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Mapping and GIS analysis of place names along the Sonora coast in Mexico

GEO 511 Master's Thesis

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Abstract

Recent research in the field of ethnophysiography investigated how landscape categories and place names are related. It was shown that toponyms have referential potential. However, before toponyms can be analysed, they need to be documented. Therefore, this thesis elaborates on methodologies to record and georeference toponyms along the Sonora coast in Mexico. The area is inhabited by an indigenous culture, namely the Seri. The Seri used to live as semi-nomadic hunter-gatherers in brush shelters until they became sedentary in the second half of the 20th century. The Seri territory lies within the Sonoran Desert and is characterised by dunes and coves in the coastal area, rocky desert mountains, alluvial plains, dry lakebeds and dense vegetation further inland.

The aim of the thesis is to analyse Seri campsite locations with respect to ethnophysiographic research questions. It will be investigated how Seri campsite toponyms can be located in space, to what extent they use generic terms in creating campsite toponyms and whether they can be related to landscape. Finally, it also addresses geographic characteristics of Seri campsite locations.

The methodologies applied to document Seri toponyms are a semi-structured interview and field surveys. The data are then explored and analysed using GIS software.

Semi-structured interviews combined with Google Earth satellite images proved to be an adequate approach to document Seri toponyms. Field surveys did not contribute as much information as the interviews. However, they covered additional aspects and were an important information source. The exploration and analysis of the recorded campsite toponyms confirmed that toponyms can have referential potential and that generic terms can denote landscape features. One of the main findings of the analysis includes the identification of a naming pattern which is based on generic terms. The recorded locations suggest that Seri campsites are evenly distributed along the coastline and do not seem to be related to geographic characteristics such as aspect, height or slope.

The identified benefits and limitations of semi-structured interviews and field surveys for documenting indigenous toponyms provide useful information for further toponym studies. Additionally, the documentation of toponyms is part of preserving indigenous knowledge and contributes to ongoing indigenous mapping studies. However, future work should follow to investigate the relation of Seri campsite locations to natural resources. Furthermore, ontological research is needed to better understand and represent Seri conceptualisations of campsite and landscape features. Finally, the application of Google Earth in toponym und community mapping studies seems promising and should be further investigated.

Zusammenfassung

Das Forschungsgebiet der Ethnophysiographie widmet sich dem Zusammenhang von Landschaftskategorien und Ortsnamen und zeigte, dass Ortsnamen referentielles Potenzial haben. Bevor Ortsnamen jedoch analysiert werden können, müssen sie dokumentiert werden. Daher untersucht diese Masterarbeit am Beispiel der Seri, einer indigenen Bevölkerung, die an der Küste von Sonora in Mexiko lebt, Methoden um Ortsnamen zu erfassen und zu georeferenzieren. Die Seri lebten als halbnomadische Jäger und Sammler in Unterkünften aus Büschen und Unterholz bis sie in der zweiten Hälfte des 20. Jahrhunderts sesshaft wurden.

Die Masterarbeit erforscht Seri Lagerplätze im Zusammenhang mit ethnophysiographischen Fragestellungen. Es wird untersucht wie Seri Ortsnamen dokumentiert werden können, in welchem Ausmass die Seri generische Begriffe in den Namen der Lagerplätze verwenden und ob sich diese auf die Landschaft beziehen. Schliesslich werden geographische Charakteristiken von Seri Lagerplätzen ermittelt.

Die angewendeten Methoden um Seri Ortsnamen zu erfassen sind ein Leitfadeninterview und Felderhebungen. Die Daten wurden anschliessend mittels GIS Software erforscht und analysiert.

Die Kombination von Leitfadeninterviews mit Satellitenbildern von Google Earth stellte sich als angemessene Herangehensweise für die Dokumentation von Seri Ortsnamen heraus. Die Felderhebungen ergaben nicht so viele Daten wie die Interviews. Sie deckten jedoch zusätzliche Aspekte ab und waren eine wichtige Informationsquelle. Die Erkundung und Analyse der erfassten Standorte der Seri Lagerplätzen bestätigt, dass Ortsnamen referentielles Potential haben und generische Begriffe Landschaftsmerkmale bezeichnen können. Ein interessantes Ergebnis der Analyse ist das Herauskristallisieren eines Namenssystems, welches auf generischen Begriffen basiert. Die erhobenen Daten suggerieren weiter, dass die Lagerplätze gleichmässig entlang der Küste verteilt sind und sich nicht an geographischen Charakteristiken wie Ausrichtung, Höhe oder Neigung orientieren.

Die aufgezeigten Vor- und Nachteile von Leitfadeninterviews und Felderhebungen zur Dokumentation von Ortsnamen bieten eine nützliche Basis für weitere Forschung. Zudem wird durch die Aufzeichnung ein Teil des indigenen Wissens erhalten und ein Beitrag zu laufenden indigenen Kartierungsprojekten geleistet. Weiterführende Forschungsarbeit sollte den Zusammenhang der Seri Lagerplätze mit den natürlichen Ressourcen untersuchen. Auch ontologische Forschung wird weiter benötigt, um die Seri Konzepte von Lagerplätzen und Landschaft besser zu verstehen und abzubilden. Schliesslich sollte die vielversprechende Anwendung von Google Earth im Zusammenhang mit der Dokumentation von Ortsnamen und Kartierungsprojekten weiter untersucht werden.

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Notation

Abbreviation	Meaning
DEM	Digital elevation model
GIR	Geographic information retrieval
GIS	Geographic information system
GPS	Global positioning system
GT	Geospatial technologies
ICOS	International Council of Onomastic Sciences
INEGI	National Institute of Statistics and Geography (Mexico)
IUCN	International Union for Conservation of Nature
INSPIRE	Infrastructure for Spatial Information in the European Community
MCDA	Multi criteria decision analysis
PPGIS	Public participation geographic information system
SRTM	Shuttle Radar Topography Mission
UNGEGN	United Nations Group of Experts on Geographical Names

1 Introduction

The following introduction section provides information on the context of toponyms and presents the motivation and goal of this master thesis. It focuses on the two main aspects of this study, the contribution to ongoing scientific research as well as the contribution to the local Seri community where fieldwork was done. The outline of the thesis is given, too.

1.1 Scientific context

Toponyms are part of our everyday live. We use street signs indicating place names when driving by car, names of train or bus stations when traveling by public transport or commonly known place names when arranging a gathering for the night. Toponyms are not only used in western cultures but all over the world, although they may be used on a different daily bases and not possess the same legal power (Rose-Redwood & Alderman 2011). Different cultures attribute different significance and importance to toponyms. However, the latter are still omnipresent (Williams & Stuart 1998). As well as every culture has its own toponyms, people inhabit a distinct landscape (Burenhult & Levinson 2008). How landscape is perceived and categorised is highly individual across the world (Levinson 2008; Mark et al. 2011). People have developed their own ontologies for experiencing their surroundings (Burenhult & Levinson 2008).

Until recently, little research has been conducted on landscape conceptualisation (Mark et al. 2011). Toponyms have received a lot of traditional linguistic attention since they conserve many elements in a language (Burenhult & Levinson 2008; Radding & Western 2010; Tichelaar 2002). However, the relation of generic parts to ontological categories has received less attention (Mark et al. 2011). Bringing those two aspects together, a new transdisciplinary subfield emerged: the field of ‘ethnophysiography’ which arose in the year 2002 (Turk & Stea 2014). Ethnophysiography examines landscape ontologies and their appearance as generic parts in toponyms (Turk & Stea 2014; Mark, Turk & Stea 2010). Thus, ethnophysiography investigates how landscape categories and place names are related (Mark et al. 2011).

1.2 Context of the Seri

“More indigenous territory can be reclaimed and defended by maps than by guns” (Nietschmann 1995: 37). This quote shows the urgency for indigenous groups to have maps of their territory to thereby achieve self-determination. Maps are needed to illustrate the dispersion of the community and to conserve the place names and attributed knowledge. Traditional knowledge is in danger since

many young people lose their cultural roots (Laituri 2002). Additionally, many traditional nomadic or semi-nomadic communities become sedentary and therefore the loss in knowledge is accelerated (Sieber & Wellen 2011).

The previous started collaboration between Prof. Dr. Ross Purves, Dr. Flurina Wartmann from the University of Zurich and Prof. Dr. Carolyn O'Meara from the National Autonomous University of Mexico has made this thesis possible. It was also Prof. Dr. Carolyn O'Meara who has done a lot of research about the Seri and brought up the need of the Seri to document their territory. This master thesis contributes to ongoing indigenous mapping studies. It records, analyses and maps the toponyms of an indigenous community in Mexico, the Seri. Therefore, it helps to preserve indigenous Seri toponyms and the attributed local knowledge.

The Seri are an indigenous community living in Sonora, Mexico (O'Meara 2010). Seri toponyms are most often used for naming campsites, hills and springs, but they also name islands or places where you can hunt (Marlett & Moser 2001). Many initiatives have been started by different researchers to document and monitor traditional Seri knowledge. Examples include turtle nest, bird and plant documenting and monitoring. This information could be added and displayed on a Seri map to show for example where medicinal plants were originally collected and where they still can be found. It could be vital and interesting for the next generation of Seri people. It would also be of interest to the Seri to have a map which displays the waterholes and springs that are in their territory. Despite being a water resource for them, it could find application in their business of selling hunting permits to outsiders. It is of main interest to hunters camping in the area to know where they can find water resources but also to know where they would probably find animals getting water, too. Therefore, a Seri map is needed displaying the local information. The map can be an important factor in preserving local indigenous knowledge and passing it on to the next generations.

1.3 Motivation and goal

Proper names are often said to be pure referencing expressions and therefore not to have semantic meaning or sense. "There is no necessary connection between a name including *Tunnel* and a thing that is a tunnel, even if there is a strong expectation that such relationship will prove to be valid (Coates 200: 365)." The example to support this statement is a railway bridge called *Peak's Tunnel* located in North East Lincolnshire, England. *Peaks's Tunnel* is a normal railway bridge and not a tunnel as the name suggests. However, there are also contrasting perspectives. Burenhult and Levinson (2008) explore the linguistic categories of landscape terms and place names in different languages and find that place name components are drawn from landscape features, body parts and

animals, to name just a few (Burenhult & Levinson 2008). Apparently there is not an agreement on whether proper names, and therefore also toponyms, are meaningless regarding topography and landscape elements or not.

This master thesis does not aim to provide an answer to the question if toponyms have sense or not but to contribute to the ongoing research. This will be addressed through the Seri case study. The aim is to analyse Seri campsite locations with respect to ethnophysiographic research questions. Those questions include for example:

- To what extent do the Seri use landscape terms when creating toponyms?
- Can generic parts in Seri campsite toponyms be related to landscape?

Investigating these questions will reveal information on how indigenous Seri people related and depended on their environment. It will also provide insights on if and to what extent toponyms can be related to landscape in the Seri case study. Additionally, this thesis aims at georeferencing Seri toponyms and thereby providing valuable information to local Seri people as well as making data available for further research.

1.4 Outline

The following chapter provides an overview of the research relevant for this study. It presents research on toponyms, perception and conceptualisation of landscape, ethnophysiography and indigenous toponyms and community mapping. Then, research gaps are identified and the research questions that will address those gaps are introduced. Afterwards, the study area and the data gathered at the beginning of the research are described in chapter three. Chapter four specifies the methodologies for data collection, data processing, data exploration and data analysis. The methodologies are followed by the presentation of the results in chapter five. The results include data sources, data exploration and data analysis. Then, the different steps of the methodology as well as the results are critically reflected and discussed in chapter six. Based on the discussion the research questions are answered. Finally, the conclusion is drawn and an outlook on future work is given in chapter seven.

2 Background

This chapter provides an overview of the research areas which are relevant for this master thesis. It introduces the theoretical background on toponyms and the related questions of properhood, sense and translation in toponymy. People's perception of landscape is addressed through the concepts of landscape ontologies and mental maps. Further, an insight into the research area of ethnophysiography, the differences of landscape conceptualisations, is given. It also presents research done and problems identified in community mapping. Finally, current research gaps are revealed based on the literature review and it is shown how this master thesis contributes to the ongoing research.

2.1 Toponyms

This section provides an outline of the research on toponyms. It starts by introducing different toponym definitions and indicating the definition used for this thesis. It also highlights the elements of toponyms. Furthermore, the concepts of properhood and sense are discussed, which leads to the question of the referential potential of toponyms. Finally, approaches and practices of toponym translation are presented.

2.1.1 Definition and aspects

Place names and toponyms are often used equivalently. This already implies what toponyms are, given names to places. This is quite a general and broad explanation though. Looking at toponym definitions in more detail, it becomes apparent that there is more than just one definition being used in literature. Definitions are for example provided by the United Nations Group of Experts on Geographical Names (UNGEGN), the Infrastructure for Spatial Information in the European Community (INSPIRE) and the International Council of Onomastic Sciences (ICOS). According to their definitions a toponym is a:

- "Proper noun applied to a topographic feature. Comprehensive term for geographical names and extraterrestrial names" (Kadmon 2002: 26).
- "Proper noun applied to a natural, man-made or cultural real world entity" (INSPIRE 2014: 1).
- "Proper name of a place, both inhabited and uninhabited" (ICOS n.d.: 5).

The toponym definitions are diverse, but they all have the one thing in common that a toponym is defined as a proper noun. This proper noun is then either applied to a topographic feature, a real world entity or a place.

