

REPORT OF THE ETHNOGRAPHIC FIELD SCHOOL IN BELIZE (SUMMER 2024)



CENTER FOR APPLIED ANTHROPOLOGY, NORTHERN KENTUCKY UNIVERSITY

REPORT OF THE ETHNOGRAPHIC FIELD SCHOOL IN BELIZE (SUMMER 2024)

CENTER FOR APPLIED ANTHROPOLOGY, NORTHERN KENTUCKY UNIVERSITY

Prepared, published, and copyrighted by the Center for Applied Anthropology, Northern Kentucky University, May 2025.

Douglas William Hume¹, Lea B. Baker², Corinne R. Campbell², Claire H. Croxton², Tristan T. Cruz², Rebecca M. Eder², Eric Mendez³, Manuel Perez³, Maria Stone², Ripley E. Winters², and Jessica Lott³.

¹ Primary investigator, ethnographic field school director, report author, data analysis

² Ethnographic field school student participants

² Ethnographic field school student interns

³ Onsite administrator and research consultant

Primary Investigator Contact Information

Douglas W. Hume Ph.D., Director

Center for Applied Anthropology

Northern Kentucky University

1 Nunn Drive, Landrum 230

Highland Heights, Kentucky 41099, USA

humed1@nku.edu

001-859-572-5702

<http://nku.edu/cfaa>

Table of Contents

Acknowledgements.....	i
Introduction.....	1
Background	1
Methods	2
Community Development.....	3
Demographics.....	3
COVID-19's Impact on the Community	3
Job Opportunities Inside the Community	4
Job Opportunities Outside the Community	5
Job Opportunities Inside the Community for Women.....	6
Job Opportunities Outside the Community for Women	7
Children's Opportunities Beyond Child Labor	7
Garbage Disposal Practices	8
Farmers Association Impacts.....	9
Alcohol and Drug Use Support	10
Climate Change Effects	11
Wildfire Impacts	12
Pregnancy and Birth Services	13
Non-Doctor/Pharmacy Medicine	14
Types and Illnesses and Causes.....	15
Sugar Cane Farming	19
Farmer's Concerns with Associations.....	19
Will Farmers Continue Farming Sugar Cane?	20
Network Analysis.....	21
Fertilizer Information Source Network	22
Herbicide Information Source Network.....	23
Pesticide Information Source Network.....	24
Sugar Cane Variety Information Source Network.....	24
Combined Information Source Network.....	25
Summary of the Information Sharing Networks Analyses	26
Conclusion	27
Appendices	
Appendix I: Informed Consent Statement – English	29
Appendix II: Informed Consent Statement – Spanish	30
Appendix III: Ethnographic Interview Schedule (Procedure), Part I	31
Appendix IV: Ethnographic Interview Schedule (Procedure), Part II	32
Appendix V: Fertilizer Information Source Network	33
Appendix VI: Herbicide Information Source Network	34

Appendix VII: Pesticide Information Source Network	35
Appendix VIII: Sugar Cane Variety Information Source Network	36
Appendix IX: Combined Information Source Network	37
Bibliography.....	39

Acknowledgements

We would like to acknowledge the partnerships with the following agencies and organizations that made this field school and research possible:

Belize Sugar Cane Farmers Association
34 San Antonio Road
Orange Walk Town, Belize, Central America
bscfacom.management@gmail.com
011-501-322-3670

Cooperative Center for Study Abroad
Western Kentucky University
Honor College International Center
3rd Floor, Suite 3041
1906 College Heights Blvd
Bowling Green, KY 42101
info@ccsa.cc
001-270-745-4512

Institute for Social and Cultural Research
National Institute of Culture and History
Corner Constitution Drive
Belmopan City, Belize, Central America
rolando.cocom@nichbelize.org
011-501-822-3307

Jessia Lott, Ph.D., Onsite Administrator and Research Consultant
Northern Kentucky University
1 Nunn Drive, LA 246
Highland Heights, KY 41099
lottj1@nku.edu
001-859-572-7845

Jungle River Tours
20 Lover's Lane
Orange Walk Town Belize, Central America
lamanaimayatour@btl.net
011-501-670-3035

Office of Education Abroad
Northern Kentucky University
1 Nunn Drive, University Center 330
Highland Heights, KY 41099, USA
studyabroad@nku.edu
001-859-572-6908

Progressive Sugar Cane Producers Association
Philip Goldson Highway
Orange Walk, Belize, Central America
alotpscpa@gmail.com
001-859-614-1568

Sugar Industry Research and Development Institute
Mile 66-1/2 Phillip Goldson Highway
Buena Vista Village, Corozal District, Belize, Central America
sirdi.belize@gmail.com
011-501-677-4734

We sincerely thank the village councils and community members of San Estevan, San Juan, San Lazaro, and Yo Creek for participating in interviews and allowing us to learn from them about their communities.

Introduction

This report documents the findings of the Ethnographic Field School in Belize organized by the Center for Applied Anthropology (CfAA) at Northern Kentucky University (NKU) in Orange Walk District, Belize, during the summer of 2024. Ethnographic interviews were conducted within the communities of San Estevan, San Jose, San Lazaro, and Yo Creek in cooperation with the Sugar Industry Research and Development Institute (SIRDI), Belize Sugar Cane Farmers Association (BSCFA), Progressive Sugar Cane Producers Association (PSCPA), and the four communities within which interviews took place. This field season's research focused on the following topics: job opportunities inside and outside of the community, including those for women, children's opportunities beyond child labor, alcohol/drug use, pregnancy and birth services, causes and types of illnesses, climate change, farmers association investment, garbage disposal, COVID's effect on the community, farmers association impacts, wildfires, and networks of information sharing. This report presents the preliminary findings of the 2024 field season and recommends research topics for the next field season.

Background

While the educational aim of the ethnographic field school is to train students in basic ethnographic methods, the applied purpose of the field school is to collect and analyze data that can then be used by SIRDI, BSCFA, PSCPA, and community members in the development of programs for the betterment of the sugarcane farming communities in northern Belize. As written on the field school's web site (CfAA 2022):

This course immerses students in Belizean culture and trains them in contemporary anthropological field methods. Students will gain valuable research skills (e.g., ethnographic interviewing and qualitative data analysis) to apply anthropology in their future careers (e.g., applied anthropology or other social/behavioral discipline), an appreciation for Belizean cultural diversity, and further their personal growth. While in Belize, students will be primarily engaged in guided applied ethnographic fieldwork. Students will learn about the local culture by doing participant-observation and conducting ethnographic interviews in a community-based research project. Students will learn research ethics, unobtrusive observation, participant observation, field note writing and coding, ethnographic and life history interviewing, ethnolinguistic data collection, community mapping, rapid assessment procedures, qualitative data analysis, and other ethnographic methods in addition to basic ethnographic writing. After successful completion of this course, students will have:

- developed a basic understanding of Belizean culture,
- formulated an understanding of ethical and validity issues in ethnographic research,
- practiced skills in research design and ethnographic methods of data collection,
- applied basic ethnographic research methods in a non-western culture,
- engaged in a community-based research project, and
- analyzed ethnographic data resulting in an ethnographic monograph.

Since the literature review was written for last season's report (Hume et al. 2024), additional scholarly research related to this field school's research has been published. One article

(Leonardo et al. 2024) investigates factors influencing Belizean sugarcane farmers' adoption intentions regarding organic fertilizers, revealing that perceived health risks and environmental concerns significantly impact attitudes and subjective norms, which in turn affect adoption intentions, suggesting that enhancing awareness and positive attitudes towards organic fertilizers can promote sustainable sugarcane farming in Belize. Another article (Baines and Zarger 2024) argues for prioritizing community goals in heritage projects with Maya communities in Belize, demonstrating how collaborative ethnographic approaches can advance decolonial community archaeology and suggesting that a more nuanced, fluid understanding of heritage can be achieved through such collaborations. Finally, the field school director published an article (Hume 2025) describing how the Ethnographic Field School in Belize trains American and Belizean students in ethnographic research methods, contributing to community development by sharing research findings with agencies and organizations while fostering students' personal growth and cultural understanding for future careers. An important scholarship about Belize's people and natural resources continues to be published.

Methods

As in previous field seasons, upon arrival in the villages of San Estevan, San Juan, San Lazaro, and San Pablo, Antonio Novelo (Jungle River Tours) introduced the field school members to village council representatives and assisted Douglas Hume in explaining our collaborative research project to gain local approval for our presence in the community. Each village council gave their permission and was supportive of our efforts. We presented printed copies of last year's report (Hume et al. 2024) to the councils of San Estevan, San Lazaro, San Pablo, and Yo Creek. In addition, we printed business cards with shortened URL links to earlier reports to give to individual community members.

Participants of the field school (Lea B. Baker, Corinne R. Campbell, Claire H. Croxton, Tristan T. Cruz, Rebecca M. Eder, Eric Mendez [Belizean Intern], Manuel Perez [Belizean Intern], Maria Stone, and Ripley E. Winters) conducted house-to-house interviews in a census sampling methodology. Jessica Lott (Assistant Professor of Anthropology at Northern Kentucky University) was the onsite administrator and a research consultant before, during, and after fieldwork. The Cooperative Center for Study Abroad hired Antonio Novelo (Jungle River Tours) as the field school's land agent. He served as both a cultural liaison and research assistant during field research. Mr. Novelo explained our general purpose and introduced students to community members. Students would then present the informed consent statement in English (Appendix I) and Spanish (Appendix II). Upon an informant's consent to be interviewed, the students would have the informant sign a copy of the informed consent statement (on file) and offer an unsigned copy for the informant's records.

Interviews were conducted on the informant's property (e.g., porch, house, et cetera) with a pair of students, one serving as the primary interviewer and the other as an observer. The standard method used for this research was the ethnographic interview (Spradley 2016), which is informant-centered (Levy and Hollan 1998) rather than interviewer-centered. Interviews were from five minutes to an hour, depending upon the informant's time constraints and willingness to be interviewed by the students. Ideally, the interview would flow naturally from topic to topic. It would end when the interviewer or the informant perceived a natural stopping point or when the informant no longer seemed comfortable or interested in continuing the interview (Levy and Hollan 1998).

All informants were asked about job opportunities inside and outside of the community, including those for women, children's opportunities beyond child labor, alcohol/drug use, pregnancy and birth services, causes and types of illnesses, climate change, farmers association investment, garbage disposal, COVID's effect on the community, and wildfires (see Appendix III: Ethnographic Interview Schedule [Procedure], Part I). Self-identified sugar cane farmers were also asked about farmers association investment and information-sharing networks (see Appendix IV: Ethnographic Interview Schedule [Procedure], Part II). Students digitally recorded interviews and took field notes during and after each interview.

Data from each interview were aggregated and analyzed upon returning from the field. After analysis, the digital audio recordings were securely erased. Douglas Hume then conducted statistical and network analyses and compiled this field report.

Community Development

Demographics

A total of 233 informants were interviewed: 60 (26%) in San Estevan, 40 (17%) in San Jose, 66 (28%) in San Lazaro, and 67 (29%) in Yo Creek. The median age of the informants was 40 years, with a minimum age of 18 and a maximum age of 89 years. One hundred and twenty-eight (56.1%) of the informants were female, and 100 (44%) were male. Of the 233 total informants, 40 (17%) self-identified as sugar cane farmers.

COVID-19's Impact on the Community

When community members were asked about the impact that the COVID-19 pandemic had on their community, their responses centered on themes of health and safety, economic impacts, education, and community adaptation. The keywords used in their responses included: sickness (21 mentions), deaths (19), isolation (6), infections (6), vaccines (6), curfew (5), masks (5), online classes (4), quarantine (2), and social distancing (2).

Health and Safety

The COVID-19 pandemic profoundly affected the health and safety of community members. Community members reported that they had contracted the virus, with some experiencing severe symptoms and long-term health effects. For instance, one interviewee shared that their sister caught COVID-19 and continues to suffer from health problems. Additionally, the pandemic instilled a pervasive sense of fear and caution, leading to reduced social interactions. An elderly interviewee mentioned that they rarely go out now due to the fear of contracting the virus, illustrating the heightened anxiety and caution that became a part of daily life for community members.

