by the influx of new actors who choose not to participate in the existing social order, preferring closed compounds and minimal interaction with established individuals. Actors who serve as knowledge hubs are also threatened by age and economic standing, as if they leave the region, their role must either be adopted by another or cease to exist.

Payoff Rules: Although legislation has provided a framework for the conservation of land and water resources, the schedule of enforcement is wildly sporadic, based on funding received, work force allocated, and the area designated to receive oversight. This causes participants in the system to have fear that they may conflict with some law they are not aware of, or fall prey to corrupt officials who have power to disseminate fines. A system of informal payoffs for clandestine activities also exists, which further strains enforcement. Participation in the system can however provide a sustainable long-term land holding with the necessary resources for continued habitation.

Concluding Remarks

When considering how this data might be utilized for decision-making, it is necessary to consider the status of the system and how it differs from the imaginaries of its actors. Social stress in the region is high, as traditional forms of land-use are being replaced by condominiums and luxury homes, which in turn generates ecological stressors as native forest and water resources become more difficult to conserve. As such, the imaginary that most directly opposes this trend is the one in which the rural exodus is stymied by a mix of government supports and campaigns around generating a proud and successful identity for the rural and water producer. Ecologically, the success of the Cantareira reservoirs is dictated by the production of water through natural processes. Currently the continuity of the system is under threat from poor ecological maintenance of native forests, new land clearing operations, recreational usage, as well as micro and macro environmental changes. In opposition of the current conservational paradigm, the imaginaries elicited discuss increased emphasis on environmental and sustainable education at all levels, greater enforcement and oversight of natural resources, and an emphasis on reforestation and proper land-use practices. Tourism has become a profitable enterprise for the region; however, its proliferation as populations has grown is one of concern to the participants in this research. A measured and thoughtful approach ought to be taken in relation to how recreation activity should be accommodated without damaging natural resources, utilizing existing data from other projects and policies already in existence in other locations. The imaginaries of sustainable futures presented here will require an ambitions transdisciplinary effort to achieve, however it is paramount

99

to include the community and its actors in the considerations and planning, as it is their future that is being decided upon.

The findings presented in this thesis allude to the complexities of creating a successful future for the Cantareira System, while providing context valuable for the development of SETS policy initiatives and programs, which incorporate regional and personal narrative constructs. A future of success can be defined as one where the reservoirs of the Cantareira continue to fulfill their purpose and potential, as a water catchment and delivery system for the RMSP, however it would be short-sighted to ignore the role humanity plays in that future. As such, a successful future is dictated by the ability of the system to provide a space for human success, capacitation, livelihood, and progression; while ensuring responsible management of the eco-technical elements that sustain water quality and supply. This progression should be decided upon by the inhabitants of the rural areas, guided by their experiences and outcomes, accountable to their goals and futures. Thematically the findings represent the core issues facing the region, as perceived by actors from diverse occupational backgrounds, positions, and roles. The list cannot be defined all-inclusive, as the breadth of the human imagination is immense, therefore the themes encountered through elicitation did not reveal additional concepts beyond those discussed here. The hope is that this thesis, the themes it addresses and the narratives it elaborates upon, will be of use to policy makers, not as a prescription, but rather in consideration of the intricacies of development as a human endeavor. In order to create continuity, this work should be used to prompt discussions of how to better address the concerns, both personal and systemic, that exist around the

paths that may lead to the future. Imagining a better future, then building it, should be a

collaborative effort, in which everyone has a right to participate.

REFERENCES

Almeida, F., & Curado, M. (2019). The role of observation, cognition, and imagination in Keynes's approach to decision-making. EconomiA, 20(1), 15-26. https://doi.org/10.1016/j.econ.2019.03.001

Atkinson, Rowland & Flint, John. (2001). Accessing Hidden and Hard-to-Reach Populations: Snowball Research Strategies. Social Res Update. 33.

Atlas dos serviços ambientais do sistema Cantareira - 1. ed. - São Paulo: Memnon Edições Científicas: IPÊ - Instituto de Pesquisas Ecológicas, 2017.

Beatty, J. (2017). Narrative possibility and narrative explanation. Studies in History and Philosophy of Science Part A, 62, 31–41. https://doi.org/10.1016/j.shpsa.2017.03.001

Charmaz, K., & Belgrave, L. L. (2015). Grounded Theory. The Blackwell Encyclopedia of Sociology. https://doi.org/10.1002/9781405165518.wbeosg070.pub2

CHESS Crise Hídrica, Estratégia e Soluções da SABESP. (2015).

