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Repeated Disasters and Chronic Environmental Changes Impede Generational Transmission of Indigenous Knowledge

Shanondora Billiot
University of Illinois Urbana Champaign, sbilliot@illinois.edu

Soonhyung Kwon
University of Illinois Urbana Champaign, sk31@illinois.edu

Catherine E. Burnette
Tulane University of Louisiana, cburnet3@tulane.edu

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Repeated Disasters and Chronic Environmental Changes Impede Generational Transmission of Indigenous Knowledge

Until recently, most of the research into the human consequences of global environmental changes has focused on the psychosocial impacts following acute disasters or macro-level consequences of climate change, such as physical infrastructure, water supply, and food security (Adger, 2006; WHO, 2014). Such research has found that greater exposure to these acute onset events may lead to increased social, personal, and emotional issues, such as poorer mental health or more substance use (Fergusson, Horwood, Boden, & Mulder, 2014). Research focused on chronic global environmental changes argues that exposure will exacerbate existing inequalities in social, economic, and health conditions, due to extensive damage to physical infrastructure (Adger, 2006; WHO, 2014). There is limited data illustrating the impact of hurricanes and associated environmental change experienced by coastal communities on health and mental health, with even less research focused on the impacts on marginalized populations like Indigenous peoples (Berry, Bowen, & Kjellstrom, 2010 2010; Portier et al., 2010 Maslak, Radtke, Strickman, & Trtanj, 2010). Research illustrates that repeated exposure to "extreme weather events" leads to cumulative mental health effects related to displacement, loss, or disruption to place (Fritze, 2008). This suggests that repeated exposure to environmental changes, and thus, disruption to place, may be additional stressors lead to adverse health and mental health outcomes (Fritze, 2008; Portier, Hess, Luber, Maslak, Radtke et al., 2010). The purpose of this study was to elucidate meaning from shared cultural perceptions of experiencing hurricanes and other environmental changes among an Indigenous community on the Gulf Coast. *This study contributes to the scarce research exploring environmental determinants of Indigenous health disparities, and epidemic and widespread problem.*

Indigenous populations

Indigenous peoples are disproportionately affected by changes in the environment because of their connection to the environment and their interdependence with place to sustain their tradition, culture, and livelihoods (Billiot & Mitchell, 2018). While there is much speculation about the health and mental health impacts of climate change, to date there is a dearth of academic literature on the health or mental health impacts of climate change among Indigenous peoples (Ford et al., 2014; Furgal & Seguin, 2006). A recent study found that those who experienced

discrimination and greater exposure to environmental changes were more likely to meet criteria for a mental health diagnosis of either anxiety, depression, or PTSD (Billiot, 2017). Qualitative studies with Indigenous communities and exposure to climate change suggest other psychological symptoms, such as feelings of grief, distress, and loss (Berry, Bowen, & Kjellstrom, 2010; Berry, Hogan, Owen, Rickwood, & Fragar, 2011; Cunsolo Willox, Harper, Ford, et al., 2013).

Other studies have found Indigenous people in the Circumpolar North experience dramatic evidence of climate change where climate warming has resulted in melting or reduced snow, ice, and permafrost. Indigenous peoples in this region believe these changes impact health and mental health through decreased safety, food, and subsistence gathering. Other reported impacts are social and economic factors like unemployment, loss of cultural values, acculturation, lack of self-determination (at the tribal level), and discrimination (outside of tribal areas) (Brubaker, Berner, Chavan, & Warren, 2011; Cunsolo Willox, Harper, Ford, et al., 2013; Ford, 2012, 2013; Ford & Beaumier, 2011; Ford et al., 2014; Ford & Pearce, 2012; Furgal & Seguin, 2006). The combined body of research illustrates that Indigenous peoples have health concerns related to repeated exposure to natural and technological disasters calling the cumulative effect of exposure to environmental changes (Lowe et al., 2016). These concerns are centered on Indigenous people's connection to land.

Place attachment, Culture, and Continuity in Indigenous communities

Place attachment was first introduced into environmental literature by Fried (1963), who referenced affected bonds to place as he studied forced human dislocation from suburbs in the Boston area. Fried found that forced displacement dislodged one's *sense of continuity* into two facets of identity: spatial and group identities. Fried discussed this separation of place as a psychodynamic facet of mourning. Further studies have shown the symbolic interaction of "*place attachment,*" where place is reciprocally transformed by human interaction, and peoples' subjective meaning of place is altered by interacting with one's environment, and the environment is altered by human interaction (Berdoulay, 1989). The discourse between place and human can lead to the formation of an identity based on that place (Burley, 2010).

In a qualitative study completed among 141 participants in 6 parishes within Louisiana, Burley (2010) found that coastal Louisianan

residents expressed a loss of their identity due to environmental changes in the landscape due to hurricanes and coastal erosion. Through momentous shared life experiences with the land, residents developed their identity as coastal residents through interactions with the land. They further expressed emotional loss for the loss of land as a loss of themselves (Burley, 2010). Residents who had a significant history with the coast developed an attachment to that place (Burley, 2010). These experiences with a physical place led to developing social meanings of that place and the meanings, in turn, connected with their identity. The threat to lost coastal land posed a threat to their identity.

In Burley's study, we see how place and identity are subjectively intertwined with a particular place and a particular lifestyle. For many Indigenous peoples, identity is formed and expressed through the environment, as evidenced by this tribal leader's congressional testimony pleading for federal assistance in protecting their lands:

> Common wildlife located in our homeland that historically provided for our people included rabbits, ducks, deer, and other wild game as well as fur-bearing animals such as the mink and muskrat. Additionally, crawfish, crabs, shrimp, oysters and many varieties of fish have always been plentifully available. Naturally growing plants include sage, roots, palmetto, and other plants that we have gathered for our traditional medicine and basket weaving. From this land come many traditions we still practice today. (Dardar, 2012).

As with the participants in Burley's study, members of this tribe experience an identity crisis or pending loss of identity as they lose their land (Burley, 2010). Many Indigenous scholars believe through qualitative data that disruptions or loss of land can lead to psychological distress and other mental health issues (Berry, Bowen, & Kjellstrom, 2010; Colomeda, 1999; Cunsolo Willox, Harper, Ford, Edge, Landman et al., 2013; Cunsolo Willox et al., 2012; Healey et al., 2011). As mentioned, there is a lack of empirical evidence on the pathways between disruptions or loss of land and mental or emotional distress.