Economic Impacts

The economic repercussions of the pandemic were significant, leading to widespread job losses and financial difficulties. Community members reported that they had to find alternative ways to earn a living. For example, community members started selling food or other goods online to meet ends. One interviewee noted that they lost their job during the lockdown and had to start selling

food online to make ends meet. They said it was difficult, but they managed to get through it. This anecdote underscores the resilience and adaptability of individuals facing economic hardship in northern Belize's sugar cane farming communities. Business closures further worsened the economic challenges. One interviewee mentioned that the lockdowns and business closures made it difficult for people to work and earn money, highlighting the broader economic impact on the community.

Education

The shift to virtual learning presented challenges for children and their parents. Parents reported struggling to support their children's education due to lack of resources and knowledge. One parent mentioned that their child struggled with virtual classes and fell behind in their education. She said, "My child struggled with virtual classes. She was supposed to be learning to read, but without proper support, she fell behind. It was really frustrating for both of us." Families faced difficulties in adapting to remote education. The transition to virtual learning also affected children's literacy and overall educational progress. An interviewee noted that their child, who should have been learning to read, could not do so effectively through virtual classes, which was one type of educational challenge brought on by the pandemic.

Community Adaptation

Despite the challenges, the community showed resilience and adaptability. Community members reported becoming more self-sufficient and entrepreneurial during the pandemic. For example, one interviewee mentioned that people started selling food and other items online to cope with the economic challenges. The community also found new ways to support each other. One interviewee shared, "We had to find new ways to support each other. I started using home remedies and relied on my neighbors for help. It brought us closer together in a way." A sense of solidarity and mutual support appeared within the community, and how people adapted to the new circumstances and supported one another through challenging times.

Job Opportunities Inside the Community

When community members were asked about job opportunities, their responses centered on limited job opportunities, entrepreneurship, and self-sufficiency. The keywords used in their responses included cane farming (170 mentions), farming (81), can cutting (55), construction (47), agriculture (13), driving (10), cleaning (10), cattle ranching (6), fumigation (6), driver (6), shop work (6), online jobs (5), farmer (5), crop farming (3), masonry (3), and teacher (3).

Limited Job Opportunities

Within the community, job opportunities are somewhat limited, with many individuals engaging in domestic work, such as housekeeping, babysitting, and cleaning houses. One interviewee shared, "I work as a housekeeper for a family in the village. It's not much, but it helps me support my family." Many rely on domestic work as a primary source of income.

Small-scale construction projects also employ some community members. These projects include building and repairing houses and other structures. An interviewee mentioned, "I do construction work, building and repairing houses. It's hard work, but it's what I know how to do." While

opportunities for construction are available locally, they are also competing with other communities (Mennonites).

Farming and agriculture, particularly sugarcane farming, are significant sources of employment. One community member noted, “Most of us here are involved in sugarcane farming. It’s a tough job, but it’s our main source of income.” Many community members engage in planting, harvesting, and other related activities.

Some community members have also started small businesses selling food, snacks, and other goods. This became more common during the pandemic as people looked for alternative sources of income.

Entrepreneurship and Self-Sufficiency

The pandemic increased online sales, with many community members selling food and other items through social media and other online platforms. One interviewee mentioned, “I began selling clothes and other items on social media. It was a new experience, but it helped me get through the tough times.”

Others have opened small shops or stalls selling groceries, clothes, and other items. An interviewee shared, “I opened a small grocery shop in the village. It’s been a good way to earn a living and serve the community.” This has provided a source of income for those who lost their jobs during the pandemic.

Job Opportunities Outside the Community

When community members were asked about job opportunities outside their community, their responses centered on diverse job opportunities and commuting to work. The keywords used in their responses included: construction (69 mentions), shops (19), office jobs (13), banks (12), call centers (11), stores (9), teachers (12), farming (4), call center jobs (4), business (3), restaurants (3), taxi (3), cane cutting (3), government (3), cleaning (3), factories (2), cane factory (2), welding (2), mechanics (2), bakery (2), security (2), bank tellers (2), and coconut farmers (2).

Diverse Job Opportunities

Many community members find employment opportunities outside their immediate locality, engaging in various professions. Teaching and education are common career paths, especially for women, with most securing jobs as teachers in nearby towns and cities.

Office work is another prevalent job category, with opportunities available in businesses such as banks, credit unions, and other financial institutions. An interviewee mentioned, “I found a job as a secretary in a bank in Orange Walk. It’s a good job, and it helps me support my family.” Both men and women take on these roles.

Construction and manual labor jobs are significant sources of employment, often found in larger cities and towns. One community member noted, “I work in construction in Belize City. It’s hard work, but it pays well, and I can provide for my family.” These roles include construction, masonry, and other forms of manual labor.

The retail and service industry also offers job opportunities, with some community members working in shops, restaurants, and other service-related roles. An interviewee shared, “I work as a cashier in a store in town. It’s not the best job, but it’s what I could find.” Service jobs include positions such as cashiers, waitstaff, and store attendants.

For those with higher education and specialized skills, there are opportunities in professional roles such as nursing, secretarial work, and other specialized office positions. One interviewee mentioned, “I trained as a nurse and now work in a hospital in the city. It’s a demanding job, but it’s rewarding to help people.”

Commuting for Work

Many community members commute daily to nearby towns and cities for work, traveling to places like Orange Walk and Belize City. This daily commute is a common aspect of life for those seeking employment outside the community. However, the need to commute for work significantly impacts family life, as parents may spend long hours away from home. This is particularly challenging for families with young children, as the extended absence of parents can affect family dynamics and childcare arrangements.

Job Opportunities Inside the Community for Women

When community members were asked about what job opportunities existed inside their community for women, their responses centered on the theme of common job opportunities. The keywords used in their responses included domestic work (19 mentions), house cleaning (5), cooking (5), babysitting (4), teacher (3), selling clothes (3), selling food (3), working in homes (3), stores (3), housekeeping (3), restaurants (2), shops (2), gas station attendant (2), washing clothes (2), housework (2), shop keeping (2), cashiers (2), and cleaning houses (2).

Common Job Opportunities

Within the community, many women engage in domestic work, such as housekeeping, babysitting, and cleaning houses. Domestic work is one of the most prevalent job opportunities available for women.

Some women have started small businesses selling food, snacks, and other goods, especially during the pandemic, as they looked for alternative sources of income. Women often run small shops or stalls selling groceries, clothes, and other items.

Childcare is another common job for women, with many taking care of children for families who work outside the community. One interviewee noted, “I take care of children for families who work outside the village. It’s a steady job, and I enjoy spending time with the kids.” This provides a source of income and serves the community’s needs.

The pandemic increased online sales, with many women selling food and other items through social media and other online platforms. Women have also started home-based businesses, such as baking and selling pastries, to support their families.

Job Opportunities Outside the Community for Women

When community members were asked about job opportunities for women outside their community, their responses centered on the same themes as our more general question about jobs outside the community—diverse job opportunities and commuting to work. The keywords used in their responses included: office jobs (25 mentions), domestic work (16), stores (11), housekeeping (11), secretary (9), babysitting (8), cashier (7), call center (5), waitress (5), study (5), cooking (4), nurses (4), teacher (3), and construction (2).

Diverse Job Opportunities

Several women community members find employment opportunities outside their immediate locality, engaging in various professions. One interviewee shared, “I work as a teacher in a nearby town. It’s a stable job, and I enjoy working with the children.” Teaching and education are common career paths, especially for those with higher education, providing a stable source of income.

Office work is another prevalent job category, with opportunities available in roles such as secretaries, clerks, and administrative assistants. These jobs are found in various businesses, including banks, credit unions, and other financial institutions.

The retail and service industry also offers job opportunities, with some women working in shops, restaurants, and other service-related roles. One interviewee shared, “I work as a cashier in a store in town. It’s not the best job, but it’s what I could find.” These jobs include cashiers, waitstaff, and store attendants.

For those with higher education and specialized skills, there are opportunities in professional roles such as nursing, secretarial work, and other specialized office positions. One interviewee mentioned, “I trained as a nurse and now work in a hospital in the city. It’s a demanding job, but it’s rewarding to help people.”

Women also find jobs in housekeeping and domestic work outside the community, often working in private homes or hotels. An interviewee noted, “I work as a housekeeper in a hotel in the city. It’s hard work, but it pays the bills.”

Commuting for Work

Many women commute daily to nearby towns and cities for work, traveling to places like Orange Walk and Belize City. This daily commute is a common aspect of life for those seeking employment outside the community. However, the need to commute for work significantly impacts family life, as women may spend long hours away from home. This is particularly challenging for families with young children, as the extended absence of parents can affect family dynamics and childcare arrangements.

Children’s Opportunities Beyond Child Labor

When community members were asked about opportunities for children outside of child labor, their responses centered on educational opportunities, recreational activities, cultural and community programs, and extracurricular activities. The keywords used in their responses

included: school (39 mentions), sports (21), football (21), church (18), library (13), summer camp (7), drumming (6), scholarships (3), cadet core (2), cleaning (2), and cooking (2).

Educational Opportunities

Children in the community attend school, a primary activity outside of work. One parent shared, “My children go to school, and we try to make sure they keep up with their studies, even though it was tough during the pandemic with virtual learning.” Education is highly valued, and efforts are made to ensure children continue their studies.

Recreational Activities

Many children participate in sports, including football (soccer), basketball, and volleyball. These activities are often organized through local teams and tournaments. One parent mentioned, “My son plays football in a local team, and they have tournaments every few months.” It’s a great way for him to stay active and make friends.” Additionally, some children are involved in football academies, which provide structured training and opportunities to compete in tournaments. An interviewee noted, “There’s a football academy in our area, and my child attends training sessions there. It’s well-organized and helps them improve their skills.” The community also organizes various sports tournaments, providing children opportunities to engage in healthy competition and physical activity. “We have community sports tournaments, and all the kids get really excited about them. It’s a big event for everyone,” shared another community member.

Cultural and Community Programs

There are programs focused on preserving and promoting local culture, such as Maya cultural activities. These programs help children learn about their heritage and participate in traditional practices. One interviewee emphasized, “We have programs that teach children about our Maya heritage. It’s important for them to know where they come from and keep our traditions alive.” Children also participate in community events and festivals, which provide opportunities for social interaction and cultural engagement.

Extracurricular Activities

Some children are involved in scouting programs or police cadets, which offer structured activities, leadership training, and community service opportunities. One parent shared, “My daughter is part of the police cadets. They do a lot of activities and learn about leadership and community service.” Various church groups also organize activities for children, including Bible study groups, Sunday school, and youth groups. An interviewee mentioned, “Our church has a youth group that my kids attend. They do Bible studies and other activities that keep them engaged and learning.”

Garbage Disposal Practices

When community members were asked how garbage is disposed of within the community, their responses centered on collection services, alternative disposal methods, and challenges and issues. The keywords used in their responses included garbage truck (32 mentions), burn garbage (11), designated dumping spot (3), no garbage truck (3), and children throwing garbage in open lots/streets (2).

Collection Services

The community has access to a local garbage collection service that operates for a small fee. This service is available to those who can afford it and prefer not to handle their garbage disposal. One interviewee shared, “We have a garbage truck that comes every Wednesday. We pay a small fee, and they take our trash away. It’s convenient, but not everyone can afford it.” The garbage collection service typically operates weekly, with pickups occurring on specific days, such as Wednesday.

Alternative Disposal Methods

Many community members resort to burning their garbage, especially when they have much organic waste, like leaves. This method is common due to the lack of comprehensive waste management infrastructure. One interviewee mentioned, “I burn my garbage, especially the leaves and organic waste. It’s easier than paying for the collection service, but I know it’s not the best for the environment.” Additionally, some people take their garbage to designated dump sites outside the village. This is often done by those who prefer not to pay for the collection service or have large amounts of waste to dispose of. An interviewee noted, “When I have a lot of garbage, I take it to the dump site outside the village. It’s a bit of a hassle, but it’s better than letting it pile up at home.”

Challenges and Issues

The fee for garbage collection, although small, can be a burden for some families. This leads to inconsistent use of the service and reliance on alternative methods like burning. One interviewee shared, “The fee for garbage collection is about \$5 to \$10, depending on the amount. It’s not much, but for some families, it’s still a lot. That’s why many people burn their trash instead.” Burning garbage and improper disposal at dump sites can lead to environmental issues, such as air pollution and health hazards from smoke and unregulated waste. Another interviewee emphasized, “The smoke from burning garbage can be a problem, especially for people with respiratory issues. We need better waste management solutions to protect our health and the environment.”