Chiodi, Rafael Eduardo, Sarcinelle, Oscar, & Uezu, Alexandre. (2013). Gestão dos recursos hídricos na área do Sistema Produtor de Água Cantareira: um olhar para o contexto rural. Revista Ambiente & Água, 8(3), 151-165. https://dx.doi.org/10.4136/ambi-agua.1162

Ditt, E. H., Knight, J. D., Mourato, S., Padua, C. V., Martins, R. R., Ghazoul, J. (2008). Defying legal protection of Atlantic Forest in the transforming landscape around the Atibainha reservoir, south-eastern Brazil. Landscape and Urban Planning, 86(3–4), 276–283. https://doi.org/10.1016/j.landurbplan.2008.04.001

Dobrovolski, R., & Rattis, L. (2015). Water collapse in Brazil: The danger of relying on what you neglect. Natureza & Conservação, 13(1), 80-83. https://doi.org/10.1016/j.ncon.2015.03.006

Ellis, F., & Biggs, S. (2001). Evolving Themes in Rural Development 1950s-2000s. Development Policy Review, 19(4), 437-448. doi:10.1111/1467-7679.00143 https://doi.org/10.1111/1467-7679.00143

Evans, P. (1995). Embedded autonomy: states and industrial transformation. Princeton, NJ: Princeton University Press.

Faro, Guilherme Todt Cardoso de, Garcia, Joaquin Ignácio Bonnecarrère, Oliveira, Cristiano de Pádua Milagres, & Ramos, Mara Regina Samensatto. (2019). Application of indices for water resource systems stress assessment. RBRH, 24, e7. epub February 18, 2019. https://dx.doi.org/10.1590/2318-0331.241920180106

Giambiagi, F., Castro, L. B., Hermann, J., & Villela, A. (2016). Economia Brasileira Contemporânea.

Grabowski, Z. J., Matsler, A. M., Thiel, C., McPhillips, L., Hum, R., Bradshaw, A., . . . Redman, C. (2017). Infrastructures as Socio-Eco-Technical Systems: Five Considerations for Interdisciplinary Dialogue. Journal of Infrastructure Systems, 23(4), 02517002. https://doi.org/10.1061/(ASCE)IS.1943-555X.0000383

Hagerman, S., Dowlatabadi, H., Satterfield, T., & Mcdaniels, T. (2010). Expert views on biodiversity conservation in an era of climate change. Global Environmental Change, 20(1), 192-207. https://doi.org/10.1016/j.gloenvcha.2009.10.005

Hertz, Tilman & Schlüter, Maja. (2015). The SES-Framework as boundary object to address theory orientation in social–ecological system research: The SES-TheOr approach. Ecological Economics. 116. 10.1016/j.ecolecon.2015.03.022.

IBGE - Municipal Populations (2019). [Database]. Retrieved September 5, 2019, from https://cidades.ibge.gov.br/brasil/sp/

Ludtke, R., & Burdge, R. (1970). Evaluation of the Social Impact of Reservoir Construction on the Residential Plans of Displaced Persons in Kentucky and Ohio. https://doi.org/10.13023/kwrri.rr.26

Morgan, M. G. (2014). Use (and abuse) of expert elicitation in support of decision making for public policy. Proceedings of the National Academy of Sciences, 111(20), 7176–7184. https://doi.org/10.1073/pnas.1319946111

Nobre, C. A., Marengo, J. A., Seluchi, M. E., Cuartas, L. A., & Alves, L. M. (2016). Some Characteristics and Impacts of the Drought and Water Crisis in Southeastern Brazil during 2014 and 2015. *Journal of Water Resource and Protection*, 8, 252. https://doi.org/10.4236/jwarp.2016.82022

Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. Science, 325(5939), 419–422. https://doi.org/10.1126/science.1172133

Ostrom, E. (2011). Background on the Institutional Analysis and Development Framework. The Policy Studies Journal, 39(1).

Phillips, D. (2014, November 18). Taps run dry in São Paulo drought, but water company barely shrugs. Retrieved September 6, 2019, from https://www.washingtonpost.com/world/taps-run-dry-in-sao-paulo-drought-but-water-company-barely-shrugs/2014/11/17/

Porto, R. L., Porto, M. F. A., & Palermo, M. (2014). Ponto de vista. A ressurreição do volume morto do sistema Cantareira na Quaresma. Revista DAE, 62(197), 18–25. https://doi.org/10.4322/dae.2014.131

Richards, R.C., J. Rerolle, J. Aronson, P.H. Pereira, H. Gonçalves, P.H.S. Brancalion Governing a pioneer program on payment for watershed services: stakeholder involvement, legal frameworks and early lessons from the Atlantic forest of Brazil Ecosyst. Serv., 16 (2015), pp. 23-32

Richards, R. C., Kennedy, C. J., Lovejoy, T. E., & Brancalion, P. H. (2017). Considering farmer land use decisions in efforts to 'scale up' Payments for Watershed Services. Ecosystem Services, 23, 238-247. https://doi.org/10.1016/j.ecoser.2016.12.016

Rodrigues, D. B. B., Gupta, H. V., Serrat-Capdevila, A., Oliveira, P. T. S., Mario Mendiondo, E., Maddock, T., & Mahmoud, M. (2015). Contrasting American and Brazilian systems for water allocation and transfers. Journal of Water Resources Planning and Management, 141(7), 04014087. https://doi.org/10.1061/(ASCE)WR.1943-5452.0000483

Rosenstein-Rodan, P. "Problems of Industrialization in Eastern and South Eastern Europe." Economic Journal 53 (1943).