Methods

This study is part of a larger community-engaged research project that involved a concurrent mixed-methods design where interviewer-administered surveys (n = 160) and ethnographic in-person interviews (n = 19) were collected by the lead author with the intention of exploring impacts of environmental changes on the health of an Indigenous population. In this article, we will report data from the phenomenological

interviews. The purpose was to illuminate meaning from the research question, *how do shared cultural experiences among this Indigenous community influence perceptions of exposure to environmental changes*?

Study Setting

The study setting is in a coastal parish located is southern Louisiana, which is home to the majority of residents of a state-recognized tribe. At first contact with Europeans, ancestors of this tribal community were located north of the modern-day Baton Rouge area along the Mississippi River (Speck, 1976). Their land was considered the most fertile of all of the Louisiana Purchase as declared in a U.S. Supreme Court filing (Hart & Tilloston, 1859). Due to colonial land laws of French, Spanish, and then the U.S., this community was forced to relocate several times and has settled along the bayous of coastal Louisiana parishes since the early part of the 19th century (Speck, 1976). In this area, they thrived on the abundance of fish and animals. However, in the 1920s the oil field industry discovered oil in Louisiana and has since permanently destroyed the Louisiana coast through drilling, dredging marshland, and dam construction (Miller, 2004).

Data Collection Procedures

Fieldwork was conducted from October 2015 to May 2016 in Terrebonne Parish, one of six districts within the tribal service area that borders the Gulf of Mexico. The current study is a cross-sectional design from purposive sample of enrolled members. Participants were selected from a convenience sample by snowball and criterion techniques.

Interviews were collected and stored using the online Qualtrics system. The study was fully funded with institutional review board approvals from the Tribal Council and Washington University. A community Advisory Committee (CAC) approved all research activities and analysis. The CAC provided a list of 20 names of enrolled tribal members to provide referrals for participation. Fliers were distributed at the tribal program office and local gathering places such as community centers, bait shops, and docks. Participant recruitment and screening took place before the interviews, and the lead author read aloud the informed consent to each participant. Eligibility for the larger study included (a) enrolled members of the tribal community, (b) over the age of 30, (c) whose main residence was in a large coastal parish in Louisiana, and (d) they earned some income from subsistence activities. To gain a purposive

subset sample, the lead author inserted eligibility questions into the survey. If the participants indicated a strong ethnic identity through the Multi Ethnic Identity Measure-Revised (MEIM-R) and that a majority of their income was from subsistence activities, then they were asked if they would like to participate in the semi-structured interview. Ninety-eight participants were invited to participate in the semi-structured interview and 14 declined. Those who agreed to participate were placed on a separate contact list that was not linked to the survey responses. The lead author interviewed participants until the desired sample of 20 had been met. One participant terminated the interview early, and no additional participants were interviewed. Therefore, the semi-structured interview was a convenience purposive subset sample. In this article, we report results from the follow-up semi- structured interview.

Participants chose their interview locations from the following options: the tribal office closest to their location, a community center on their bayou, a tribal gathering location of their choice, or their home. Most participants preferred their home for the interview. In all public spaces the lead author ensured privacy for the interview. At the beginning of each interview, the lead author reiterated the sensitive nature of some of the questions through an informed consent procedure. The interviews were audio recorded, professionally transcribed, and reviewed by the lead author for accuracy. The participants chose not to review their transcripts for accuracy. The CAC reviewed data analysis themes, and the lead author presented all results before the CAC, Tribal Council, and community meetings prior to written and verbal dissemination.

This study advances scholarship on indigenous frameworks for decolonizing research that seeks to prioritize the community's role in defining the problem, theorizing about their lives, connecting multiple generations, and acknowledging Indigenous ways of knowing (Smith, 2012; Walters et al., 2010). In preparation of this study, the lead author spent four years interacting with the community to elucidate their research priority and methods preferred for data collection. The lead author collected pilot data and worked with a community advisory committee in the development of the interviewer-administered survey to ensure cultural appropriateness and relevance.

Data Analysis

Phenomenology is designed to illuminate meaning from shared cultural experiences so that the reader can understand an experience from one group of people (Creswell, 2013). In research, the qualitative open-ended

question format has the ability to connect the individuals or community with the political system by enhancing participants' capacity for ownership and dissemination of data that is best for the community (Van Wormer, 2011). To this end, the lead author collected additional data through participant-observer observations and observed and actively engaged with the community that participated in research. The lead author also engaged in personal communication with professionals of the health, tourism, and oil-field industries, state government officials who oversee policies regarding fish and wildlife gaming and conservation, and tribal education programs, to triangulate the information revealed from the participant interviews and gain a deeper understanding of the shrimp industry.

Two essential questions from the semi-structured interview (n = 19) were posed in order to learn the essence of the participants' experience: "*How does your livelihood put you in contact with the land"* and *"In what ways have these environmental changes impacted you personally"?* The process of horizontalization is to read each transcript in building on responses from the first two questions (Creswell, 2013). Line by line, significant quotes or phrases were highlighted. Next, participants' experiences were categorized into descriptions and meaning clusters.

A second author separately conducted a constant comparison coding method that compares specific incidents in the interview data. This process flows from developing preliminary codes, axial coding to incorporate relationships among the data, and then final codes analyzing similarities, differences, frequencies, sequencing, correspondence, and causation (Olson, McAllister, Grinnell, Gehrke Walters, & Appunn, 2016). Finally, the first two authors identified core concepts to ensure inter-rater reliability. The results reflect the agreed upon themes reflective of the emerged meaning of the participant's lived experiences.

Trustworthiness

The study has implemented several standards for rigor. Member checks were completed with tribal members, and a formal presentation was made before the community to disseminate findings and receive feedback prior to publication. Dialectical data, which uncovers new understanding in exploratory research, was collected in the form of interviews, observations with partial thick descriptions, field notes, and journal logs. In addition, the lead author and a co-author have had about seven years of prolonged engagement with the community. The observations were flexible and non-intrusive as a participant-observer. The questions utilized low inference vocabulary, and each participant received a hardcopy of the interview

questions for reflection. The lead author worked with the community advisory committee and the Tribal Council.

Principles for working with indigenous communities involve a cyclical and iterative process of relationship, responsibility, reciprocity, and redistribution (Walters, Stately, Evans-Campbell, Simoni, Duran et al., 2010). The empowering process promotes indigenous knowledge and co-learning which facilitates collaborative, equitable involvement of all partners in all phases of the research process (Walters et al., 2010). Walters et al (2010) argue that not only must researchers decolonize science, but they must call for the process of "indigenizing research" (p. 158) meaning to challenge power structures that delegitimize indigenous knowledge and sovereignty. Therefore, by understanding the shared cultural experiences of colonization, historical trauma, and discrimination among members and how these experiences influence perceptions of environmental changes, we can begin to understand the ways in which they can develop adaptation strategies.

