Value, Access, and Use of Ethnobotanical Databases in Ethnopharmacology: Methods, Ethical Research, and a Case Study on the Aurukun Ethnobiology Database Project

By

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Abstract

Traditional knowledge databases are becoming increasingly instrumental to research objectives in ethnopharmacology. Codified medicinal knowledge of Indigenous peoples is part of what constitutes these databases. Indigenous peoples' medicinal knowledge is systematized in database in order to facilitate analyses by researchers. The value, access, and use of traditional knowledge databases by Indigenous peoples is not well researched. The Aurukun Ethnobiology Database study stands as one example where Aboriginal people have co-developed a database with ethnoscientists using a participatory research process that privileges Indigenous methodologies. The adherence to cultural protocols and control of the database by the community resulted in recommendations from ethnoscience researchers that discourages such projects in the future. Standard methodologies in ethnopharmacology are incongruent with the protection, by Indigenous people, of their knowledge systems. Indigenous geographies' scholarship is used in this thesis to examine how technoscience, disciplines, researchers, and communities interact and how outcomes can work *for* and/or *against* equitable research processes, self-determination, and sovereignties' of Indigenous peoples.

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Introduction

Traditional medicinal systems have contributed to an estimated 80 percent of the world's health care needs and are vital to a growing population (Farnsworth et al. 1985). An estimated 25 percent of pharmaceutical drugs contain an ingredient derived by plants, many of which were used as medicine by traditional cultures (Fabricant 2001; Verma and Singh 2008). Ethnoscientific fields of study, interested in traditional medicine, are increasingly reliant on quantitative methods and database (Heinrich et al. 2009). This growing focus on quantification and technology can create a resistance to equitable research strategies and methodologies that provide adequate benefits to communities. This has the potential to effect the co-development of technologies like databases *with* or *for* Indigenous communities and broadly has implications for researchers wanting to establish collaborations and partnerships (Koster, Baccar, and Lemelin 2012).

The development and use of databases integrated with traditional knowledge is expanding. While there's an estimated 35 year history of using databases in ethnoscientific subfields (e.g. ethnobotany, ethnobiology, ethnozoology, ethnopharmacology etc.) we know little of their potential significance to Indigenous communities. There is also little known about how Indigenous communities might develop, co-develop, or access this expanding technology. Communities wanting to maintain control of a database will likely require autonomous development or collaborative partners committed to methodologies that adhere to cultural protocols and the protection of traditional knowledge. When considering the importance and potential development of a database it is essential to assess its value as a digital technology or technoscience.

Technoscience, or digital technologies, can contribute to the needs of Indigenous communities but Johnson, Pramono, and Louis (2005) recommend that a critical literacy be used to contextualize their historical entrenchments with colonization. Scholars in the subfield, Indigenous geographies, have reviewed and critiqued the history of geographic information systems (GIS) use in order to provide a critique of colonialisms' effect on Indigenous peoples and to provide insights about how GIS contributes to Indigenous sovereignties (see: Coombes, Johnson, and Howitt 2012). My goal is to assess how these critiques of GIS contribute to understanding the potential value of databases for Indigenous peoples and problems that might arise in the co-development of databases between researcher(s) and communities.

Equitable research processes that incorporates community into the research process include community-based participatory research and participatory action research. An examination of the Aurukun Ethnobiology Database project is presented to expound upon the relationship between equitable research processes, technology co-development, and access to data. The study provides a valuable example showing the rational of Aboriginal communities to develop a traditional knowledge database thus shedding light on the value and potential use of databases by Indigenous peoples worldwide. It also illustrates the potential for tensions to occur as researchers seek out equitable research processes that conflict with disciplinary methodological standards. Elevating the importance of cultural protocols can affect the overall outcome especially where access to co-developed technologies are concerned. The review of scholarship out of Indigenous geographies facilitates further discussions around the evolution of equitable research processes and how they impact technological development.

If communities and researchers choose to use equitable research processes to develop technologies it is important to understand the underlying dynamics that can influence both the process and the outcome. To accomplish this, I relate ethnopharmacological conceptualizations of traditional knowledge and standard methodologies to the discussions around equitable research processes emerging out of Indigenous geographies scholarship. It is not my intent to cast broad generalizations to all ethnoscientific fields based on my findings. Positioning the examination on ethnopharmacology helps understand how and why disciplinary objectives and methodologies have the potential to produce tensions with equitable research processes. Such an examination can prove useful in further examinations of other disciplinary fields. There are marked distinctions between ethnoscientific subfields, such that, each are deserving of research. Research relating to the interplay between research processes, digital technologies, outcomes, and their effects on Indigenous peoples is especially needed.

Databases and GIS are digital technologies that are both georeferenced and as such are not conceptually distinct innovations. In order to assess databases and GIS as differentiated technologies, a focus on critiques in methodologies is an appropriate strategy. I look to Indigenous Geographies, and to a large extent the methodological developments coming out of the Indigenous Peoples' Specialty Group (IPSG) of the American Association of Geographers, to develop a critique that is informed by historical entrapments between geography, GIS, and their effects on Indigenous peoples. I set out to ask the following:

Research Questions

1. What methodological lessons can be learned based on the historical relationships between communities, research, and GIS that informs the use of databases and research with Indigenous communities?
2. What is the potential value of databases for Indigenous peoples?

The thesis progresses by first examining traditional knowledge and providing context for its treatment in ethnopharmacology. I then cover the value and use of traditional knowledge databases and technoscience more generally. Next, I cover the relationship between traditional knowledge and ethnopharmacology. Certain methodological standards are examined that affect equitable research processes and methodologies. The role of technoscience and critiques focused within Indigenous geographies scholarship follows and provides structure and context for the examination of the Aurukun study. I draw on some responses in the literature to the study to elaborate upon tensions and conflicts that disciplinary objectives and field methodologies produce. The discussion section relates the outcome found in the Aurukun study to extrapolate on equitable research processes more generally. What questions can communities and researchers ask during the design phase of research that makes use of critical literacy? Such inquiries can enhance the future development of equitable research studies, collaborative partnerships, and the co-development of digital technologies.

Traditional Knowledge

Traditional knowledge systems are dynamic, operating in multidimensional physical, geopolitical, and legal realms, each of which present a set of challenges. Indigenous

epistemologies and ontologies entrenched in traditional knowledge systems are inextricably linked to ecosystems, language, self-determination, sovereignty, and biodiversity (Johnson 2012). In practice, traditional knowledge systems “offer modern societies many lessons in the management of resources” (WCED 1987, 12). Lakshmanan and Lakshmanan (2014, 31) state that traditional knowledge systems operate in “multifarious fields such as traditional medicine, agricultural innovations, food technology, biodiversity conservation, and climate change mitigation....” Given the scope of issues involved, studies concerning traditional knowledge systems comprise a dynamic range of themes and questions. How traditional knowledge systems are understood and positioned speak directly to research processes and outcomes.

Traditional knowledge has no agreed upon definition and international entities, scholars, intellectuals and Indigenous peoples have all defined it in one way or another. Berkes and Berkes (2009, 7) define Indigenous knowledge as “a body of knowledge built up by a group of people through generations of living in close contact with nature. It is local knowledge held by indigenous peoples or local knowledge unique to a given society, including some non-indigenous ones.” Invariably, Indigenous people have the right to decide what “constitutes their own knowledge, innovations, cultures and practices, and the ways in which they should be defined” (WIPO 2001, 25). Traditional knowledge categories include:

> agriculture knowledge; scientific knowledge; technical knowledge, ecological knowledge; medicinal knowledge…biodiversity-related knowledge; "expressions of folklore" in the form of music, dance, song, handicrafts, designs, stories and artwork; elements of languages, such as names, geographical indications and symbols; and movable cultural properties (WIPO 2001, 25).

The process of colonization and globalization has weakened place-based traditional knowledge systems that rely on access to land and resources. Indigenous peoples' often contest threats to land, access to resources, ways of knowing, being, and living in the world (Nadasdy 1999; WIPO 2001). The very use of the term traditional knowledge is contested in as much as it is argued to constrain people's thoughts and actions (Nadasdy 1999). This constraint on our thinking is most germane to our understandings of traditional knowledge and it relationship to science, to how it is approached practically and theoretically, and to its integration with technology (Nadasdy 1999). For now, I will contextualize traditional knowledge in order to later examine issues surrounding equitable research processes and outcomes.

For this thesis, traditional knowledge is used to refer to: traditional ecological knowledge (TEK), traditional botanical knowledge, traditional medicinal knowledge, local knowledge, Indigenous ecological knowledge, and Indigenous knowledge, In particular I focus on those forms of knowledge that are integrated into digital technologies. My rational is that traditional knowledge as a term is broader in scope but the literature citing aforementioned terms will be utilized when needed. Where context necessitates a distinction between terms one will be made.

It *is* my intent to make a distinction between how researchers and scientists generally approach and use traditional knowledge from its understanding as being inseparable from Indigenous lifeways and practices (Nadasdy 1999). There is evidence that Indigenous practices evolve through "adaptive learning, based on…a gradual understanding of the environment" and "lessons learned from mistakes" (Berkes and Berkes 2009, 7; Berkes and Turner 2006). While many recognize that traditional knowledge systems are dynamic, adaptable, and linked with cultural practices, many more treat it as static or frozen in time This treatment serves to relegate

more recent or post-colonial Indigenous cultural practices into the realm of the 'inauthentic'. (Morrow, Phyllis, and Hensel 1992)

The adoption or adaptation of cultural practices and knowledge systems to a contemporary world is considered proof that true 'authentic' traditional knowledge is disappearing (Morrow, Phyllis, and Hensel 1992). That said, we cannot ignore that Indigenous peoples are concerned with the disruption of lifeways and acknowledge that threats are upsetting their relationships to the land and each other (e.g. loss of land, land degradation, political disenfranchisement, species loss etc.). How can researchers make a distinction between traditional knowledge systems as preserved and evolving in Indigenous ways of life and forms of traditional knowledge that are collected and preserved in digital technologies?

Traditional knowledge is not *preserved* in digital technologies, only within communities, and when we speak of preserving it, we are referring to only a form of it. As Grossman et al. (2010, 2) point out: "knowledge *about* Indigenous peoples is not the same as Indigenous knowledge, which is held by the people themselves." I refer to *forms of traditional knowledge*, held in digital technologies, as systematized traditional knowledge and argue it represents a form deserving of its own critique and examination. I agree with Bohensky and Maru (2001, 6) that knowledge holders are not to be treated "merely as reservoirs of local or indigenous knowledge" but recognized as "agents with their own ideas about the salience and legitimacy of various forms of knowledge." Thus, when as researchers, we 'collect' traditional knowledge it is simply a *form* of it that we document and analyze and we should never ignore the critiques regarding its application by Indigenous knowledge holders and communities.

The ‘saving’ of traditional knowledge requires a holistic approach that confronts threats to Indigenous access to lands, resources, and rights; it upholds the importance of self-determination and sovereignty; and it cannot be accomplished via a technological solution. As Rundstrom (1995, 55) makes clear, “[i]n every case, it has seemed to me, the underlying attitude is that indigenous peoples and their geographical knowledge must be “saved,” i.e., before we destroy them, because they have information that we need.” That said, technology can play an important role in assisting such endeavors (Johnson, Louis, and Pramono 2005).

A major contemporary theme of systematized traditional knowledge is the protection of intellectual property. The World Intellectual Property Organization states that traditional knowledge is “highly diverse and dynamic,” and that it “may not be possible to develop a singular and exclusive definition (WIPO 2001, 25). In relation to intellectual property and its protection, traditional knowledge refers to:

> tradition-based literacy, artistic or scientific works; performances; inventions; scientific discoveries; designs; marks, names and symbols; undisclosed information; and all other tradition-based innovations and creations resulting from intellectual activity in the industrial scientific, literary or artistic fields. (WIPO 2001, 25).

Ethnopharmacology is interested specifically in traditional medical knowledge, its transmission and integration into databases (Heinrich et al. 2009). The World Health Organization defines traditional medicine as the:

> sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health, as well as in the prevention, diagnosis, improvement or treatment of physical and mental illnesses. (WHO 2000, 1)

The International Society of Ethnopharmacology prioritizes the documentation and sharing of Indigenous medical knowledge (ISE 2010). Edwards and Heinrich (2006) describe the study of TEK as being

> The study of TEK however, is fraught with methodological, theoretical, political and practical difficulties. It is a highly politicized act, especially given the relative policy and legal vacuum in which ethnobiologists often work, and the highly charged atmosphere of mistrust that has been generated by fears of biopiracy. Use of digital technology for documenting TEK and related scientific information for the purpose of maintenance and restoration of biocultural diversity correspondingly poses a number of challenges. (571)

Dichotomies can inform how we approach and conceptualize traditional knowledge systems as researchers. In a seminal article for the field of ethnopharmacology, *Ethnopharmacological field studies: A critical assessment of their conceptual basis and methods*, authors discuss a definition of TEK, which describes it as "a body of knowledge built up by a group of people through generations of living in close contact to nature" (Johnson 1992, 4; Heinrich et al. 2009). The authors' consider TEK a "somewhat naïve" concept and contend that "people do not live in "nature," they live in a "culture"" (Heinrich et al. 2009, 10). The *State of the World's Indigenous Peoples* states that, "dichotomies such as nature vs. culture do not exist

in Indigenous societies" (Kipuri 2008, 52). For reasons I discuss later, there are important theoretical distinctions made regarding terminology used and conceptualized that affects the treatment of traditional knowledge systems.