Farmers Association Impacts

When community members were asked about the impacts of the farmers’ associations within their community, their responses centered on financial assistance, agricultural support, training and workshops, and community development. The keywords used in their responses included: providing fertilizers and pesticides (10), community programs and projects (8), educational programs and workshops (7), financial aid and relief funds (5), issues with distribution and fairness (5), support for women farmers (4), selective aid and favoritism: (4), assistance with school programs (4), help with livestock and farming techniques (3), meetings and decision-making (3), infrastructure support (e.g., roads, parks) (3), job opportunities and recruitment programs (3), assistance with garbage disposal (3), and support during COVID-19 (2).

Financial Assistance

Farmers’ associations provide crucial financial assistance through small loans and grants. These funds help farmers purchase necessary supplies such as seeds, fertilizers, and herbicides. The interest rates on these loans are often low, making them accessible to small-scale farmers. One

interviewee shared, “The Farmers Association gave me a small loan to buy seeds and fertilizers. The interest rate was low, and it really helped me get through the planting season.”

Additionally, some associations offer fuel assistance to farmers, especially during the planting and harvesting seasons. This support helps reduce operational costs for farmers who rely on machinery. Another interviewee mentioned, “During the harvest, we received fuel assistance from the association. It made a big difference because fuel costs are high, and we need the machinery to harvest the crops.”

Agricultural Support

Associations distribute fertilizers and herbicides to farmers, either at a subsidized cost or for free. This support is crucial for maintaining soil fertility, controlling pests, and improving crop yields. One farmer noted, “We get fertilizers and herbicides from the association at a subsidized cost. It helps us maintain our fields and improve our yields.” Additionally, farmers’ associations sometimes provide access to machinery and equipment needed for farming, such as tractors, plows, and other essential tools. An interviewee shared, “The association provided us with access to a tractor for plowing our fields. It saved us a lot of time and effort.”

Training and Workshops

Farmers associations offer various training sessions and workshops to improve agricultural practices. For example, some associations provide workshops on beekeeping, teaching farmers how to manage beehives and produce honey. This provides an additional source of income for farmers. One participant mentioned, “I attended a beekeeping workshop organized by the association. Now I have a few beehives and produce honey, which adds to my income.” Associations also conduct training sessions on crop rotation, soil management, and sustainable farming techniques. These sessions help farmers improve their productivity and adopt environmentally friendly practices. An interviewee noted, “The training sessions on crop rotation and soil management were very informative. I’ve applied what I learned, and my crops are doing better.”

Community Development

Farmers associations sometimes invest in community infrastructure projects, such as building roads, schools, and community centers. These projects benefit the entire community and improve the overall quality of life. One community member shared, “The association helped build a new road in our village. It has made transportation much easier for everyone.” While the primary focus is on farmers, some associations also support non-farmers in the community. This includes educational programs, health services, and other community development initiatives. An interviewee mentioned, “Even though I’m not a farmer, the association’s educational programs have benefited my children. They offer scholarships and other support.”

Alcohol and Drug Use Support

When community members were asked about alcohol and drug use support within their community, their responses centered on the themes of limited local support services, external support services, and community and family support. The keywords used in their responses

included: Orange Walk (44 mentions), Alcoholics Anonymous (5), rehab center (4), counseling (4), Belize City (4), neighborhood watch (3), village chairman (2), and Corozal (2).

Limited Local Support Services

Many communities lack dedicated support services for individuals struggling with alcohol and drug use. This absence of local programs means those in need often seek help outside their immediate area. One interviewee shared, “We don’t have any dedicated support services for alcohol or drug use in our village. People have to go to the city if they need help.” While there is a general awareness of the issues related to alcohol and drug use, structured support systems are often missing within the community itself.

External Support Services

Some individuals seek help from rehabilitation centers located in nearby towns or cities. These centers provide structured programs for addiction recovery but accessing them can be challenging due to distance and transportation issues. One interviewee mentioned, “My cousin went to a rehab center in Orange Walk. It was hard for him to get there, but it was the only place he could find help.” In some areas, Alcoholics Anonymous (AA) meetings are available, offering peer support for those struggling with alcohol addiction. However, these meetings are not always accessible to everyone in the community. An interviewee noted, “There are AA meetings in town, but not everyone can attend them regularly. It’s a good resource, but it’s not always accessible.”

Community and Family Support

Individuals often rely on family and community members without formal programs for support. This includes emotional support, guidance, and sometimes financial assistance to seek professional help. One interviewee shared, “When my brother was struggling with alcohol, our family came together to support him. We didn’t have any formal programs, but we did our best to help him through it.” Some community members find support through church and religious groups, which may offer counseling and spiritual guidance to those dealing with addiction. Another interviewee mentioned, “Our church has been a great source of support for people dealing with addiction. They offer counseling and a sense of community that really helps.”

Climate Change Effects

When community members were asked about the effects of climate change within their community, their responses centered on changes in weather patterns, impact on agriculture, and health and livelihoods. The keywords used in their responses included very hot/extreme heat (24 mentions), drought (23), dry season (11), flooding (8), too much rain (4), unpredictable weather (4), and wildfires (3).

Changes in Weather Patterns

Many community members have noticed a significant temperature increase over the past few years. This has led to longer and more intense heatwaves, affecting people and crops. One interviewee shared, “It’s been getting hotter every year. The heat is unbearable, and it’s affecting our crops and our health.” The community has also experienced extended droughts, which have

had a detrimental impact on agriculture. “We used to have regular rainfall, but now we go months without any rain. Our crops are dying, and we don’t know what to do,” mentioned another interviewee.

Additionally, rainfall patterns have become more unpredictable, with some years experiencing excessive rain and others facing severe shortages. This inconsistency makes it difficult for farmers to plan their planting and harvesting schedules. An interviewee noted, “One year we have too much rain, and the next year we have none. It’s impossible to plan our farming activities.”

Impact on Agriculture

The increased temperatures and extended droughts have led to significant crop damage. Farmers report lower yields and, in some cases, complete crop failures. One farmer shared, “Last year, we lost almost all our crops because of the drought. This year, the heat is killing our plants before they can even grow.” The lack of consistent rainfall and the intense heat contribute to soil degradation, making it harder for crops to grow. “The soil is so dry and hard. It’s difficult to grow anything, and we have to use more fertilizers and water, which we can’t always afford,” mentioned another farmer. Changes in weather patterns have also led to an increase in pest activity. Warmer temperatures and irregular rainfall create favorable conditions for pests, which can devastate crops. An interviewee noted, “The pests are worse than ever. They destroy our crops, and we have to spend more on pesticides, which adds to our costs.”

Health and Livelihoods

The extreme heat and poor air quality from wildfires and burning garbage have led to health issues, particularly respiratory problems. Vulnerable populations, such as the elderly and children, are especially affected. One community member shared, “The heat and smoke from burning garbage are making people sick. We have more respiratory problems, especially among the elderly and children.” The adverse effects on agriculture directly impact on the community’s economy. Many people rely on farming for their livelihoods, and reduced crop yields mean less income and increased financial strain. An interviewee mentioned, “Farming is our main source of income, and with the crops failing, we’re struggling to make ends meet. It’s a tough situation for everyone.”

Wildfire Impacts

When community members were asked about the effects of wildfires within their community, their responses centered on changes in weather patterns, impact on agriculture, and health and livelihoods. The keywords used in their responses included smoke (26), heat (8), loss of cane (4), burning cane fields (4), drought (3), and breathing problems (2).

Causes of Wildfires

One of the primary causes of wildfires in the community is the practice of burning cane fields. Farmers burn the fields to clear them for the next planting season, but these fires can sometimes get out of control. One interviewee shared, “We burn our cane fields to prepare for the next planting season, but sometimes the fires get out of control and spread to other areas.”

Additionally, extended periods of drought and high temperatures create dry conditions that make it easier for fires to start and spread. The lack of rain exacerbates the risk of wildfires. Another interviewee mentioned, “The drought has made everything so dry. It’s like a tinderbox out there, and it doesn’t take much for a fire to start and spread.”

Impact on Agriculture

Wildfires can cause significant damage to crops, particularly sugarcane. When fires spread uncontrollably, they can destroy entire fields of cane, leading to substantial financial losses for farmers. One farmer shared, “Last year, a wildfire destroyed my entire cane field. It was devastating, and I lost a lot of money.” In addition to sugarcane, other crops, such as corn and vegetables, can also be affected by wildfires. The destruction of these crops further impacts the livelihoods of farmers and the community’s food supply. An interviewee noted, “It’s not just the cane that gets affected. We also lost our corn and vegetable crops to the fires.”

Environmental and Health Effects

Wildfire smoke negatively impacts air quality, leading to respiratory issues for community members. Vulnerable populations, such as the elderly and children, are particularly affected by poor air quality. One community member mentioned, “The smoke from the fires makes it hard to breathe. My children and elderly parents have been having respiratory problems because of it.” Frequent wildfires can also lead to soil degradation, making growing crops harder. The loss of vegetation increases the risk of soil erosion. An interviewee shared, “The fires have damaged the soil, and it’s becoming harder to grow our crops. The land is just not as fertile as it used to be.”

Community Response and Adaptation

Some farmers take measures to control fires, such as burning fields in the evening when temperatures are lower, and the risk of the fire spreading is reduced. However, these measures are not always effective. One farmer noted, “We try to burn our fields in the evening when it’s cooler, but sometimes the fires still get out of hand.” In the aftermath of wildfires, community members often come together to support affected farmers. This includes helping with replanting crops and providing financial assistance. An interviewee shared, “After the fire, our neighbors came together to help us replant our crops. It was a tough time, but the community support made a big difference.”

Pregnancy and Birth Services

When community members were asked about the availability of pregnancy and birth services within their community, their responses centered on the themes of limited local services, the need to travel for comprehensive care, and community support. The keywords used in their responses included clinic (92 mentions), hospital (30), mobile clinic (11), vaccines (6), health center (5), doctor (4), nurse (3), medication (2), and contraceptives (2).

Limited Local Services

The community relies heavily on mobile clinics that visit monthly to provide basic health services, including vaccinations for children and prenatal care for pregnant women. These clinics are crucial

for maintaining maternal and child health without permanent healthcare facilities. One interviewee shared, “We have a mobile clinic that comes once a month. They give vaccinations to the children and check on pregnant women. It’s really helpful because we don’t have a hospital here.”

Additionally, some villages have community health workers who assist with basic health needs and provide support during mobile clinic visits. They also offer health education and guidance to pregnant women. An interviewee mentioned, “Our village has a community health worker who helps with basic health needs. She is always there during the mobile clinic visits and provides health education to the women.”

Need to Travel for Comprehensive Care

For labor and delivery, women often need to travel to nearby towns or cities, such as Orange Walk, to access hospital services. This trip can be challenging, especially for those without reliable transportation. One interviewee noted, “When it’s time to give birth, we have to go to Orange Walk. It’s a bit of a journey, but that’s where the hospital is. We don’t have the facilities here for labor and delivery.” Any complications during pregnancy or childbirth require travel to hospitals where specialized care is available. This includes access to surgeries, emergency care, and advanced medical interventions. Another interviewee shared, “If there are any complications, we need to go to the hospital in town. It’s not easy, especially if you don’t have a car, but it’s necessary for the safety of the mother and baby.”

Community Support

In the absence of extensive healthcare services, pregnant women often rely on family and community members for support. This includes help with transportation to medical appointments, childcare, and household duties during pregnancy and postpartum periods. One interviewee emphasized, “During my pregnancy, my family helped me a lot. They took care of my other children and helped with the housework. The community really comes together to support pregnant women.”

Non-Doctor/Pharmacy Medicine

When asked about remedies not from the doctor or pharmacy, the informants told us about several home remedies they used.

- *Oregano* is commonly used to treat colds, coughs, and stomach issues. It is prepared by boiling and consumed as a tea or poultice for swelling and pain. One community member shared, “I use oregano for my colds and coughs. I boil it and drink the tea, and it really helps with my symptoms.”
- *Garlic* is another popular remedy for treating colds, high blood pressure, and cholesterol. It can be consumed raw, boiled, or mixed with honey. An interviewee mentioned, “Whenever I feel a cold coming on, I eat raw garlic or mix it with honey. It helps boost my immune system and keeps me healthy.”
- *Lemongrass* is used for treating fevers and digestive issues. It is typically boiled and consumed as a tea. One person noted, “Lemongrass tea is my go-to remedy for fevers and digestive issues. It’s soothing and effective.”