Ruggiero, P. G., Metzger, J. P., Tambosi, L. R., & Nichols, E. (2019). Payment for ecosystem services programs in the Brazilian Atlantic Forest: Effective but not enough. Land Use Policy, 82, 283-291. https://doi.org/10.1016/j.landusepol.2018.11.054

Seixas, S. R., Höeffel, J. L., Renk, M., & Silva, B. N. (2012). Quality of Life and Socioenvironmental Degradation in the Cantareira System Environmental Protected Area, SP, Brazil. Urban Studies Research, 2012, 1-9. https://doi.org/10.1155/2012/918931

USAID - Conducting Key Informant Interviews. (1996). In Performance Monitoring and Evaluation. USAID.

Usher, W., & Strachan, N. (2013). An expert elicitation of climate, energy and economic uncertainties. Energy Policy, 61, 811-821. https://doi.org/10.1016/j.enpol.2013.06.110

Wang, Q., Du, Y., Su, Y., & Chen, K. (2012). Environmental Impact Post-Assessment of Dam and Reservoir Projects: A Review. Procedia Environmental Sciences, 13, 1439-1443. https://doi.org/10.1016/j.proenv.2012.01.135

Williams, D. (2013). International Development and Global Politics History, Theory and Practice.

Wittmayer, J., Backhaus, J., Avelino, F., Pel, B., Strasser, T., Kunze, I., & Zuijderwijk, L. (2019). Narratives of change: How social innovation initiatives construct societal transformation. Futures, 112, 102433. https://doi.org/10.1016/j.futures.2019.06.005

APPENDIX A

EXAMPLES OF INTERVIEW QUESTIONS

- **Context:**
  - What is your work/connection/history within the region?
  - What has changed in the region?
- **Narrative:**
  - How do you envision the future of the region?
  - What role do you see yourself playing in the creation of this future?
  - How much control do you have in creating this future?
- **Behavioral**
  - What resources are available (exist) that you know of, to assist you in developing (creating) your vision for the future?
  - What resources/support would you like to see implemented?
  - Do the viewpoints of your neighbors, colleagues, and/or friends differ from yours?
  - How likely are you to/what is your commitment to this idea?
  - Do you have alternative plans/ideas?
- **Structural/Knowledge-Based**
  - What role should other sectors play in creating the future? Government, Local Farmers/Landowners, Experts/Scientists?
  - What is your greatest strength/advantage toward creating your vision of the future?
  - What is your biggest obstacle in creating your vision future? What are some of the challenges you may face?
  - What would you consider a successful future for the region?

APPENDIX B

IRB APPROVAL LETTER

EXEMPTION GRANTED

Mary Jane Parmentier
Future of Innovation in Society, School for the
480/727-4518
MJ.Parmentier@asu.edu

Dear Mary Jane Parmentier:

On 6/8/2018 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	A Transdisciplinary Approach to Mapping Sustainable Futures for the Cantareira Region of São Paulo
Investigator:	Mary Jane Parmentier
IRB ID:	STUDY00008324
Funding:	Name: US Agency for International Development (USAID)
Grant Title:	
Grant ID:	
Documents Reviewed:	• Protocol.docx, Category: IRB Protocol; • Scholar Award Letter, Category: Grant application; • IPE Acceptance Letter, Category: Grant application; • Sample Workshop Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Sample Workshop Agenda, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Consent Form.pdf, Category: Consent Form;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 6/8/2018.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Cody Staats
       Farah Najar Arevalo
       Thomaz Carvalhaes
       Cody Staats

BIOGRAPHICAL SKETCH

Cody Bertrand Staats was born in Kingston, New York on July 28th, 1990. He received his elementary education at Kerhonkson Elementary, Valley Horizon Elementary, and Crane Middle School. His secondary education was completed at Kofa High School, in Yuma, Arizona. In 2008, Cody entered Arizona State University, Tempe, Arizona majoring in Economics. After completion of his first year of studies, he embarked on an eclesiastical mission to the Brazilian states of Paraná and São Paulo. It was there that he gained a love for the culture and people of Brazil and an appreciation of the intricacy of complex systems. Returning in 2012, he recommenced his studies, adding a certificate of Brazilian Studies to his academic schedule. He graduated Summa Cum Laude in 2014. In 2015 he began work at the Center for Science and the Imagination at Arizona State University, as a Program Coordinator in Business and Operations. With support from his colleagues and leaders at CSI, as well as a fellowship funded by USAID and ASU's Global Development Research, he traveled to Brazil in the summer of 2018 to conduct research on the narrative imaginaries of individuals in the Cantareira Region of São Paulo and the impact they have on developing sustainable future