Research on toponymy has experienced a shift from traditional linguistics, through geography to the more recent field of ethnophysiography (Jett 1997; Jones & Purves 2008; Mark, Turk & Stea 2007;

Radding & Western 2010). Those research areas have been investigating toponyms in their own way and are further addressed in this section. Originally, toponyms were studied by linguists as part of the human language (Radding & Western 2010). Linguists are mainly interested in the morphology, syntax and semantics of names (Meiring 1993). Morphology addresses the structure and form of words, syntax refers to the correct arrangement of words in a sentence and semantics looks at the meaning (Kadmon 2002). Toponyms are particularly suited for linguistic studies since place names are preserved over decades or even centuries and can contain a lot of information about a language (Tichelaar 2002). However, linguists have not investigated toponyms as an own research area. They have treated the toponyms as part of the human language (Radding & Western 2010). Toponyms are studied by the linguistic branch of onomastics which investigates names in general (Hajdú 2003). However, toponyms do not only reflect linguistic characteristics, they also have a geographic aspect: they allow a basic spatial communication. In the field of geography toponyms have received more discrete attention. Research in the field of Geographic Information Retrieval (GIR) investigates toponyms in order to detect geographic references in text documents and users' queries. GIR also aims at disambiguating toponyms and determining the geographical definition of vague places (Derungs et al. 2013; Jones & Purves 2008). It is the field of ethnophysiography which has recently brought new insight into the research on toponyms. The study of toponymy in ethnophysiography focuses on landscape terms appearing in toponyms, their relation to landscape categorisation and the emotional and spiritual bonds people have to place and landscape (Mark, Turk & Stea 2007).

The prior mentioned research areas address different aspects and properties of toponyms. This points out that toponyms are not simple but rather complex objects and have different elements attributed on different levels (Hećimović & Ciceli 2013; Jakir, Hećimović & Štefan 2011). One approach in defining the components of a toponym has been undertaken by Jakir, Hećimović & Štefan (2011) and is illustrated in figure 1.

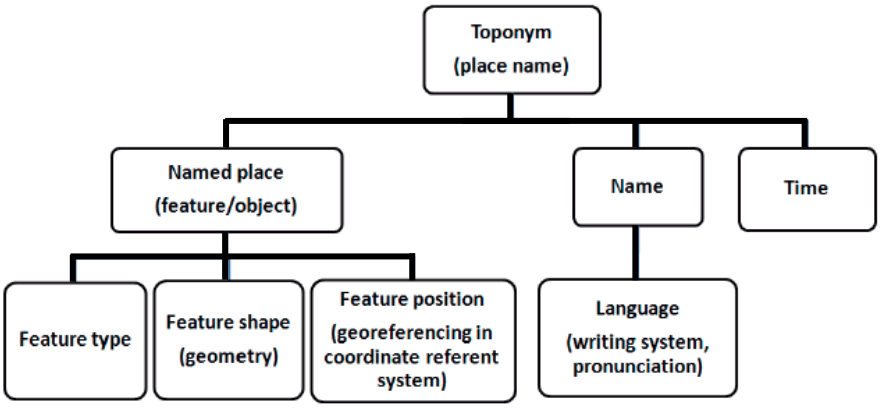


Figure 1: The elements of a toponym (Jakir, Hećimović & Štefan 2011)

The model showing the elements of a toponym consists of three levels. The toponym itself constitutes the first level. On the second level toponyms are assigned to a place through a name in time. The time component is mostly explicit and allows a distinction between historic and present toponyms. Time is also formally essential for geographical name standardizations since they are bound to represent geographical names. The third level represents the defining universal concept. The place is defined through a feature type, shape and position. The name is further specified through the language and its characteristics. It can be argued that time has also a third level which is the applied time concept. This allows further distinctions in not only past and present toponyms and places but also in permanent occupation and cyclic revisiting of a place. The interpretation of time depends on culture and can be metric or historic. Metric time imposes a linear time evolvement and can be measured using numbers. Other metric time models are branching time, to represent past and future possibilities, and cyclic time for period phenomena or seasons (Worboys & Duckham 2004). In contrast to the discrete time models historic time concepts base on social processes which attribute content to time like subjective imagination or meaning. This type of time cannot be measured using metric concepts but has its own system, complex overlaid cyclic concepts for example as it is the case for Bali people. The Balinese have two different calendars: the permutational and lunar-solar calendar. The permutational calendar consists of ten different cycles of day-names which take place simultaneously and is more relevant in the every-day life of people in Bali than the lunar-solar calendar. For Balinese it is not so important to be able to have a metric time measurement but it is more fundamental to characterise time and to embed social, intellectual and religious significance in it. The cycles are endless and uncountable. The emphasis does not lie in time as such but in quality of time (Geertz 1973).

The systematic partitioning of the elements of a toponym illustrates nicely that the analysis of toponyms is multi-faceted and dependent on the chosen scale. The elements on the third level, particularly feature type and feature shape, are highly dependent on aggregation and scale. The adequate representation of the shape of a feature can change between a point and a polygon depending on scale. This is probably the most obvious example. But it can also be shown that feature types change with scale. They can evolve from general classifications to more detailed classifications. One can think of the classification of water as an example illustrating this effect. The general classification of water can be further divided into sweet water, surface water, lake water, mountain lake water and so on.

2.1.2 Properhood in toponymy

The above mentioned definitions of toponyms all include the term proper noun. Toponyms are indeed an important subclass of proper nouns or proper names (Coates 2006). *Zürich* or *Julia* are

examples for a proper noun or proper name. But what does ‘proper’ mean? How can ‘proper’ be defined? It is not easy to define properhood, the state of being proper. There is no commonly agreed definition among linguists (Coates 2006). The question is divided: Can a concept of etymology or sense be applied to proper names or do they have purely referential meaning? This section presents the etymological concept and the idea of being unique. The topics of sense and referential meaning will be addressed in the following two sections.

Applying the etymological concept to proper names suggests that proper names have true meaning, in so far as the word ‘etymology’ is derived from the Greek *étumos* meaning ‘true’. The key question is whether proper names are applied specifically using some kind of natural appropriateness or whether they are applied arbitrarily. This etymological concept has not been discussed thoroughly in western theoretical linguistics. However, it is frequently applied in western cultures as many newborns are named according to a supposed meaning of a name (Coates 2006). However, the true meaning of a name does not imply in reality.

Properhood in proper names can also be regarded as having no indeterminacy, meaning that they are unique and destined to refer uniquely (Swiggers 1982). This proposition neglects the existence of ambiguity. The toponym *London* can either refer to the capital of the UK or to the city of London, Ontario, Canada, or even to about 40 other places on earth with the name of London. Thus, a toponym is only unique within a restricted geographic area. However, even when a toponym refers to a single place or feature, the place or feature can have different toponyms agreed on by different groups (Jakir, Hećimović & Štefan 2011). There is the additional problem that toponyms are not totally resistant to change. Toponyms and their boundaries can change over time (Leidner 2007; Vestavik 2004). Linguistic shifts also occur in areas where migration is dominant or settlements are recent (Zelinsky 1955). With respect to the above mentioned possibility of toponym ambiguity and toponym shift, it does not seem adequate to define properhood as having no indeterminacy.

2.1.3 Toponyms and the question of sense

The matter of sense in toponymy has been widely discussed in literature. Coates (2006) delivers some examples illustrating that proper names are senseless. It is apparent that names such as Saturn or Rome do not have sense in themselves. However, names which appear to make sense at first sight do not necessarily stand the test. He shows this by giving the example of a railway bridge called *Peak’s Tunnel* located in North East Lincolnshire, England. *Peaks’s Tunnel* is a normal railway bridge and not a tunnel as the name suggests. Therefore, one cannot conclude from the name *Peaks’s Tunnel* that the thing it relates to is a tunnel (Coates 2006). Examples of the opposite make it indeed impossible to claim a hypothesis of sense in toponymy (Romano & Siegel 1986). The assumption of senselessness in toponymy is also supported by Mill (1843). He suggested that proper names cannot

be characterised in terms of connotation. Connotation, a term used in linguistics, is here being used similar to sense. So, in other words, proper names apply directly to something, regardless of its meaning. Or as Wittgenstein (1922) puts it: “Der Name bedeutet den Gegenstand. Der Gegenstand ist seine Bedeutung“ (as cited in Coates 2006: 363). This translates as follows: ‘The name means the thing. The thing is its meaning.’ Proper names relate to individuals or things regardless of their characteristics. Therefore, properhood is not attached to sense in the first place and can be understood as senselessness. According to the principles of statistics, by providing an example with sense in a toponym would lead to the rejection of the hypothesis that toponyms are senseless, too (Romano & Siegel 1986). This is not a difficult task to do. The proper name of one of the world’s most famous bridges is ‘Golden Gate Bridge’ located in San Francisco, USA. The toponym suggesting a bridge makes sense since the name in fact refers to a bridge. It has been shown in literature that toponyms, at least in English, often contain meaningful components and can therefore possess sense (Hollis & Valentine 2001). Concluding from this small excursus to statistics and hypothesis testing, the hypotheses of sense and senselessness in toponymy need to be rejected. Therefore, toponyms can have sense, but they do not need to.

Leaving for a moment the question of sense in toponymy aside, raises the issue of meaning in toponymy. Sense refers to the etymological word of a toponym, whereas meaning describes a toponym and can be seen as an attribute. Toponyms are not meaningless. They can be used to refer, to set up cultural expectations and to contain social information (Algeo 1973; Alford 1988; Coates 2006). The importance of toponyms and their meaning can be illustrated by observing the ongoing municipality fusion discussions in Switzerland. In the amalgamation of municipalities the agreement on a new name is one of the critical matters in the process (Kettiger 2004). People identify themselves with the name of their city, their municipality. Radding & Western (2010) have thus concluded that one cares more about names than one cares about other words. They rhetorically asked the reader whether it would be the same to change the word ‘morning’ to for example ‘tog’ as it would be to change the name of the hometown. They stated it would be obviously easier, though somehow useless, to change the word ‘morning’ than to change the word for a place name (Radding & Western 2010).

Concluding from the findings in literature and the discussion on meaning and sense in toponymy it becomes apparent that the discussion is still ongoing. Hollis & Valentine (2001) make a point in arguing in favour of different subcategories for proper names since evidence suggests that landmark names often have a greater degree of meaning than people’s names and country names. So, in summary the question of sense in toponyms cannot be fully answered. As it was already suggested,

meaning or sense in toponymy is partial or probabilistic and can vary depending on circumstances, language and culture (Derungs et al. 2013).

2.1.4 Referential potential of toponyms

In the section on sense of toponyms the issue of reference was touched but not yet fully covered. Up to now no clear distinction was made between 'denotation' and 'reference' in terms of properhood. Denotation can be understood as a referential potential whereas reference is the applicability to a thing in reality (Coates 2006). So, by saying 'I crossed the river', the denotation is any river that falls under the word 'river'. But in the sense of reference, a specific river is meant and it is assumed that the listener can derive from the context. Therefore, as far as denotation is concerned, proper names cannot be used to denote uniquely and consequently uniqueness of denotation is not a useful definition for properhood (Coates 2006; Hockett 1958; Strawson 1950). The question if uniqueness in reference is the better definition remains open. Considering the concept of ambiguity, one can conclude that proper names often do not refer to something unique. But still, proper names can refer uniquely if applied in context. So, in summary, proper names do not denote or refer uniquely but have referential potential; they differ according to the extent that they depend on the context and according to the degree of their innate descriptive meaning (Strawson 1950).

One possibility to identify the referential potential of a toponym is to identify its generic parts (Jordan 2009; Tentand & Blair 2011). One of the first explorations in generic terms of toponyms and their link to cultural history was done by Zelinsky (1955). He looked at toponyms in the northeastern United States and its generic terms and identified a few regional and temporal categories such as the Atlantic Seabord which contains many Anglicisms and archaic terms (Zelinsky 1955). The generic parts often define a feature. This feature can be characterised in terms of its nature and its current or historical function (Jordan 2009; Zelinsky 1955). When analysing generic parts of toponyms one should have in mind that the generic terms in a toponym can be different from the landscape vocabulary. The word 'Mount' often appears in English toponyms, such as in 'Mount Everest', but the corresponding landscape term is 'mountain' (Derungs et al. 2013). Most toponyms are preserved over a long time which can lead to fossilized generic terms in toponyms. This means that the generic term appearing in a toponym cannot be found anymore in a dictionary of the language. These fossilized terms can give information about historical periods (Wang & Situ 2007).

2.1.5 Translatability of toponyms

The issue of proper name translatability is still being discussed. Around the globe there are different approaches and practices, quite irrespective of scientific and theoretical discussions.

One basic argument is that if proper names do not have sense, they cannot be translated (Zabeeh 2012). Coates (2006) investigated the translation of toponyms too and broke it down into his

proposed distinction between reference and denotation. Among others, he gave the example of the commercial name 'The Body Shop'. If it had to be translated into German for a new shop or to be rebranded in Germany, the name 'Das Körpergeschäft' could not possibly be the appropriate name even though it would be the correct translation. Coates (2006) argues that this name is rather a translation of the single non-proper parts of the name than a translation of the proper name. Therefore, he concluded that proper names referring to given apprehensions cannot be translated. However, proper names such as 'The Body Shop' can have literal equivalents like 'Das Körpergeschäft', which may also be replaced in some cases. Then, the translation needs to be identical in sense. So, proper names as denoting expressions can be translated according to Coates (2006).

A different approach focuses on the translation of toponyms looking for the closest possible phonetic match instead of matching the meaning. This approach neglects the cultural and descriptive meaning of toponyms and brings it back to a word consisting of arbitrary sounds (Radding & Western 2010). This procedure has been pointed out in Friel's popular play *Translations* (1981) where it was used by colonial translators in Ireland who matched the Irish toponyms to English sounds. So, the Irish place-name 'Muine Beag', meaning little thicket, got the phonetically correspondent English place name 'Moneybeg', which has no meaning (Nash 1999).