- *Soursop leaves* are boiled to treat infections and reduce inflammation. The water is consumed as tea. An interviewee shared, “I boil soursop leaves and drink the tea to help with infections and inflammation. It’s a natural remedy that works well for me.”
- *Guava leaves* are boiled to treat diarrhea and stomach issues, and the water is consumed as tea. One community member mentioned, “When I have stomach issues, I boil guava leaves and drink the tea. It helps with diarrhea and settles my stomach.”
- *Honey* is widely used for treating coughs and sore throats. It is often mixed with other ingredients like garlic or lemon for added benefits. An interviewee shared, “For sore throats and coughs, I mix honey with lemon or garlic. It’s a natural remedy that provides relief and tastes good too.”
- *Fever grass* is used to treat fever and infections. It is boiled and consumed as a tea. One person noted, “Fever grass tea is what I use when someone in the family has a fever. It helps bring the fever down and fights infections.”
- *Lime* is used to treat sore throats and boost the immune system. It is mixed with honey or boiled with other herbs. An interviewee mentioned, “When I have a sore throat, I mix lime with honey and drink it. It soothes my throat and helps me feel better.”
- *Avocado leaves* are boiled and consumed as a tea to treat high cholesterol. One community member shared, “I use avocado leaves to help manage my cholesterol. I boil them and drink the tea regularly.”
- *Chaya* is used to treat various ailments and boost overall health. It is boiled and consumed as tea or added to food. An interviewee noted, “Chaya is a versatile plant. I use it in my cooking and also drink it as a tea for its health benefits.”
- *Aloe vera* is used to treat skin conditions and digestive issues. It can be applied directly to the skin or consumed as a juice. One person shared, “Aloe vera is great for treating burns and skin irritations. I also drink the juice to help with digestion.”
- *Cinnamon* is used to treat colds and digestive issues. It is boiled with other herbs and consumed as a tea. An interviewee mentioned, “I add cinnamon to my herbal teas when I have a cold. It helps with the symptoms and tastes great.”

Types and Illnesses and Causes

In the previous field season, informants were asked to free list types of illnesses and causes of illnesses. This field season, we asked informants to complete a free pile sort of both sets of types of illnesses and causes of illnesses on three-by-five cards. This data was analyzed using non-metric cluster analysis and multidimensional scaling.

Non-metric cluster analysis on free pile sort data groups items based on their perceived similarities, as determined by participants. The results typically show clusters of items that are frequently sorted together, revealing patterns in how people categorize and relate different types of illness and causes of illness. This helps us understand the underlying cognitive structures and cultural models influencing these categorizations.

Multidimensional scaling (MDS) on free pile sort data visualizes the perceived similarities between items by placing them in a spatial configuration. Items that are sorted frequently appear closer to each other in the resulting map, revealing the dimensions along which participants differentiate and categorize different types of illness and causes. This helps in understanding the cognitive and cultural structures underlying these categorizations.

Non-metric Cluster Analysis of Illness Types

Figure 1 below shows the results of the non-metric cluster analysis of the types of illness pile sort data. The circled area at the top is cardiovascular/metabolic illnesses. The next circled area shows arthritis and pain (a symptom rather than an illness). The next circled area on the upper left side is urologic illnesses. The next circled area on the upper left side is prostate and cancer, which are closely related to urologic illnesses. The next circled area in the upper-right-side are mosquito-borne illnesses and diarrhea (a symptom rather than an illness). The bottom circled area is respiratory illnesses.

The dendrogram from the non-metric cluster analysis groups types of illnesses based on their perceived similarities among informants. Here are the key clusters:

- Chronic Conditions: Obesity, diabetes, high blood pressure, high cholesterol, stroke, heart disease, arthritis, pain, kidney failure, gallbladder stones, kidney stones, prostate disease, cancer.
- Infectious Diseases: Diarrhea, malaria, dengue fever, Zika.
- Respiratory Issues: Asthma, bronchitis, pneumonia, cold/flu, COVID-19, allergies.

These clusters indicate how informants categorize illnesses, likely reflecting common perceptions and experiences within the community. Chronic conditions are grouped, suggesting a shared understanding of long-term health issues, while infectious diseases and respiratory issues form distinct clusters, highlighting their acute and contagious nature.

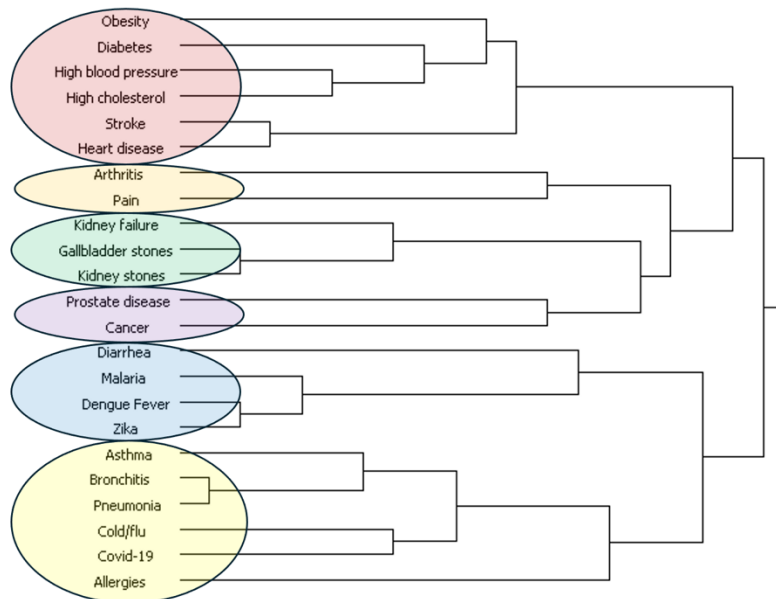


Figure 1 - Non-metric Cluster Analysis of Illness Types

Multidimensional Scaling of Illness Types

Figure 2 below shows the results of the multidimensional scaling of the types of illness pile sort data. The circled area on the upper left side is urologic illnesses. The circled area in the middle is pain and arthritis. The circled area in the lower left side is cardiovascular/metabolic illnesses. The

circled area on the upper right side is mosquito-borne illnesses. Respiratory illnesses occupy the circled area on the lower right side.

Similar to the analysis above, the multidimensional scaling plot groups types of illnesses based on their perceived similarities among informants in northern Belize. Here are the key clusters:

- Chronic Conditions: Diabetes, heart disease, stroke, high blood pressure, obesity, high cholesterol, kidney stones, kidney failure, pain, and arthritis.
- Infectious Diseases: Diarrhea, Malaria, Zika, and dengue fever.
- Respiratory and Allergic Issues: Allergies, COVID-19, cold/flu, pneumonia, bronchitis, and asthma.

These clusters indicate how informants categorize illnesses, reflecting common perceptions and experiences within the community. Chronic conditions are grouped, suggesting a shared understanding of long-term health issues, while infectious diseases and respiratory issues form distinct clusters, highlighting their acute and contagious nature.

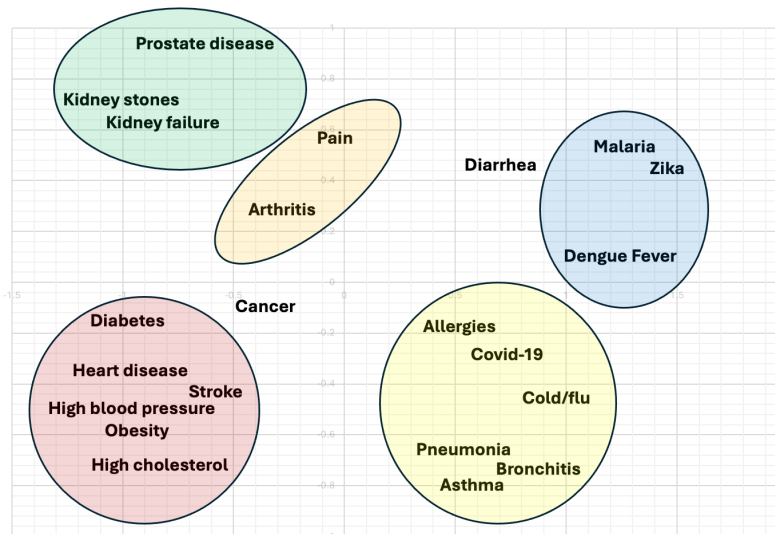


Figure 2 - Multidimensional Scaling of Illness Types

Non-metric Cluster Analysis of Illness Causes

Figure 3 below shows the results of the non-metric cluster analysis of the illness causes pile sort data. The circled area on the top is economic/personal causes. The circled area on the bottom is environmental causes. The non-metric cluster analysis groups causes of illness based on their perceived similarities among informants in northern Belize. Here are the key clusters:

- Substance Abuse and Access to Healthcare: Substance abuse, distance from health professionals, and health care costs; and
- Environmental Factors: household and farm chemicals, climate change, air pollution, and water pollution.

These clusters indicate how informants categorize causes of illness, reflecting common perceptions and experiences within the community. The first cluster highlights issues related to substance abuse and barriers to accessing healthcare, while the second cluster emphasizes environmental factors contributing to illness.

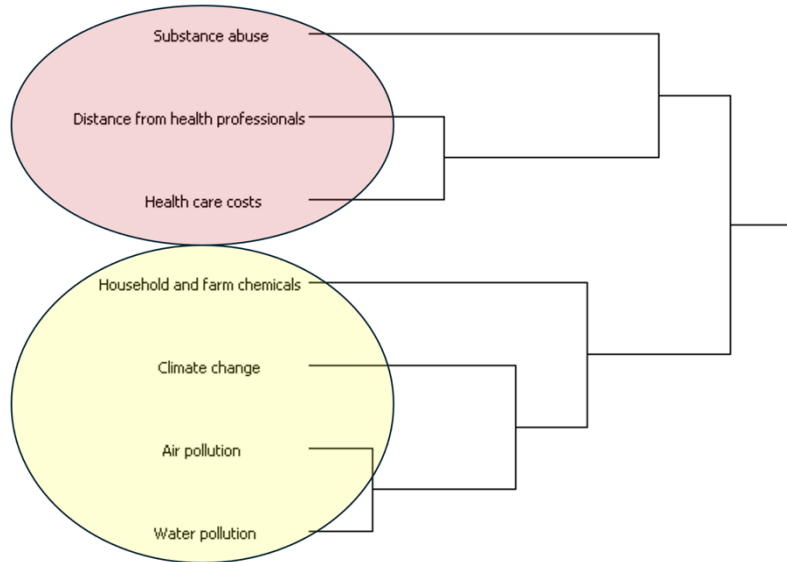


Figure 3 - Non-metric Cluster Analysis of Illness Causes

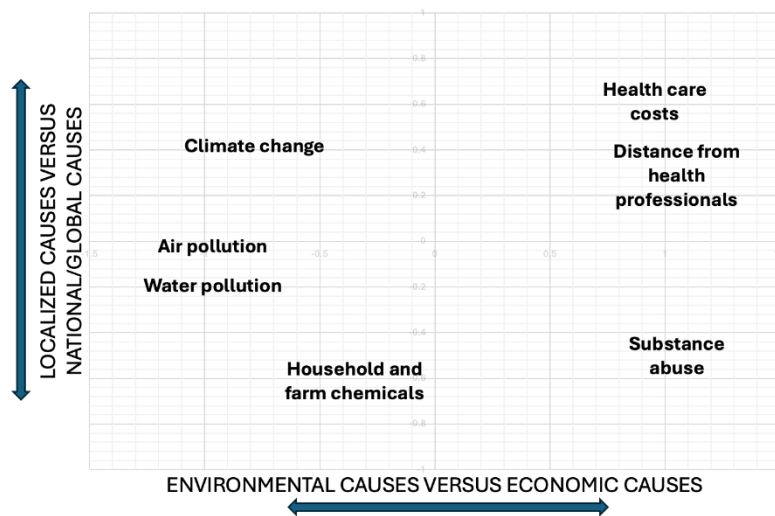


Figure 4 - Multidimensional Scaling of Illness Causes

Multidimensional Scaling of Illness Causes

Figure 4 above shows the results of the multidimensional scaling of the illness causes pile sort data. The multidimensional scaling plot visualizes the perceived similarities between causes of illness among informants. The axes represent different dimensions:

- X-axis: Environmental causes versus economic causes.
- Y-axis: Localized causes versus national/global causes.

Here are the key clusters:

- Environmental Causes: climate change, air pollution, water pollution, and household and farm chemicals; and
- Economic Causes: health care costs, distance from health professionals, and substance abuse.