Traditional Knowledge Databases

Traditional medical knowledge comes via contemporary documentation or historic ethnographic text. Once integrated, the text is considered codified (TKDL 2015). Databases that integrate forms of traditional knowledge have been utilized since the 70s. Government agencies, countries, academics, organizations, and institutions (typically Universities) have all developed these databases for different reasons. Databases, specifically ethnobotanical and ethnobiological ones, are integrated more or less with traditional medical knowledge and knowledge related to the taxonomies and understandings about the environment and its lifeforms. Databases can also be hybridized, meaning they are integrated with both traditional knowledge and Western scientific knowledge (Edwards and Heinrich 2006).

There are a number of challenges to developing a medicinal plant database, these include the following sample of issues and potential problems: data integration (i.e. common protocols and metasearch engines), lack of a model, multiple taxonomies (e.g. globally unique identifier), location, intellectual property rights, data accuracy, data maintenance, "data heterogeneity", databases size, number of users, and cost (Ningthoujam et al. 2012, 27; Heinrich 2009). Nomenclature elements of a database include: scientific name, family, geography, common names, and authority (Heinrich et al. 2009). Databases can also include standards developed by the Biodiversity Information Standards and/or the Economic Botany Data Collection Standard.

The adoption of semantic web ontologies are likely to drive database development by changing the way "information and knowledge are accessed and exchanged" (Heinrich et al. 2009, 13).

Databases and Legal Protections

For some a database legitimates and preserves traditional knowledge while making the information more readily accessible and amenable to analysis (Moerman 1979, 2013; Heinrich et al. 2009). Accessibility is a key concern for both Indigenous peoples, researchers, countries, and institutions. It is only in recent decades that Indigenous peoples and developing countries are beginning to develop traditional knowledge databases for their own purposes. It is *not* the aim of this thesis to examine all the types of traditional knowledge databases in use or the myriad features of intellectual property law. There is a range of applications and accessibility features for every database, each with their own legal protections-both for the database and knowledge integrated therein (Gupta 2004). It is necessary to understand that traditional knowledge databases have evolved from simple repositories to digital tools that have *defensive* and *positive* legal protective features (Heinrich et al. 2009; Gupta 2004; Ningthoujam et al. 2012; Timmerman 2003).

Integrating texts (e.g. ancient texts) into publicly accessible databases, and making them available to international patent offices, helps to defend against biopiracy, misappropriation, and wrongful patenting (Gupta 2004; TKDL 2015). Often pharmacological claims to novelty are related directly to novel compounds 'discovered' through laboratory research. Traditional medical knowledge is treated as anecdotal evidence and today is used to study various pharmacopeias (e.g. Traditional Chinese Medicine) (Gertsch 2009). While the value of ethnomedical knowledge is, in part, due to its ability to steer pharmacologists in the 'right'

direction it is unclear if using traditional knowledge as a lead in the drug discovery process has been successful (TKDL 2015; Gertsch 2009).

Although there is uncertainty regarding traditional medical knowledge and its usefulness in drug development there is mounting evidence that it is "widely susceptible to misappropriation" (TKDL 2015). Turmeric stands as a key example. As an ancient Indian medicinal, turmeric, has long been known to have wound healing properties. In 1997, a patent on turmeric was revoked by the US Patent Office and stands as the first against a patent using "traditional knowledge of a developing country" (TKDL 2015). Legal defensive protections are those that prevent misappropriation of traditional knowledge held in the public domain (Timmerman 2003; TKDL 2015). The law "is not sufficient to guarantee benefit-sharing with regards to profits" (Nordin, Hassan, and Zainol 2012, 14; TKDL 2015). Internationally, work is ongoing to develop legal structures that better protect traditional knowledge while providing an avenue for benefit-sharing (CBD 1992; Timmerman 2003; WIPO 2001).

Unfortunately, preventing others from claiming novelty is a defensive measure that takes rights away from knowledge holders as well (Timmerman 2003). As Timmerman (2003, 749) notes, "once people lose their rights, they are less likely to receive a fair share of the ensuing benefits…" Once in the public domain, making claims to novelty in order to develop innovations is difficult. Intellectual Property Rights are ineffective in providing adequate protections for biological resources and traditional knowledge (Timmerman 2003). Institutional Review Boards, "Free, Prior, and Informed Consent", and ethical codes/guidelines all serve as mechanisms meant to prevent harm and protect institutions from liability (Grossman et al. 2010, 2). These

mechanisms can serve to adequately protect traditional knowledge holders when proper negotiations are elevated above the needs of the researcher or institution (Grossman et al. 2010).

Accessibility Features

Integrating text into a database is laborious task with many benefits to researchers once completed. A database can facilitate the overall research process by allowing for statistical analysis of the recorded use of biological resources by Indigenous/local peoples. Typically, in ethnoscientific fields of study databases perform a practical function in facilitating analyses and can be invisible to outsiders or made publically accessible. (Heinrich et al. 2009) Accessibility features for existing and developing databases is a key concern for researchers, institutions, and communities.

Moerman's online Native American Ethnobotany Database was described as "the largest taxonomically reliable medicinal reference guide to Native American medicinal plants ever published" and a resource with "unlimited value" (Ford 1986, viii; Waldram, 1987, 152). Who values it and what is its purpose? (Lassiter 2005) Questions like this are why there has been growing concern about access and benefit-sharing for traditional knowledge holders. An early review of Moerman's database by Waldram (1987) is critical of the database for its inability to include Indigenous languages, he states:

> one other concern that I have about the data, and one brought to my attention by Native students, is the lack of common names in the various Indian languages. Many of my students knew only the Indian name for a medicine and, lacking any botanical knowledge, found these volumes frustrating to use…such an addition should be considered in any reprinted or updated versions. (153-4)

By adding Indigenous language components, "the data can become even more useful to the many Native people who, in Moerman's words, "provided the fountain of human knowledge from which we are privileged to drink" (Moerman 1986, ix.). As Maffi (2001, 12) states in regards to language, "…landscapes are…symbolically brought into the sphere of human communication by language: by the words, expressions, stories, legends, songs and verbal interactions that encode and convey human relationships with the environmental and inscribe the history of those relationships onto the land." Language and cultural diversity are widely recognized as being interconnected to place, traditional knowledge, and biological diversity (Berkes 2012).

One can access Native American Ethnobotany Database via an online multi-entry interface. Accessibility features are a function of institutional objectives and database design. Accessibility features can limit the user to searching terms. Without access to source files one could not: make changes to suit the specific needs of the community, create output tables, or conduct statistical analyses. There is certainly no reported mechanism through which a tribe can gain access to an existing source file in order to amend, add, or delete data for their own purpose.

There is evidence that files are shared amongst researchers; for instance, the Prairie Ethnobotany Database (University of Kansas) and the Creek/Seminole Database (University of Florida) were partially constituted by files provided by Moerman (Hutton 2010; Kelly, Corbett, and McClure 2013; NMPRP 2015). I co-authored a study that made use of the Prairie Ethnobotany Database (see Kindscher, Corbett, and McClure 2012). The database is offline, existing on a lab computer, which limits accessibility by those outside the institution. Many databases are going to be proprietary to a University/institution and have intellectual and

copyright laws attached to them. It should be clear that digital technologies are not understood as stand-alone entities, they come with owners, institutions, and legal protections.

The International Ethnobotany Database, housed at the Missouri Botanical Gardens, uses software and represents one example where the software to create an traditional knowledge databases is publicly accessible (Quantum Imagery 2015). The database software is a technology that could easily allow Indigenous peoples to preserve forms of traditional knowledge for themselves. While the software is not open source, the license ensures that legally others are free to use the database and decide whether or not that data is visible (Quantum Imagery 2015). A user's data automatically is covered by copyright (Missouri Botanical Gardens 2015).

Databases and Indigenous Peoples

For certain, Indigenous peoples are struggling to preserve their traditional knowledge and cultural traditions, their way of life. The value of ethnographic data contained within databases would likely be challenged by communities as another example of colonial dispossession (Rundstrom 1995), full of misinformation about their past, and present relationship to plants and the environment. But like GIS, Indigenous people can find technologies useful in pursuing their own objectives (Johnson, Louis, and Pramono 2005). Systematized traditional knowledge held within databases have the potential to strengthen cultural preservation and land/resource management activities; much in the same way that GIS is used to strengthen tribal sovereignty in a variety of processes, including land and resource claims (Palmer 2009). As Johnson, Louis, and Pramono (2005, 82) state: "while we caution Indigenous communities about how they engage with Western cartography, we also recognize the value these technologies have brought to the struggles of our communities."

Indigenizing technology (Palmer 2009) is valued because the community finds reason to use it. The promising feature inherent in technologies is its amenability to the user. When Indigenous peoples knowledge of, access to, and/or ownership of digital technologies, the data can be amended, added and deleted readily. Ethnobotanical databases, much like GIS, freeze traditional knowledge and "cause stasis" but also have the potential to be more inclusive and flexible in representing a knowledge systems (Palmer, 2012, 81). This relates directly to Palmer's (2012, 8) conceptualization of an indigital geographic information network (iGIN); a network that merges "Indigenous, scientific, and digital technologies into inclusive forms of technoscience."

Control (power) is noted as an "area of potential conflict" in research. Who has access and where the database is stored (geography) is of utmost concern. Heinrich and others (2009, 12) ask, if databases will "be in the public domain…or private with limited password controlled access"? This situation exists already regardless of Indigenous communities' participation as co-producers of systematized traditional knowledge. Moerman's database is essentially in the public domain, being accessible over the web in a limited capacity, while others like NAPRALERT® and the International Ethnobotany Database, require passwords, and/or charge a fee (NAPRALERT® 2015; Missouri Botanical Gardens 2015).

Edwards and Heinrich (2006, 571) note that the "centralisation of indigenous knowledge databases in museums, or other academic research institutes, can disempower the local custodians of traditional knowledge." Digital technologies integrated with forms of traditional knowledge are not free from disputes about the role of colonization, control, power and their compounding effects on Indigenous peoples. The interest of traditional knowledge holders in

any scenario should be considered along with the implications regarding the documentation and integration of forms of traditional knowledge into database. The Aurukun study reveals a scenario where a database was co-developed *with* ethnopharmacologists but was *for* the Aboriginal community. The databases hybrid structure integrates Western knowledge and traditional Wik knowledge (Edwards and Heinrich 2006). The following statement is directly related to the Aurukun database:

> Small, local databases may be effective for managing (and even repatriating data for…a…minority ethnic group or area (e.g. Aurukun Ethnobiological Database…), but these may be totally inappropriate in areas where IT capabilities, or even literacy skills, are limited. Locally managed databases, while serving a function for local peoples…may not be ideal from a scientific perspective, since they may be developed to different standards, thus inhibiting comparison of data between groups (Heinrich et al. 2009, 13).

Let it be noted that this statement comes from Sarah Edwards and Michael Heinrich, the same researchers who authored the article on the Aurukun study (see: Edwards and Heinrich 2006).

It seems likely that future databases will come out of collaborative partnerships. Like all traditional knowledge databases, their use and accessibility, will differ according to the objectives set out. Too often there is a focus only on the goals and objectives of researchers and communities. We forget that researchers are influenced greatly by their particular fields of study. For this reason I focus briefly on the field of ethnopharmacology in order to relate equitable research processes and their outcomes back to disciplinary objectives. Each ethnoscientific field

will have established their own goals and objectives and therefore my analysis is related specifically to the field of ethnopharmacology. That stated, research strategies discussed that encompass researcher-discipline-community dynamics can be generalized more broadly.

Ethnopharmacology

Ethnopharmacology

Ethnomedicine is applied traditional medical knowledge and is recognized as an 'alternative' form of medicine in industrial countries (Timmerman 2003). Farnsworth et al. (1985, 966), with the WHO, asserted that globally primary health care was provided by traditional medical systems for approximately 80 percent of the population. Timmerman notes the ironic notion of what is referred to as an "alternative" when ethnomedical traditions are the only option for millions in the developing world and an increasingly popular "alternative" for the industrialized world (Timmerman 2003, 746). Ethnopharmacology as a field of study is directly focused on and concerned with the documentation and application of traditional medicines (ISE 2010).

From its earliest inception, ethnopharmacology emerged as multidisciplinary field focusing on the study of "indigenous medical systems" (Elisabetsky and Etkin 2005). It has since relied on the ethnography of healing to connect to the physiological applications of medical practices (ibid.). The field is increasingly being considered an information science, its data relating to "biological organisms and derived products" (Heinrich et al. 2009, 13; Morgan et al. 2004). This occurred, in large part, to mobilize the drug discovery process and to explicate upon the construction and transmission of traditional knowledge systems.