Literature shows that the translation of proper names has been done from the Middle Ages up to the present time (Albin 2003). Despite the theoretical discussion on toponym translatability, translations and replacement of toponyms are often imposed by political and colonial authorities. In that case, toponyms are used to demonstrate power or political control (Bassett 1994; Grounds 2001). This form of political toponymy usage has been found for example in the territories captured by Israel in the Six Days War in the year 1967 where toponyms were used as symbols to reinforce competing Zionist ideologies (Cohen & Kliot 1992). Studies focusing on connecting place names and power had emerged by the mid-1990s (Rose-Redwood, Alderman & Azaryahu 2010). Critical toponymy addresses the power of toponyms in historical and contemporary landscapes (Vuolteenaho & Berg 2009).

Getting even more specific, Maurel et al. (2007) investigated how proper names can be translated from and to French, Serbian and Bulgarian. Additionally to the above mentioned problems in translation, they came across the transcription problems between the Latin and Cyrillic alphabet. Furthermore, in Bulgarian and Serbian nominal inflections take place. This means that a noun gets inflected depending on case, number and gender. Different derivations of proper names, relational nouns and the number of instances for relative adjectives add even more complexity to the

translation of proper names. Their work focusing on the specific characteristics of three languages suggests that even though toponym translatability is a general question of proper names and sense, there cannot be a general answer or even a recipe on appropriate translation if a translation is wanted at all (Maurel et al. 2007).

Different approaches on how to translate toponyms were presented. It was also shown that translations are often combined with power demonstration. Little was proposed in literature on the circumstances which qualify toponym translation, though. Therefore, I conclude that whenever possible traditional toponyms should be preserved and favoured.

2.2 Perception and conceptualisation of landscape

The relation of toponyms and landscape is quite diverse among cultures (Mark et al. 2011). Therefore, it is important to address the concepts of perception and conceptualisation of landscape in toponymical studies. The first part of this section presents the concepts of 'Ontology' and 'ontology' and the difference implied by capital or lower-case notation. Then, different ways of landscape perception and their implication on toponyms are discussed. To complete the section on landscape perception, information on mental maps is provided since mental maps can reveal the way in which people perceive the world (Diercks 1988; Gould 1966). It is the field of Naïve geography that deals with models of the common-sense geographic world (Egenhofer & Mark 1995).

2.2.1 Ontology

Ontology is widely used in literature, having quite distinct interpretations. Giaretta & Guarino (1995) looked at different definitions and interpretations of the word 'ontology'. The interpretations they found in literature are, among others, a philosophical discipline, an informal conceptual system and a formal semantic account. The discussion of the different definitions led them to the distinction between Ontology as opposed to ontology with lower-case letter. They defined 'Ontology' as the "branch of philosophy which deals with the nature and the organisation of reality" and 'ontology' as either "a logical theory which gives an explicit, partial account of a conceptualisation" or a "synonym to conceptualisation" (Giaretta & Guarino 1995: 7).

Ontology originates from philosophy where it describes a systematic account of existence and relates to the nature of reality and its organisation (Giaretta & Guarino 1995). Ontology in information sciences does not address questions such as the existence of a specific landform. It deals with the different categories depending on the knowledge base and how they can be defined and represented (Mark & Turk; Smith & Mark 2003). So, ontology deals with the conceptualisation through tools rather than the philosophical question of existence. In terms of GIS this means that ontology defines

which objects, fields, etc. exist. It also determines attributes and properties such as size, shape or curvature. Additionally, ontology in geographic information systems (GIS) establishes the categories and its respective relations to which entities can belong (Mark & Turk 2003; Smith & Mark 2003).

Ontology provides the basic vocabulary used to express the perceived. Deriving from this basic vocabulary complex expressions can be formed. The aim of ontology is to share knowledge based on consensus and on conceptualisations (Gruber 1993; Giaretta & Guarino 1995). A nice illustration is provided by Gruber (1993). He compares ontology to a conceptual scheme in a database system. The schema is needed in order to allow applications and databases to interoperate. Similar to the conceptual schema which provides a logical description of the shared data, ontology provides terms to represent knowledge. It is important to have ontology in order to render intercommunicable information gathered in different conceptualisation settings and provide a neutral framework (Smith & Mark 2003). One interesting application of ontology is landscape since every human is surrounded by an environment. The landscape inhabited can be highly variable (Burenhult & Levinson 2008).

2.2.2 Landscape ontologies and their reflection in toponyms

The way in which humans perceive and understand their surrounding has been of interest to many disciplines such as archaeology, anthropology, psychology, philosophy and cognitive geography (Tilley 1994; Feld 1997; Ellen & Fukui 1996; Mark, Smith & Tversky 1999). The terms attributed to landscape and its features are also of interest to linguists (Burenhult & Levinson 2008). A related question is what makes a landform worth labelling. Perceptual salience is one of the reasons which can determine landscape features to be labelled (Brown 2008). Cultural and ecological preoccupations can have even more influence (Burenhult & Levinson 2008; Johnson 2012). Those include for example subsistence pattern, symbolic significance, human affordance or hindrance (Burenhult 2009; Carmichael et al. 2013; Gibson 2014). Utilitarian factors might also be of importance (Burenhult & Levinson 2008). Through labelling, space becomes place (Williams & Stuart 1998). The label attributes meaning to a specific place, which would otherwise be void of meaning (Byrnes 2001). Research also addresses the questions if the same generic terms that appear in describing landscape features are used in creating place names (O'Connor & Kroefges 2007).

Great variations within the ontology of labelable landforms exist among languages and cultures (Burenhult & Levinson 2008). It was shown that one possibility to categorise the environment is through the language and its structure. This design principle categorises landscape with the help of an already existent linguistic system which is not specific to landscape terms (O'Meara & Bohnemeyer 2008). The different approaches for categorisation and labelling result in quite diverse outcomes for similar landscape types and features (Burenhult & Levinson 2008; O'Meara & Bohnemeyer 2008). Examples were provided by Burenhult & Levinson (2008) who investigated

linguistic categories of landscape terms and place names in nine distinct cultures. They found that the extent to which landscape terms are used in creating place names differs greatly across the languages. The denotational properties of those place names are highly dependent on culture. This is why it is central to capture the landscape ontology of a culture (Burenhult & Levinson 2008). Their analysis led them further to the distinction between 'feature names' and 'area names'. Feature names are used to describe identifiable natural or human-made features in the environment such as rivers, trees or settlements. Area names differ from feature names, as they do not depict individual features. Area names denote regions which are not given by nature but by political, administrative or other conceptual orders. Examples for that are lands defined by usage rights, ethnicity or myth. Area names have the potential to totally cover the environment, whereas feature names are applied to concrete geographic features (Burenhult & Levinson 2008). Thinking of those two name concepts identified by Burenhult & Levinson (2008) it can be argued to add a third category: area names which are based on a dominant natural feature and do not necessarily totally cover an environment. One can think of a forest, for example. The forest can have a name depicting the area of the forest and being based on an individual, natural feature, namely the tree.

There is no such thing as a universal ontology for landscape features. Landscape ontology is highly context dependent (Levinson 2008). The context can include language, culture, mental model, situation and geographic scale (Sinha & Mark 2010). Despite the discussed different landscape perceptions, Sinha & Mark (2010) proposed some physical percepts which they believe are similarly noticed by human beings independent of context. Languages are too diverse and too rich to identify common-sense landscape categories across and even within languages or cultures (Burenhult & Levinson 2008). This is why Sinha & Mark (2010) stressed the need for simple concepts with which specific and more complex concepts for local studies can be based on. The constituents of their foundational landscape ontology are illustrated in figure 2.

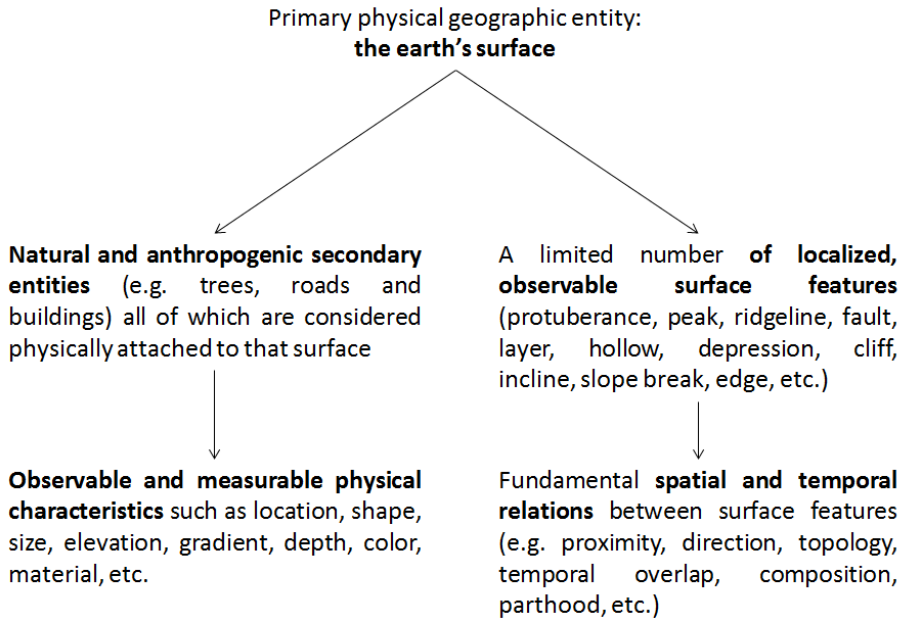


Figure 2: Constituents of landscape ontology (adapted from Sinha & Mark 2010)

Sinha & Mark (2010) identified basic landscape structures which they claim to be independent of our perception. Those constituents include natural and anthropogenic entities, their observable and measurable physical characteristics, as well as a number of localized, observable surface features and their spatial and temporal relations. Even though it might be very useful to have such basic universal landscape constituents, it is doubtful whether they exist. Referring to Burenhult & Levinson (2008) a valley can be conceived as a concave fold or as the flat bottom between two mountain ranges. This contrasts with the proposed assumption of similar observable surface features and their fundamental spatial relations. The way in which people perceive landscape as well as other real world entities is reflected in their mental maps.

2.2.3 Mental maps and Naïve Geography

Mental maps can be defined as being the spatial framework: a "cognitive or mental image of an environment held by an individual or group" (Pocock 1976: 493). Mental maps differ from cartographic maps due to the fact that the mental maps are not based on Euclidean geometry (Gluck 1996). There are two types of spatial knowledge: procedural or survey knowledge. Procedural knowledge means that the spatial knowledge is gained through experiencing the surrounding. Through the physical exploration of the geography, space is conceptualised from different views and a mental map is constructed out of bits of information. The way people gain their information using the procedural spatial knowledge is different to the survey spatial knowledge. Survey spatial knowledge is learned by looking at maps and getting an overview. In both cases spatial knowledge is gained, but the translation between the two is difficult for humans (Gluck 1996; Vestavik 2004).

The way by which people perceive, structure and process the world in our minds is embossed by experience and social forces. Spatial cognition can be defined as the knowledge, its acquisition, storage, retrieval, manipulation and use to achieve behavioural goals in space (Montello 1995). It is often argued that spatial knowledge is triggered by culture (Berkenkotter & Huckin 2016; Egenhofer & Mark 1995; Sinha & De López 2000). Aspects of spatial cognition where culture seems to make a difference are for example presented by Montello (1995). He argues that spatial knowledge has a strong relationship to spatial thinking. Therefore, the ontological understanding of a surrounding affects its mental representation. Further, pictorial representation is not practiced to the same extent by all cultures. Consequently, pictorial perception, which is acquired through training and practice, differs among cultures. Finally, home ranges and activity spaces, which are fundamental causes for spatial cognition, depend largely on culture, too. Environmental cues are also related to language and home ranges. Cultural differences are claimed to exist because different environmental features are remembered and labelled (Montello 1995). However, Montello (1995) also addresses the exaggeration of the influence of culture on spatial cognition. He proposes a list with supposed universal spatial cognition concepts. The list is based on the idea that all humans were exposed to similar environmental problems, to which their cognitive apparatus adapted. The list includes nine universal concepts. In my opinion, Montello's (1995) mentioned universal concepts are rather spatial problems people encountered all over the world and dealt with differently. So the 'universal concept of categorical and hierarchical organisation of regions' can also be interpreted as being proof for cultural differences since those categories and hierarchies are different for each language or culture.

The field that investigates how people perceive and manage spatial information is 'Naïve Geography'. "Naïve Geography is the body of knowledge that people have about the surrounding geographic world" (Egenhofer & Mark 1995: 3). It addresses both conscious and subconscious thinking of geographic space and time. Naïve is to be understood as instinctive or spontaneous (Egenhofer & Mark 1995). People's mental maps and the way they think about spatial information have limits when it comes to representing it in a geographic information system which is based on mathematical models. Naïve Geography studies common-sense geographical thinking to develop models and incorporate them into future GIS (Egenhofer & Mark 1995). Therefore, Naïve Geography has to deal with cognitive and linguistic approaches on spatial concepts and spatial behaviour as well as with formal approaches on mathematical models to be implemented in software (Hernandez 1994; Papadias & Sellis 1994; Talmy 1983).

2.3 Ethnophysiography – a collaborative research area

As was pointed out previously, the way in which people perceive and conceptualise landscape is diverse. Ethnophysiography addresses exactly this issue. An introduction into the collaborative research area of ethnophysiography is provided in this section. The dimensions forming the ethnophysiographic space are also presented. Further, the link of ethnophysiography to linguistics and toponymy is discussed. The focus lies on identifying research from different phases of toponymic studies.