The plot shows how informants differentiate between causes based on their nature (environmental vs. economic) and scope (localized vs. national/global). Environmental causes are perceived as broader, affecting larger areas, while economic causes are seen as more localized and directly impacting individuals' access to healthcare and lifestyle choices.

Sugar Cane Farming

Forty of the 233 informants self-identified as sugar cane farmers and were asked additional questions about their perception of sugar cane farmers' associations and information-sharing networks. The median age among the farmers interviewed was 45, with 38 (95%) male and 2 (5%) female. The farmers were from 17 San Estevan (17, 42.5%), San Jose (3, 7.5%), San Lazaro (11, 6.5%), and Yo Creek (9, 22.5%). The farmers were members of either the Belize Sugar Cane Producers Association (22, 55%) or the Progressive Sugar Cane Producers Association (9, 22.5%), with the rest claiming no membership. There were no Corozal Sugar Cane Producers Association members within our informant sample. The informants reported that their roles as sugar cane farmers included 26 owners, 5 group leaders, and eight laborers (driving, cutting, fertilizing, spraying pesticides, planting, and cleaning). As suspected from prior field seasons, identification as a sugar cane farmer is a cover term for different roles and does not only include farm owners.

Farmers' Concerns with Associations

When farmers were asked about their concerns with the associations, their responses centered on financial transparency and fairness, access to resources, training and education, representation and advocacy, and infrastructure and community development.

Financial Transparency and Fairness

Farmers have expressed concerns about the mismanagement of funds by associations and agencies. They feel that the money intended to support farmers is not being used effectively or fairly distributed. One interviewee shared, "We were promised financial support, but the money never seems to reach us. It's frustrating because we need that support to keep our farms running." Some farmers reported that they do not receive the financial support they need, such as loans or grants, despite being promised assistance. This lack of support makes it difficult for them to sustain their farming operations.

Access to Resources

Farmers mentioned that they do not always receive the necessary fertilizers and herbicides. When these resources are provided, they are often insufficient or not delivered on time. One farmer noted, "We often don't get the fertilizers and herbicides we need. When we do, it's usually too late, and the quantity is not enough." There are also concerns about the availability and accessibility of machinery and equipment. Farmers need these tools to improve their productivity but often face difficulty accessing them.

Training and Education

Farmers feel that the training programs offered by associations are inadequate. They need more comprehensive and practical training to improve their farming practices and adopt new

technologies. One interviewee mentioned, “The training programs are not very helpful. We need more practical and hands-on training to improve our farming practices.” Additionally, there is a lack of information and guidance provided to farmers. They need better access to information about sustainable farming practices, pest control, and crop management.

Representation and Advocacy

Farmers feel that the associations do not adequately represent their interests. They believe that the leadership of these organizations does not advocate strongly enough for their needs and concerns. One farmer shared, “Our interests are not well represented by the associations. They don’t advocate for us strongly enough.” Some farmers also expressed concerns about political influence within the associations. They feel that decisions are often made based on political considerations rather than the best interests of the farming community. An interviewee noted, “Decisions are often influenced by politics rather than what’s best for the farmers. It’s disheartening to see our needs being overlooked.”

Infrastructure and Community Development

Farmers reported that infrastructure projects, such as road construction and maintenance, are often neglected. This neglect affects their ability to transport goods and access markets. One farmer mentioned, “The roads are in terrible condition, and it makes it hard for us to transport our goods. We need better infrastructure support.” There is also a perception that associations do not do enough to support the broader community. Farmers believe more should be done to improve their villages’ overall quality of life. An interviewee shared, “The associations should do more to support the entire community, not just the farmers. We need better services and infrastructure in our villages.”

Will Farmers Continue Farming Sugar Cane?

When farmers were asked whether they would continue farming sugar cane in the future, their responses were either reasons for continuing sugar cane farming (tradition and livelihood, economic necessity, and community and support systems) or considering alternatives (economic challenges, labor shortages, and environmental factors).

Reasons for Continuing Sugar Cane Farming

Tradition and Livelihood: Many farmers have been farming sugar cane for generations. It is a significant part of their heritage and identity. Despite the challenges, sugar cane farming is seen as a stable source of income. Farmers rely on it to support their families and maintain their livelihoods. One farmer shared, “I was born doing that. So, yeah, it’s kind of like your most secure option to keep.”

Economic Necessity: Some farmers continue farming sugar cane because it is their primary source of income. They have invested in the necessary infrastructure and equipment, making switching to other crops or industries difficult. The sugar cane industry provides employment opportunities for many community members, including cane cutters and truck drivers. An interviewee mentioned, “That’s our livelihood. We give jobs, a lot of cane cutters that nothing stays without job. When the crop finishes, we give jobs to them.”

Community and Support Systems: Farmers benefit from the support of associations and cooperatives, which provide resources such as fertilizers, herbicides, and financial assistance. This support helps them sustain their farming operations. The community often comes together to help each other during difficult times, such as wildfires or droughts. One farmer noted, “We have a commercial agreement. Cane farmers pay 65% and the Millers 35% so automatically, that makes us part of the business.”

Reasons for Considering Alternatives

Economic Challenges: The high cost of inputs, such as fertilizers and herbicides, and the low prices for sugar cane make it difficult for small-scale farmers to make a profit. Some farmers are exploring alternative crops or industries that may offer better financial returns and require less investment. One farmer shared, “The expense is very high, and the energy, no problem. And the job is very tough.”

Labor Shortages: There is a labor shortage, particularly for cane cutting. Younger generations are less interested in manual labor and are seeking other opportunities. This makes it challenging to maintain sugar cane farming operations. An interviewee mentioned, “Now the new generations don’t want to cut cane. Do you think that’s going to be an easy transition to get to now, because it’s a big amount of money that you need to invest in buying machinery.”

Environmental Factors: Climate change and unpredictable weather patterns have made sugar cane farming more difficult. Extended droughts, increased temperatures, and unpredictable rainfall have negatively impacted crop yields. Wildfires and other environmental challenges also pose risks to sugar cane farming. One farmer noted, “The weather has become so unpredictable. We need to learn sustainable farming practices to cope with the changes.”

Network Analysis

In prior field seasons, sugar cane farming knowledge concerning sugar cane varieties, fertilizers, pesticides, and herbicides was collected, as well as how knowledge is shared among farmers. In other words, we sought to discover what social networks (e.g., kinship, friendship, and farming collaboratives) contribute to farmers’ intracultural variation of farming knowledge. This field season involved collecting network data on how agricultural knowledge is shared between farmers, associations, agencies, and businesses from the farmer’s perspective. Farmers were asked from whom they requested or received information on each subject of information (e.g., fertilizer, herbicide, pesticide, and sugar cane) from each organization (farmers, Belize Sugar Cane Farmers Association [BSCFA], Corozal Sugar Cane Producers Association [CSCPA], Progressive Sugar Cane Farmers Association [PSCPA], Sugar Industry Research and Development Institute [SIRDI], store/supplier, village chairman, American Sugar Refineries/Belize Sugar Industries [ASR/BSI], and sugar board). Data were then analyzed using UCINET (Borgatti, Everett, and Freeman 2002) and Netdraw (Borgatti 2002).

The network diagrams (Appendices V through XVI) were constructed with the node sizes determined by eigenvector centrality. The node size is set by eigenvector centrality. The eigenvector centrality measure accounts for the number of connections a node has to other nodes and the number of connections those nodes have with other nodes. A higher eigenvector centrality

score indicates that a node has more connections with other highly connected nodes. Eigenvector centrality finds those important nodes because they are more connected to other important (highly connected) nodes. In the case of this analysis, the larger the information source's node (BSCFA, PSCPA, SIRD, ASR-BSI, etc.), the more connections it has with farmers connected with other information sources. The larger the farmer's node, the more connections the farmer has with information sources connected with other farmers. In sum, the larger the node, the more information the node is connected to as compared with all other nodes within the network. The layout is based on node repulsion and equal edge length bias adjusted for readability.

For all of the network diagrams, the nodes may be differentiated by the following:

- Black square nodes: Represent sources such as associations, agencies, companies, and officials.
- White round nodes: Represent farmers who claimed no farmers association membership.
- Darker grey nodes: Represent members of the Belize Sugar Cane Farmers Association members.
- Lighter grey nodes: Represent members of the Progressive Sugar Cane Producers Association members.

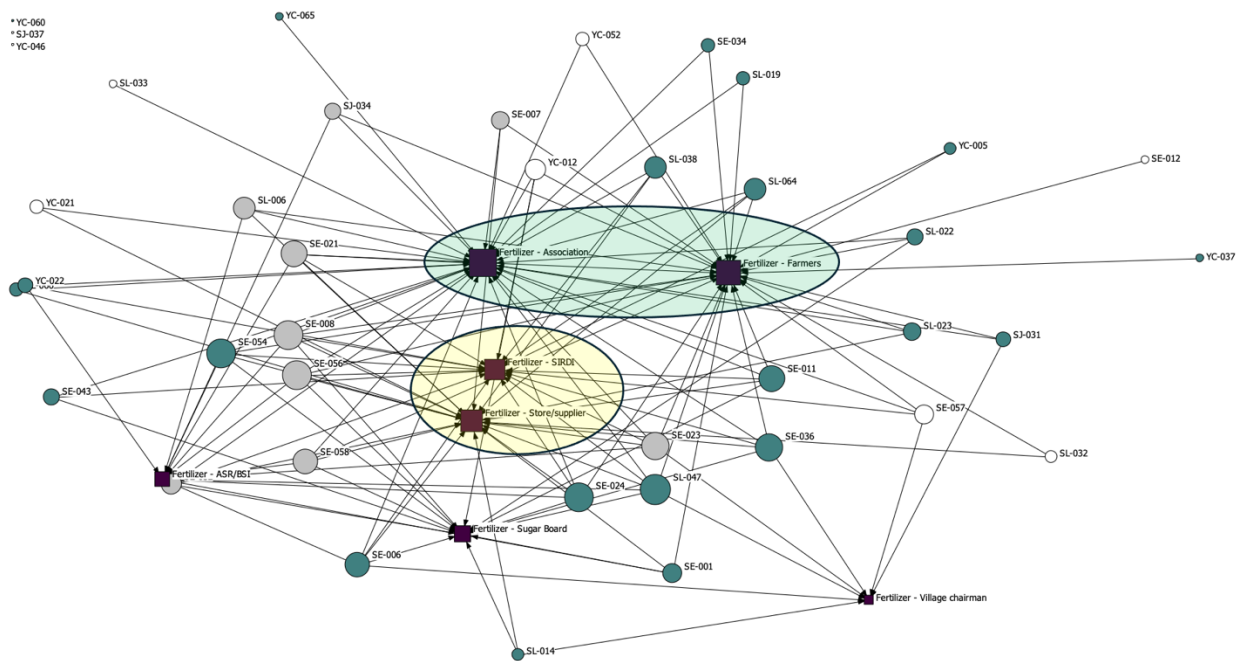


Figure 5 – Fertilizer Information Source Network (See Appendix V for larger image)

Fertilizer Information Source Network

The Fertilizer Information Source Network diagram (Figure 5 above) illustrates the relationships between sugar cane farmers in northern Belize and their sources of information about herbicides. The following regions of the diagram are of interest:

- Upper-middle area: This circled area includes the main sources of information about fertilizer, which consists of associations and other farmers. These sources are central to the network, indicating their importance in disseminating information.

- Lower-middle area: This circled area includes secondary sources of information about herbicides, specifically the Sugar Industry Research and Development Institute (SIRDI) and the store/supplier. These sources are less central but still play a significant role in providing information.

The network shows how information flows between different types of farmers and their associations, highlighting the central role of certain organizations and farmers in spreading knowledge about fertilizer.