Reflexivity

The lead author was constantly aware of the praxis as a researcher in this community. She was both an insider and outsider. As a tribal member, she was given an opportunity to respectfully ask permission to enter the community. Yet, she was an outsider because work and school drew her away from the community. The dual role provided advantages, yet she had to be reflexive at any given point. Practicing mindfulness and being aware of how to approach each situation while maintaining a professional yet friendly demeanor allowed her to escape political situations. To parse out (bracketing) her previous experiences growing up in the community, she made journals through note-taking and phone app audio. The journals were not intended for meaning analysis, rather as a method to process any memories of similar experiences that arose when interacting with participants. The journals were also intended to serve as a reflection process to incorporate information as both an insider and outsider. Journaling between each interview allowed for some separation between the lead author's experience and the next participant. These methods are suggested for phenomological research (Creswell, 2013).

Results

Results from qualitative interviews illuminate shared cultural experiences of exposure to environmental changes among members of the Indigenous

community. Participants answered questions about how their livelihoods put them in contact with the land, how the land has transitioned over time, ways that these changes impacted them and their families, how their families have adapted to these changes, and their opinions on long-term effects for the tribe and their families. Common among all participants was the shared memory of structural racism in their parish that remained until the late 1960s by denying “Indian” [sic] children access to an education. Termed discrimination, we present this theme first to emphasize the institutional barriers participants have faced. Moreover, they persisted. Next, we present a summary of participants’ shared experiences of living off the land, observations of environmental changes, and commonly expressed beliefs on the causes of those changes. The final section presents the theme of the interconnectedness of participants’ shared experiences that highlights the barriers to passing on cultural knowledge.

Discrimination

As mentioned, participants discussed their experiences with institutional discrimination through “Indian Schools” and connected their history to their shared perceptions of environmental changes, particularly with governmental responses to disasters and land loss.

An elder recalled that when he was growing up, tribal members were not allowed in restaurants (observation notes). Signs on all the restaurants and bars in Houma said: “NO INDIANS ALLOWED.” What made matters worse, he said, was that the discrimination caused Indians to fight each other in bars. People from different bayous or families would fight people from other bayous. He reflected that perhaps they fought each other because they believed the colonized message from the White majority that they were not good (observation notes). Also, during segregation, tribal members were not allowed to go to public school. Baptist and Methodist missionaries in remote locations along the bayou built schools designated as “Indian schools”. One elder who grew up in one of the most remote locations of the community recounts his experience:, “My daddy had all told us while we were young that we was going to have to learn the water, because we was unable to get an education” (participant 4). He did attend the first “Indian School” in the community, and he went on to share how ineffective the instruction was. “I didn't learn much. I learned my ABC, *[sic]* and I learned how ... Most of all my reading I have to say I learned on my own” (participant 4).

In 1968 (14 years after desegregation), tribal members could graduate from public schools. However, some people still feel unwanted in certain

White neighborhoods. In fact, many participants shared the belief that discrimination is the main reason their communities are isolated. In one community, a road from their remote location was built over water rather than over a natural ridge. In reference to the road, a participant said, “and the Whites over there, they didn’t want the Indians running through their backyard … that’s why they built the road this way (pointing to the road over water) and not over the ridge (pointing in the opposite direction)” (participant 6).

Participants also felt they were not welcome in White institutions, which prevented many from obtaining wage or industry employment. “An Indian guy, he couldn't borrow no money at the bank. That was a no-no.” (participant 15). Participants admitted that it is different now because they can go to school, eat at restaurants, sit anywhere in the theater, and borrow money from the bank. Yet, every participant similarly described how Indigenous peoples were treated from the non-Indigenous community. They accordingly chose to teach their children to fit in as best they could by speaking English instead of their language, dressing with store-bought rather than hand-made clothes, and attempting to gain a U.S. education.

Causes of changes in the environment

This section presents the participants shared beliefs on the causes of changes to the environment.

Oil field dredging and navigation canals.

The oil industry arrived in Louisiana around 1928, and many participants believe industry practices began the dramatic shift in loss of land. "Oil companies started drilling - opened canals and then didn't fill them, left them open. That started the erosion. First noticed it when they built the canal - Houma Navigation canal (around the late 1970s)." (survey comment, participant unknown). Another participant said, “it's saltwater intrusion you know and that's coming from the oilfield digging bayous and not concerned about what it would do to the land you know” (participant 1).

After decades of exposure to salt water, the once small canals are much larger. One participant describes, “when the first oil company started digging [the] canal - and then today, what was a canal back then, that's a bayou now. It's a navigation bayou now” (participant 15). One participant goes on to say that in the past oil companies could dig wherever they wanted, “this island was five miles wide and seven miles long before the

oil field came in here" (participant 6). Today, companies cannot dig canals with the same freedom they had in the past; however, when asked if he thought oil companies would repair the land, the participant responded:

> No. Not really, because saltwater is washed away the land. It just took away the natural way of bayous. The hurricanes came in. When, I think the oil fields, whenever they dug it. They hadn't let wooden dams or shell dams that they were supposed to maintain. They never maintain it. Now everything's just a big lake. Most of your seafood is going to follow its original migrating pattern like it always did. Now, it just has more of a bigger area to go into. (participant 6)

Dams

Cutting off fresh water supply through building dams has contributed to land loss in southern Louisiana. One participant described the harmful impact dams have on the marsh:

> They got locks and they got dams that are keeping all the water from coming into the marsh. And that's what I said a while ago, that you've got too much salt water coming in the marsh. That's why it's killing all the trees and your grasses and everything. If you had more fresh water coming in … In other words, [if] you had a lot of fresh water coming in that would make you keep your grass grow and trees all. (participant 15)

Boat traffic

The increase of boat traffic and the speed at which they travel provides constant waves washing up on the banks. A participant who lives further down the bayou noticed the boat traffic increase and said, "… what makes it wider, believe it or not, is these smaller boats that are going real fast and making wakes … I notice a difference you know because there's one place where the bulkhead is kind of rotting away" (participant 1). The waves in the past were fewer, smaller, and had a great deal less salt. The constant exposure to saltwater erodes the soil along the banks and slowly washes away the land.