2.3.1 Introduction

Ethnophysiography aims at understanding the differences in conceptualisations of landscape with an emphasis on physical components (Mark et al. 2010). It investigates for instance the cultural differences of perceiving landforms, water features and vegetation (Mark & Turk 2003). One way this can be done is by comparing the terms people use to refer to a certain feature. Ethnophysiography addresses all questions related to the identification, delimitation and classification of landscape features. It also addresses emotional and spiritual bonds people have to landscape and places (Mark, Turk & Stea 2007). Questions dealt with are for example: How is landscape perceived? Is it homogenous or does it contain various objects? Is it a mix of the two of them? What features get named? Do they get common names or proper names? Do the proper names contain common names (Mark et al. 2010: 27-28)? Ethnophysiography not only investigates landscape categories but also people's emotional and spiritual bonds to place and landscape and their role in traditional knowledge (Mark, Turk & Stea 2007). Ethnophysiography relies on ontology in order to adequately characterise people's landscape perception. With respect of geographic information systems, the technological conceptualisation should be closest possible to people's perception (Gruber 1993; Giaretta & Guarino 1995; Mark et al. 2010).

Different factors can lead to different conceptualisations of landscape. The determining agents identified by Mark, Turk & Stea (2007) are illustrated below in figure 3. They identified seven factors which are likely to interact with each other. Mark, Turk & Stea (2007) do not claim that they have come to a complete model. Instead, they point to the need of collective research around the world in order to develop a descriptive model and identify all factors and their relations.

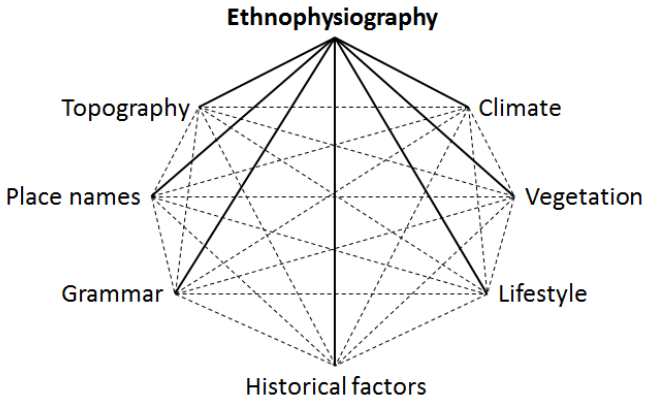


Figure 3: Ethnophysiography dimensions (adpated from Mark, Turk & Stea 2007)

The different factors of ethnophysiography are displayed here interacting with each other. This is just an assumption made in order to illustrate the idea of dimensionality. It can be argued that topography, climate and vegetation are correlated and have an implication on the lifestyle and traditional economy of a group. It is not obvious though whether all factors depend on each other. In my view, there is no obvious connection between topography and grammar. As the authors Mark, Turk & Stea (2007) stated, further research will be needed to determine all factors and their relationships properly.

2.3.2 Ethnophysiography and linguistics

The language provides insights into people's conceptualisations (Mark, Turk & Stea 2007). Language reflects the importance a particular landscape and its forms possess as well as the influence of a culture or lifestyle on how people interact with landscape (O'Meara & Bohnemeyer 2008). The impact of language itself, its grammar and lexicon, on linguistic terms of landscape conceptualisation should certainly be taken into consideration (Mark & Turk 2003). In the following, four research papers are presented which studied linguistic aspects in the field of ethnophysiography.

First, research combining ethnophysiography and linguistics was done by Mark & Turk (2003) who investigated landscape categories in Yindjibarndi, an indigenous community in Australia. They used photographs of landform examples found in Yindjibarndi territory to discuss landscape categories for water and convex topographic features with locals. They prepared themselves with a list of geographical features including landscape and geologic terms and earth materials. The authors found that the Yindjibarndi divide up subdomains quite distinct compared to English terms. Therefore, permanent and temporary water features are different kinds in their language whereas in English it is the same feature with a different attribute expressed through adjectives. Mark & Turk (2003) pointed also to the significance of proper names. During their research local people often mentioned that significant geographic features are referred to by their proper name rather than their generic term (Mark & Turk 2003).

Second, research was done by O'Meara (2010) on how the Seri, an indigenous group of Mexico, classify their landscape and use spatial reference. She found that the Seri use mainly complex landscape terms which are based on the material substance of the landscape described. Consequently, meronyms, semantic relations describing that something is a component of something else, are important in landscape categorisation (O'Meara 2010). O'Meara & Bohnemeyer (2008) analysed how the Seri categorise landscape through their language. The focus of their research was on the linguistic organisation of landscape terms and in how far they depicted culture-specific properties and universal principles. By identifying an analytical system for the Seri language which also applies to their landscape terms, new insights into the relation of language and conceptualisation are provided (O'Meara & Bohnemeyer 2008).

Third, Burenhult (2008) analysed the hydrological lexicon in Jahai, an indigenous tribe of Malaysia. His research also focused on linguistic aspects of ethnophysiography by exploring lexical categorisations of hydrological features. He found that the Jahai place naming system is based on the fundamental domains of body and kinship which is then adapted to hydrological systems (Burenhult 2008). Burenhult (2009) concluded in his field report on the Jahai case study that Jahai toponyms do typically not refer to landscape featuers. They are applied to areas containing different features. Therefore, toponyms and landscape terms appear to have independent conceptual systems (Burenhult 2009).

Fourth, a collaborative study connecting the individual case studies was done by Burenhult & Levinson (2008). They brought findings from nine diverse languages on landscape categories and toponyms together. The study revealed great variation not only across but also within languages on how landscape and toponyms are categorised. Consequently, they stress the need for researchers to understand the underlying ontology (Burenhult & Levinson 2008).

2.3.3 Ethnophysiography and geography

As Mark, Turk & Stea (2007) stated, the knowledge about key places in landscape and their cultural meaning have crucial impact on the conceptualisation of landscape. The conceptualisation on the other hand has implications on toponymy, too. This section reports on research connecting ethnophysiography with the field of geography.

The structure of toponyms is of interest to ethnophysiography (Burenhult 2009). Questions arise such as: Are the toponyms descriptive, do they include generic landscape terms, how do they arise and how are they constructed (Mark, Turk & Stea 2007). Questions addressed in research concern the relation between landscape terms expressed through common nouns and place names denoted with proper nouns. Not only the degree of appearance of landscape terms in place names has been

investigated but also whether the landscape terms appearing in place names can be used to draw conclusions on landscape (Burenhult & Levinson 2008). Therefore, an important research topic of place names consists in defining whether generic parts in toponyms can be used to infer landscape descriptions (Burenhult & Levinson 2008; Derungs et al. 2013). This issue was addressed by Derungs et al. (2013) in a case study for mountains in Switzerland. They compared a digital elevation model with a gazetteer on Swiss toponym data including a feature classification. To relate toponym locations to topography, they considered three buffer zones ranging from 200m to 2000m. Then, similarity measures were used to compare topographies of generic terms. With one exception, they found a general topographic pattern of toponyms with the same generic parts (Derungs et al. 2013).

A study reporting on collecting indigenous place names was undertaken by Jett (1997). He analysed place names in the Navajo territory, located in the United States and lying within the states of New Mexico, Arizona and Utah. Only few analytical studies on Navajo toponyms were done before. Place names were collected in hiking trips with local informants aiming to identify all named landscape features. The findings from the field survey were then confirmed by other local residents. Additionally, a literature review was done to provide background information on history and names. The names were subsequently translated by a Navajo translator. The analysis of Navajo toponyms revealed directional components on trails and positional elements such as ‘alongside’. A few references to aspect and exposure were also found. Further, the features having names were analysed and categorised. There were almost as many natural features as cultural features named. Few generic terms of Navajo place names were identified but were not yet related to landscape (Jett 1997).

A recent study conducted in Guangdong, China, reports on investigating past distributions and migration of ethnic groups as well as on mapping landscape features based on toponyms (Qian, Kang & Weng 2016). They used the fact that some generic terms are specific to an ethnic group to visualise spatial patterns of this ethnicity. They also proposed the method of ‘toponym mapping’ to use toponyms as thematic data for spatial analysis and cartographic methods to reveal toponym characteristics in an intuitive way. To visualise the distribution of landscape features, interpolation methods were used on a binary classification of landforms and land use (Qian, Kang & Weng 2016).

The literature review on ethnophysiographic studies focusing on linguistic or geographic aspects reveals that little is done on how toponyms are acquired and georeferenced. Most studies are based on either a linguistic analysis of recorded toponyms or on a spatial and referential analysis of captured and already georeferenced toponyms. Only the study of Jett (1997) reports on collecting toponym locations in field trips. This may be due to the fact that most research is done on toponyms which are already recorded and available for analysis. It is the linguists who also explore

unacquainted toponyms for linguistic insights. However, they have no need for knowing the exact location of a toponym in order to do linguistic studies. Therefore, little was suggested on how to capture and locate unknown toponyms. The field of community mapping has to deal with similar issues. In community mapping toponyms are recorded as a side product, but the emphasis does not lie on capturing toponyms and their exact location in a coordinate system. The following chapter presents aspects and findings on indigenous toponyms and community mapping.

2.4 Indigenous toponyms and community mapping

This section provides information on the protection of indigenous toponyms and indigenous territories. It also presents research from the area of community mapping and related topics such as the incorporation of geospatial technologies and participation.

2.4.1 Declaration on indigenous toponym preservation

The Declaration on the Rights of Indigenous Peoples emphasises that the land which was traditionally occupied by an indigenous group belongs to them and that they are allowed to retain their place names (United Nations n.d.). Therefore, maps are needed which illustrate traditional expansion and the respective toponyms.

The Rights of Indigenous Peoples has been declared by the General Assembly of the United Nations and have to be taken into account by all member states. The General Assembly of the United Nations has been established in 1945 and plays an important role as the policymaking organ of the United Nations. It is also central in the process of standard-setting and the codification of international law. As of November 2016 the United Nations had 193 Member States. Within its competence the assembly is empowered to make recommendations to the Member States on international issues (United Nations n.d.).

According to the Declaration on the Rights of Indigenous Peoples from September 2007 the territory and toponyms of indigenous groups are protected. This is shown in the following by citing the most relevant articles for indigenous territory and toponym protection.

> **Article 10**
> "Indigenous peoples shall not be forcibly removed from their lands or territories. No relocation shall take place without the free, prior and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return."

Article 13

1. “Indigenous peoples have the right to revitalize, use, develop and transmit to future generations their histories, language, oral traditions, philosophies, writing systems and literatures, and to designate and retain their own names for communities, places and persons.”

Article 26

1. “Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired.”

2. “Indigenous peoples have the right to own, use, develop and control the lands, territories and resources that they possess by reason of traditional ownership or other traditional occupation or use, as well as those which they have otherwise acquired.”

(United Nations General Assembly 2008)

An important step in protecting indigenous territory and toponyms is to document them (Olson, Hacket & DeRoy 2016). Therefore, the following section focuses on the research conducted in the area of community mapping.

2.4.2 Research on community mapping

Community maps are produced collaboratively with and by local residents and often aim to include local knowledge and resources (Parker 2006; Perkins 2013). Community mapping is often linked to traditional land use studies (Olson, Hacket & DeRoy 2016). However, a wide range of diverse applications use community mapping (Chambers 2006). Those include for example prevention of crime, water and sanitation (Liebermann & Coulson 2004; Narayan-Parker 1993). In the following, the focus lies on research concerning community mapping in the original sense of land use studies.

Maps proved to be an effective tool to support indigenous land claims since maps have the potential to reflect traditional land use extent (Nietschmann 1995). Place names displayed on maps are also carriers of indigenous knowledge (Basso 1996). The path towards useful and adequate community maps is difficult and main themes such as inclusion, transparency and empowerment have to be dealt with (Parker 2006). An example of inclusion and empowerment was given by Sletto (2009) reporting on his experiences of a mapping project in the Gran Sabana, Venezuela. He insisted on including women in a participatory workshop in order to get a more complete and rhetorically powerful map of land uses and places, a task considered a privilege of elder men by the community. Therefore, his approach made an uneasy intervention in the local social life and structure (Sletto 2009). An additional difficulty in community mapping is the lack of definitions and methods to analyse and assess the produced maps (Parker 2006). Mapping indigenous place names is just one

gain of community mapping and often comes along with mapping traditional territories (Perkins 2013). Therefore, little was proposed on how accurate and precise toponyms gathered trough community mapping methods are. In the frame of traditional land-use studies methods and quality indicators are often based on objectivity (Tobias 2000). However, indigenous knowledge is rather viewed as qualitative and intuitive (Olson, Hackett & DeRoy 2016). Consequently, a lack of methods and approaches with which to incorporate participation and indigenous knowledge into geospatial technologies has been identified by Olson, Hackett & DeRoy (2016). In the following, literature is reviewed concerning the integrations of technology and participation in community mapping.

2.4.3 Digital technologies and participation in community mapping

The conservation of indigenous cultural knowledge and sovereignty is a worldwide challenge. Using western technologies is not new to the area of mapping indigenous communities. Geospatial technologies (GT) such as digital maps, satellite images and global positioning systems (GPS) are applied since the 1970s in community mapping. The data and maps produced by GT help towards protecting tribal resources, documenting territorial sovereignty, creating tribal utility databases and managing watersheds (Pearce & Louis 2008). Independent of the advantages of GT in community mapping and bearing the importance of indigenous cultural knowledge, differing ontologies can have a negative effect on the preservation of cultural heritage (Pearce & Louis 2008).