Estimates for the number of traditional plant species used globally is from 10,000 to 53,000 (Schippmann, Leaman, and Cunningham 2002; McChesney, Venkataraman, and Henri 2007). Only a small fraction of these species has been screened in laboratories for biological activity (Soejarto et al. 2005; Gurib-Fakim 2006). Early laboratory discoveries revealed the chemical properties of caffeine, foxglove, quinine and others, yet, few 'new' discoveries have been made in the last 20 years (Gertsch 2009). Some suppose that there is not much left to discover (Moerman 2008a), while others envision a future where advancements in pharmacology, and innovations in lab methods, will usher in a new era of multi-target drug development (Gertsch 2009; Mukhejee, Venkatesh, and Ponnusankar 2010).

Moerman (2008a, 178) asserts that "the low-hanging fruits have already been picked" that today's ethnopharmacologists will have to toil to find molecules of equal value to those early discoveries. Gertsch (2009) states that there has been an overemphasis of data interpretations that exaggerate bioassay results. As previously mentioned: little is known of success rates for testing of species using traditional knowledge as a screening tool or lead in the drug discovery process (Gertsch 2009). Pharmaceutical companies have decreased their investments in natural products (Harvey 2008). This could be due to the development of the CBD which may have affected interested in further bioprospecting activities (Saslis-Lagoudakis et al. 2012, 15838; Wynberg and Laird 2009). Given the small proportion of the known traditional medicinal plants tested it unclear what conclusions can be made. Despite conflicting views regarding the value and importance of ethnopharmacology today research in the field is expanding, witnessing a "revival" in the 80s (Gertsch 2009).

Journal of Ethnopharmacology

It is important to recognize the importance and influence of major journals for subfields. The International Society of Ethnopharmacology publishes the *Journal of Ethnopharmacology*. Objectives of the journal includes: the documenting and exchange of information on "people's use of plants," and their "biological and pharmacological effects" (ISE 2010). The journal also "seeks to draw attention to the importance of nature-derived products (plant extracts and pure compounds)" (ISE 2010). Verpoorte (2012b) states the following:

> Traditional medical knowledge has two potential values, one as an easy accessible and low-cost source of medicines for primary health care, the other as the source for finding novel leads and/or targets for drug development. (455)

Later, I will discuss the influence of the journal in terms of methodological standards related to quantification, anthropological field methods, and publication.

Bioprospecting

Bioprospecting is the "exploration of biological material for commercially valuable genetic and biochemical properties" (Harvey and Garicke 2011, 323; Martinez-Solis 2014; Reid et al. 1993). 'Progressives' consider bioprospecting to be central to "social and economic progress" (Martinez-Solis 2014, 1). Pharmaceutical bioprospectors hope to discover active principles derived from biological and genetic resources that have the potential to treat modern diseases (i.e., cancer, diabetes, hypertension, and HIV/AIDS). Work in the World Intellectual Property Organization and the Nagoya Protocol, adopted by the CBD, present and create complex mechanism for protecting traditional knowledge, putting bioprospectors into

increasingly complicated international legal spaces to pursue the capture of forms of traditional knowledge related to health and healing (Watanabe 2011; Saslis-Lagoudakis et. al. 2012).

While bioprospecting is only one facet of ethnopharmacological field work its notoriety for being exploitative abounds and in effect leads to a suspicious and critical perception of ethnopharmacology (Saslis-Lagoudakis et al. 2012; Gertsch 2009). According to some, the development of the CBD resulted in a "decrease in investment in ethnobotanically directed natural products research schemes," especially in the 90s (Saslis-Lagoudakis et al. 2012, 15838; Wynberg and Laird 2009). Despite ongoing criticism bioprospecting continues (Harvey and Gericke 2011; Reid et al. 1993). In fact, publications in the *Journal of Ethnopharmacology* doubled between 2003 and 2005 (Gertsch 2009).

Timmerman (2003) argues the main incentive, especially for pharmaceutical companies, is related to the potential to patent products and effectively increasing profitability. This animosity towards the field and bioprospectors is related to a lack of benefits going back to traditional holders of knowledge and the community (Martinez-Solis 2014). Harvey and Gericke (2011, 325) state that the "age of blockbuster drugs" (i.e. drugs generating 1 billion per year) is over and that the royalty streams once considered a mechanism for valuing biodiversity conservation and developments for Indigenous communities are unlikely to succeed.

Ethnopharmacology and Traditional Knowledge

For certain, the objectives and goals of ethnopharmacology, especially as they relate to bioprospecting, benefit-sharing to communities, and access to research outcomes is difficult and wrought with complexity. It is unclear if the fields 'treatment' of traditional knowledge systems in mechanistic ways has proven beneficial to Indigenous peoples. While it is true that the

employment of databases has facilitated a 35 year debate on statistical methods, extended the literature around knowledge transmission, and acted as screening tool for lab testing, its inherent benefit to Indigenous peoples is not understood and has been understudied. Largely, the benefits to Indigenous peoples are broadly stated as a way to preserve, conserve, save, and protect traditional knowledge from being 'lost' and to support global health care and the conservation of biodiversity (Nadasdy 1999; Romanelli 2014).

The world's widespread use of traditional knowledge systems and their associated medical applications are highly valued but threatened; again, this often validates researchers by making their objectives and research endeavors relevant to the global community. It harkens back to the "Dying Native" narrative, where again we see a narrative of loss/extinction mobilized to make claims to data, in this case medicinal knowledge (Rowse 2014, 246). This story is told broadly in ethnoscientific fields to further scientific philosophical underpinnings and the disciplinary objectives that support them. So it is not that we need to criticize the narrative as much as we need to criticize why it is being used, as Lassiter (2005, 102) states, "collaborative ethnography is ultimately about *power* and…*control* – about who has the right to represent whom and for what purposes" (Cook 2005).

An abundance of evidence accumulates revealing the many threats to Indigenous peoples and their knowledge systems (Zent and Maffi 2009; McCarter, Baereleo, and Love 2014). While these threats should be readily acknowledged, the narratives that develop from them can serve an agenda that actively seeks the commodification of traditional knowledge without adequate compensation or benefit-sharing. Such endeavors rarely seek to work alongside communities as

allies to meet the needs, agendas, and objectives of the community (Louis 2007; Nordin, Hassan, and Zainol 2012).

Currently, it is unclear to what extent ethnopharmacology makes their objectives clearly known to communities. In the article *Anthropological Methods in Ethnopharmacology,* Etkin (1993) makes the following statement:

> Anthropologists work in a positivist tradition that…contends that, within limits, an objective portrayal of other cultures is possible; we are confident that we can communicate our interests to the satisfaction of local residents; and our experience persuades us that people are indeed interested in their culture and in its preservation. Thus, we set as high priority that our research objectives be understood locally and that residents find their participation a value that transcends whatever immediate remuneration we offer. (94)

It appears that to some extent, ethnopharmacologists believe that communities will recognize the pharmacological value of the work, enough so that their own desire to *preserve* and *conserve* will act to compel them into research studies, collaborations, projects, and partnerships. The issue is that Etkin equates preservation with objectives in ethnopharmacology which supports an argument that Indigenous communities and ethnopharmacologists want the same thing.

Anthropological Methodological Standards in Ethnopharmacology

The following sections are largely taken from the article, *Ethnopharmacological Field Studies: A Critical Assessment of their Conceptual Basis and Methods* (Heinrich et al. 2009). As discussed earlier, this is a seminal article in the field of ethnopharmacology and served as a turning point,

after which, the *Journal of Ethnopharmacology* would require that quantitative data be included in all article submissions (Heinrich and Verpoorte 2012; Heinrich et al. 2009).

As stated previously, anthropology provides ethnopharmacology with selected methodological standards with a focus on "thick description", an ethnographic representation that is highly relevant to ethnopharmacology for a number of reasons. The field seeks to capture local knowledge in great detail and the tradition in "thick description" supports this endeavor. The goal is to be exhaustive in gathering as much relevant information regarding the use and practices surrounding medicinal plants as possible. Ethnomedicine is thus constituted by this breadth of knowledge allocated in part by a methodology in "thick description" which informs other methods like interviews, focus groups, surveys etc. (Heinrich et al. 2009, 12)

Introductory sections of ethnobotanical writings are to include: ecological setting, socioeconomics, degree of "integration into the national culture", linguistic/cultural information, "gender-specific" knowledge, and "special aspects" (Heinrich et al. 2009, 9). As noted, Heinrich and others (2009, 9) privilege the use of "local knowledge", as being more encompassing and only make note of CBD and equitable benefit sharing as it relates to TEK. It does appear that a concerted effort to separate the two, TEK from local knowledge, is occurring.

Methodological Standards for Quantification of Data

Knowledge is not to be viewed simply as information, as such, ethnobotanical studies have moved away from simplistic listings of plant (Heinrich et al. 2009). At the very least analysis of data in the form of descriptive statistics is now the norm in ethnobotanical studies. For what is classified as legend and myth (e.g. magic, ritual, and ceremony), qualitative methods are deemed more appropriate (Heinrich et al. 2009). The only way that meaning can come from

counts of species used is when counts are compared to the total flora of a region (Moerman 1979). To some extent modes of preparation, “routes of application,” and parts used can be quantified (Heinrich et al. 2009, 11). Frequency of consumption, and, frequency of use, are valuable assets to a study (Heinrich et al. 2009).

Five rules were published by the *Journal of Ethnopharmacology* for editors to use as a guide in the rejection process for submitted manuscripts (Verpoorte et al. 2006). “Rule 4” set out the following criteria for surveys of culturally important species: “To be able to make choices for further studies is important, to have information how frequently plants are cited in surveys, and to have, if at all possible, cross checks for the information." (Verpoorte et al. 2006, 310) One criteria listed under “Rule 4” guides the rejection process and states the following: "Species are listed uncritically without giving information about the cultural importance of these species e.g. by giving the frequency of citation of use by informants, or no clear cross verification of information" (Verpoorte et al. 2006, 310).

Leaving out information of cultural importance is grounds for “immediate rejection of the manuscript” (Heinrich et al. 2009, 11; Verpoorte et al. 2006). This makes sense given the narrative and belief that most species used for medicine are known. Verpoorte (2012a, 683) states, “for the journal we require that in one way or the other quantitative data needs to be included to have some measure of the importance of the information." For this reason and for the sake of increasing sample sizes, the cultural uses (and how often that is recorded), are deemed vitally important to the conducting of ethnopharmacological research. This logically extends to ethnobotany and other ethnoscientific fields and researchers who want to publish in the journal.

The ability to quantify cultural importance (via an index or math function(s)) is directly related to its presence in use reports in ethnobotanical surveys (Heinrich et al. 2009). According to Heinrich and others (2012, 11-2) species deemed culturally important have an above average number of citations and are thought to be: "more effective, used for more common disease or event, easily available, or have a special cultural significance"; those cited less often may: "be artefacts, have fallen into disuse…," "be ineffective for the condition(s) reported, have become rare species, or might belong to cultural fringe knowledge." In effect, development of "ratios of cultural importance" are made possible and these can be used in comparative studies (Heinrich et al. 2009, 12). The field rejects the standard categorization proposed by the World Health Organization namely because of its own interest in "thick description" and need to classify local knowledge using the "emic perception of the informants." A commitment to "emic perceptions" does require extensive field work and makes "inter-cultural comparisons based on indexes" hard to accomplish. (Heinrich et al. 2009, 12)

An intercultural comparison seeks to compare data from "one ethnic group, culture or region…to that of another" (Heinrich et al. 2009, 12). Standardization in technosciences (e.g. digital technologies) does result in a reduction in complexity and usually tends to allow for its broader diffusion (Palmer 2009). In a way, an avoidance of standardization means a maintenance of current controls (less diffusion) for various actors/institutions involved in the production and use of databases.

Inferential statistics are used when employing hypothesis testing and are strongly encouraged. It denotes the existence of "incomplete knowledge" and allows for interpretations and inferences based on quantification of the whole from a sample. This is in contrast to

Moerman's use of regression analysis noted previously, which assumes that data represents a census (e.g. the whole) rather than a sample (Moerman 1979, 1991), but again this is in reference to species used as medicine not the unfathomable number of *ways* they are used. Inferential statistics *can* contend with inter-cultural comparisons. The use of inferential statistics would not be possible without a database system that can efficiently store the data, in turn making sorting, retrieval, and analysis possible (Farnsworth and Loub 1983; Heinrich et al. 2009; Ningthoujam et al. 2012). According to Moerman (1979, 1991), statistical methods add weight to the idea that Native Americans chose plants with bioactive properties; he argues that databases aid in the screening of species for the development of botanical medicines.

A point of contention is the assumption that all medicinal species are known is a notion Moerman both asserts then disproves (Moerman 1979, 1991, 1996). The assumption was needed in order to conduct regression analysis. Stating that the data represented a census, precluded the use of inferential statistics which by its very nature is used to make inferences on samples of data. In 1996, Moerman added 427 species to his database and the number of tribes represented went from 124 to 216; these additions increased the number of medicinal species represented by 20 percent (Moerman 1996). Even if we continued to assume that these numbers would not increase significantly 19 years later, for certain all the *ways* in which medicinal species are used and understood is not known. The evaluation of importance comes down to cultural importance which is understood through a species' "frequency of use" (Verpoorte et al. 2006, 310). Moerman cannot assume a census of uses the way he assumes that all medicinal species are represented.