Interconnectedness of place, culture, and health

Key findings show the cyclical nature between sociocultural events, physical environmental changes, and impacts (see Figure 1). Members expressed a great connection to their land (term to describe their place that includes the water, land, air, location, and all its living creatures).

These participants are dependent on the land for their basic subsistence and thus daily observe changes to their environment. Anthropogenic activities lead to a loss of medicines and harvest, which leads to impacts on health and livelihoods, which leads to loss of cultural knowledge transmitted and reiterated between and among generations, which leads to loss of knowledge on protecting land, which leads to developing anthropogenic activities that cause changes in the environment.

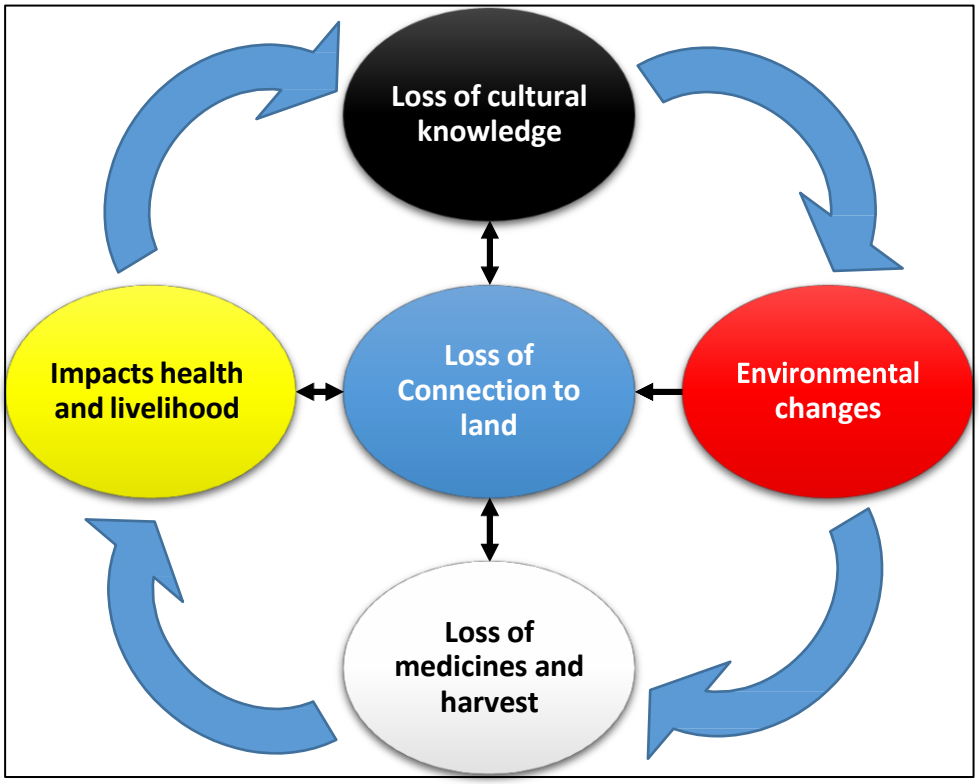

Figure 1: Interconnectedness of Shared Cultural Experience of Exposure to Environmental Changes Leading to Loss of Connection to Land

Connection to land

Participants grew up living off the land and in turn learned how to care for their physical environment. Older participants recall traditional ways of living off the land and rarely consuming material goods:

> You didn't need much in my time. All you bought in my time was sugar, coffee, rice, and flour. That was four things you bought. Everything else you lived off the land. That's how it was. Everything else was grown right there on the land. Whenever you'd buy flour and sugar, flour, and rice, they would come in a beautiful bag. Then the mammas would either make you a shirt or a pants with it (participant 4)

Another participant listed many of the fruits and vegetables they can no longer grow, “we plant our okras, sometimes our potatoes, squash, we have fig, we have cucumbers, we have orange” (participant 7). Parents taught their children that there were ways passed onto them to care for the land so they could reap the benefits of the land.

> You wouldn't want to throw that [the trash], or it - we eat the crab and the brother fish, crab, and the last thing you want to do is pollute the water. You want to keep that water as clean as possible. You know, we eat the crab and we eat the fish from out of that water. So the last thing you want to do is go and pollute that water and everything in that (participant 15).

Living off the land was a family effort that followed the seasons. From spring to early fall, families harvested water animals such as fish, shrimp, crab, and oysters. Trapping season was from November 1 through March 1. During this time, the children were taken out of school. The whole family would travel (by boat) to a mostly swampy area deep within the marsh and live in a camp with a palmetto roof. Alternatively, families would live in the boat. When asked how he felt about the area, one participant said, “I'm always gonna have a connection here. This is where I was born. This is where I was raised” (participant 6). All participants shared this sentiment. However, they also expressed sadness that their children, grandchildren, and great-grandchildren would not have the same connection because they can no longer perform these activities.

Observing changes in the environment

This section describes shared experiences of observing changes in the environment such as repeated disasters, chronic land loss, and climate change.

Repeated disasters

Juan, Lilly, Andrew, Katrina, Rita, Ike, Gustav—there have been many hurricanes (see Table 1); however, it was not until the early 1990s that people started experiencing consistent, repeated damage to their homes, “[Be]cause I been through all the storms since 1965 ... It was Andrew put

12 inches of water in the house" (participant 14). Another participant said, "(w)e used to have some big trees on that side and some on that side but with the storm coming and all, they all fell over on the roof over there. One fell on the porch on that side."

Participants recount their whereabouts for each hurricane, the emotional turmoil of making evacuation decisions, and how much water was in their homes. One married participant who harvests with her husband described one of her experiences:

> We was only home two weeks from Katrina. We evacuated for Katrina, but Katrina didn't really hurt us in the yard. We was only home two weeks for Katrina that we had to evacuate for Rita. Then Rita's the one that brought a lot of water in this yard. Then, in between [Ike] and Gustav, we evacuated to Little Rock, Arkansas for Gustav. We was over there, it was costing too high 'cause I had all my kids and I was paying their room. I said, "We're going to go to Texas." I said, "I'm going to rent a beach house.", 'cause we have friends over there in Texas that it wasn't going to cost me as high. I could get one beach house and pay one thing. But Ike was brewing too. We was in Texas and watching the news. My daughter says, "Mom, when we going to leave?", 'cause she was worried about the … I said, [Name], I don't know where Ike is going yet. When I'm a little for sure where Ike is going", I says ... 'Cause I didn't know if I should start ... Which ways to start. ... Yeah, that was about maybe the scariest, 'cause I didn't know which way I was going to go from Texas, if I was going to come towards Louisiana, or go further north. (participant 2)

Her description of the types of important decisions needed to evacuate (what to save if your home is destroyed, who will share financial support, and which is the safest route) demonstrate the high stress that occurs before a hurricane. The participant also highlights the relatively new actions of evacuation.