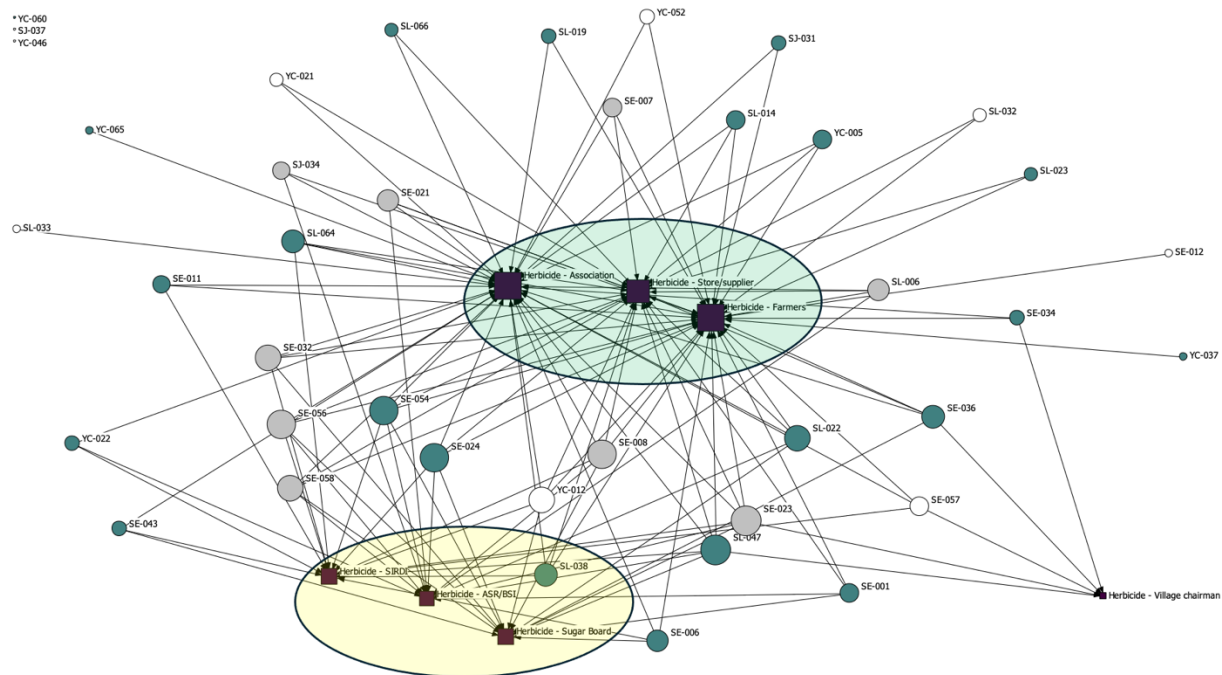


Figure 6 – Herbicide Information Source Network (See Appendix VI for larger image)

Herbicide Information Source Network

The Herbicide Information Source Network diagram (Figure 6 above) illustrates the relationships between sugar cane farmers in northern Belize and their sources of information about herbicides. The following regions of the diagram are of interest:

- Upper-middle area: This area includes the main sources of information about herbicides, which consist of associations, store/suppliers, and other farmers. These sources are central to the network, indicating their importance in disseminating information.
- Lower-middle area: This area includes secondary sources of information about herbicides, specifically the Sugar Industry Research & Development Institute (SIRDI), American Sugar Refining/Belize Sugar Industries (ASR/BSI), and the Belize Sugar Industry Control Board. These sources are less central but still play a significant role in providing information.

The network shows how information flows between different types of farmers and their associations, highlighting the central role of certain organizations and farmers in spreading knowledge about herbicides.

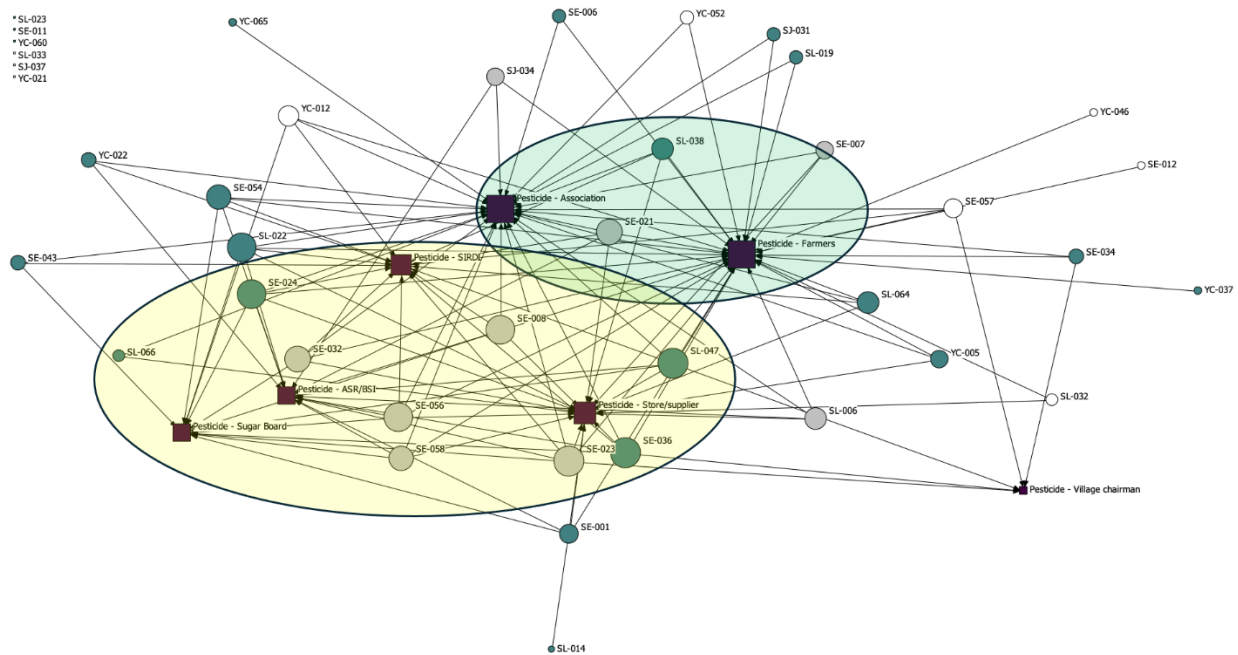


Figure 7 – Pesticide Information Source Network (See Appendix VII for larger image)

Pesticide Information Source Network

The Pesticide Information Source Network diagram (Figure 7 above) illustrates the relationships between sugar cane farmers in northern Belize and their sources of information about pesticides. The following regions of the diagram are of interest:

- Upper-middle area: This area includes the main sources of information about pesticides, including SIRD (Sugar Industry Research & Development Institute), associations, other farmers, and the store/supplier. These sources are central to the network, indicating their importance in disseminating information.
- Lower-left area: This area includes secondary sources of information about pesticides, specifically the Belize Sugar Industry Control Board and ASR/BSI (American Sugar Refining/Belize Sugar Industries). These sources are less central but still play a significant role in providing information.

The network shows how information flows between different types of farmers and their associations, highlighting the central role of certain organizations and farmers in spreading knowledge about pesticides.

Sugar Cane Variety Information Source Network

The sugar cane variety Information Source Network diagram (Figure 8 below) illustrates the relationships between sugar cane farmers in northern Belize and their sources of information about sugar cane varieties. The following regions of the diagram are of interest:

- Middle-top area: This area includes the main sources of information about sugar cane varieties, which consist of other farmers, store/suppliers, associations, SIRD (Sugar Industry Research and Development Institute), and ASR/BSI (American Sugar

Refining/Belize Sugar Industries). These sources are central to the network, indicating their importance in disseminating information.

- Middle-bottom area: This area represents the Belize Sugar Industry Control Board, which serves mostly as a para-governmental organization with members including representatives from farmers’ associations, ASR/BSI, and others.

The network shows how information flows between different types of farmers and their associations, highlighting the central role of certain organizations and farmers in spreading knowledge about sugar cane varieties.

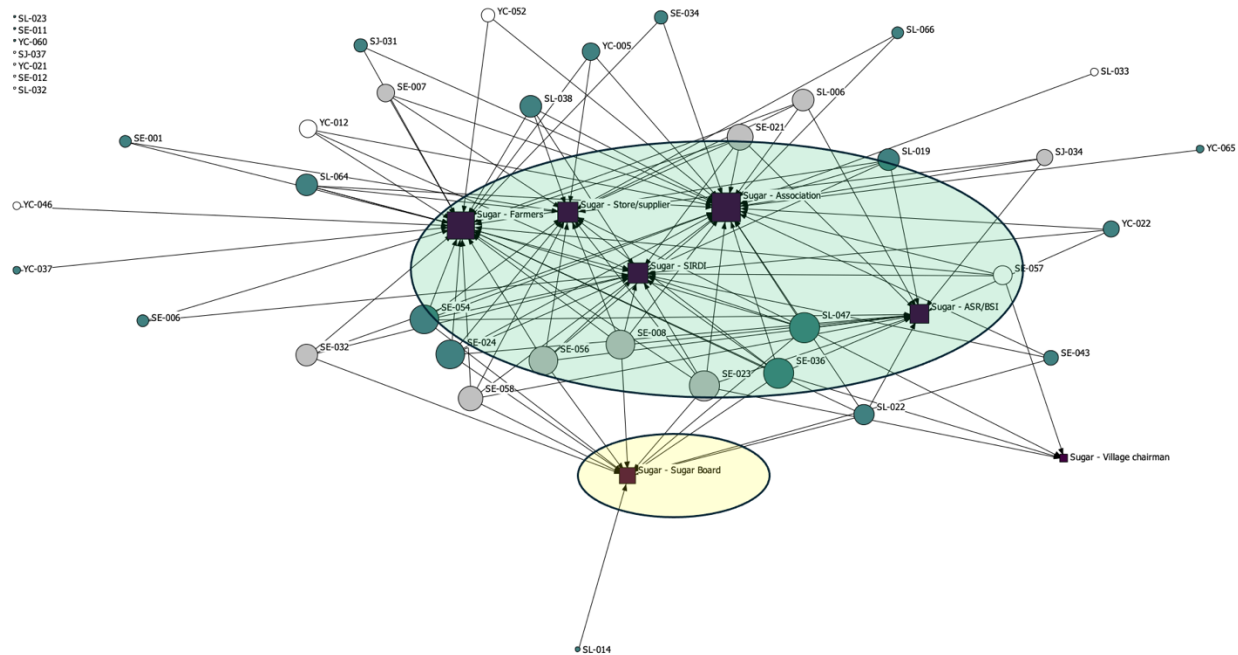


Figure 8 – Sugar Cane Variety Information Source Network (See Appendix VIII for larger image)

Combined Information Source Network

The combined Information Source Network diagram (Figure 9 below) illustrates the relationships between sugar cane farmers in northern Belize and their sources of information about fertilizer, pesticides, herbicides, and sugar cane varieties. The following regions of the diagram are of interest:

- Left area: This area includes the Belize Sugar Industry Control Board, which serves mostly as a para-governmental organization with members including representatives from farmers associations, ASR/BSI (the mill), and others.
- Top-center area: This area includes SIRDl’s (Sugar Industry Research & Development Institute) sources of information about herbicides, fertilizer, and sugar cane varieties.
- Middle-right area: This area includes the associations’ sources of information about sugar cane varieties, herbicides, fertilizers, and pesticides.
- Lower-right area: This area includes farmers and store/supplier sources of information.

The network shows how information flows between different types of farmers and their associations, highlighting the central role of certain organizations and farmers in spreading knowledge about various agricultural inputs and practices.