Statistical approaches also contribute to understanding how traditional knowledge of medicinal plants change and/or how knowledge is transmitted over time and place. Traditional knowledge is not static and as such represent dynamic knowledge systems persisting for generations and always place-based (Timmerman 2003; Watanabe 2011; Johnson and Larsen 2013; Palmer 2012). Understanding methodological standards in any field of study can help communities make informed decisions about the partnerships and collaborations that best suit their own needs. Disciplinary standards can help communities and traditional knowledge holders understand how their knowledge is treated and what mechanisms are used to make inferences that affect how and why the knowledge is used outside the community.

Indigenous Geographies

While ethical methodologies, attributed to studies that engage community-based participation and activist's axiologies are certainly present across disciplines, what we find in the case of the Aurukun Ethnobiology Database study is that ethical methodologies create friction and tension within the field of Ethnopharmacology. Situating the examination in one discipline, in this case the literature arising out of Indigenous geographies, may allow for distinct discipline-specific justifications and nuanced understandings to be brought to the surface.

Specialty groups may arise out of contentious spaces or more likely than not are organized according to interests. Few disciplines have specialty groups devoted to ethical considerations involving research with Indigenous peoples. Grossman et al. (2010, 3) state that Indigenous Peoples Specialty Group's (IPSG) purpose in writing the *Declaration of Key Questions about Research Ethics with Indigenous Communities* is to "to open a conversation

about how to conduct more ethical research in and with Indigenous communities." It was not their intention to "draft a statement or guidelines on proper research ethics from an authoritative positions" (Grossman et al. 2010, 3).

In the case of IPSG, a specialty group can prove beneficial to the broadening of ethics within research methodologies, especially when outcomes of studies deal directly with digital technologies, either in their use, development, or co-development. Studies focused on elucidating the tensions between successful application of equitable, participatory, and/or Indigenous methodologies and disciplinary objectives and standards can allow for more diverse methodologies to develop. Identifying where and why tensions and conflicts occur can also motivate scholars to think critically about how their respective disciplines work against self-determination. A finer-grained approach to the examination and assessment of research producing disciplinary conflicts can also assist in reviewing and aligning objectives to decrease the possibility of tensions arising in the first place.

A main goal of the IPSG Declaration is to "investigate what ethical research means in relationship to Indigenous communities and help guide researchers in conducting such research" (Grossman et al. 2010, 1). The IPSG stands apart in some ways from other scholars and ethics-based institutions as they represent an "Indigenous-centered" group that draws their critique from both the historic and modern critical research paradigms that influence geographers (Johnson and Larsen 2013, 12). Contributions coming out of Indigenous geographies can serve to influence researchers broadly, far beyond the field of geography. I assert that applying their critiques and insights can inform a nuanced examination of databases and their relationship to both researchers, communities, and the broader networks whose role in knowledge production and co-

production are often ignored. The purpose of this section is to review elements from Indigenous geographies relating to the application and use of databases and digital technologies more generally.

Arising out of the 'quiet revolution' in information science, databases represent a way in which ethnoscientific fields create synergies with information technology (Thomas 2003). Synergies might be an extension of "embedded colonial relationships" between technology, science, and academia, the result being the production of systematized traditional knowledge and 'centers of calculation' (see: Nadasdy 1999) for further knowledge production that does not actively seek to empower the communities who empower it with data inputs (Palmer 2009, 34). Palmer (2009, 33) reminds us that the "exchange of technologies between Western institutions and indigenous people has occurred for centuries."

Like cartography and GIS, databases act as a "techno-science", a place where the technology is the very "embodiment of science" (Johnson, Louis, and Pramono 2005; see: Turnbull, 2000). Maps, under the colonist domain of knowledge production, were often a result of simultaneously occurring "cycles of accumulation" which served in material and data collection pursuits that included: "natural resource inventories, exploration, military surveys, biological surveys, ethnographic surveys, and public land surveys"; they also contributed to a 'digital divide' which privilege the dominant Western research paradigm (be it governmental, institutional, or organizational) (Palmer 2009, 35). As Palmer (2009) notes in regards to GIS,

> the lack of participation by American Indians in BIA development projects is a problem that further intensifies the digital divide between the haves and have nots, making it less

likely that indigenous people can actively contribute to the shaping of information technology. (36)

Rundstrom takes an even broader viewpoint in considering the potential effects of “cross-cultural contact, data-sharing, and technology implantation on the world's epistemological diversity" (Rundstrom 1995, 45). The search for traditional knowledge is often done in order to transform it into systematized traditional knowledge in order to serve the global community, but he has pointed out, in relation to GIS, that this serves to homogenize (e.g. standardize) these systems, in effect disrupting global "epistemological diversity", the very character that makes traditional knowledge so appealing in the first place (Rundstrom 1995, 45). Essentially it is that traditional knowledge represents the diversity of human experience and as such can be exploited in order to serve Western institutions and endeavors (e.g. drug development).

Rundstrom (1995, 46) makes two arguments in regards to GIS and Indigenous peoples. First, that Western mechanisms for collecting and using GIS data are "incompatible" with Indigenous epistemologies. “Ubiquity of relatedness” (among other characteristics) undergirds Indigenous epistemologies (Rundstrom 1995, 46). The principle of “ubiquitous relationships…means there is very little that is involuntary, unintelligent, or random about what exists or occurs in nature” (Rundstrom 1995, 46-7). Secondly, in regards to cross-cultural applications, GIS is simply a "tool for epistemological assimilation…the newest link in a long chain of attempts by Western societies to subsume or destroy indigenous cultures” (Rundstrom 1995, 45). It is not my contention that ethnopharmacologists, their associated networks, or activities represent an effort to *destroy* Indigenous lifeways but this point does orientate the

discussion towards the implications of continuing on in a pattern of development that has sought out traditional knowledge for centuries.

Geographic Information Systems and databases can be considered valuable in facilitating ethical research (Grossman et al. 2010, 1). Digital technologies can be a means to empower *or* disenfranchise communities with context-based implications to engaging with them (Johnson, Louis, and Pramono 2005; Palmer 2009). Indigital is a "neologism that describes the relationship between indigenous knowledges and digital technologies" (Palmer 2009, 33). Rundstrom's (1995, 46) discussion on the "principle of ubiquitous relations" shows us that "human/nonhuman relations are complex." With this complexity in mind it is the amalgamation of materials, ideas, and knowledge systems that constitutes a hybrid technoscience (Palmer 2012). Hybrid digital technologies can treat Indigenous and Western knowledge systems as both complementary and contradictory; yet, they can also "disrupt dichotomies" like culture versus nature that have implications for ethnoscience fields and the use or development of traditional knowledge databases (Palmer 2012, 81). The Aurukun database stands as one case in point where Wik knowledge and language is incorporated alongside Western scientific categorizations.

Hybrid databases are not the norm in ethnopharmacology. The presence of a database is often invisible to the reader (Heinrich et al. 2009). To the user (inscriber) it represents a means to facilitating the analytical and interpretative process (Farnsworth and Loub 1983; Heinrich et al. 2009; Ningouthjam et al. 2012). In effect it is an "efficient solution" to knowledge management that requires much toiling in its initial development phase (Ningouthjam et al. 2012; Rundstrum 1995). Making known to communities how information collected is situated and used in a digital framework, is recommended (Posey and Dutifield 1996; Bannister and Barrett 2000). Without an

avenue for dialogue, continued suspicion and distrust will likely continue unabated. Posey and Dutifield (1996) call for a responsibility to disclose data origins, in this case the disclosure surrounds data use and application (Bannister and Barrett 2000).

Cross-cultural applications that seek to embed forms of traditional knowledge into Western-derived systems can lead to the "epistemological assimilation" of traditional knowledge (Rundstrom 1995, 45). Despite the transformative nature that technoscience represents, scholars and Indigenous peoples' are embracing the potential role that technologies have on strengthening self-determination. Johnson, Louis, and Pramono (2005, 82-3) state that "technoscience has an ability to passively participate in transforming the world and in "delivering apparent 'realities.'" While it might seem easy to disregard the applications outright as tools to assimilate, others take a reflexive approach in their "engagements" with technoscience (Johnson, Louis, and Pramono 2005, 82).

To put it in terms of equitable research processes, technology transfer is being used in benefit-sharing schemes (Mmaduakolam 2010). The acceptance of digital technologies requires a critical consciousness in order to assess "advantages and risks that accompany" engagement with them (Turnbull 1998, 38; Johnson, Louis, and Pramono 2005, 83). Johnson, Louis, and Pramono (2005) discuss the need for critical cartographic literacies and caution how communities interact with Western cartography. Arguments around literacy extend from viewing it as a singular, deterministic, and 'autonomous' action to one that is contextual, relational, embodied by a fluid understanding that varies across time and that is dependent on the histories and the cultures that read them (Street 2003, xi and 4; Johnson, Louis, and Pramono, 2005, 84).

The test to developing a critical literacy is compounded when issues of multiple literacies arise. How can Indigenous communities seeking to develop collaborative partnerships concurrently develop critical literacies? What are the expected community reactions to such critical literacies, assuming critical literacies are not present? It seems reasonable to suggest that in a database project a critical literacy around its historic value and use be integrated with a critical literacy on the history and impact of Western research practices and movements towards integrative research that respects Indigenous peoples' rights to be decision makers in the research process. What this will entail and how knowledge transfer will occur will be one crucial layer to a complex set of negotiations ("tricky ground") that communities may or may not wish to confront. (Johnson 2008; Palmer 2012, 81).

Research

In order to discuss technological tools and their role in facilitating research with Indigenous peoples, I look to ethical considerations and ensuing challenges. Authors of the IPSG Declaration (Grossman et al. 2010) state that:

> the discipline of geography must overcome its distinctly colonial heritage, and its continuing relationship with power structures that define how knowledge is created and reproduced. This introspective process will require acknowledging how geographic research is conducted. (1)

This also extends to other fields such as anthropology. The colonial heritage embedded in disciplines weighs heavily on how current engagements with Indigenous peoples" occur (Coombes, Johnson, and Howitt 2014). In order to overcome such challenges, IPSG members suggest that self-determination can help reshape research practices founded on "colonial-based

relations of power and knowledge production" (Grossman et al. 2010). The dominant Western research paradigm values "community members as passive subjects [informants]" and researchers as "knowledge holders" (Koster, Baccar, and Lemelin 2012, 195-8). Indigenous research paradigms, epistemologies, and methodologies are reflexive and dynamic, beyond singular representations in the quest for definitions (Koster, Baccar, and Lemelin 2012). As others have noted they are culture and context specific. (Fletcher 2003; Koster, Baccar, and Lemelin 2012; Louis 2007; McGregor et al. 2010; Wilson 2008).

There are however underlying principles common to all Indigenous paradigms, including a recognition that Western ways of thinking about research processes are not the only ones; that the goals of research should be determined in ways that are sympathetic, respectful and ethical; and that research should be conducted in ways that incorporate and are informed by Indigenous perspectives (Louis 2007). Koster, Baccar, and Lemelin (2012) state:

> Research projects conducted on Indigenous communities have largely been developed within a dominant Western research paradigm that values the researcher as knowledge holder and community members as passive subjects. The consequences of such research have been marginalizing for Indigenous people globally, leading to calls for the decolonization of research through the development of Indigenous research paradigms. (295)

But, research using the principles of Indigenous research paradigms have the potential to be long-term, that "empowers the historically marginalized." Research following such a course can "challenge[s] non-Native practitioners to step outside of their intellectual and

methodological conventions into a world in which knowledge-making is an ethical act of facilitating self-determination." (Johnson and Larsen 2013, 9; Bishop 2005)

Johnson and Larsen (2013, 8) link movements towards "meaningful research collaborations" to the developments of Indigenous research paradigms and the "elaboration of critical social theory in…the humanities and social sciences." This paradigmatic shift came about incrementally and was initiated by anthropologists (Johnson and Larsen 2013, 8-9). In conducting research using Indigenous research paradigms, Koster and others (2012), suggest a number of steps that include:

1. development of a partnership,
2. co-creation of the research process, an
3. agreement around benefits and how they "flow to the community," a
4. mechanism for partners to "review and revise" written documents, and the
5. maintenance of relationships that should exist within both "Western ethics protocols" and "Indigenous cultural frameworks." (199)

Research Design

Linda Tuhiwai Smith's key critique on research has provided a foundation to broaden scholarship around the colonial impact on contemporary disciplines (see: Smith 1999). There are forms of imperialism that are born out of academic elaborations on the 'other' or its process of 'othering' that are still exerted onto cultures and societies. For indigenous scholars, Smith (1999) stresses the importance of understanding the history of imperialism in order to resist its continued ontologies and epistemologies within the academy. Indigenous research paradigms and Indigenous methodologies contrasted to the conceptualizations and standard methods in

ethnopharmacology assist in developing a critique that centers Indigenous peoples as active agents in research rather than simply ‘informants’ or ‘subjects’ of it (Smith 1999).

Research design using a collaborative framework functions to be inclusive to communities as decision makers in their own right throughout the research process. As Castleden et al. (2012, 162) state “the need to not only involve, but also collaborate with, communities through all stages of the research process was put forward as a way to address the colonial legacy.” In some cases Indigenous methodologies are employed and the community is included in decision-making (e.g. if the research is co-created to reflect the needs of the community (*for* the community), the researcher (*on* the community), or both (*with* the community)) (Koster, Baccar, and Lemelin 2012). Researchers are cautioned to: "…move away from methods that perpetuate the traditional ways of working ON Indigenous communities to methods that allow us to work WITH and FOR them, based on an ethic that respects and values the community as a full partner in the co-creation of the research question and process, and shares in the acquisition, analysis, and dissemination of knowledge" (Koster, Baccar, and Lemelin 2012, 195).