Older people heard stories from their elders about hurricanes of the past. One story is about a hurricane in 1885 that wiped out a plantation turned resort-mansion in Grand Isle, Louisiana (the hurricane actually occurred in 1893). The story highlighted that as long as their parents and their parents' parents have been there, there have been hurricanes. However, the participants' perception was that the "big ones" only came around once a decade or generation. Now, they believe that not only are larger hurricanes much more frequent, but there are no longer natural defenses to protect them. Additionally, participants perceive that manmade defenses like levees are ill-equipped (observation notes).

The repeated hurricanes caused permanent damage to their lands, "nature was still the same, until the hurricanes came and changed the whole landscape" (participant 14). Now, they say damage comes from

heavy rainfall or lesser grade storms, “The only time you had water on the land was for hurricane. But now, if you get a tropical depression, tropical storm, and you get high water” (participant 15). Table 1 lists all of the recorded disasters and their impacts on the community.

Chronic land loss

Louisiana’s coastline has lost an area about the size of the state of Delaware, and projections estimate that a further amount about the size of the Baltimore and Washington, DC area will be lost by 2050 (Boruff, 2005). The loss of land is salient along the bayous of coastal parishes. Affected trees appear to be in hibernation with no leaves, even in the summer. The loss was frequently discussed by participants and described in different ways. A female participant said, “(s)hoot, we don’t have no more land. It's like the land would separate like the bays and the lakes and all. Now it's all one” (participant 3).

One semi-retired man said, “they used to have land on both sides. Now it’s all open. It all washed away. And it’s getting worse every year. Every hurricane it washes them away, you know” (participant 12). Going forward, many elders are concerned about the amount of time they have left to live on their land. A married couple said “every year is less and less, and it’s not going to get any better, because the more loss of land we have, the more damage is being done” (participants 7 & 8).

Participants advise that the land is eroding so fast that they now need a GPS system and radar to recognize their location. “A lot of people go down there, they don’t know where they are at and they get lost” (participant 3). Participants who are away from the coast for a few months or a season have trouble recognizing certain places when they return. These instances confirm for them how fast land is eroding and what they are losing.

> The water has changed. The area has changed. Oh, lord a lot of the coast, the coastline and especially where we would go shrimping at has changed tremendous because it all ate up. Some places we would go was just a little small lake. Now you go, it's a big wide-open lake. (participant 10)

While participants indicate it feels like the land eroding “fast,” the erosion is not always associated with a specific event, such as a hurricane or a technological disaster. For the most part, participants do not know the exact moment a piece of land separated from their wharf, never to return. While hurricanes do contribute to loss of land, the majority of the loss

cannot be seen as it is eroding. Only once you have stepped away and then returned can you see the land is gone.

Health of environment impacts health and livelihood of the people

Climate change

Participants believe that warmer temperatures have led to changes in migration patterns of birds and seafood. Participants noticed that duck and pouldeau (American coot) have been arriving later in the past few years than they did in past decades. When they do arrive, participants have a small window to harvest them because of the hunting season laws set by the Louisiana Department of Wildlife and Fisheries. Regarding the avian migration and the law, one participant said, “the duck season was always far too early for us down here. They should wait until the first good freeze to open up the first good part of duck season. Here it should go up into February” (participant 5).

Pollution of bayous or canals

Participants have noticed changes in the environment through pollution of the bayous or canals. “Because I was living in this house for (Hurricane) Juan, and Juan brought in some waters … And then after two, three days … the water turns black. It’s like a polluted water” (participant 14).

> They got so much pollution in there the fish die in the bayou sometime. This year for sure I think. Yeah, after we had that hard water and a lot of the water they didn’t pump it out right away, and it stayed, oh Lord, it stunk. Water got black, black. Black, black and the fish were popping up. (participants 7 & 8)

When the water becomes black and fish “pop up”, there is little oxygen in the water, which kills the fish. In the past, this only occurred after hurricanes, but now it happens more frequently, such as after lesser storms or flooding to the north.

Communications with representatives from Louisiana state departments reveal that formal responses will not acknowledge climate change nor any observed impacts, such as fish and wildlife migration patterns, seasonal changes, or pollution in the Gulf of Mexico and inside waters (LeBreton, 2015). Official responses rely on standard claims of “variations from year to year,” and though they acknowledge research into these areas, their response is that they do not see enough research to confirm climate change.

Loss of medicines and harvest reduction

Several people shared that they did not go to doctors when they were growing up. Instead, if they had health problems, the traiteur (a healer), would use traditional medicines of herbs, plant roots, trees, solvents, and prayer to heal them:

> Well, yes, a long time ago. Like down here, we didn't go to the doctor every time that we had something. [If the kids] had a bad cough or asthma. We would call [the traiteur] and she would come. She had some big staff or something like that, and she had her rosary with her to say a prayer. I would believe in that. Then I had my grandpa; if you cut yourself and you was bleeding anywhere, he'd come and treat you. He'd make a cross on your forehead, and he'd say a prayer. That bleeding would stop. We didn't go to the doctor or anything like that. Oh, yes. I believe in those days, but that's gone. (participant 15)

When asked why they no longer use traiteurs, the consensus was that there are few, if any, practicing traiteurs remaining. Participants who do know of some of the prayers and ways of the traiteurs travel to northern Louisiana to find many of the plants and trees because they no longer grow in the area (observation notes).

Participants have experienced a reduction in harvest. Those who fish for shrimp note the volume of their harvest and the size of the shrimp they catch. The brown shrimp travels from the Gulf into the bayous, and traditional methods were to catch the shrimp as they funnelled out of the bayous on their way back to the Gulf. Not only are the shrimp now in “inside” waters (water less than three miles between land and the Gulf), but quantities and sizes are smaller.