Public participation geographic information systems (PPGIS) arising in the mid-1990s aim at enhancing citizenship engagement and democracy. PPGIS has the focus on investigating spatial issues through group dynamics, consensus building and joint planning (Schlossberg & Shuford 2005). Community mapping is sometimes combined in literature with the term PPGIS in the sense that GIS technology is combined with participation of local informants to achieve the final map (Parker 2006). The problem of PPGIS in community mapping lies in the fact that many projects only incorporate local voices into the map produced and are controlled by external specialists and therefore do not enhance democratic spatial governance (Perkins 2013). The process of mapping, participants' discussions on places and representations is as important as the final map itself (Parker 2006). This process is not achieved through a GIS but mainly on paper and in discussions. This brings me to the conclusion that PPGIS is not the right term to go with community mapping. GIS technology is not used during the process of map-making since many indigenous communities do not have the infrastructure or the technological knowledge to do so. GIS technology is used mainly by external experts to complete the final map. Therefore, it is rather participatory mapping, a term common in literature too, which describes the mapping of indigenous communities more appropriately (Chambers 2006; Olson, Hackett & DeRoy 2016).

When using the term participation in participatory mapping the different forms and degrees of participation have to be considered. A first classification of citizen participation has been presented by Arnstein (1969). Arnstein (1969) clearly differentiates between an excessive, empty process of participation and participation empowered to affect the outcome. The participation ladder shown in figure 4 goes from the low rungs of nonparticipation through the middle rungs of tokenism up to the highest rungs of citizen power and identifies eight levels of participation.

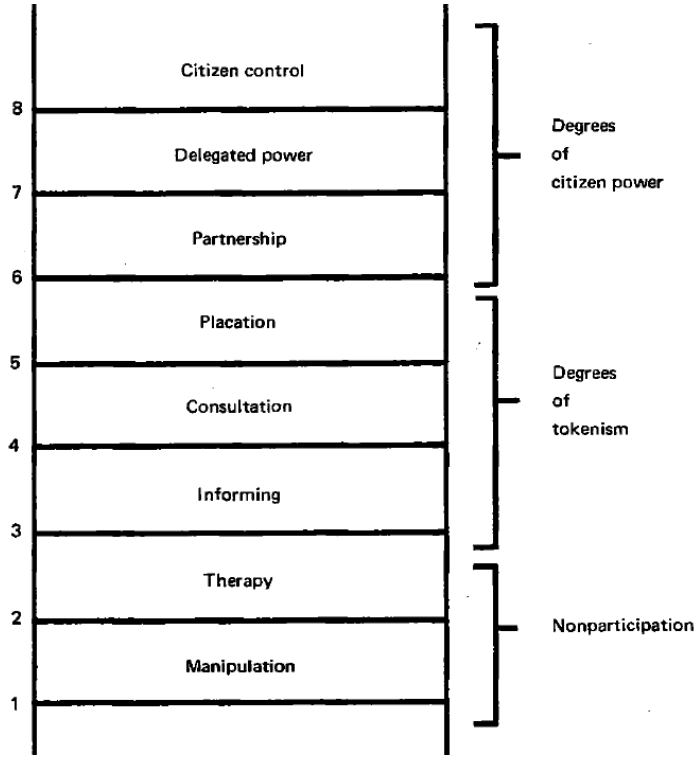


Figure 4: Ladder of citizen participation (Arnstein 1969)

Arnstein's (1996) participation ladder is not a perfectly suited model for all aspects which include participation but stays present in almost every further adjustment of this idea to specific areas (Aggens 1983; Beierle 1999; Connor 1988; Wiedemann & Femers 1993). Examples include Choguill (1996) who developed a participation ladder for underdevelopment countries or Molinari & Ferro (2009) who adjusted the participation ladder to the current times of Web 2.0.

In the process of community mapping different degrees of participation appear. While many projects only incorporate local voices to maps produced and controlled by external specialists, others fully assign projects to the community (Choguill 1996; Perkins 2013). Problems of participation in community issues are recruiting community participants, bringing participants to productively work together and to sustain their efforts over time (Lasker & Weiss 2003).

2.4.4 Implementations of community mapping

Even though the distortion, suppression and assimilation of indigenous knowledge into western maps were broadly discussed, no solutions were suggested so far. The need for development of indigenous cartographies is given since indigenous maps do not possess the same power and authority as western maps do (Fox 2002). Western cartography is not per se unsuited for indigenous mapping. However, effort has to be made to adapt it to traditional indigenous geography (Pearce & Louis 2008). Maps should reflect the ontological perception of a culture. Therefore, geospatial technologies should provide spatial tools for a particular time and space. When spatial concepts of one culture are expressed by the spatial tools of another, the cartographic translation inevitably leads to a loss in information (Pearce & Louis 2008).

Up to now, no recipe was offered on how to map indigenous land properly. There will be no generally valid recipe for indigenous land mapping since indigenous cultures are basically very diverse: They have different ontologies, logics and cognitive structures. The only thing they have in common is their localness (Turnbull 2003). Despite the lack of guidance in community mapping, a few key practices were proposed. The approach suggested by Pearce & Louis (2008) for instance is based on the informed use of the cartographic language. This means that the emphasis lies on the structure of the map and the mapping process. A different methodology was offered by Johnson (2012), who argues that a place-based approach is necessary in order to understand indigenous knowledge. Therefore, one needs to engage with a community and its places in order to understand and capture the ontology. This is also supported by Gruenewald & Smith (2014) who state that the sense one has of a place is shaped by our everyday lives. Consequently, in order to capture the right ontology of an indigenous group one has to live with them (Gruenewald & Smith 2014).

The literature review on community mapping shows that participatory mapping has become quite popular (Fox 2002). Community mapping has its roots in land use studies but was adapted to a broad range of other studies. The ontological aspects of community mapping are widely discussed. However, little was done on suggesting methodologies to create community maps as well as on how to evaluate the obtained maps. This research gap, as well as the research gaps identified concerning toponyms, landscape conceptualisation and ethnophysiography will be addressed in this project. The research gaps and the related research questions are the topic of the following section.

2.5 Research gaps and related research questions

In the following section, the research gaps detected in the previously discussed literature are pointed out. Further, it will be explained how the research questions will address these gaps.

2.5.1 Toponyms and landscape conceptualisation

The discussion of sense and meaning in toponymy is still ongoing. The potential meaning of toponyms does not seem to be absolute; it rather varies across languages and cultures (Derungs et al. 2013). Little research was done so far to investigate landscape categories appearing in toponyms and their referential potential. I propose to address this gap through a case study which investigates the relation of generic terms to landscape. The details of the case study area will be described in the following chapter. The corresponding research question is as follows.

RQ) To what extent can generic parts of Seri campsite toponyms be related to landscape?

2.5.2 Ethnophysiography

This master thesis also contributes to the research done by O'Meara & Bohnemeyer (2008) and Burenhult & Levinson (2008) by providing an additional case study on how landscape terms and other categories such as vegetation and material are applied in creating place names. By analysing Seri place names in terms of their generic parts this research explores Seri ethnophysiography since toponyms constitute one of the seven ethnophysiographic dimensions by Mark, Turk & Stea (2007). This research gap will be addressed by the following research question.

RQ) Do Seri campsite toponyms contain generic parts and to which categories do those generic parts belong?

2.5.3 Toponym mapping

The literature review on indigenous toponyms and community mapping reveals that despite the importance of having community maps for land claims, no clear definitions and methods exist on how to record or evaluate community maps (Parker 2006). The input to this research field will be the provision of a case study on toponym mapping and its critical contemplation. It will thereby help to identify possible strategies for toponym documentation.

Not much is written in literature on how to collect toponym data or which methods are suited for community mapping. This gap will be addressed by investigating the benefits and limitations of using interviews and field surveys to collect toponym locations. The related research question is listed below.

RQ) How can Seri campsite toponyms be located in space? How much information can be gathered by semi-structured interviews and field surveys?

2.5.4 Toponym collection

It was outlined that there is a gap in literature on how to collect and georeference toponyms. Additionally, a new approach is proposed which has its focus on one key aspect: identifying geographic characteristics of campsite locations in order to create a model with which a prediction can be made about further possible campsite locations. This will be addressed through identifying geographic characteristics of campsites and how they can help in prognosticating probable campsite locations. The proposed model building based on campsite characteristics will be investigated for the Seri case. It addresses the following research question.

RQ) Are there specific geographic characteristics of Seri campsite locations?

2.5.5 Research questions

This master thesis contributes some missing pieces in the research gaps apparent in literature concerning toponyms, ethnophysiography and community mapping. However, it also makes a contribution to the Seri community by gathering and mapping their indigenous knowledge on the Sonora coast through their toponyms.

To start with, campsite toponym locations are needed. Methodological approaches on how to collect toponym data will be explored. Then campsite toponyms will be analysed to detect generic parts and their categorisation. It will be further investigated to what extent those generic parts can be related to landscape. Finally, these locations will be examined to find geographic characteristics such as height or aspect in order to describe campsite locations. This approach results in the following coherent structure of the research questions.

RQ1) How can Seri campsite toponyms be located in space? How much information can be gathered by semi-structured interviews and field surveys?

RQ2) Do Seri campsite toponyms contain generic parts and to which categories do those generic parts belong?

RQ3) To what extent can generic parts of Seri campsite toponyms be related to landscape?

RQ4) Are there specific geographic characteristics of Seri campsite locations?

3 Study area and data

This section introduces the study area: the Seri and their territory in Sonora, Mexico. It describes who the Seri were, where and how they lived. It also provides information on why the Seri case study is of particular interest to an ethnophysiographic related study. Furthermore, the characteristic landscape of the Seri territory is described to provide a general overview of the study area. Then, the data used in this thesis are presented. The data include a linguistic list containing Seri toponyms and their translation, archaeological findings on Seri campsites as well as geographic data collected for this thesis.

3.1 Study area

Reliable data on Seri history are scarce. According to Bahre (1980) no comprehensive ethnography was done to provide information on Seri demography, ecology and socio-political structures. The hunting and gathering background of the Seri, especially in an area where drinking water is scarce, underlines how important it was for the Seri to know their territory in order to survive. They depended on their knowledge of the landscape, water and food resources (O'Meara & Bohnemeyer 2008). The connection of the Seri to their diverse surroundings provides an interesting setting for an ethnophysiographic study (O'Meara 2010). It is due to this link to ethnophysiography that the information presented on the Seri study area is related to the ethnophysiographic dimensions proposed by Mark, Turk & Stea (2007). Consequently, all ethnophysiographic related aspects of the Seri setting are highlighted. Therefore, an overview of the Seri history, lifestyle, environment, climate, vegetation and language is given. Together with the analysis of Seri place names done later in this project all ethnophysiographic dimensions suggested by Mark, Turk & Stea (2007) are covered.

3.1.1 Seri history – from the past to the present

The Seri live and have been living along the north western coast of Mexico, next to the Gulf of California in the state of Sonora. Traditionally, they were divided into several bands and lived as semi-nomadic hunter-gatherers in brush shelters and occupied the area from present-day Guaymas to Puerto Lobos (Moser 1963). The study area, the mentioned towns Guaymas and Puerto Lobos as well as the capital of Sonora, Hermosillo, are illustrated in figure 5.

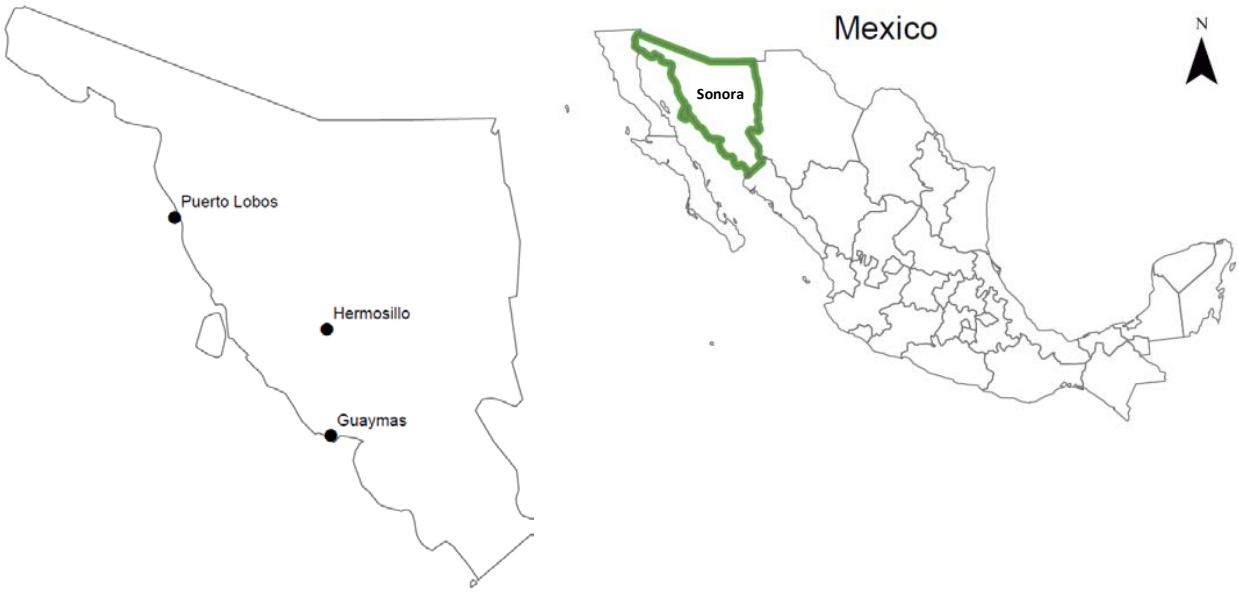


Figure 5: Map of the state of Sonora and its location within Mexico

There is disagreement on the size of the Seri population and the number and sizes of traditional Seri bands in literature. In the 18th and 19th century the Seri population is estimated to range between 1.000 and 9.000 individuals (Sheridan 1977). A more narrow estimation based on colonial archival materials stated about 5.000 aboriginal Seri in this period (Sauer 1934). Research has determined the existence of at least six bands (Moser 1963). A division of the average population estimation of 5.000 Seri people by the six bands results in a Seri band size of 833 people. This band size seems very high considering the arid environment and the rare potable water occurrences (Bahre 1980). Therefore, Bahre (1980) suggests that there were more than the six bands considering that the average Seri band size was approximately between 50 and 200 individuals. His average band size estimation results in a total of 25 to 100 historic bands (Bahre 1980).