The distinction concerning research *with* versus research *for* Indigenous peoples is important as the latter is noted as potentially problematic for researchers. Koster, Baccar, and Lemelin (2012) state:

> when research is conducted on a community, the main beneficiary is the researcher; when conducted with, both parties receive benefit; while research for the community may result in benefits mainly for the community…while such work (for the community) will be within the researcher's field of expertise, it

> might not…result in publications (which might mean that it has little immediate professional value. (200)

The 'publish or perish' paradigm is the "central criterion for academic rewards and advancement" that in turn, situates researchers who create or co-create products (generated by 'data') that feeds the academic engine of knowledge production (Bannister and Barrett 2000, para. 8). It is the criteria by which they are judged: no data, no publication, no career. To ignore this puts careers in jeopardy. As Bannister and Barrett (2000) state,

> withholding research data may curtail an academic career, neglect legal obligations to employers, and ignore a moral obligation to share potentially beneficial information with society. Academic research guidelines, ethical review criteria, and professional codes of conduct rarely acknowledge these emerging issues (para. 8).

This will be an important point as we discuss discipline-specific tensions with equitable research designs and methodologies. *This also reflects back to making disciplinary objectives clear from the onset.* In most cases we cannot or perhaps should not see researchers as autonomous persons. It is too simplistic to limit objectives to researchers (i.e., the need for publication) since most research is an extension of an academic, corporate, or industrial field(s) with their own objectives, spheres of influence, and networks.

Indigenous Methods

Like TEK there is no one definition for Indigenous methodologies but they are considered integral to staying "relevant to Indigenous communities" (Louis 2007, 132- 33).

Steinhauer (2002, 70) claims they are necessary to strategies use to "reframe, reclaim, and rename" areas of importance to Indigenous peoples. The matter of methodologies is directly connected to a community's power and to their desire to "emancipate their voices from the shadows" (Louis 2007, 133). Indigenous methodologies differ from Western methodologies in a number of ways. These include: accepting/advocating, positioning, directionality, and determination of an agenda (Louis 2007).

While Indigenous methodologies are a reflection and expression of Indigenous knowledge systems, Louis (2007) states there are characteristics, or principles, that Indigenous methodologies have in common. The four "unwavering principles" proposed by Louis (2007, 133) are helpful in relating researcher-discipline-community dynamics to equitable research processes and outcomes. Provided below are the principles with a sampling of their attributes and citations of scholars contributions that help frame issues around Indigenous methodologies.

1. **Relational accountability:** Refers to an acknowledgement of Indigenous knowledge systems and epistemologies (i.e. ways of knowing) (Kovach 2005; Koster, Baccar, and Lemelin 2012). For researchers this means a recognition of the interconnected nature of the research process and requires that "sincere and authentic investments" investments are made in the development of partnerships (Koster, Baccar, and Lemelin, 2012, 198-199; Louis 2007; Kovach 2005). Acknowledging Indigenous epistemologies connect to Rundstrom's (1995, 85) discussion on "ubiquity of relatedness." As Louis expounds, relational accountability describes a conceptualization around a "dependence on everything…" (Louis 2007, 133).

2. **Respectful representation:** Requires researchers show "humility, generosity, and patience" throughout the co-creation process. It respects Indigenous peoples' decisions around knowledge and data-sharing (Louis 2007, 133). Kovach (2005, 23) notes, that control over research findings is "critical in pushing forward community-based goals".
3. **Reciprocal appropriation:** Recognizes that 'all research is appropriation' and "requires adequate benefits for both Indigenous people and researcher" (Rundstrom and Deure 1999, 239; Louis 2007, 133).
4. **Rights and regulation:** Denotes research determined by Indigenous protocols, that has conveyed goals clearly, and that has accounted for possible outcomes and their effects. (Louis 2007; Koster, Baccar, and Lemelin 2012; Smith 1999). It acknowledges Indigenous peoples as owners of their knowledge, seeks to be "non-extractive," recognizes intellectual property rights, and "demands that the entire research process be a collaboration" (Louis 2007, 133).

The following case study is meant to highlight how equitable research design processes, Indigenous methodologies, and respectful relationships produce outcomes of great benefit to the local community but unwanted outcomes for the discipline. The case represents one of only a few where an Indigenous community has sought out researchers for the specific purpose of developing a traditional knowledge database (see: J.P Harrington Database Project). As databases in the field of ethnoscience are increasing so are the legal ramifications. In this case, the community ensured the protection of their medicinal knowledge from outsiders per their own cultural protocols which dictate who can be holders of such knowledge (Mmaduakolam 2010).

Partnerships and Collaborations

The IPSG Declaration sets out the following questions for researchers-read as approaches to collaborative research (Grossman et al. 2010, 3-10). I have labelled and categorized the questions. Only the questions are cited from the aforementioned source.

1. **Involvement:** “How involved is the Indigenous community (and its legal representatives) in formulating the research plan, or being presented with a completed research plan?" "How is the community shaping the ultimate purpose and goals of the project so it can ultimately benefit them?"
2. **Legitimization:** "Is Indigenous knowledge being legitimized only when it corresponds to Western discipline-based knowledge, or respected as a source of knowledge on its own merits? Are subjective or experiential values of Indigenous peoples presented as their perspectives, or set aside in favor of purely "objective" knowledge?”
3. **Protections:** "What measures are being taken so that the research findings or materials are not being made available (purposely or inadvertently) to third parties that might use the information to harm the Indigenous community's security or rights? What form of accountability is in place to ensure that the information is safeguarded from release to third parties?"
4. **Substantiation:** “Is the researcher attempting to heighten the tension, contrast or similarities [sic] between Indigenous knowledge ("Indigenous science”) and Western Science, or presenting Indigenous knowledge as possessing value in its own right?"

5. **Methodological incorporations:** "How are local Indigenous cultural frameworks and protocol being incorporated into the project methodologies? How are diplomatic relationships constructed within and between the local Indigenous peoples?"

6. **Knowledge reproduction**: "Some Indigenous communities value the reproduction of knowledge-such as through intergenerational teaching-as much or more than the development of new areas of knowledge. Is the outcome of the research project solely to accumulate new knowledge? Does the project place value on revisiting and renewing established areas of knowledge, in order to reinforce community understanding?"

7. **Investment in relationships:** "is the primary goal of the research project to build a relationship with the Indigenous community, and further its larger interests, or to serve the interests of academic careers or institutions? Is the project being directed by funding opportunities or constraints, or by the needs of the Indigenous people?"

Ethics

In regards to collaborations and partnerships it is believed that institutional review boards and current ethical guidelines are "inadequate to building collaborative relationships" because they privilege institutional protections from "legal liability and financial recriminations of research projects" (Grossman et al. 2010, 2). As Grossman and others (2010, 2), the nature of collaborative research, using an Indigenous research paradigm, is that the research serves in some magnitude to protect Indigenous "rights and security." Louis and Grossman (2009) warn that ethical issues stemming from projects should not be seen as isolated from "larger political, socioeconomic and cultural contexts."

The declaration calls for research to be mutually beneficial (Grossman et al. 2009). Research of mutual benefit to communities is especially relevant for developing countries where global debates surround biodiversity-related activities like conservation and bioprospecting (Mmaduakolam 2010). The CBD has as one of its three major goals, the "fair and equitable sharing of the benefits from the use of genetic resources" (Uprety et al. 2012, 8; CBD, 1992). CBD also speaks to access. ABS refers to access and benefit sharing in much of the literature and these features share characteristics central to ethical approaches to research. Mmaduakolam (2010, xx) argues that "effective benefit-sharing in the form of technology transfer and advanced partnership" are now the norm, not the exception. Whether there is a misconception around equitable research is yet to be seen. During a workshop titled, Research the Indigenous Way, participants discussed their experiences with research, they "pointed out that colonial research approaches are still practiced' and "they argued that until northern Indigenous peoples begin to take control of their own research agenda, achieving Indigenous governance will remain elusive" (McGregor, Bayha, and Simmons 2010, 102).

Aurukun Ethnobiology Database Study

The Aurukun ethnobiological database study is a case where equitable research design and research processes that are co-created are confronted by disciplinary objectives. The issue is centered on the outcome, in this case a database. In 2009, three years after the publication of the Aurukun study, the authors discourage these types of collaborations in a seminal article for the field of ethnopharmacology (Heinrich et al. 2009). Why is this? It is concerning that equitable research practices negatively affect or in this case directly conflict with disciplinary objectives. Rather than detour scholars from following suit, we should examine very closely where and why

tensions are arising and problematize where discipline-specific objectives and epistemologies are playing a part in continuing Western research paradigms that marginalize Aboriginal First Nations peoples, denying them a role in traditional knowledge construction (Ardill 2013). Research practices can also serve to further disenfranchise and dispossess Aboriginal groups of their sovereignties (Ardill 2013).

I characterize the study by first describing the project; its overall design, purpose, and methods. I link aspects of the study to critiques on the role of technosciences that compartmentalize Indigenous knowledge systems and to Indigenous methodologies. Lastly, I will contextualize my findings with later critiques within the discipline of ethnopharmacology and hypothesize why tensions are produced and make an argument for why diversifying disciplines and creating space for Indigenous voices, concerns, and scholarly products help us motivate and transform the future objectives of our respective disciplines. This is especially important for multi-disciplinary fields that engage traditional knowledge directly and which would cease to exist in its modern form without continued engagement.

First I provide some background including some relevant issues around Native title to land. Next, I outline the approach, design, objectives, and methodologies of the research project. I then link aspects of the study to critiques on the role of technosciences that compartmentalize Indigenous knowledge systems. Lastly, I contextualize my findings with later critiques within the discipline of ethnopharmacology and hypothesize why tensions are produced and make an argument for why diversifying disciplines and creating space for Indigenous voices, concerns, and scholarly products help us motivate and transform the future objectives of our respective disciplines. This is especially important for multi-disciplinary fields that engage traditional

knowledge directly and which would cease to exist in its modern form without continued engagement.

Aurukun, established as a mission in 1904, is a township in Australia on the Cape York Peninsula in Queensland. The Wik, Kugu and Wik-Way Aboriginal communities of Aurukun make up most of the Aboriginal population in Aurukan (Edwards and Heinrich 2006). Of the three, the Wik are the "largest Aboriginal community in Cape York Peninsula" in a remote region of North Queensland (Edwards and Heinrich 2006, 572). Land, home, homeland do little to characterize how Aboriginals conceptualize 'homeland', theirs is an embrace, a 'country', and 'hearth', but still there is no correct translation to encompass their meaning in English (Meyers and Mugambwa 1993). As Meyers and Mugamba (1993, 1204) state, "[t]he Aboriginal would speak of 'earth' and use the word in a richly symbolic way to mean his 'shoulder' or his 'side."

In 1993, the *Mabo* case determined that the Crown sovereignty, based on *terra nullius* (i.e., "empty land"), was "based on a fiction," and therefore the Crown had no legitimate claim to the land (Ardill 2013; Edwards and Heinrich 2006, 574). *Terra nullius* had effectively denied Aboriginals of recognition in any legal sense (Meyers and Mugambwa 1993). *The Native Title Act of 1993* would lead to a 1996 case, *Wik People v. Queensland*, which established that pastoral leases did not void native title, that they can co-exist.

In 2000, native title was recognized by the Australian Federal Court establishing that Wik have legal right including "pastoral leases on Crown land" (Edwards and Heinrich 2006, 573). While the study authors' refer to these pastoral leases, it does not put them into a legal context. As per the decision of the High Court, while Native title and pastoral leases can co-exist, where there is conflict, Native title holders rights are never subordinate to pastoral leaseholder rights'

(Mabo and Wik). In addition, mining leases also “have legal precedence.” At the time of the study, two mining leases were in effect, both for bauxite. (Edwards and Heinrich 2006, 573)

Degradation of the environment is a cause for great concern as communities contend with destruction caused by invasive species, ranching and mining activities (Edward, 2010). Despite this, land claims are contested and unsettled for the majority of Aboriginals in Australia (Uprety et. al. 2012; Usher 2003; Natcher et al. 2009). Being able to have power over management and land governance would contribute to Aboriginal people being “more open to shar[ing] their knowledge” (Uprety et al. 2012, 201; Natcher and Davis 2007). Relationship to ‘country’ is central to Aboriginal relationships to place, it “is one of nurturing and responsibility, akin to “kinship relationships” that involve “mutual co-dependency”” (Edwards and Heinrich 2006, 574; Rose 1996).

Wik-Way are from the north of the Archer River while Wik and Kugu are from the south. There are fifteen languages belonging to Wik group, these come by “right of clan or country” (Edwards and Heinrich 2006, 573). ‘Wik’ and ‘Kugu’ mean language. More specifically ‘Wik’ means “(totemic) story” (Sutton 1978, x). The major language spoken in Aurukun is Wik-Mungkan. (Edwards and Heinrich 2006, 573). Kugu languages are dialects of Wik (Sutton 1978, x).