The decrease in shrimp size and population, in turn, influences the price per pound. Other participants describe the size of the population of shrimp, “Before it used to have more shrimp than now” (participant 3). Crab fishermen shared similar concerns on the health of the crabs. “That’s why crabs are getting less and less. They’re not throwing back the small ones so they can grow and produce more crabs”. Another reason some participants believe their livelihood is impacted is through globalization of seafood harvesting:

> Ain’t got no price now. Them shrimp there used to be like $8, $7 a pound. Now we got a hard time to get $2, that's a big difference. … the factories say it's because of the globalization, because of buying from foreign shrimp, that's why their setting the prices so low. (participants 7 & 8)

The health of the Louisiana coast limits the amount of seafood it can produce. The reduced amount of production cannot meet demand for

seafood, and factories supplement their sales with imported products (observation notes). Describing the long-term effects of environmental changes on their way of life, participants did not seem hopeful that future generations can continue their way of life, because the land has changed so much in their lifetime, “I don’t think they’ll never get it back to just what it was 20 years ago … There’s no way. We’ve lost a life that’ll already never be restored” (participant 5). A common phrase was “they’re doing too little, too late”.

In response to the question of whether they think their health and the health of their family has been impacted because of these changes, participants had mixed reactions, from describing ability to have fresh food and vegetables, to beliefs that the changes are causing health problems:

> No, not everything, no. But the land is not like it was before, because I was born across the bayou and I can tell you that for a fact my grandma raise their own garden, like green beans, potatoes. We had sweet potatoes, we had corn, and we had good potatoes. That was the last you all year until next grow. You see, they wouldn't go to the store and buy that. And uh, and that's how it was. We didn't have no freezer, you see. That was all put in jars. Where they had flowers and stuff planted in the front, now every time during the summer time, in the summer time when the water get high, it got water then. At that time, it was high and dry. The only time you had water on the land was for hurricane. But now, if you get a tropical depression, tropical storm, and you get high water. (participant 15)

For many, the loss of land has meant the loss of access to fresh food and water**.** Participants used to grow their own food. “My grandpa, we grew okra, corn, squash, cucumber, potato, snap beans, peas… Everything was all for our own consumption” (participant 6). However, the increase in salt content of the soil decreases its ability to grow medicines and healthy foods. Instead of planting on their property, either they buy food and medicine or plant further from the Gulf (up the bayou) where the soil is better. One younger participant said:

> It’s like I said, its different season for different things because we used to plant okra and stuff like that down the bayou. Now the ground is I guess more saltier water. That don’t grow down there. We’ve got to plant it up here further north. (participant 9)

An elder participant said:

> And today, where we used to do that, they cut canal and … and everything. That's mostly salt water today. Just like where we live right now, you see, where we live right now, you can make your garden in the back, you can plant your green beans or whatever you wanted to plant

> and it will grow [in the past]. But now you've got too much salt in the soil. It will not grow. And if it grow, it will not produce any vegetable at all. It would get pretty and leaves, but you won't have no tomatoes, no cucumbers, no nothing. (participant 15)

Growing up, participants had access to fresh fish as a source of nutrients like protein, vitamin D, and omega-3 fatty acids. Now, participants say they are limited in their ability to catch seasonal fresh water fish, "(w)e ain't had none … not like we would have had if the fish would be biting like we used to had in October, November." (participant 5). They believe this, in turn, impacts their health:

> Maybe cancer too because you hear a lot about the younger, you see we had two daughters had cancer… I guess that too has a lot to do with the environment, because, I'm 68, and he's 70, and when we were growing up, you never hear about a lot of cancer. (participants 7 & 8)

Another person attributed high cancer mortality to the British Petroleum (BP) oil spill, "We worked for BP cleaning up and all … Since the oil spill there's a lot of people that died of cancer down here" (participant 12). The same participant expressed how the oil spill contributed to the health of the seafood as well, "before the oil spill, they was catching a lot more crab. And there were more oysters, too, and shrimp."

Participants wonder if changes in the environment, including disasters, coastal erosion, and pollution, are causing other health conditions like sinus problems or allergies,, "(y)ou think about everybody that's dying down here, so it makes you wonder if our soils are not contaminated or if our air is not contaminated or something and it's slowly killing everybody down here." (participant 2).

Another participant said, "(y)eah, most probably sinus" (participant 7). While others are more cautious to believe that there are health impacts:

> Well I … I'm hoping that you know we can see more results on some of the tests that they've been doing and all this. And I'm just hoping that nothing comes of it … I don't want to let go of it. And I don't ever want to hear that we can't eat you know because we do eat a lot of fish here you know. And because of the cholesterol level, my wife doesn't want to eat a whole bunch of shrimp you know. She's a lot more about regulating what we take in you know. (participant 1)

Expressing sadness of coastal erosion and connecting the health of land with overall wellbeing, one community member said in passing,

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"[coastal erosion is)] it's the cancer of the land" (direct quote in observation notes)

Loss of cultural knowledge

Traditions need to be continually reinforced and practiced to maintain relevance to a culture. For example, older participants who lived a more traditional lifestyle recall that when they got their first boat, there was a ceremony to mark the occasion. However, younger participants worked for wages on other boats to save for their first boat and did not have rite of passage boat ceremonies. The only remaining ceremony is the annual boat blessing that occurs just before the first day of spring shrimp season.

Fishermen are now forced to be more reliant on technology to navigate the waters. With many of the land markers disappearing, they must use a combination of computer systems equipped with GPS and radar technology. Without these tools, even the most experienced fisherman can get lost.

To make a living, fishermen have had to adopt Western practices of harvesting and operate not only as individuals harvesting for subsistence, but as commercial fishermen. The transition from traditional methods to Western practices also meant that some adopted techniques were not sustainable practices. Therefore, adopting the Western techniques interrupted the reiteration of traditions and passing on of knowledge, such as caring for the land.

Surviving as a commercial fisherman requires many more skills today than in the past. In many pockets of the parish, among predominately White and wealthy residents, there is still a low perception of fishing as an occupation. Wealthy residents believe that because shrimping is labor intensive, it does not require much skill or intelligence and does not produce wealth. However, every participant in the study exhibited tremendous intelligence and skill. There is a set of skills, termed ecological knowledge, associated with knowing how to navigate the water and working with the ever-changing seasons and laws guiding the practice that are unique to tribal members. In addition, commercial fishermen must possess management and leadership skills to successfully run a small business. The lead author spent weeks trying (unsuccessfully) to understand all the laws associated with the fishing industry and migration patterns to conduct interviews with them. Study observation notes express constant awe of their ability to continue to persevere with the constant changes and threats.

State laws prohibiting traditional practices contribute to lack of tribal sovereignty of the Tribal Council and agency among individual members

to protect the environment. For example, trapping used to be a major source of revenue for many tribal families. Not only did trapping for nutria reduce the invasive species population that causes extensive damage to the wetlands, nutria pelts were also sold to the fur trade industry. Then in the 1980s, nutria were labelled as protected animals, and the fur trade industry declined. “Well, that [trapping laws] started changing about the 1980s. That’s about the time it started change for the worst for us” (participant 15). However, Louisiana state officials noticed an increase in the damage to the marsh from a lack of nutria population control and implemented a coast-wide nutria control program. The program offers $5 per nutria tail delivered to the department of wildlife and fisheries (observation notes).