Limited water resources played a crucial role in Seri history (Bowen 1976; Bahre 1980; Sheridan 1999). It also affected the Seri and European contact in colonial times in a great deal. The first documented contact of the Seri was with the Spanish and took place in the early 16th century (Bowen 1976). Due to the lack of water, the Spaniards viewed the area as unsuited to agriculture and therefore saw no benefit in settling in the area (Bowen 1976). Consequently, the Seri were not influenced by early Spanish colonialism (Bowen 1976). Due to the Spanish expansion into northwestern Mexico in the course of the 16th century, missionary and military stations came closer to the Seri territory (Marlett & Felger 2014). The Seri bands that lived further inland had more contact with the Spanish as well as the Mexicans. However, the contact was mainly embossed by conflict (Burckhalter 2000). Therefore, the Seri concentrated on the coastal area as well as on Tiburon Island (Marlett & Felger 2014). Later, in the 17th and 18th century the Seri came into contact with Jesuits who tried to convert the nomadic Seri into farmers (Sheridan 1999). Their attempt to

settle down the Seri failed (Burckhalter 2000). In the 19th century the Spanish as well as the Mexicans tried to enslave and exterminate the Seri, but about two hundred Seri survivors could escape and got back to their traditional way of life (Burckhalter 2000). Additionally to the inland conflicts, the Seri had to deal with infant mortality and disease (Sheridan 1999). These impacts lead to a significant decrease in the Seri population. In the year 1920 less than 200 Seri had remained (Moser 1963). These Seri managed to maintain their traditional way of life until the 20th century and their population has been constantly growing since then (Bowen 1976; Hills 2000). The Seri became even more sedentary in the second half of the 20th century and came to rely on Mexican economy through the sale of fish and handicraft (O'Meara 2010). Almost all Seri settled first in El Desemboque and later in Punta Chueca by the end of the 1960s where they still live nowadays (Burckhalter 2000; Marlett & Felger 2014). In the year 2007 there were about 900 Seri inhabitants (Lewis 2009). The Seri occupation area is shown in figure 6. The Seri continue to visit traditional camps during hunting, fishing or gathering expeditions (Martínez-Tagüeña 2015). The expeditions are also undertaken to gather goods for festivals or the production of handicrafts (O'Meara & Bohnemeyer 2008). Even though the Seri have access to basic grocery stores, they still rely on the resources of the desert and the sea. The Seri fishermen provide a substantial contribution to the Seri diet as well as to commercial markets (Marlett & Felger 2014). While some traditional campsites are still used by the Seri, the sites they visited to practice vision quests are not used anymore (Burchkalter 2000). Their traditional religion of shamanism and vision quest has been substituted by Christian doctrine. Therefore, both Punta Chueca and El Desemboque dispose of a church (Burckhalter 2000).

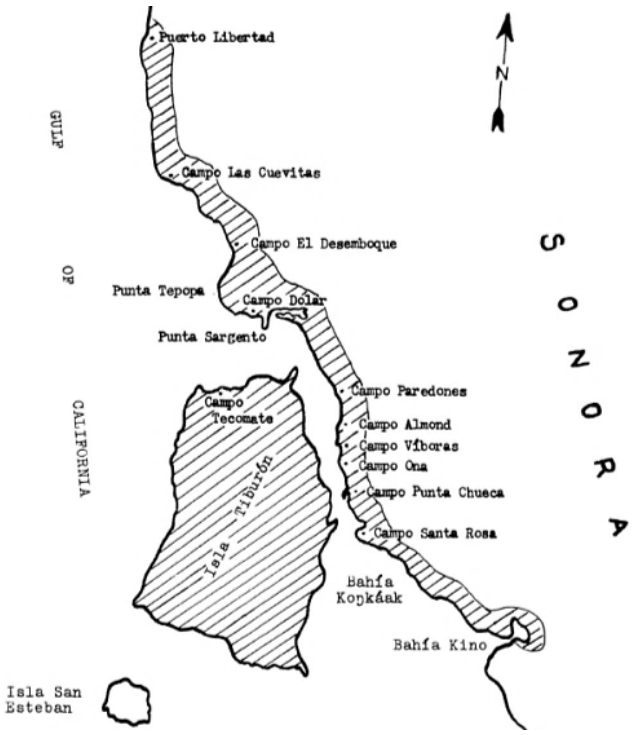


Figure 6: Area of Seri occupation (Moser 1963)

Seri mobility changed significantly over time. Traditional mobility was restricted to walking on the land and to rowing in self-constructed boats on the sea (Burckhalter 2000). In present days, the Seri move by truck in the desert and by motorboat on the sea (Burckhalter 2000). The current Seri living situation is described by Burckhalter (2000) as follows. The Seri houses are appointed with basic furniture such as beds. Some Seri also have propane stoves, but most people still cook outside. They do not have plumbing or refrigerators. The concrete houses they live in are prefabricated and built by the Mexican government. The water is brought by truck on a daily basis from Kino Bay to Punta Chueca over a distance of 32 kilometres. The electricity in Punta Chueca is received from a thermoelectric plant in Puerto Libertad. El Desemboque is more remote than Punta Chueca. It has its own pumping system from a local well to supply the village with water. It has no electric power from the main line. Both villages have some grocery stores and an elementary school but there is no police or health clinic (Burckhalter 2000).

3.1.2 Seri lifestyle and what they consider home

Regarding their semi-nomadic hunters, gatherers and fishers background the Seri used to move quite flexible around their territory. Consequently, their mental maps include information about seasonality, landscape, animals, plants, wind and the sea (Hills 2000). Due to the history and the way Seri people lived, the Seri identity is embossed by independence and family unity (Burckhalter 2000). Hills (2000) investigated the Seri cognitive maps about what they regard to be home in his project "Seri Concepts of Place". The first time he collected data was in the year 1973. The average area the Seri drew back then regarding home was about 233 km^2. Hills (2000) also found that the maps of elderly Seri people show much more than just boundaries and routes. The drawn maps describe Seri activities on the land they inhabit and reflect interpersonal relationships. The Seri perceive time and space as a continuum (Hills 2000). Interestingly, he also found that most elderly people cannot tell when and where they were born, but they can still take you to the exact spot where their placenta was buried. This location was also frequently referred to on the drawn maps depicting what is considered to be home. Traditionally, the placenta of a newborn baby was taken into the desert by the maternal grandmother and buried there at the base of a large saguaro or cactus or a new cactus was planted to mark the spot (Moser 1970). This tradition is being lost over the years. Nowadays, the placenta is often not buried anymore (Hills 2000). One example even shows the adaptation of this tradition to modern life as the placenta was buried in the garden of the hospital in Hermosillo (Hills 2000). About 25 years later, in the year 1999, Hills (2000) came back and asked the Seri again to draw what they perceive to be their home. He was able to find six Seri people from his original map collection who were still alive. The maps they drew in 1999 shrinked drastically compared to the maps they drew in 1973. None of the newer maps included an area bigger than 2.6 km^2. This change in Seri maps seems to suggest a cultural change reflected in Seri cognition (Hills 2000). The

decreasing Seri mental maps can be related to a continuous decline in Seri territory. Figure 7 shows the Seri territory extent from the 17th century up 1960. The dark grey area depicts the Seri residence territory whereas the light grey area shows the Seri range. The Seri have residence and utilization rights to their *ejido*, communal land, an area of about 777 km^2 (Hine & Hills 2000). They acquired those rights in a presidential decree in 1970 (Basurto 2006; O'Meara 2010). The territory attributed to the Seri in 1970 is only a fraction of their original extent and is illustrated in the figure below with a shaded area in the last map from 1960.

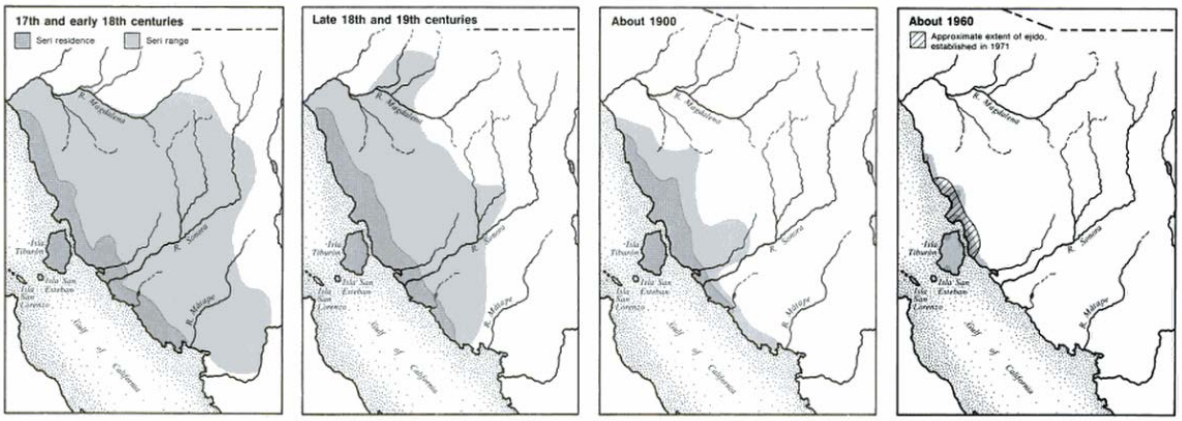


Figure 7: Changes in Seri territory (Bowen 1983)

3.1.3 Environment

The present Seri territory includes around 100 km of coastline and is about the size of 2110 km^2 (O'Meara 2010). Topography and vegetation vary greatly within the area (O'Meara 2010). Dunes and coves can be found in the coastal area, a narrow strip next to the shoreline. Behind the coastal area there are rocky desert mountains and extensive alluvial plains. A few roads exist in the plains but they are separated by kilometres of wasteland. Dry lakebeds are also common in this area and further inland dense vegetation appears (Bowen 1976; O'Meara 2010; O'Meara & Bohnemeyer 2008). The biggest island in the Gulf of California, Tiburon Island, is also part of the Seri territory. Tiburon Island is, among other islands, islets and coastal areas in the Gulf of California, a protected area of the UNESCO World Heritage List. According to the World Heritage List, the area of the Gulf of California is of outstanding universal value (UNESCO 2016). The Gulf of California is also called "Aquarium of the World". The Sonoran Desert is less famous but the terrestrial conservation values are of equal importance (UNESCO 2016).

3.1.4 Climate and water resources

The Seri territory lies within the Sonoran Desert (Leopold 1950). Aridity and summer heat are characteristic for the central coast (Bahre 1980). Precipitation shows high seasonal variation and the total annual rainfall changes from year to year (Bowen 1976). Precipitations occur mainly in July,

August and September and often come along with convectional thunderstorms. Such a storm can bring a significant amount of the total annual rainfall of a region in very short time. Due to high evaporation rates and pervious soils, the water of a storm disappears within hours (Bowen 1976).

There are three natural sources for water consumption: playas, *tinajas* and springs (Bowen 1976). Playas are dry lakes and can be found in several parts. The dry lakes can accumulate water during summer when precipitation is high enough. The largest dry lake in the area is Playa Noriega. In the past, when there was more rain than there is nowadays, Playa Noriega could hold water for several months. The second natural water source are *tinajas*. *Tinajas* are natural bedrock depressions that catch runoff or seeps. Most *tinajas* hold water only for short periods. But there are some *tinajas* that are perennial. There are also springs in the Seri territory, some of which provide water during the whole year. But most of the springs are intermittent (Bowen 1976). According to Bahre (1980) the major Seri potable water sources have not been mapped yet.

3.1.5 Flora, fauna and its food supplies

The flora and fauna in the Seri territory is very rich and plants have served the Seri in several ways. They represent a reasonable food supply and provide materials for manufacture (Bowen 1976). But plants were not the only food supply of the Seri. They hunted mammalians, mainly mule deer, desert bighorns, peccaries, black-tailed jackrabbits and desert cottontails (Bowen 1976). The desert also provides the Seri with cactus fruits and important medicinal plants (Marlett & Felger 2014). However, the Seri did not only focus on the gains of the mainland. The proximity to the sea and its products such as mollusks, sea turtles, shellfish, eel-grass and marine birds and mammals have been important, too (Bowen 1976). The marine resources supplemented and stabilised the Seri diet significantly (Bahre 1980). The tidal change of the Gulf of California reaches 2 meters in the Seri territory and exposes many resources for the people living along the shore area (Marlett & Felger 2014). Additional important natural features are the estuaries providing food resources such as fish and sea turtles (Marlett & Felger 2014).

3.1.6 Seri language or *Cmiique Iitom*

The name Seri is an exonym. This means that the name was given to the Seri by outsiders (Marlett 2011). The Seri refer to themselves by the name of *Comcaac* and call their language *Cmiique Iitom* which means the *Seri person's word* (Marlett 2011). Nowadays, the Seri people speak both Seri and Spanish (Hine & Hills 2000; O'Meara 2010). Seri is spoken in everyday life but most people are not able to read or write their language (Marlett 2011). This may be due to the fact that the schools in the Seri villages teach in Spanish (O'Meara 2010). The Seri language was formed through social structures and lifestyle. This can be shown by the importance family had in their traditional way of life which is reflected in the language since the Seri language disposes of over fifty primary terms for

kin terms which is one of the highest developed vocabularies (Marlett 2000; Marlett 2011). This example illustrates how language can reveal cultural practices and preserve traditional aspects.