The project was initiated by Traditional Owners through the Aurukun Shire Council's Land and Sea Management Centre in 2001 (Edwards and Heinrich 2006, 572). Rangers from the centre acted as mediators between researchers and Traditional Owners (Edwards 2012). PhD candidate at the University of London, Dr. Edwards, was invited by Aurukun community elders to co-develop a database. Broadly, the database was conceptualized to be an educational and

professional tool. (Irving 2014) Fieldwork was conducted between 2001 and 2004. In a talk presented in 2014, Edwards states about her experience:

> I was invited to attend ceremonies and to go on camping trips with families to remote clan estates where no other Europeans had been before, to eat bush foods, "yarn" by the fire, and sleep under the stars. (Irving 2014)

The Aurukun Ethnobiology Database comes out of a great concern about the loss of traditional knowledge due the devastation to its subsistence economy forcing it into a 'passive welfare' state. (Edwards 2012). This is in concert with ongoing environmental degradation. In this way the technology serves as an *additional* tool for the community to transmit traditional knowledge, provide an educational resource to youth, and play a technological role in approaching conservation and resource management (Edwards and Heinrich 2006, 571-72, 581; Edwards 2012). The Aurukun database also serves an economic development function in two ways. First, to facilitate KM around the sustainable harvesting of species identified for commercial uses (Edwards 2012); and secondly, as a tool for youth to promote an initiative on ecotourism (581).

Funding for fieldwork came from the Thriplow Trust through its Center for Economic Botany, the University of London's School of Pharmacy, and the Royal Botanic Gardens Kew (Edwards and Heinrich 2006). Edwards was approached while working with Kew as a database specialist, by the Aurukun Shire Council and an Indigenous NGO, the Balkanu Cape York Development Corporation. "An initial 3 month scoping study led to a PhD funded project at the University of London, with further fieldwork undertaken over a 12 month period in Aurukun

between 2001 and 2003" (Edwards and Heinrich 2006, 572). It is unclear if the Council, the NGO, or the Aboriginal communities contributed financially to the study.

To summarize, the Aurukun database is used by local students, personnel from the Centre, and the local health clinic (Edwards, Nebel, and Heinrich 2005, 31-2). The database is meant to:

1. "act as a repository of local traditional knowledge of plant foods," and to
2. "record existing local knowledge of biodiversity for the community;" to serve as a
3. "Land and Sea Management tool to assist 'caring for country'" and to help
4. "elevate health status by promoting the safe use of local bush foods and phytomedicines." (Edwards, Nebel, and Heinrich 2005, 32; Edwards and Heinrich 2006, 569 and 581).

Project and Database Design

This cross-cultural ethnopharmacological research project is designed to be a collaborative partnership and inclusive to both knowledge systems (i.e. Indigenous and Western) based on local priorities (Edwards and Heinrich 2006). The project was innovative in its acknowledgment that databases, while common place for academia, organizations, and institutions are largely lacking in communities. The project went one step further in designing a study that sought to co-develop a locally-controlled database (Edwards and Heinrich 2006, 580).

A “syncretic” and “interdisciplinary approach” was used that linked information “between Wi and scientific ontological domains” to “model autochthonous biological knowledge and scientific data” (Edwards and Heinrich 2006, 569, 581). The design and framework was

established during fieldwork and with “ongoing consultation” with "Wik Elders and Traditional Owners" (Edwards and Heinrich 2006, 575). Wik community members who were unable to participate in data collection were consulted at a center, photography and books were used to identify “locally occurring plants and animals, and digital images and records in the dataset” (Edwards and Heinrich 2006, 577).

The database was designed to integrate phytotherapies and IK, giving "parity to both knowledge systems" (i.e. scientific and traditional knowledge) (Edwards and Heinrich 2006, 581). In order for the project to be possible Aboriginal protocols were established. An important protocol to the success of the project was to adhere to sanctions around how traditional knowledge is transferred to others. Community Songmen, the “traditional knowledge custodians,” ‘adopted’ Edwards in order for transmission of traditional knowledge to be in alignment with kinship rights (Edwards 2012; Edwards and Heinrich, 2006). Essentially, the database was created as a “hybridisation of scientific and Wik knowledge” (Edwards and Heinrich 2006, 581). As the authors’ (2006) state,

> Hybridisation’ of scientific and Wik knowledge represented by the database may also facilitate inter-cultural communication and understanding between Wik people and visiting scientists; thus facilitating development of new synergistic methods to overcome environmental problems, promote sustainable use of biodiversity, and assist with habitat conservation. (581)

Is a traditional knowledge database always a hybrid technology? Is it an in-between place, as Turnbull (2000, 1) states, a *transmodern space*, where a “synthesis of indigenous and scientific spatial knowledge systems can be achieved, without the excess of either” (Palmer 2012, 81)? As

stated previously, “hybrid spaces” can “disrupt dichotomies, allowing people to negotiate with one another” (Palmer 2012, 81). As Edwards and Heinrich (2006) state, the Aurukun database represents a hybrid technology that incorporates both Wik traditional knowledge and Western scientific knowledge.

It is Wik cultural protocol to protect knowledge (Edwards and Heinrich 2006). In the study, cultural protocols dictated who could gain knowledge about animals and plants. Such knowledge was reserved for only those with “kinship ties to clan estates” (Edwards and Heinrich 2006, 575). Visitations to clan estates required that Edwards be “‘initiated’ into ‘country’” (Edwards and Heinrich 2006, 577). The scent of a Traditional Owner was “rubbed” on Edwards to familiarize ancestors to her - to effectively eliminate her ‘strangeness’. In addition, data was allowed to “present itself” and as such represented a “phenomenological-hermeneutic approach” to methodology. Facts and information were gathered “interpreted and reconstructed.” Project fieldwork methods called for an “immersion’ in “Wik ontologies” which assisted in “remov[ing] any pre-existing cultural filters or presuppositions.” (Edwards and Heinrich 2006, 576)

Methodologies also included periodic workshops and meetings be held to “demonstrate the database” to the community and “to discuss project outcomes and intellectual property rights issues” (Edwards and Heinrich 2006, 580). As Edwards (2006, 580) states, this served as an “on-going collaborative process” that provided a “forum in which Elders, Traditional Owners, Justice Group Members and Shire Council representatives could provide feedback” and raise concerns.

Indigenous methodologies dictate that protocols be context-driven and respectful. For example, a Wik context means that a Traditional Owner when speaking ‘on country’ is being watched and informed by ancestors on what to say to researchers. During the study a Wik-

Mungkan Traditional Owner says: “It’s important to talk…[to visiting scientists]…on own country so ancestors who are watching can send thoughts-help him with words to say” (Edwards and Heinrich 2006, 576). Asking questions can be disrespectful in an Australian Aboriginal context for it is not for you to dictate what is shown or told to you. Knowledge sharing is done through storytelling, situated in a place of respect not through asking questions directly (Craig 2000; Edwards and Heinrich 2006). Sutton (1979) chose out of necessity to

> abandon…[the] usual elicitation of methods…to let the people teach me in their own way and at their own pace. For several months I virtually never asked a question…my main research tool was paying attention…all the important things I needed to know were told me without my asking. (xvi, xvii).

Privileging cultural protocols in research will not always be congruent to standard methodologies (Holmes et al. 2002; Edwards, Nebel, and Heinrich 2005).

Data Collection

Traditional Owners led the collections of data for the project (Edwards 2012). Data elements included in the Aurukun database included: environmental elements, local plant taxonomies, and “traditional land management techniques” (Edwards 2012). Ecological surveys were used to record weed species distributions that would contribute to land management planning (Edwards and Heinrich 2006, 577). Species vouchers and coinciding photographs (i.e. herbaria plant specimens) are kept at James Cook University and the Queensland Herbarium. Voucher duplications are housed at the School of Pharmacy at the University of London. According to the authors, species vouchers are the “property of Wik Traditional Owners” (Edwards and Heinrich 2006, 577).

As the authors state it would even give the Aboriginal community access using their local names for species, a practical feature that others have noted being of importance for inclusion into ethno-based databases (Edwards and Heinrich 2006; Waldrum 1985). Locations were recorded, using GPS, in concert cultural data and local plant and place names. The Koolkan School contributed students who learned alongside during data collections; they also developed “new skills such as use of GPS and digital camera.” (Edwards and Heinrich 2006, 577)

In addition to complex interactions between cultural continuity and the environment are socio-political reasons which have forced Aboriginal First Nations peoples into a 'passive welfare' economy instead of their traditional subsistence-based economies. These environmental and socio-political factors lead to the "breakdown of Wik pedagogy" evidenced by the closure of their sacred school over 35 years ago. This 'school' provided men instruction on fundamental and sacred elements of 'caring for country' (Edward and Heinrich 2006, 574). Edwards and Heinrich (2006, 576) note the devolution of traditional knowledge among some Wik who did not know the cultural names of some plants, a reflection, they say, of the knowledge fading from common usage.

Local Control

Intellectual property rights are protected since "control and ownership" is held by the Aboriginal community (Edwards and Heinrich 2006, 581). It is unclear what methods were used to formalize negotiations prior to the start of the project. Authors’ acknowledge that communities are concerned about protecting intellectual and cultural property (Edwards and Heinrich 2006, 580; Commission on Intellectual Property Rights 2002). The Centre maintains local control of the database allowing only a “read-only version…with sensitive records removed” made

accessible by youth at Aurukun's Koolkan School. Researchers state that the locals ultimately control what knowledge is integrated into the database. The Songman of the community states: "I got memory…of what need…If I say 'No' I don't want it record; that's my right. Have to tell you what you can do and what can put in that computer and …radio [audio recorder]" (Edwards and Heinrich 2006, 580).

The database has functions that 'flag' sensitive information and thereby serves as a mechanism to inform end-users that restrictions have been placed on the record (Edwards and Heinrich 2006, 580). Sensitive records may contain a variety of information including gendered data (i.e. "women's business"). The database is copyrighted and provides a 'proof of ownership' to traditional knowledge. (Edwards and Heinrich 2006, 580)

Critique

The subfield of Indigenous Geographies, has developed cross-disciplinary critiques that can be applied to ethnoscientific fields of research. These fields conduct research directly related to Indigenous peoples, folk cultures and communities and their relationships to the landscape. Researchers can support self-determination or undermine it. Disciplinary dynamics may drive the use of equitable research designs and methodologies that promote the needs of communities in tandem with politicization of the research project. As Rundstrom and Duer (1999, 242) point out, "in many respects, research remains fundamentally dependent on intellectual appropriation." This highlights the inherent imbalance in power that shapes to what extent forms of traditional knowledge can be manipulated and represented. As Huggan (1991, 68) asks, "what constitutes the "legitimate" representation of a "dominated" culture by a "dominating" one?" Or in this case, what constitutes legitimate methodologies for studies *on*, *with*, and *for* Indigenous communities?

Increasing computing capabilities allowed for the evolution of information technology and as a result, the development of traditional knowledge databases. The scholarly pursuit to make traditional knowledge more accessible to scholars is apparent. Technologies increase power to use statistics in approaching knowledge systems from a Western scientific (positivist) tradition of its own knowledge production. What makes the Aurukun case special is its design, approach, and its methodological choices in the context of ethnopharmacology. It represents a case where the community maintains control (power) throughout the research process.

Goals for databases in ethnopharmacology are to store and facilitate data analyses (Heinrich et al. 2009). In ethnopharmacological studies, the aim of constructing and utilizing databases is not centered on tribal needs as they are not the intended end-users or beneficiaries of the technology. As stated, databases are often unknown to communities and readers of ethnopharmacological publications (Heinrich et al. 2009). Integrating traditional knowledge into the technology is for the sake of analyses. The Aurukun database study stands in contrast to this trend. Initially, it was Edward's hope that the study would serve as a prototype for other research projects wanting to create a database (Edwards 2012; Edwards and Heinrich 2006).

The ability of the academic and those in the network to make data 'work' is incalculable compared to the networks supporting Indigenous sovereignty. This imbalance cannot be worked out in the realm of research methodologies aside from data being largely restricted by the Indigenous community, as is the case in the Aurukun database study. Power is centered and remains in the community only when they restrict access to their knowledge via legal mechanisms or other restrictive protocols that serve to protect the knowledge and to set limits on knowledge construction outside of the community. This scenario speaks to what is touted in the

ethnopharmacological literature as a need to protect and preserve traditional knowledge before it is lost. The unspoken truth is the intent to protect and preserve traditional knowledge when it is of direct benefit to their field, the broader academic community, industry and 'mankind' not directly *for* or *with* the Indigenous communities' sharing the knowledge (Koster, Baccar, and Lemelin 2012).

Forms of traditional knowledge that are preserved and protected in collaboration with Indigenous peoples into digital technologies need not be accessible to academics, but as shown in the Aurukun study, an academic backlash can occur that serves to detour future studies from following suit. What's particularly damning in this case is that the prescription to disengage from these types of studies is made by the authors of the study. As Coombes (2012, 290) articulates, "ethical conflicts in the engagement between Indigenes and outside researchers reflect competition between multiple ontologies (or "multi-naturism"); they are not the result of competing epistemologies applied to a single world yet allegedly reconcilable through inter-subjectivity" (Blaser 2009).