Another activity outlawed was the practice of burning, which trappers practiced to help preserve the marsh for the following year. An elder participant discusses how it protected the land from natural and manmade disruptions:

> Just about every storm that they had that came, you had a big change. Big change. Any time you're going to have a powerful storm that's going to come, it's going to take some marsh with it. If you don't have the marsh, you don't have much to protect the land. When they had trappers that trapped the land, they would burn the land every year. Every year they would burn the marsh. Right when trapping season closed, they would burn the marsh, and the marsh would stay hard. It would keep the marsh hard. Then a new growth would come, and that would keep the land. Yeah, that would keep the land. (participant 4)

Indigenous practices included things like burning the marsh annually in different locations to strengthen it. These cultural practices also include maintaining interactions with the environment as essential to reinforcing cultural knowledge. Older participants who earned above median income still interacted with the land and water in some way.

In another example, because of their experience working on the waters from a young age (youngest reported running his own boat at age 10), fishermen were sought to run tug boats along the Mississippi River. They knew the water, and more importantly, knew how to navigate in calm and treacherous conditions. In addition to their wage-earning career, fishermen would still take to the waters on their days off in shrimp, crab, or oyster boats. In many instances, their spouses and children would run the fishing boats in their absence. When those interactions are interrupted, they lose the ability to care for the land.

Participants noticed changes in their environment through land loss and migration patterns and believed these changes were impacting their

livelihood. One possible example is the reduction of brown shrimp for shrimp harvesters. Three measurements are key to stock yield and level of growth for brown shrimp: temperature, salinity, and tidal height. Prior to the 2015–2016 brown shrimp season, NOAA (2015) predicted a low-catch season, in which there would be about 24.8 million pounds of brown shrimp harvested off the coast of Louisiana. This volume prediction was lower than the 53-year historical average of 30.8 million pounds. The decrease was attributed to record high rainfall (NOAA, 2015). In addition, during the 2015 shrimping season, fertilizer entering the Gulf impacted fishermen livelihood. (Smith et al., 2017) found that fertilizer and other chemicals introduced into the Mississippi River through its tributary system impacts the relative price of shrimp through the process of coastal hypoxia, which affects the size of shrimp within the population. Fertilizer and other chemical runoff flows into the Mississippi River system during times of high rainfall, leading to greater hypoxia in the Gulf (Smith, Oglend, Kirkpatrick, Asche, Bennear et al., 2017).

Observations made by participants about shrimp size and population were accurate for the 2015–2016 season, even without the advantage of scientific data. This highlights the importance of accepting and utilizing Indigenous knowledge to improve the quality of research and expand resource management (Huntington, 2000). If the knowledge provided by NOAA was shared with tribal members, harvesters could make informed decisions. Likewise, if NOAA scientists consulted with tribal members, then their prediction models could have greater forecast precision. A possible solution could be to include NOAA scientists in the development of a formal mutual consultation effort.

These findings further shed light on the need for social workers to be trained in environmental justice issues for both macro and individual-level practice. At the macro level, the findings highlight the interconnectedness of anthropogenic activities, the health of the environment and people, livelihoods, and culture. In the finding just described, environmental justice practitioners could work to develop interventions to address non-sustainable practices.

At the community level, social workers can be part of the call to action, to develop and implement educational and sustainable living interventions (adaptations) and guidelines. Mezzo-level social workers can concentrate their efforts among those in rural versus urban geographic locations (Green, Niall, & Morrison, 2012), as these social vulnerabilities only enhance impacts to environmental changes. Here, social workers can conduct vulnerability assessments and develop disaster preventative plans with clients. As evidenced by the work presented in this paper,

mental and physical health needs abound. Therefore, building workforce capacity to handle the influx of need, developing mental health strategies to adapt to environmental changes, and creating resources for food and water-stricken communities are all areas in which social work practitioners can be involved.

At a national level, the micro-level practice field also offers many opportunities for social workers to engage in addressing global environmental change. Clinical social workers can develop trauma and crisis interventions that build on attachment theory that is used in early childhood and adolescence and as a guideline for working with indigenous clients who experience loss or disruption to their environment. Medical social workers can follow examples from Australia, New Zealand, Canada and Peru to develop culturally appropriate health services that integrate western practices with indigenous medical practices (Stephens, Porter, Nettleton, & Willis, 2006). Additionally, there is a need for social workers to develop a culturally relevant notion of "environment" similar to that of aboriginal Inuit—where personhood is understood as identity that includes one's relationship with the land and environment (Kirmayer, Dandeneau, Marshall, Phillips, & Williamson, 2011).

Limitations

This exploratory study is part of a larger cross-sectional study with a convenience sample recruitment of 19 people. The results from this study have the potential to inform future studies related to Indigenous peoples' connection to land, generational decline in sharing knowledge due to external factors such as environmental changes from climate change, coastal erosion, and repeated disasters. In addition, the study might also inform studies that seek to identify risk factors from environmental changes. However, this shared cultural meaning can only be generalized to the participants in the study and not to other members of this tribal community nor other indigenous, coastal, or Louisiana communities.

Conclusion

Exposure to global environmental changes will pervade into life on Earth (Moran, 2010). Thus, humans will experience social, economic, and health impacts (Boruff, Emrich, & Cutter, 2005; Nicholls et al., 2007; WHO, 2014). For instance, rising temperatures will mean widespread vector-borne illnesses (i.e., malaria), malnutrition, and diarrheal diseases (World-Bank, 2010). Additional research suggests increases in non-

communicable diseases (i.e., cancer, cardiovascular disease, mental health and stress-related disorders) as potential impacts on human health (Portier, Hess, Luber, Maslak, Radtke et al., 2010).

How humans experience consequences of environmental change depends on proximity to exposure as well as social and economic differences across communities (Adger, 2006; Boruff, 2005; Cutter, Boruff, & Shirley, 2003; Gillespie, 2010; Nicholls, Wong, Burkett, Codignotto, Hay et al., 2007; Vogel, Moser, Kasperson, & Dabelko, 2007). Marginalized populations, such as indigenous coastal communities, are especially vulnerable to additional pressures on their struggling social systems. Environmental change impacts on human health will be exacerbated among indigenous peoples due to existing health inequalities (Ford, 2012; Gracey & King, 2009).