The Seri language is still very important to Seri people since it forms a big part of their identity (Burckhalter 2000). The first ones to analyse the Seri language were Edward and Mary Moser (Marlett 2000). The Seri language is based on an ancient language stock of the Americas, commonly believed to be Hokan (Marlett 2007). Seri is the only language that has survived of its direct linguistic family (Marlett 2000). But little is known about this linguistic family and the relationship of Seri to other languages. Historical linguistic standards have never been met to determine the belongings of the Seri language. The assumptions on the history of the Seri language are rather based on suggestive data (Marlett 2011).

The Seri language is a linguistic isolate (Marlett 2007). It is not related to other languages spoken in the area. Originally, there used to be six geographically separate groups who spoke three different dialects (Moser 1963). After the second half of the nineteenth century they came together and formed one group which ultimately led to a loss of dialectal variations (O'Meara 2010; O'Meara & Bohnemeyer 2008). Some dialects may have disappeared with their speakers, others have merged together and form the present Seri language (Marlett 2011). Additionally to the loss in dialectal variations, information on the places they used to visit and their corresponding names is being lost since much of this information is specific to individual people or groups (O'Meara 2014). The Seri language is currently classified as "vulnerable" by the UNESCO Atlas of the World's Languages in Danger (Moseley 2010).

Much effort has been done by O'Meara (2010) to study Seri landscape classification. It lies in the nature of hunter-gatherers that they strongly depend on the knowledge of the ecology and geography of their area (O'Meara & Bohnemeyer 2008). Therefore, landscape is highly significant in Seri culture. Seri landscape terms can be classified according to their structure which is either simple or complex (O'Meara 2010). An example for a simple landscape term is *xatj* which means reef. Simple landscape terms are unanalysable and less frequent than complex landscape terms. The complex landscape terms of Seri classify geographic entities in terms of their material make-up plus either shape and orientation, merological relation to some larger landscape entity or some other spatial or physical property. Therefore every geographic entity referred to by an analytical landscape term is classified in terms of whether it consists of seawater, fresh water, stone or earth (O'Meara 2010; O'Meara & Bohnemeyer 2008). The classificatory substance terms are not only used in the landscape domain. Additionally to the described complex landscape terms, there is a construction for talking about natural assemblages of vegetation where the plant name is followed by the relational noun 'area of'. This is particularly useful to refer to an area of desert by indicating which vegetation types it

covers (O'Meara 2010). O'Meara (2010) suggests that simple landscape terms lexicalise concepts which cannot be expressed by the system of complex terms. *Zaaj*, for example, means cave and refers to an empty space and does not consist of any of the four classificatory materials (O'Meara 2010). Even though there are many islands in the Seri territory, the Seri language does not have a generic term for island. Do the landscape terms depict the Seri conceptualisation of geographic entities? It seems that the Seri language uses in general a typological "design principle" (O'Meara & Bohnemeyer 2008). Similar structures to complex landscape terms are shared in other aspects of the Seri language. The model used for complex structures can be found for natural kind terms as well as for artefact terms (O'Meara & Bohnemeyer 2008).

3.2 Data

This section presents the data available at the beginning of this project. It further states why the focus of this study is laid on campsite toponyms. Due to the emphasis on campsite locations, specific archaeological findings on Seri campsites are then addressed. Finally, the data collected for this study are listed.

3.2.1 Linguistic data on Seri toponyms

The linguistic toponym data used in the beginning of this thesis were provided by Prof. Dr. O'Meara. The data are a list including the toponym, a free Spanish translation, a literal translation and, if known, the type of geographic entity as it is illustrated in table 1. The list contains 765 toponyms. The toponym list is based on Marlett & Moser (2001).

Table 1: Example of toponym data (Marlett & Moser 2001; pers. comm. O'Meara 2016)

Toponym	Free Translation, Spanish	Literal translation	Geographic entity	Source
Hantixp An Hax	Lugar donde se encuentra agua dulce en la isla Tiburon	Lit. 'agua de Hantixp'	Fuente de agua dulce	Marlett & Moser 2001
Hast Quiijam	Cerro al norte de Guyamas	Lit. 'cerro que tiene vista'	cerro	Marlett & Moser 2001

Of the 765 toponyms provided, 462 have been classified according to their type of geographic entity. An analysis of this classification revealed that most of the toponyms are campsite locations. The counts of the three most frequent types of geographic entities appearing in toponyms are shown in table 2.

Table 2: Geographic entity types appearing most

Type of geographic entity	Translation, English	Count
Campamento	Campsite	198
Cerro	Hill, island mountain	68
Fuente de agua dulce	Fresh water spring	42

Given these data, the decision to focus on campsite toponyms was made. On one hand because there are enough toponyms available and on the other hand different landscape terms are expected to appear in campsite toponyms. Consequently, the analysis is assumed to be diverse. Additionally, campsite locations are probably located all over the Seri territory. Therefore, the possibility that no toponyms of the chosen geographic entity appear in the field work area can be excluded.

3.2.2 Archaeological findings on Seri campsites

The central coast of Sonora was long unexplored by archaeologists. This is mainly due to the inaccessibility of the region. In the year 1966, Bowen (1976) started his field work for his dissertation on the archaeology of the central coast of Sonora. The central coast of Sonora consists of a narrow area adjacent to the shoreline, rough mountains and alluvial plains. Since the accessibility of the shoreline is much better than the mountainous regions or the interior alluvial plains, Bowen, as well as previous visitors, limited their studies to the coastal area (Bowen 1976).

Most of the sites recorded by Bowen (1976) are on either recent beach dunes or on older secondary dunes and lie within a few hundred meters of the shoreline. According to Bowen (1976), the Seri name several reasons for preferring to locate their camps on sand dunes. Probably the most obvious reason is that sand is softer than rocks or dried mud and therefore more comfortable for sleeping. Due to the elevation of sand dunes, the habitation sites are always dry. Low areas can be wet during rainy seasons. An additional advantage of the elevation of the sand dunes is the good lookout. Finally, dunes are not often frequented by snakes. The Seri prefer to camp on sites that have been used before. The only reason to choose a different location is if the site is known to contain burials. Then they chose a location close by. Sand dunes exist on the shoreline or further inland they can be found bordering some playas (Bowen 1976).

3.2.3 Data collected

In order to analyse Seri campsite locations a set of digital data are needed. The most fundamental requirement is a digital elevation model (DEM). Additional information is gathered based on the analysis of the generic terms of the list with campsite locations by Marlett & Moser (2001).

Generic terms appearing in campsite toponyms are related to water resources, animals and plants, nature of ground and landscape features. Information on landscape features can be derived from the

digital elevation model. Consequently, no additional dataset is needed. Hydrological maps can also be calculated directly from the digital elevation model. However, this was not done here because of the distinction between perennial and intermittent water sources which a digital elevation model cannot reveal. Additionally, information on animals, plants and the nature of the ground are needed. In the following section the respective sources and a brief description of the different information used in the analysis are mentioned.

The National Institute of Statistics and Geography (INEGI) of Mexico provides a lot of digital information. Consequently, the INEGI is the main data source. The data used in this study are freely available on their webpage http://www3.inegi.org.mx/sistemas/productos/. The digital elevation model used from SRTM can be freely downloaded from https://earthexplorer.usgs.gov/.

Animals and plants. The INEGI does not provide information on animal or plant distribution. No useful and available source of information could be found for animal or plant distribution in the Sonoran region.

Digital elevation model. Two available datasets were compared. The first dataset is from the INEGI. The digital elevation model is based on Lidar data and has a resolution of 50 meters. The second dataset is from the Shuttle Radar Topography Mission (SRTM) which was flown in February 2000. This dataset provides a worldwide coverage of 30 meters resolution. Due to the better resolution and less artefacts in the data, the digital elevation model provided by the SRTM was chosen to work with.

Nature of ground. It was not possible to get information on the nature of the ground. The closest match is some vector information provided by the INEGI on land use and vegetation which does not contain the desired information. Therefore, information on the nature of the ground could not be included in the analysis.

Seri toponym locations. Data on Seri toponym locations had to be collected, too. This was done in semi-structured interviews and field surveys in January and February 2017 with local Seri people and in collaboration with Prof. Dr. Carolyn O'Meara. The methods and technical equipment used to document toponym locations are described in detail in the following chapter on the methodology.

Topographic map. For the field work a topographic map was needed in order to have local people mark toponyms on the map. However, no complete and coherent maps are available for the Seri territory. Consequently, 53 data tiles were downloaded from the INEGI and then printed on A3 to form a map. The topographic map is based on vector data 1:50.000. The data tiles have different capture dates ranging mainly from 2001 to 2015 with one exception from 1980. The cartographic presentation varies slightly between the years.

Water. A shapefile provided by the INEGI is used for information on surface water. The data is divided into a category of running water and bodies of water. It is additionally categorised into perennial, intermittent and maritime water. The data are available at a scale of 1:1.000.000. They were derived from topographical data measured between 1993 and 1997. The hydrological maps were published in the year 2000.

4 Methodology

This chapter on methodology explains the different steps taken and methods applied from data collection through data processing to final data exploration and analysis. It focuses on qualitative methods since little has been done on Seri campsite toponyms and qualitative methods are well suited for unexplored research areas to find out and define the issues (Britten et al. 1995). The relevant methods chosen and used in this study are presented by first introducing the scientific context and then explaining the implementation.

4.1 Data collection through semi-structured interviews and field surveys

The methodologies and associated materials for data collection were prepared before leaving to conduct field work in Sonora, Mexico. The preparation included a strategy on how to recruit possible participants and then choosing a meaningful sample, an informed consent and demographic questionnaire. Additionally, the semi-structured interview was composed and key points on how to conduct field surveys were researched. These steps and why they represent adequate methodologies for this project are explained in the following. The informed consent, demographic questionnaire and semi-structured interview are listed in the appendix.

4.1.1 Participants

Background. Sampling has more possibilities in qualitative than in quantitative research and highly affects the outcome of the study (Coyne 1997). Consequently, the participants of this study were chosen purposefully. This means a theoretical sampling was applied. Theoretical sampling allows for choosing the participants in an ongoing process by including the knowledge and insights gained during the study and the evolving theory (Coyne 1997; Schwandt 2014). The participants are not defined in advance but during the process (Strauss 1987; Strübing 2014). Theoretical sampling further aims at reaching saturation (Draucker et al. 2007). Saturation is reached when additional data do not contribute anything new to the concept (Schwandt 2014). Three types of coding processes have been suggested in the literature to go with theoretical sampling: open, axial and selective (Strauss 1987). They are also related to the sampling strategy. This study uses selective coding with “discriminate sampling, in which data are gathered to verify the emerging theory and to further develop categories that have not been well saturated” (Draucker et al. 2007: 1138).

Literature reports different sample sizes for qualitative small scale studies (Robinson 2014). Smith & Osborn (2015) suggest between 3 and 16 participants for an interpretative phenomenological analysis. Denscombe (2014) reports a sample size of 5 to 30 participants for an explorative approach and 30 to 250 for a representative study. Not much attention is given to the number of participants in toponymic studies. The sample sizes are sometimes mentioned but they are not discussed as

having an influence on the toponyms recorded. To underline the variations in the number of participants for toponymic studies reported in literature three examples are given. A study about Hopi toponyms states that 15 participants were interviewed and they produced records of 282 linguistic and ethnocartographic place-names (Hedquist et al. 2014). In contrast, Kari (2003) based his map mainly on the knowledge of one local informant. His informant knew more than 600 toponyms. Hunn (1994) reports on 12 case studies and suggests a correlation between toponym and population density. However, he does not talk about the sample sizes on which the toponym registries are based on.

Implementation. In respect to the above mentioned sample size suggestions, the sought after sample size was set to be around 15. Interviews were held in both Seri villages with an emphasis on the village of El Desemboque. Finding and selecting participants for the study was a sequential process. It started with a more selective sampling in the village of El Desemboque. This selection was based on inputs from Prof. Dr. O'Meara who introduced several people. It also depended on the interest of local Seri people willing to participate. The initial sample resulted in a woman from the council of elders who is respected for her knowledge as well as in an elder man who has great interest in mapping and lots of local knowledge.

After working with the two Seri individuals mentioned above, four female participants were interviewed. The selection of female participants had to do with a combination of external factors: Men are occupied during the day fishing when the weather is good and women tend to socialise with other women and not men. Additionally, these four women were chosen in order to have some heterogeneity in age range. After conducting these interviews, a first exploration of the data was done. The analysis of the six interviews resulted in the assumption that the younger the women are, the less they know about traditional campsites. It also revealed that the one man interviewed knew more campsite names and locations than all five women put together.

Consequently, further sampling was done on theoretical bases. Men who had or still have fishing experience were specifically targeted because it was assumed that due to their occupation outside the village they might know more about campsite names and locations. Fieldwork observations gained suggest that either the lack of experience, the abstract concept of maps or vision problems prevent elder people from being able to read the map. The applied theoretical sampling led to three interviews of former or active Seri fishermen. Participants were chosen according to heterogeneity in age range, still regarding the fact that the eldest were excluded from participating. However, no young man could be found to participate in the study for better saturation of the sampling. Therefore, one more woman in a younger age range was interviewed. This discriminate sampling approach led to productive interview sessions. The sessions were productive in the sense that the

participants chosen based on discriminate sampling were all able to locate places on the map and contributed more toponyms than previous participants.

Then, the research was relocated to the village of Punta Chueca. The analysis of the interviews completed so far confirmed the assumptions that interviews with men lead to the documentation of more campsite names and locations than interviews with women and that people at the age range of around 40 to 60 years have traditional knowledge as well as the capability of dealing with maps. Therefore, men in the middle age range were mainly targeted in Punta Chueca.

4.1.2 Informed consent

Background. Informed consent is a basic requisite for conducting research with people in general but also for field work with indigenous communities (Dickert & Sugarman 2005; Hanna & Vanclay 2013; Rosenthal et al. 2006). Informed consent has a long evolving history. Its need was urged by misconduct in the early history of large-scale human research projects (Brody, Cluck & Aragon 1997). Informed consent aims at protecting the participants and ensuring the principle of autonomy by explaining the research project and agreeing on the use of the obtained data (Faden & Beauchamp 1986; Flory & Emanuel 2004).