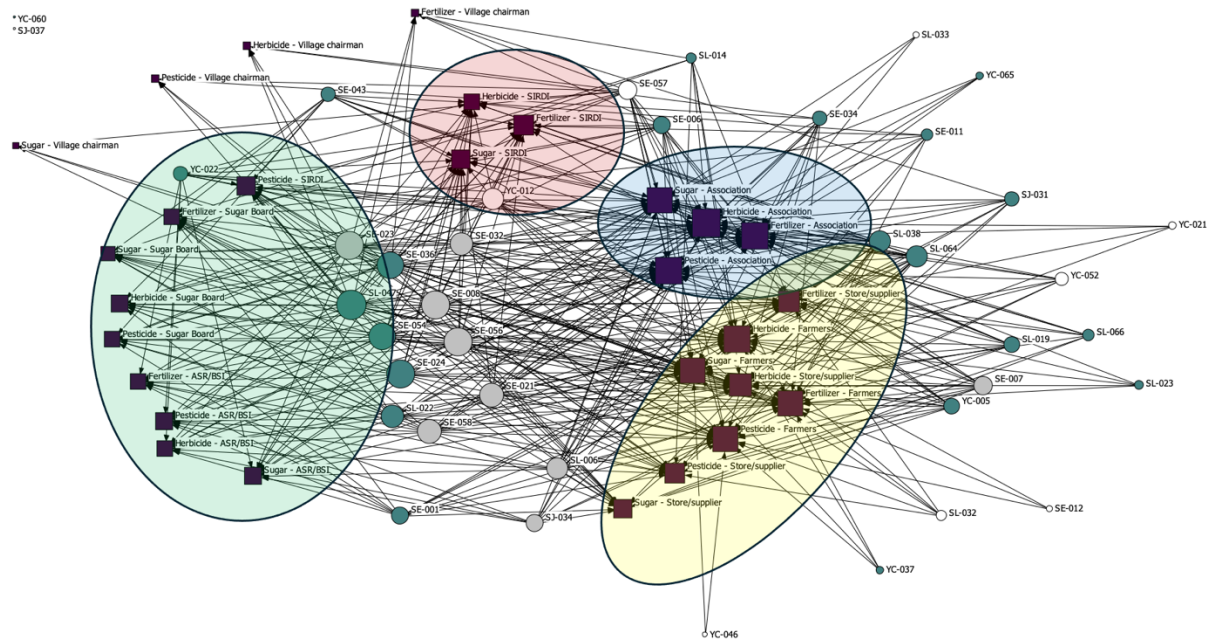


Figure 9 – Combined Information Source Network (See Appendix IX for larger image)

Summary of the Information Sharing Networks Analyses

The analysis of the information source networks for sugar cane farmers in northern Belize reveals several key findings:

- Organizations such as the Belize Sugar Cane Farmers Association (BSCFA), Progressive Sugar Cane Producers Association (PSCPA), and the Sugar Industry Research and Development Institute (SIRDY) are central to the network and crucial in disseminating information about fertilizers, herbicides, pesticides, and sugar cane varieties.
- The American Sugar Refining/Belize Sugar Industries (ASR/BSI) is also a significant source of information, particularly for herbicides and sugar cane varieties.
- Farmers who are members of associations like BSCFA and PSCPA have more connections and access to information than those who are not. These associations facilitate the flow of agricultural knowledge among their members.
- The Belize Sugar Industry Control Board, which includes representatives from various associations and ASR/BSI, is a secondary source of information, particularly for pesticides and herbicides.
- Stores and Suppliers are important secondary sources of information, especially for herbicides and pesticides.
- The network diagrams show that the centrality of nodes influences information flow. Nodes with higher eigenvector centrality scores, such as key associations and agencies, are more connected and thus more influential in spreading information.

- The flow of information is not uniform; it is heavily dependent on the central nodes. Farmers connected to these central nodes have better access to agricultural knowledge, which can impact their farming practices and decision-making.

Overall, the analysis highlights the importance of associations, agencies, and key organizations in disseminating agricultural information among sugar cane farmers in northern Belize. It also underscores the role of network centrality in facilitating effective information flow.

Conclusion

The Ethnographic Field School in Belize, organized by the Center for Applied Anthropology at Northern Kentucky University, successfully conducted ethnographic interviews in the communities of San Estevan, San Jose, San Lazaro, and Yo Creek during the summer of 2024. The research focused on various community development issues, including job opportunities, child labor, alcohol/drug use, pregnancy and birth services, causes and types of illnesses, climate change, farmers' association investment, garbage disposal, COVID-19's impact, wildfires, and information-sharing networks.

The key findings from this season's field research include:

- The COVID-19 pandemic has brought significant health, economic, educational, and community adaptation challenges.
- Job opportunities within the community are limited, with many relying on domestic work, small-scale construction, and sugarcane farming. Diverse opportunities exist outside the community, although commuting impacts family life.
- Women's employment predominantly includes domestic work, small businesses, and childcare within the community, with more diverse outside opportunities.
- Children's opportunities include education, sports, cultural programs, and extracurricular activities.
- Garbage disposal services are available but costly, leading to alternative methods like burning, which pose environmental and health risks.
- Farmers associations provide financial assistance, agricultural support, training, and community development, but concerns about transparency, resource access, and representation persist.
- Support for alcohol and drug use is limited locally, with reliance on external support and community/family assistance.
- Climate change adversely affects weather patterns, agriculture, health, and livelihoods.
- Wildfires, caused by burning cane fields and drought, impact agriculture, the environment, and health.
- Pregnancy and birth services are limited locally, with reliance on mobile clinics and the need to travel for comprehensive care.
- Home remedies are commonly used for various ailments, including oregano, garlic, lemongrass, soursop leaves, guava leaves, honey, fever grass, lime, avocado leaves, chaya, aloe vera, and cinnamon.
- Illness types and causes are categorized into chronic conditions, infectious diseases, respiratory issues, substance abuse, access to healthcare, and environmental factors.

For the next field season, in addition to suggestions from our partners (e.g., BSCFA, PSCPA, and SIRD) we will explore the following research questions:

- How are farmers adapting their practices to cope with changing weather patterns and environmental challenges?
- What improvements can be made to enhance farmers' associations' transparency, resource distribution, and advocacy?
- What local health initiatives can be developed to address the gaps in pregnancy and birth services, alcohol and drug use support, and respiratory health?
- What alternative income-generating activities can be promoted within the community to reduce reliance on sugarcane farming and domestic work?
- How can virtual learning and educational resources be improved to support children's education during disruptions like pandemics?
- What sustainable waste management practices can be implemented to reduce garbage disposal's environmental and health impacts?
- What is the efficacy of commonly used home remedies, and how can traditional knowledge be integrated into formal healthcare practices?

These questions aim to build on the findings of the 2024 field season and contribute to the sustainable development and well-being of the sugarcane farming communities in northern Belize.

Appendix I: Informed Consent Statement – English



College of Arts and Sciences
Department of Sociology, Anthropology,
and Philosophy
Landrum Academic Center 217C
Nunn Drive
Highland Heights, Kentucky 41099
tel 859.572.5259 | fax 859.572.6086
www.nku.edu

INFORMED CONSENT TO PARTICIPANT IN A RESEARCH PROJECT

TITLE OF PROJECT: Ethnographic Field School

NAME OF PRINCIPAL INVESTIGATOR: Dr. Douglas Hume, Northern Kentucky University

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEMS: Douglas Hume, Ph.D., Associate Professor of Anthropology, Northern Kentucky University, humed1@nku.edu or 859-572-5702.

PURPOSE OF RESEARCH: This research project records the way of life of sugar cane farmers in Northern Belize with the intent to share the results on the Internet, journals and conference proceedings as well as in a report to the Belize Sugar Cane Farmer’s Association, Institute of Social and Cultural Research, and the Sugar Industry Research and Development Institute.

PROCEDURES/METHODS TO BE USED: The interview includes questions about your household economic behavior and sugar cane farming methods. The interview is estimated to last between five minutes to one-half hour. The audio recording of the interview will be securely stored and destroyed after it is transcribed. Data collected in this study will then be anonymous, as we are not collecting names or other identifying information. You will not be paid for being in this study.

RISKS INHERENT IN THE PROCEDURES: There are no known risks.

BENEFITS: It is hoped that the results of this research will influence how the Belize Sugar Cane Farmer’s Association and the Sugar Industry Research and Development Institute develop educational programs about farming, health, and economics for sugar cane farming families in Northern Belize.

CONFIDENTIALITY: The only identifying information that we will keep on record is this signed document, which may be inspected by the Institute of Social and Cultural Research and other human protection bodies. This document will not be connected with you interview data.

LIABILITY: Neither the researchers, their agents, or you (the participant) are liable for any damages or penalties from participating in this research.

PARTICIPATION: Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document.

Participant name (printed)

Participant signature

Date

Witness to signature (project staff)

Date

Appendix II: Informed Consent Statement – Spanish



College of Arts and Sciences
Department of Sociology, Anthropology,
and Philosophy
Landrum Academic Center 217C
Nunn Drive
Highland Heights, Kentucky 41099
tel 859.572.5259 | fax 859.572.6086
www.nku.edu

FORMULARIO DE CONSENTIMIENTO INFORMADO PARA PARTICIPAR EN UN PROYECTO DE INVESTIGACIÓN

TITULO DEL PROYECTO: Ethnographic Field School

INVESTIGADOR PRINCIPAL: Dr. Douglas Hume, Northern Kentucky University

CONTACTO EN CASO DE PREGUNTAS/PROBLEMAS: Douglas Hume, Ph.D., Profesor Adjunto de Antropología,
Northern Kentucky University, correo electrónico: humed1@nku.edu; teléfono: 859-572-5702.

OBJETIVO DE LA INVESTIGACIÓN: Este proyecto de investigación registra el modo de vida de los cañeros en el norte de Belice con el propósito de difundir los resultados por Internet, en revistas académicas y actas de congresos, así como en un reporte a la Asociación de Cañeros de Belice, el Instituto para la Investigación Social y Cultural, y el Instituto de Desarrollo e Investigación de la Industria Azucarera.

PROCEDIMIENTOS/MÉTODOS DEL ESTUDIO: La entrevista incluye preguntas sobre la economía doméstica y los métodos empleados en el cultivo de la caña de azúcar. La entrevista durará entre cinco minutos y media hora y será grabada. La grabación se almacenará en un lugar seguro y se destruirá luego de su transcripción. La información recopilada en esta investigación es anónima, ya que no registramos nombres ni otros datos personales. No se recibirá ningún tipo de compensación económica por participar en esta investigación.

RIESGOS INHERENTES EN LOS PROCEDIMIENTOS: No hay riesgos conocidos.

BENEFICIOS: Se espera que los resultados de esta investigación tengan un impacto en cómo la Asociación de Cañeros de Belice y el Instituto de Desarrollo e Investigación de la Industria Azucarera desarrollan sus programas educativos sobre agricultura, salud y economía para las familias cañeras en el norte de Belice.

CONFIDENCIALIDAD: En cuanto a información identificatoria, sólo guardamos esta hoja con su firma, la cual puede ser inspeccionada por el Instituto para la Investigación Social y Cultural y otros organismos de protección de derechos humanos y civiles. En ningún momento este documento podrá ser emparejado con la información que Ud. comparta en la entrevista.

RESPONSABILIDAD LEGAL: Ni los investigadores, ni sus agentes ni Ud. (el/a participante) serán responsables por daños o sanciones como resultado de su participación en esta investigación.

PARTICIPACIÓN: La participación en este proyecto es voluntaria. Si decide participar en esta investigación, tiene derecho a anular este formulario y dejar de participar en cualquier momento sin sanciones o pérdida de beneficios a los que tenga derecho.

Su firma confirma que Ud. ha leído la información contenida en el mismo y que firma este formulario de consentimiento por su propia voluntad. Su firma también confirma que Ud. ha recibido una copia de este documento en la fecha indicada.

Nombre del/a participante

Firma del/a participante

Fecha

Testigo (un miembro del equipo de investigación)

Fecha

Appendix III: Ethnographic Interview Schedule (Procedure), Part I

All Informants

1. COVID's impact
2. Jobs inside community
3. Jobs outside community
4. Jobs inside community for women
5. Jobs outside community for women
6. Children's opportunities beyond child labor
7. Pregnancy and birth services
8. Garbage disposal
9. Farmers association impacts
10. Alcohol/drug use support
11. Climate change effects (inf)
12. Non-doctor/pharmacy medicine - ingredients and uses (inf)
13. Causes of illness pile sort
14. Types of illness pile sort
15. Wildfires
16. Additional topics