The purpose of this study was to elucidate meaning from shared cultural perceptions of experiencing environmental changes among an Indigenous community. Tribal members' perceptions were searched through interviews and observations. Results indicate the complex relationship between their connection with the land and their ability to pass on their knowledge. Tribal members observed environmental changes through repeated disasters, chronic land loss, climate change, and pollution. Their shared cultural perceptions of exposure to environmental changes illuminates the cyclical interconnectedness of place and human activities. Their experience of place is also informed by structural and persistent discrimination. This shared knowledge informs how tribal members perceive exposure to environmental changes. Although desegregation occurred more than 50 years ago, there is still an informal boundary demarcated by a tunnel separating the west side from the east side based on race and wealth.

Feelings of discrimination and being an 'other' on a subordinate level was infused with the how they have come to view the extreme land loss and its impacts. These external political, economic, and social forces occurred out of their control. As a result, it is possible that the grief expressed is due to historical lack of agency and self-determination to protect themselves and the environment that is central to spirituality, subsistence, and way of life.

This study contributes to previous research that found natural resource-dependent communities, like Indigenous populations, are deeply connected to their place, and disruptions to place cause additional stressors (Cunsolo Willox, Harper, Edge, et al., 2013; Cunsolo Willox, Harper, Ford, Landman, Houle et al., 2012) by contributing to negatively impacting feelings of place (Cunsolo Willox et al., 2012) or sense of loss

(Healey, Magner, Ritter, Kamookak, Aningmiuq et al., 2011). Participants discussed an increase in stress, especially in times of disaster response.

These findings are consistent with notions of place attachment. The transformation or loss of interaction with the environment is expressed as trauma for those whose traditions, memories, and resources are dependent on the environment. The sadness extends to their future generations loss and their inability to pass on that knowledge. This research contributes to the previous call for empirical studies that seek to understand the physical environment as a potential determinant of mental health indicator in future practice, policy and research to contribute to our understanding of attachments to place. Future research could also explore place as a factor in enhancing or eroding identity and another potential risk factors for mental health.

As with disaster response and recovery work, disaster preparation is funded only when a disaster becomes a crisis. Similarly, the slow onset of global environmental changes limits funding for research and planning due to lack of sudden crises. Some states and tribal communities are developing their own climate change laws and strategic planning, yet without a national or binding international law to address climate change and adaptation, disasters will continue in intensity, duration, and occurrence. The interconnectedness between place and culture shown in this study highlights the importance of adapting to environmental changes not only for physical protection but also for health and wellbeing.

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Table

Table 1:
Summary of Natural and Technological Disasters in the Community, 1957-2019

Disaster	**Year**	**Primary Impacts**
Audrey	1957	Flooding, infrastructure
Betsy	1965	Storm surge, levee breaches
Camille	1969	Flooding, fatalities, major infrastructure damage
Juan	1985	Flooding, levee breaches
Shell Oil Explosion	1988	Fatalities, lasting pollution
Andrew	1992	Property, school, infrastructure damage, loss of millions freshwater fish
Georges	1998	Fatalities, flooding, destroyed barrier islands
T.S. Allison	2001	Storm surges causing evacuations
Lilli	2002	Infrastructure damage caused 1 fatality (carbon monoxide poisoning), storm surge, flooding
Katrina	2005	Flooding, storm surge
Rita	2005	Massive loss of property, flooding, permanent residential decline
Gustav	2008	Levee breaches, loss of wildlife
Ike	2008	Infrastructure and property damage
BP Oil Spill	2010	Fatalities, permanent loss of fishers and population
Mississippi River Flooding	2011	Infrastructure and property damage, levee breaches
Isaac	2012	Storm surge, property and infrastructure damage

Note: T.S. = Tropical Storm 2. The named disasters listed are immediate onset events and excludes ongoing and chronic environmental exposures to toxins within the “Cancer Alley” along the Mississippi River and coastal erosion.

Figure

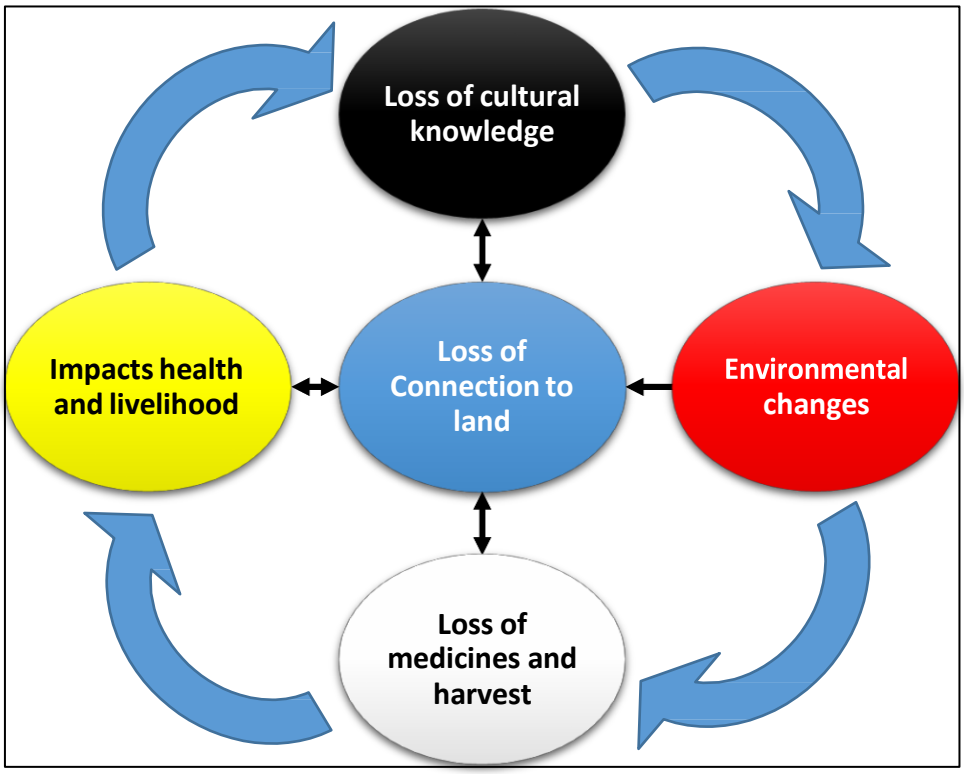

Figure 1: Interconnectedness of Shared Cultural Experience of Exposure to Environmental Changes Leading to Loss of Connection to Land