In relating the case study to the use of technoscience we can link critiques on GIS to the use of databases in general. Easily one can confound the two as GIS is readily made up of a vast database of its own. It is my argument that traditional knowledge databases are technologies shadowed in comparison, not having, until more recently, strong ties to national agencies and tribal or Indigenous governments as explored and examined by Palmer and other scholars. While the colonial-based history of GIS is evident we should recognize that databases are a comparable technology that serves similar objectives within a Western research paradigm.

Databases can represent their own indigital geographic information network (iGIN) (Palmer 2012). When and if, Indigenous peoples begin to utilize them to the extent they use GIS to meet their needs is yet to be seen. It should be recognizes the Indigenous geographical understandings begin by “reasoning from a culture-specific principle of relatedness to an explanation of individual elements and their behaviour” (Rundstrom 1995, 47). Certainly developing countries like, India and Bangladesh are at the forefront of developing databases to protect their intellectual property from biopiracy. There are different scenarios and reasons to develop a database that will largely dictate their function for the community.

Critiques in geography surfaced to outline the need for critical cartographic literacy in supporting tribal use of GIS (Johnson, Louis, and Pramono 2005). I suggest a need for a critical database literacy. Communities should be aware or at the very least primed on the historic use of traditional knowledge databases, why they are created, used; how traditional knowledge is integrated and transformed, and how systematized traditional knowledge is produced and manipulated within the system. In the Aurukun case, the community initiated the project and provided the directive for the ethnobiological database to be created for its own use and purpose. In most cases, Indigenous communities do not have access to the scholars’ database or electronic files, or they have limited access if the database is published online.

It is unclear whether the specialty discipline of ethnopharmacology has a stance on scholars sharing their database files with the community. Only time will tell if Indigenous communities make use of the free software to create their own databases. Repatriating systematized traditional knowledge from existing database files will take care negotiating with

researchers and institutions as proprietary and copy right features are attached to databases and their contents.

Indigenous geographies have conceptualized and extended our understanding around the effects of GIS on Indigenous peoples. Extending elements of that literature to the expanding use of databases is relevant locally and globally. Databases are continuing to develop and evolve alongside information technology sectors. It is a good time to begin discussing their potential use in an Indigenous context, by Indigenous peoples as a tool to preserve the forms of knowledge most relevant to them. The relationship between GIS and Indigenous peoples can help tease out where and how database can serve to strengthen or weaken self-determination and sovereignty. Research paradigms, design, approach, and methodology are all integral to the research process. Collaborative research approaches, like community-based participatory research, are likely to aid in furthering the work of Indigenous peoples as they seek to "reframe, reclaim, and rename" (Steinhauer 2002, 70; Louis 2007, 133).

The establishment of a partnership that promotes the communities needs is an important feature of an Indigenous research paradigm. The Aurukun database project sought to co-develop a database to meet the needs of the community. Ranchers from the Centre, Wik Traditional Owners, youth and the broader community were included in the overall research design and process. Cultural protocols were followed such that weighed heavily on the overall approach and the methodologies employed. Protocols surrounding who could access the knowledge were strictly observed, not only to stay aligned with 'ways of being' but also to protect intellectual property. This contradicts the mandate by the *Journal of Ethnopharmacology* and the standard anthropological methods that the discipline supports.

To reiterate, the development of an Indigenous research paradigm includes the development of a partnership, the co-creation of the research process, an agreement around benefits, a mechanism for partners to "review and revise" written documents, and finally the maintenance of relationships (Koster, Baccar, and Lemelin 2012, 199). It is unclear what methods were used to formalize negotiations prior to the start of the project. Despite this it is clear that the community had control to effect the overall research process along with its outcomes. It is also unknown to what extent the community had in the review and revise process prior to publication.

The questions posed by Grossman et al. (2010), as being important to for collaborative research included questions around: involvement, legitimization, protections, substantiation, methodological incorporations, knowledge reproduction, and investment. In addition, Louis (2007) suggest characteristics that are common to Indigenous methodologies, namely: relational accountability, respectful representation, reciprocal appropriation, rights and regulations.

Overall the community was highly integrated and involved in the research process. The purpose of the study being to meet the needs of the community. The particulars around *how* the community was shaping the research process can only be inferred given the article but ultimately the project did benefit them. It is apparent that the traditional knowledge held within this community was valued and it does not appear that the knowledge was overly objectified. Intellectual property was of utmost concern and as such there was no formal quantitative analysis presented in the study. This was in line with Indigenous protocols that assigned who could access knowledge connected to clan estates.

Edwards makes an effort to compare and contrast Western and Indigenous knowledge through a hybridization method in developing the database. This attribute was dictated by the community who desired that Western scientific knowledge be available to them alongside their own. In terms of methodological incorporations, cultural frameworks and protocols were centralized. There was a point to create a process that supported intergenerational transmission of knowledge (i.e., knowledge reproduction) and to engage youth in technologies that underpin this effort. There were multiple purposes that the database was meant to support including: conservation, knowledge transmission, resource management, and conservation. Finally, the 'investment in relationships' was the "primary goal of the research" it set out to further the interests of the community.

The relational accountability principle of Indigenous methodologies were recognized. A partnership was developed that included a significant time investment to accomplish the goals set by the community. It is possible to connect the principle of 'respectful representation' to the role of Centre ranchers, youth, and Wik Traditional Owners as data collectors. A process was formalized that open spaces for continual feedback from the community that fed back into the research process. Despite the communities unwillingness to have their knowledge quantitatively applied and published the research went forward to their benefit.

In terms of reciprocal appropriation, we can question whether this project served the researcher and the discipline of ethnopharmacology to an acceptable level. Multiple publications came out of Edward's time in Aurukun, including another study at the local health clinic (see Edwards, Nebel, and Heinrich 2005). The project outcomes were clearly directed by the community. The 'rights and regulations' were aligned with cultural protocols and overall it

appears that the study was a full collaboration between a Western trained scientist and the community (Louis 2007).

Disciplinary Response

To reiterate, the *Journal of Ethnopharmacology* is the journal of the International Society of Ethnopharmacology. From its inception in 1979, databases were present to facilitate quantitative analysis derived from ethnographic text and research of that time. Today, the journal does not accept manuscripts for publication that leave out cultural uses of plants and quantitative data (Verpoorte et al. 2006; Heinrich et al. 2009; Heinrich and Verpoorte 2012). To have any cultural use data withheld from publication is cause for "immediate rejection" (Heinrich et al. 2009). This is not likely to change as the field is continuously looking to employ information technology and to adhere to more rigid scientific methods. As stated, further research like the Aurukun study are not recommended (Heinrich et al. 2009).

Researchers working within an Indigenous research paradigm "empowers the historically marginalized." This has the effect of challenging "non-Native practitioners to step outside of their intellectual and methodological conventions into a world in which knowledge-making is an ethical act of facilitating self-determination." (Johnson and Larsen 2013, 9; Bishop 2005). But we can see where this produces tensions in the field. The discipline cannot employ scientific methods within an Indigenous research paradigm, especially when the outcome is entangled with their ability to quantify systematized traditional knowledge. This problem goes hand in hand with the "publish or perish" situation that most researchers find themselves (Bannister and Barrett 2005).

Publications benefits researchers who work with Indigenous people and communities (Koster, Baccar, and Lemelin 2012, 200). The Western research paradigm has a broad reach with theoretical and applied structures that allows for knowledge transmission to extend beyond the originating author(s) and the community. For this reason we should not view researchers as autonomous. Many researchers underestimate benefits to the academic community and their broader networks especially in ethnosciences. Additionally, academic benefits can compound over time regardless of what originating authors do (Bannister and Barrett 2000).

Edwards and Heinrich detail the local priorities which shaped the objectives and directed research activities. The Aurukun Ethnobiological Database study was designed to promote "inter-generational transmission of knowledge." (Edward and Heinrich, 2006, 575) The 'hybridized' database was to include Western scientific data and forms of traditional knowledge (Edwards and Heinrich, 2006). Fieldwork also entailed locating local plants and weeds, paying attention to mining areas, and helping to plan for post-mining rehabilitation. Identification of plant species with potential for income generation, particularly from areas to be cleared for mining, was also desired by the community. All this data was not to be accessed by outside researchers, it was to be protected. Indigenous methodologies and protocols being central to the research design served to restrict the author(s) ability to publish data that is analyzed or can be analyzed by others. This has severe consequences for the field of ethnopharmacology to employ Indigenous methodologies.

Daniel Moerman (1979) was the first to publish an article on the potential use of databases in the field of ethnopharmacology. It was published in the first issue. It also initiated a 35 year debate on statistical approaches to quantifying forms of traditional knowledge for the

ongoing knowledge production around systematized traditional knowledge. As methods have developed seeking to be more equitable the field has responded more or less to argue against any notion of 'secrecy' in the field. Particularly, the decision of researchers to reserve sensitive information (probably per agreements with communities) from quantification is highly contested.

In an editorial piece titled, On Secrecy, published in *Ethnobotany Research & Applications*, Moerman (2008b) asserts that an "approach to plant knowledge based on secrecy is wrong and damaging, and should never be entered into by any scientist unless it is absolutely necessary." He reflects on Jeffersonian notions around progressive development to make his point. He believes that any desire to hold knowledge secret is "highly inflated" and attributes such attitudes to "exaggerating ethnobotanists" He suggest that any place where people and communities seek to hold knowledge secret, "simply should not be research sites." (Moerman 2008b, 324)

Transparency is thought to be the pinnacle of good research even though there is an acknowledgment that outcomes can be negative (Moerman 2008b, 324). Moerman (2008b) puts forth the following case:

> I maintain that a) any ethical arrangement involving secrecy is bound to have a bad result sooner or later, and hence should be avoided whenever possible, and b) in ethnobotany, it is best to assume before the fact that there is always prior art, even if you can't find any evidence of it. (324)

Essentially, all Indigenous peoples should assume that their knowledge "(x is used to cure y)" is already known and there is no need to 'protect' it (Moerman 2008b, 324). Moerman (2008b) asserts that:

> anyone who has ever read more than one list of useful plants knows that they inevitably seem to overlap by about half. Read one more and they all overlap by about two thirds. Keep reading, and there is no such thing as an "endemic" (as in "endemic knowledge.") This seems to me to be the basis for a rich and important ethical principle. (324)

In other words, traditional knowledge holders, according to Moerman, may inflate the value of their own knowledge.

Ethnopharmacology is concerned with the cultural uses of medicinal plants. It might continue to be assumed that 'most' medicinal plants are known (even this point can be argued) but one cannot assert that all the *ways* they are used as medicine are known. If this was the case why the need for ethnopharmacology at all? Moerman fails to attribute secrecy to sacred knowledge. Indigenous cultural practices have evolved to transmit, care for, and protect sacred knowledge and cultural protocols often dictate who can and cannot have access to knowledge. Arguments about the likelihood that x plant is already known as a medicine for y, does not provide a full picture regarding cultural use or frequency of use, an element of great import for ethnopharmacologists (Verpoorte et al. 2006, 2008).

This disregard for traditional knowledge as having novel attributes is linked to the ongoing misappropriation of knowledge that communities fear. As stated earlier, bioprospecting of traditional knowledge "has always been an easily accessible treasure and thus has been susceptible to misappropriation." (TKDL 2015) Often scholarly articles in ethnopharmacology fail to consider incongruences between standards and arguments set out within the discipline and the rightful claims of Indigenous peoples to control their own knowledge systems. As stated, "it

is conveniently assumed that since it is in public domain, communities have given up all claims over it [traditional knowledge]." (TKDL 2015)

Publication, and for that matter, patenting is embedded into the scientific culture. One is meant to protect knowledge; the latter to claim novelty (the absence of prior art). To follow Moerman's (2008b), Jeffersonian argument that, *openness is always better*, assumes everyone is afforded access, and can achieve equal recognition and benefits for their knowledge innovations. The discipline of ethnopharmacology seems to lack any desire to attribute 'antecodotal' evidence back to knowledge holders in any rigorous manner, and in so doing, erase their mark on it and the innovations that arise from it. (cf. Johnson and Murton 2007) What ethical principle might this be based on?

Credit is given to the author for ideas, studies, and findings that come from it; databases are proprietary and the information contained therein, copyrighted. The whole realm of intellectual property is wrapped up in materializing products (i.e. innovations) that can be protected for a set period of time. Protecting collective knowledge passed down for generations is not an attribute that intellectual property law was created to protect. Ethics and equitable research processes, prior and informed consent, and institutional review boards can serve to protect Indigenous peoples' rights (i.e. fill the gap) and elevate the status of their traditional knowledge despite the restrictive features of international law.

Disciplines like ethnopharmacology, walk a slippery line, putting them in the position to make ethical arguments for transparency rather than engaging in ethical arguments around the protection of traditional knowledge. It seems apparent that the *Journal of Ethnopharmacology* is to some extent dictating standards in the field. This is compounded with standards and code of

ethics developed in the ethnoscientists' respective field(s) of study; be it chemistry, biology, anthropology and so on.