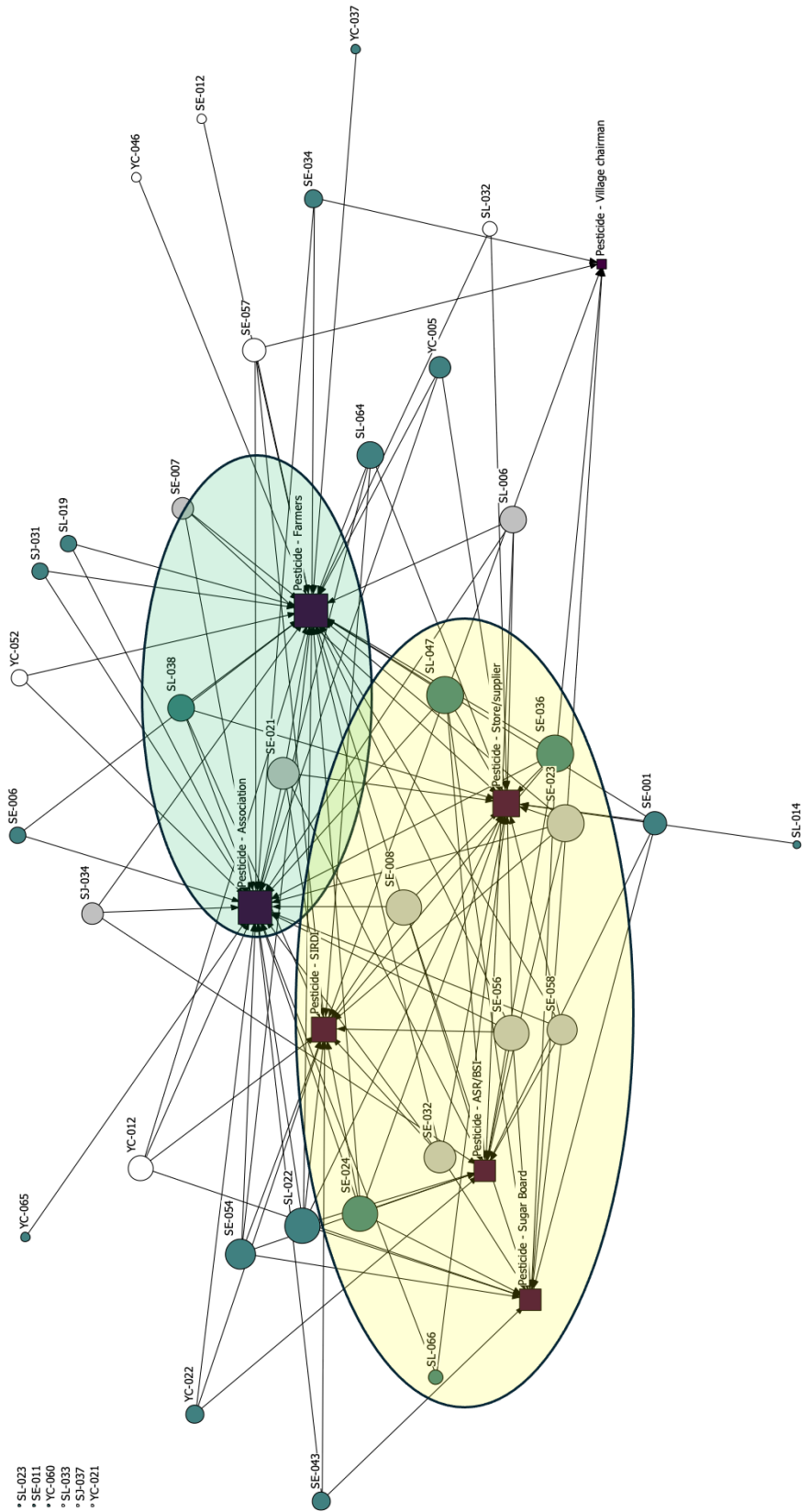
Appendix IV: Ethnographic Interview Schedule (Procedure), Part II

Farmers Only

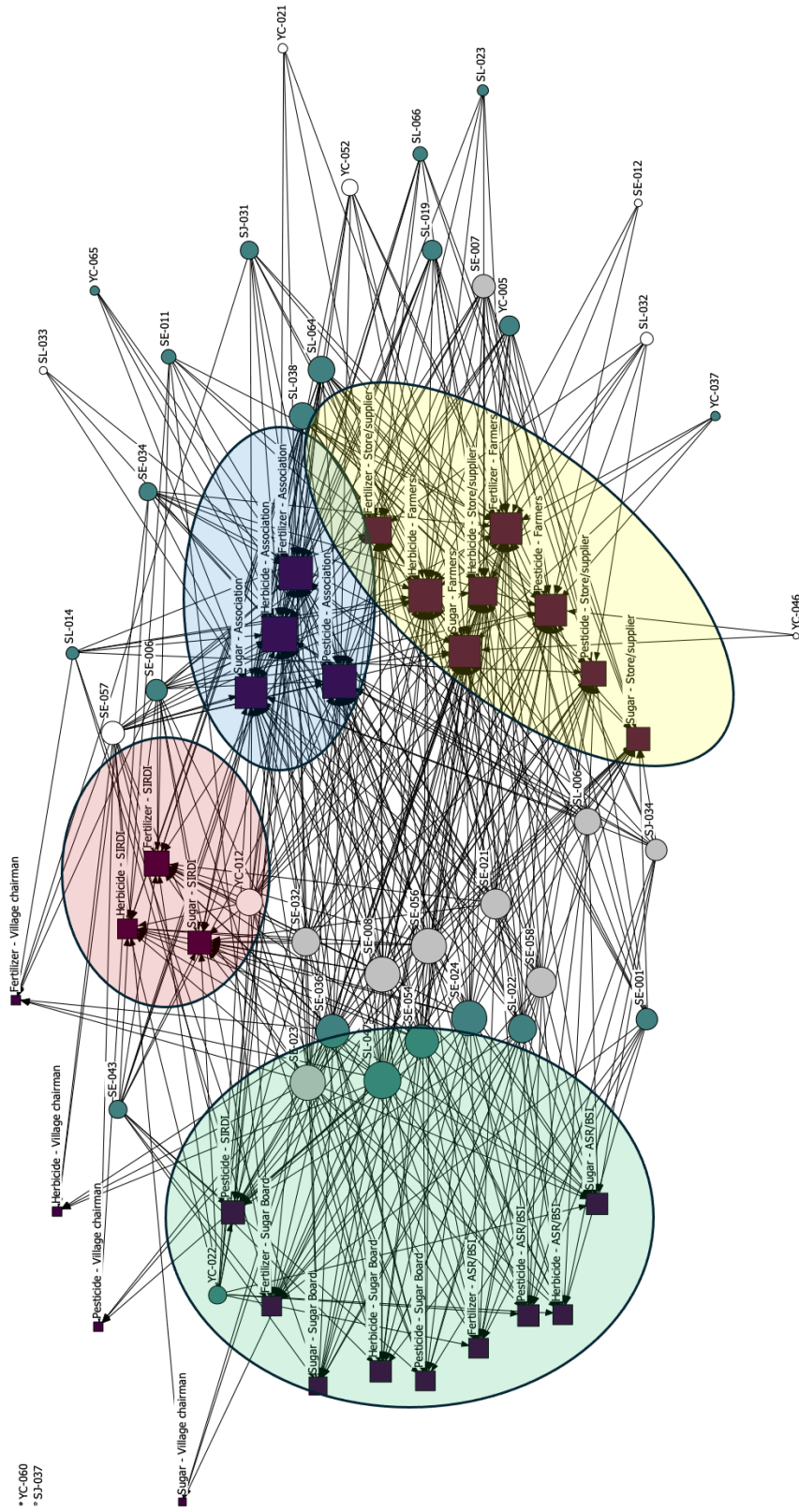
1. Organizations
 1. Membership (i.e., BSCFA, CSCPA, PSCPA) - inf
 2. Role (i.e., owner, group leader, cutter, etc.) - inf
 3. Association/agency concerns (associations, SIRD, Sugar Board, and ASR/BSI)
 4. SIRD Concerns - inf
2. Ego-centric information networks - inf
 1. Sets
 1. Fertilizer
 2. Herbicide
 3. Pesticide
 4. Sugar cane
 2. Entities
 1. Farmers
 2. Association - Belize Sugar Cane Farmers Association, Progressive Sugar Cane Producers Association, etc.
 3. SIRD - Sugar Industry Research and Development Institute
 4. Store/supplier
 5. Village Chairman
 6. ASR/BSI - American Sugar Refineries/Belize Sugar Industries
 7. Sugar Board
 8. Others?

Continue farming sugar cane? Why or why not?

Appendix VII: Full Size Pesticide Information Source Network



Appendix IX: Full Size Combined Information Source Network



Bibliography

This bibliography includes all past Center for Applied Anthropology Reports and Publications, whether or not they are cited in the text.

- Baines, Kristina, and Rebecca Zarger. 2024. Dilemmas of Making and Unmaking Environmental and Cultural Heritage in Southern Belize. *International Journal of Heritage Studies*. 30 (9): 1088-1102. <https://doi.org/10.1080/13527258.2024.2369556>.
- Borgatti, Steve P. 2002. *NetDraw: Graph Visualization Software*. Harvard, MA: Analytic Technologies.
- Borgatti, Steve P., Martin G. Everett, and Lin C. Freeman. *UCINET 6 for Windows: Software for Social Network Analysis*. Harvard: Analytic Technologies.
- CfAA. 2025. *Ethnographic Field School in Belize*. Center for Applied Anthropology, Northern Kentucky University. <https://inside.nku.edu/artsci/centers/cfaa/ethnographic-field-school.html>.
- Hume, Douglas W. 2025. "Legacy of the Ethnographic Field School in Belize." *Annals of Anthropological Practice* e12233. <https://doi.org/10.1111/napa.12233>.
- Hume, Douglas W., Lydia Alvarez, Julia Arzu, Abigail Burbank, Christian Cansino, Miranda Kaplan, Musseit M'Bareck, Jordan Myers, Madalyn Roberts, Edward Stephens, and Christy Valdez. 2021. "Report of the Ethnographic Field School in Belize (Summer 2019)." *Highland Heights: Center for Applied Anthropology, Northern Kentucky University*. <https://doi.org/10.13140/RG.2.2.34166.11842>.
- Hume, Douglas W., Adelle Bricking, Rosa Christophel, Jesse Hendricks, Sofia Javed, Gabrielle Locke, Lydia Schuldt, Evan Steelman, Nicholas Thaxton, and Stephanie Zach. 2014. "Report of the Ethnographic Field School in Belize (June 2013 Season)." *Highland Heights: Center for Applied Anthropology, Northern Kentucky University*. <https://doi.org/10.13140/RG.2.2.21149.44001>.
- Hume, Douglas W., Clara Maxine Bone, Hannah Grace Howard, Charlee Hutchinson, Stefan Kienzle, Marguerite Kinne, Samantha Louise Krieger, et al. 2016. "Report of the Ethnographic Field School in Belize (June 2015 Season)." *Highland Heights: Center for Applied Anthropology, Northern Kentucky University*. <https://doi.org/10.13140/RG.2.2.21988.30087>
- Hume, Douglas W., Colin Bindas, Stephanie Feltner, Gabriella Locke, Ian Takaoka, Nicholas Thaxton, Jade Michel Underland, and Gina Yoon. 2015. "Report of the Ethnographic Field School in Belize (June 2014 Season)." *Highland Heights: Center for Applied Anthropology, Northern Kentucky University*. <https://doi.org/10.13140/RG.2.2.24504.88320>.
- Hume, Douglas W., Rebecca Eder, Chantal Kifunga, Diego Salinas, and Joshua Stephenson. 2022. "Report of the Ethnographic Field School in Belize (Summer 2021)." *Highland Heights: Center for Applied Anthropology, Northern Kentucky University*. <https://doi.org/10.13140/RG.2.2.21388.18564>.
- Hume, Douglas W., Karin Floyd-Glutz, Autumn Gilbert, Rachael Haupt, Fantasia Mejia, Laura Oprisch, Adriane Pontecorvo, and Andrea Shiverdecker. 2019. "Report of the Ethnographic Field School in Belize (June 2018 Season)." *Highland Heights: Center for Applied Anthropology, Northern Kentucky University*. <https://doi.org/10.13140/RG.2.2.10244.24964>.
- Hume, Douglas W., Kourtney Zigelmier, Allison Cate, Anna Cloud, Tessa Forwalt, Emily Fox, Laura Bronte Murrell, et al. 2018. "Report of the Ethnographic Field School in Belize (June 2016 Season)." *Highland Heights: Center for Applied Anthropology, Northern Kentucky University*. <https://doi.org/10.13140/RG.2.2.18632.85760>.

- Leonardo, Tzul Yuri, Szu-Hung Chen, Gwo-Bao Liou, and Chi-Ming Hsieh. 2024. "Evaluating Belizean Sugarcane Farmers' Adoption Intentions Regarding Organic Fertilizer." *Agronomy* 14 (10): 2356. <https://doi.org/10.3390/agronomy14102356>.
- Levy, Robert, and Douglas Hollan. 1998. "Person-Centered Interviewing and Observation." In *Handbook of Methods in Cultural Anthropology*, edited by H. Russell Bernard, 333–64. Walnut Creek: Altamira Press.
- Murrell, Laura Bronte, and Douglas W. Hume. 2018. "A Comparison of Farmers' Perceived Impacts on the Environment in Belize and Kentucky." *Contemporary Journal of Anthropology and Sociology* 8 (1): 19–33.
- Spradley, James P. 2016. *The Ethnographic Interview*. Long Grove, Illinois: Waveland Press, Inc.
- Zach, Stephanie, and Douglas W. Hume. 2014. "Changing Mortuary Rites: An Ethnohistory of 19th Century and Contemporary Religion in Northern Belize." *Contemporary Journal of Anthropology and Sociology* 4 (2): 149–61.