Despite these criticisms fieldwork in being conducted into the 21st century (Gertsch 2009). I suggest the transparency that Moerman argues for be extended to researchers expounding upon the possible patents that might derive from the knowledge shared. Not only that, but that researchers establish very clearly that the knowledge shared is already in the public domain (i.e., prior art) showing them proof of such a claim. Even so, ethnopharmacologists are not patent lawyers. Communities would need to confirm their hesitations to collaborate with patent lawyers, preferably person(s) or organizations trusted by the community, preferable professionals who have something to gain from communities' working to elevate self-determination and in turn stabilizing their own ways of knowing and being in the world without risk of misappropriation.

Discussion

For colonizers, the continent of 'Australia' represented a *Terra Nullius,* meaning empty land (Edwards and Heinrich 2006, 574). Indigenous' epistemologies/ways of being are disrupted and dishonored when the environment in which it depends is degraded for economic gains and development. Given the magnitude of environmental degradation and its effect on cultural biodiversity many disciplines use it to substantiate the importance of their research. The "Dying Native" story is rationalized by ethnopharmacology in making its objectives and research endeavors relevant to the global community (Rowes 2005). The effect is that resources and

knowledge systems' extraction are justified and those outside the community benefit (Rundstrom 1995).

The organization, Terralingua (2015), declared that the Aurukun study was one of four (out of forty reviewed), that was "devoted to the maintenance and restoration of biocultural diversity" (Edwards and Heinrich, 2006, 580). The mission of Terralingua is to "sustain the biocultural diversity of life…through an innovative program of research, education, policy-relevant work, and on-the-ground action" (Terralingua 2015). They mention the potential of databases "to promote cultural transmission in communities" (Terralingua 2015). As stated in the Aurukun study, "other Aboriginal communities are noted as having an interest in creating their own databases" (Edwards and Heinrich 2006, 581; Edwards 2012). How interested would Indigenous people be in managing their own databases? This is unknown and presents an interesting question. Given concerns around misappropriation, a database can serve to protect traditional knowledge already in the public domain from misappropriation. Understanding how to contest wrongful patents would be central to using a database for that purpose. It is more likely that Indigenous communities' interest in a database would parallel the interests of the Wik communities. Like GIS, a database can serve to strengthen self-determination in conservation, cultural preservation, knowledge transmission, and resource management to name a few. There is also good reason to use a database to further work around food sovereignty initiatives. This connects directly to increasing self-determination.

Specialty groups that privilege the rights and needs of Indigenous communities need more academic attention. Normally specialty groups are created to bring academics with specific interests into conversation together. Groups organize and meet in tandem with yearly meetings.

Specialty groups with a focus on methodologies, process, and outcomes related to research with Indigenous communities can allow for organized discussion and ultimately influence their respective disciplines to review objectives that appear in conflict with ethical research approaches. Even if the discipline makes no changes there are publications that elaborate upon the goals and approach of specialty groups and those may very well stand in contrast to disciplinary trends.

One foundational issue in the Aurukun study is that the researchers do not create a framework that integrates their needs beyond abstractions about TEK loss and biodiversity. They essentially fall into the 'trap' of doing research *for* the community (Koster, Baccar, and Lemelin 2012). The effect is of great benefit to the community but the researchers fail to reap the benefits of their work in producing publications drawing from an empirical approach. This is not to say that collaborative projects can't be *for* the community, just that a critical literacy about what motivates, affects, and incentivizes research is important to the research process especially during early stages.

Standardized research methods are informed, in part, by professional societies and objectives disseminated via journals. Objectives around access to traditional knowledge, especially in ethnopharmacology, will automatically conflict with cultural protocols that dictate knowledge transfer. *On Secrecy*, shows us that there is a rationalizing being displayed to counter contemporary trends to engage in alternative methodologies in the field. Maintaining a status quo in fieldwork may be in the best interest of ethnopharmacology but there are partnerships on the horizon that will ultimately relegate them to margins to watch from a distance (Louis 2007). Collaborative partnerships that find a conceptual footing in Indigenous research methods and

will still need to be aware of disciplinary objectives in order to anticipate backlash. For certain, Indigenous methodologies are controversial precisely because they elevate and empower communities to stand by their cultural mores, practices, and protocols and to engage in long-term relationships with researchers who are ultimately invested or directly affected by community outcomes. Indigenous peoples will set the pace for how often we find Indigenous research paradigms providing the foundation for Indigenous-led research in the future (see: Coombes 2012).

Finally, it is not enough to suggest Indigenous methodologies be used if we cannot link them to a context. I suggest we begin asking the following questions that are linked to developing a critical literacy around research that speaks to ways that communities can 'align' themselves with researchers and fields of study that suit their needs. Asking the questions can be the part of an initial phase in approval process for prospective researchers. Asking such questions also avoids a false notion that researchers are neutral agents (Runstrom and Deure 1999).

1. What disciplinary objectives or standard methodologies are dictating the research process?
2. How will research privileging cultural protocols, and Indigenous methodologies, effect researchers?
3. Which disciplines can assist in community needs that do not have restrictive objectives and standard methodologies?
4. How willing are we to compromise on our cultural practices and protocols to collaborate on a research study? Do we understand that researchers are not

autonomous that they are hooked up to a broader network that may include organizations, institutions, and private enterprise?

5. Do we understand the possible outcomes for the researchers, including ability to publish and benefits to their discipline (i.e., broadening of the field)?
6. How does making our traditional knowledge available assist in broader issues effecting Indigenous peoples and sovereignties?

Questions like aforementioned, represent an "alignment" strategy that relies a critical consciousness. Alignment in regards to ethnoscience fields may be difficult to comprehend.

The Aurukun Centre follows the International Society of Ethnobiology Code of Ethics (Edwards 2012; ISE 2015). The code of ethics

> affirms the commitment of the ISE to work collaboratively, in ways that: support community-driven development of Indigenous peoples' cultures and languages; acknowledge Indigenous cultural and intellectual property rights; protect the inextricable linkages between cultural, linguistic and biological diversity; and contribute to positive, beneficial and harmonious relationships in the field of ethnobiology (ISE 2015).

While ethnobiology maintains an ethics codes that supports equitable research processes it is yet unclear what effect it has the building of collaborative partnerships and the conservation of biodiversity and cultural diversity. As Bannister (2005) notes:

> the intellectual and methodological plurality of ethnopharmacology poses a variety of theoretical and practical challenges. One of these is developing a sense of cohesion among researchers with such divers sub-

> specialties as anthropology, natural products chemistry, and comparative religion…defining a research ethic and level of professional responsibility that work for all members is challenging in today's complex ethical and legal climate, especially for research involving biodiversity and the medicinal knowledge of indigenous or traditional peoples (para 1).

Bannister (2005, para. 1) asserts that "ethnopharmacologists, as brokers of knowledge and agents of change, are well-positioned to be leaders in developing ethical and equitable research practices, if these are based on agreed values and terms that are co-defined with involvement and due respect for all stakeholders." I would disagree. It is difficult to see how this might come about if ethnopharmacology does not provide more flexibility in their methodological standards and greater transparency around how systematized traditional knowledge is used in databases and broader networks. As Louis and Grossman point out (2009), research implications reach beyond the researchers to broader politicized arenas that have power in their own right to influence the research process. This issue of secrecy would have to be amended drastically if the field is interested in being 'leaders' in the development of equitable and ethical research practices (Bannister 2005).

In order for the ethnopharmacology to come to terms with its own colonial history and to commit to equitable research processes there will need to be dissension and plurality in the field. Cohesion is what you want when you put something back together, but something needs to be broken first. An alternative conceptualization of the field is required that acknowledges, in publication, Indigenous peoples' right to safeguard their knowledge systems in whatever ways they deem appropriate. It should not be assumed that communities will share knowledge. It is not

my argument that communities take a protectionist attitude that precludes them from reaping the benefits of equitable research. If anything we need to develop a greater depth of understanding on the explicit ways that research does benefit communities. It is my hope that access and benefit-sharing will continue to imbue negotiations and will continue to be elevated in legal realms.

To critique processes of representation, one can look to the literature related to representations of Indigenous peoples in ethnography and other fields. Lassiter (2001, 102) discusses the power and politics of representation, using experiences with Kiowa consultants to illustrate how methodologies result in a power play about who represents whom, for what audience, and "for what purposes." He argues that "ethnographers now recognize how power and history shape the ethnographic process" (Lassiter 2001, 138). Again, this is a process that greatly informs sub-disciplines like ethnopharmacology.

Despite this acknowledgement, subfields that make use of ethnographic strategies (e.g. anthropological standards in ethnopharmacology) overemphasize the use of "thick description", ignoring other methodological developments. There is a push in ethnopharmacology to make methods more and more rigorous and quantifying is now the norm. But how do we use these insights to critique ongoing use of the ethnographic record and the continuation of *status quo* field methods in contemporary 'explorations'? Do we even understand the implications of not motivating ethnoscience in to more equitable and just research arenas?

Many of the protocols and methods used in the not-to-distant past would be unacceptable within academic institutions today, yet, the data collected is often treated as untarnished and neutral. While criticisms on historical colonial entrenchments and current practices seem

paralleled, we should acknowledge that we can't separate our use of the data from the colonial structures that reinforced its collection in the first place. Surprisingly, this can work for Indigenous communities as evidenced by the posthumous exclusion of 'rediscovered' research notes from J.P. Harrison. The J.P. Harrison Database Project seeks to adhere to agreements between language speakers and J.P. Harrison that were negotiated decades ago (J.P. Harrison Database Project 2015). Acknowledging research flaws and prejudices that occur, past and present, should be a part of the research process. If only to remind us that there are costs to society that are still felt in communities today. Johnson, Louis, and Pramono (2005) discuss the need for critical literacy in communities but it is also of great importance for researchers.

Conclusion

A critical literacy on the historic use and development of databases would help communities' understand the context in which they developed. In the field of ethnopharmacology it has been increasingly beneficial because it facilitates statistical analysis. Without a database it would have been difficult to assess traditional knowledge systems across regions and cultures. Coherent theorizing from an Indigenous point of view seems to be lacking in the literature (Coombes 2012). New methodologies in both geography and ethnography can pave the way for insights into how disciplines conceptualize their own experiences with research partners, industry, intellectual traditions, networks, consultants, agencies, and colleagues. Does this go far enough? The basic gap in research around participatory and collaborative research and or partnerships is around how communities conceive and embark in these relationships. We say, when x, y, and z, objectives are foregrounded, than we all get equitable results. What is meant by

equitable? Surely, we must acknowledge that Indigenous peoples around the world, are marginalized and exploited on many levels, and that these extenuating circumstances color perceptions about the risks involved in sharing traditional knowledge.

So, can there really be just and equitable partnerships in a world where capital and access to resources are wholly one-sided? Are local communities reactive in their orientation towards researchers? Where do we hear Indigenous voices praising collaborative and participatory research and what can we learn from those experiences? Demanding a space for theorizing and conceptualizing by communities that reflect back on how we might forge ahead in collaborative research is one of the most important infrastructural changes needing to happen in the academy. As part of an iterative and reflexive process, researchers need to listen and hear these voices in order to interpret their own experience. It will be our job to continue to help forge open spaces and dialogue that are meaningful. It will be Indigenous peoples' work to make use of it. We should feel desperate at this point to have Indigenous voices in the academy, desperate to make space for community theorizing about how academic/community research actualized.

Research with Indigenous peoples is a balancing act in regards to participatory and collaborative designs. The needs of the community and the discipline can be in direct conflict. As a scholar, being prepared to defend against disciplinary criticisms is vital to pushing Indigenous methodologies and more equitable research approaches to the forefront. As we find with the IPSG, in Geography, criticism from within the discipline that promotes these methodologies are powerful reinforcements for conducting research that creates space for empowerment and inclusion. Disciplines can no longer hang their epistemological hats on the

shallow notion that forms of traditional knowledge that come out of Indigenous knowledge systems belong to everyone.

Indigenous communities are aware and concerned about the loss of traditional knowledge, especially amongst youth. This concern however should not be used in academic disciplines as a hollow supposition set out to undergird bioprospecting or pharmacological endeavors with moral platitudes. Framing research as a means to alleviate loss of knowledge has turned into nothing more than a cliché in the field. The rhetoric around preserving knowledge is used in much the same way. Continuing on in empty proclamations veils who benefits from research projects. These are issues that have to do politics, power, and representation on par with the real concern for conserving biological and cultural diversity and knowledge systems.

Another overarching theme in much of the literature is that traditional knowledge needs to be documented before it is 'lost'. An alternative interpretation of this idea might be that the modes of documentation, be it written, oral, or performance-based, by Indigenous peoples' are inadequate as mechanisms to 'preserve' knowledge due to stressors affecting the continuity of the culture; in other words communities cannot be entrusted to preserve their own knowledge-because they can't-because colonization's destructive forces will or have overcome them. This idea is used with a broad stroke to characterize all local and Indigenous communities and justifies the proactive stance by academics to become knowledge saviors instead of defenders working with Indigenous communities. Success is when traditional knowledge has been documented according to Western constructs and epistemologies before colonization is complete.

Digital technologies can serve as mechanisms to disassemble, abstract, and twist traditional knowledge in order to make it useful those outside the community. Databases and GIS can serve to decontextualize and in effect (re)present knowledge in new ways that have the potential to exploit and harm communities. Of course the opposite is also true, the (re)presentation could serve to benefit communities, especially where communities are involved in the representation, revitalization, reclamation of their knowledge.

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