Implementation. The informed consent used in this study is based on a design of Prof. Dr. O'Meara. It presents the interviewer and the proposition of the study. It further explains the procedure, time, risks and benefits. It also addresses confidentiality, payment and collaboration. Concerning confidentiality, every participant is able to decide if the data collected during his or her participation can be used for specific purposes. Therefore, each participant can decide whether the data presented in any form are anonymous or whether dissemination of the research should mention the participant's name. The informed consent was always discussed and signed by the participant and the interviewer at the beginning of the session.

4.1.3 Demographic questionnaire

Background. To be able to describe the sample population of a conducted study is important since the better it is described the more valid and transparent the findings are (Mason 2002). Demographic questionnaires can help in describing the sample (Kelley et al. 2003). Different parameters such as demographic, geographic and physical characteristics can be of interest (Robinson 2014). Additionally, these characteristics can be used to decide on participants to recruit during the process if theoretical sampling is applied (Robinson 2014).

Implementation. After signing the informed consent, a demographic questionnaire was completed. The demographic questionnaire was prepared in written form and completed orally during the study. The interviewer asked the predefined questions and noted the answers on the form. This approach

was chosen since it presents a more interactive way of doing a demographic survey than handing out the form to participants to fill it in themselves. Additionally, it does not confuse participants who are not good readers or writers.

The demographic questionnaire designed for the Seri case study includes 10 questions related to demography, life history and geography. Consequently, questions concern age, education, childhood area as well as the area where the parents are from, language and mapping experience. The questionnaire provides a broad overview of relevant demographic facts. Age, education and the geographic area of the participant's expertise are relevant for knowing the characteristics of the sample interviewed and for directing the theoretical sampling. The language related questions are crucial for completing the semi-structured interview since having good skills in Spanish is a prerequisite given that the interviews were conducted in Spanish. The last question gives information about the participant's familiarity with maps. This is important for the interviewer to know in order to properly introduce the concept of maps to people who have not seen maps before. The demographic questionnaire is listed in the appendix.

4.1.4 Semi-structured interview

Background. In order to collect local Seri knowledge on toponyms survey methodology is needed. The possibilities of online-survey or telephone interviews are no option in the Seri case because of logistical issues. Additionally, it has been shown that the response rates are better with face-to-face contact than the ones of a questionnaire survey with no personal contact (Sitzia & Wood 1998). Furthermore, the face-to-face contact with local participants can enhance the interest and confidence in a project and gives people time to think about the project and ask questions (Barriball & While 1994). The small general introduction on survey methodology above has shown that the local setting of the Seri community demands a face-to-face interview leaving the possibilities for structured, semi-structured or unstructured interviews (Fontana & Frey 1994). The three interview types differ in the amount of structure they possess or in other words in the amount of freedom they leave for participants to influence the interview and its content (Cassell 1980).

The semi-structured interview can be defined as "a verbal interchange where one person, the interviewer, attempts to elicit information from another person by asking questions" (Longhurst 2003: 143). The semi-structured interview has two components which need to be prepared in advance: the introduction of the interviewer to the interviewees and the key questions (Rabionet 2011). However, the semi-structured interview is also about listening and being open to the issues the participant brings up during the interview (Krueger & Casey 2014; Longhurst 2003). It is possible to take notes during the interview or to audio or video-record it for later transcription (Longhurst 2003).

The first step in approaching the Seri people and their knowledge on toponyms was explorative and was also aimed at presenting the mapping project and building a trustful basis. Therefore, the semi-structured interview provides an adequate frame since semi-structured interviews are well suited for explorative research (Noor 2008). Semi-structured interviews enable the exploration of a heterogeneous group and offer structure while still being open to issues coming up during the interview (Britten 1995). They also allow dealing with the challenge of conducting interviews in a foreign language, namely Spanish, with participants for whom Spanish is not their maternal language, either. The flexibility of semi-structured interviews permits explaining words, the meaning of a question and clarification of the respondent's answer (Bailey 2008). They further provide some basic control such as improving comparability by making sure that all respondents answer all questions and that no external help was used to respond (Bailey 2008).

The above listed advantages and the suitability of semi-structured interviews for the Seri case study led to the decision to apply the framework of semi-structured interviews to investigate Seri toponyms. Semi-structured interviews have some characteristics which have to be considered such as the validity and reliability of the outcome of semi-structured interviews depends upon the training of the interviewers (Moser & Kalton 1971). This effect can be neglected in this case study since all interviews were conducted by the same interviewer. However, cultural differences between the interviewer and the respondents can lead to misunderstandings (Ryen 2003). When creating the central questions for the interview one has to remember that some questions or behaviour can be regarded as inappropriate by other cultures due to normative perception (Stocké 2014). This matter was minimised by discussing the questions previous to the study with Prof. Dr. O'Meara who has experience working with Seri people. It is also due to the linguistic and cultural insights as well as the relations of Prof. Dr. O'Meara with local Seri people that it was not necessary to find a local informant for this study. Usually, local informants can help considerably in the introduction to people, translations and cultural differences (Fontana & Frey 1994).

Little has been written in literature about how to collect toponyms and their location in the field. Aporta (2003) reports using an already existing database with 350 Inuit place names and then altering and completing the database. The resulting topographic map was printed out at a scale of 1:250.000 and 1:50.000 to give to local people. Unfortunately, the paper does not provide information on what scale the data were displayed and edited during the study. Later on, Aporta (2009) informs that he uses "historical documents, ethnographic research, and new geographic tools such as global positioning systems (GPS), GIS and Google Earth" (Aporta 2009: 131) to show trails and associated place names. The paper also reveals that the mapping with aboriginal people took place on paper maps which were then digitised. However, Google Earth was not part of the mapping

process but only to illustrate the results. Henshaw (2006) reports on applying community workshops, interviews with community elders, participant observation and computer database management as methods. Concerning the interviews the only information given in the paper is that they worked with maps showing the area most familiar to the participant and that they wrote the names directly on the map (Henshaw 2006). The paper further mentions that previous work on collecting toponym data has been done using topographic maps at a scale of 1:250.000 (Henshaw 2006).

Implementation. The semi-structured interview was conducted in the local environment. The interviews were done in various locations, mainly sitting in or around the house. The applied frame of fieldwork does not allow controlling the research setting. The interview duration was expected to be around 60 minutes.

The interview starts after completing the informed consent and demographic questionnaire. To begin with, the interview relates back to the demographic questionnaire and seeks more information about where and how the participant spent his or her childhood. This question is formulated in order to have a simple and broad starting point which allows follow up questions. These questions investigate their daily life and contact with toponyms in general. Afterwards, the focus lies on campsite toponyms. The questions formulated in this block aim at learning about campsite toponyms and their locations and characteristics. The characteristics are investigated by asking the participants to describe the location. An additional advantage of this question is that it has the potential to reveal if people talk about campsite locations they have not been to or they do not remember.

Before talking in detail about campsite toponyms, the two mapping options are presented. The first option is the print out of the official Mexican INEGI map at 1:250.000 or 1:50.000. The maps at 1:50.000 were brought to the field to collect data more accurately. The second option presented is to work with satellite images on Google Earth with a laptop. Due to the lack of internet access in the field, the satellite images were cached before. The presentation of the two maps includes an introduction into maps and mapping for people who have no previous experience. In the introduction the different features and their meaning as well as the zooming function of Google Earth are explained. The participants are then given the possibility to decide with which map they prefer to work. However, the presentation and explanation of the maps was moved further back in the interview structure after completing the first two interviews. Field observations suggested that the participants were overwhelmed by the information and it had a negative effect on their production of campsite toponyms. Consequently, a list with campsite toponyms they know was done first, and the maps were introduced in the following step. Finally, the names written down were referenced on the map. This approach resulted in the documentation of more toponyms. The list was a mean to give people some guidance and also triggered additional campsite toponyms they had not

remembered at first. So during the mapping of the toponyms, many participants came up with complementary information.

A second adjustment was done, too. At the beginning, the Google Earth map was totally empty. This resulted in some difficulties since no referential possibilities existed. Therefore, the main villages in the area, namely El Desemboque (*Haxöl Iihom*), Las Cuevitas (*Pajoocsim*), Pozo Coyote (*Hatajc*), Puerto Libertad (*Xpanohax*), Punta Chueca (*Socaaix*) and Tecomate (*Hajhax*), were located on the map. The georeferenced locations were from the INEGI map. This additional information helped participants as well as the interviewer considerably in locating campsites on the map. Figure 8 illustrates the Google Earth map the way it was used to work with Seri people on locating campsite toponyms. All participants had only those names on the map and were not able to see locations recorded in previous interviews. This was a simple task to do in Google Earth, since every folder can be marked as visible or invisible at any time. However, only one paper map was available to work with. Therefore, the approach was to write down numbers on the map and the corresponding names on an additional sheet of paper. Consequently, participants can only see the locations where previous participants have put names, but they cannot see the name.

The last block of questions in the interview gives people the opportunity to add any information they consider relevant and provides room to talk about what they consider important to be displayed in a Seri map. After completing the interview, field notes were taken on the procedure and the performance of the participant.

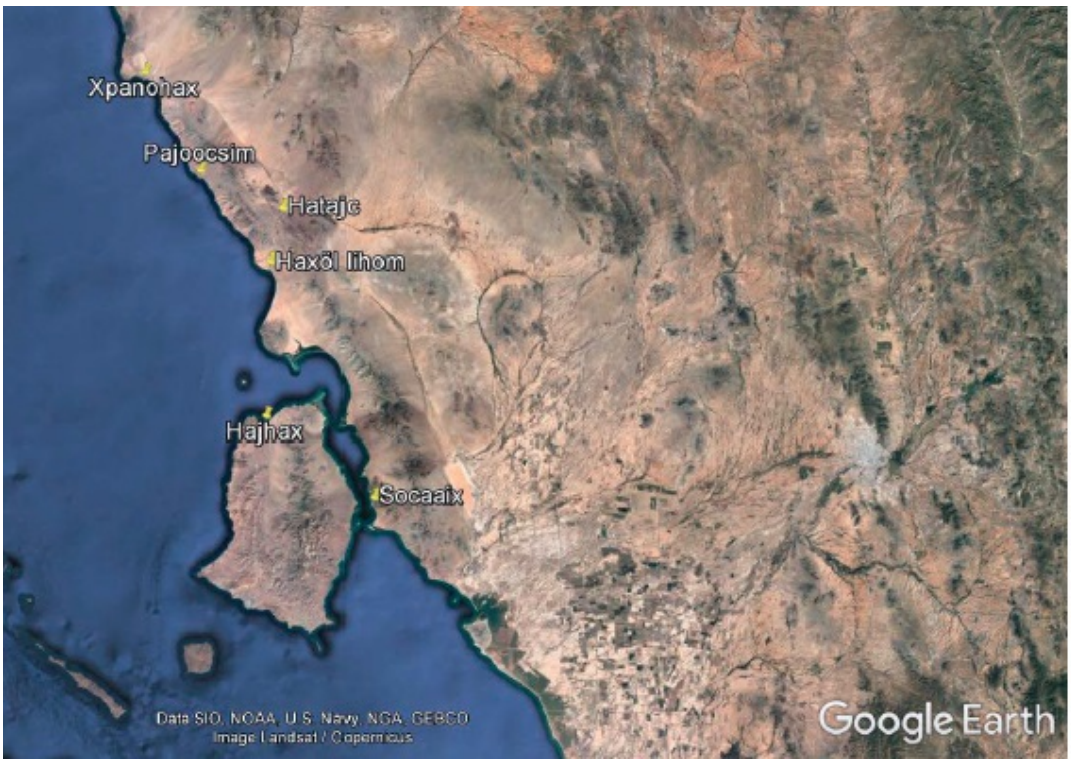


Figure 8: Overview map in Google Earth

4.1.5 Field survey

Background. It has been argued that the use of GIS to document place names and their locations has become the standard (Henshaw 2006). Additionally, the use of GPS devices in combination with mapping software has proved to be a flexible, accessible and inexpensive way of collecting place names and trails for aboriginal communities in the Eastern Canadian Arctic (Aporta 2003). Despite those compelling conclusions, not much has been written in the literature about the process of documenting toponyms with GPS devices in the field. As will be elaborated in this section, there are different factors and conditions that need to be considered when collecting GPS data of campsite locations. Descriptions such as "Locational data were compiled from verbal descriptions, topographic maps, and global positioning system coordinates collected during fieldwork" (Hedquist et al. 2014: 326) leave a lot of interpretation.

Implementation. During field surveys the locations and names of campsites, hills, waterholes, grinding holes and rock circle sites were collected. This section explains in more detail how these locations were documented. However, before explaining methods, I would like to point out, that two different types of filed surveys took place. One sort of field survey consisted in going with a Seri group or an individual and another researcher to places the researcher was interested in or working on. The other kind of field survey was specifically planned and organised by me for this research project and had the main purpose to visit campsite locations or to collect hill names which help in locating campsites. During both types of field surveys the GPS coordinates of the places visited were taken and local people were asked about the name of the place, why it was called this way and what they could tell about the site.

In the following, the GPS device used and the approach on recording campsites, hills, water catchments, grinding holes and rock circles is explained.

GPS. The GPS device used to document and collect coordinates of specific locations is a Garmin Oregon® 600 handheld with touchscreen. The positioning format is set to hddd.ddddd°, the datum and the spheroid to WGS 84.

Campsites. As was pointed out before, there are many aspects that need to be considered when collecting GPS data of traditional campsite locations: Where are the coordinates taken? Is the centre of the campsite representative? Is it more adequate to collect the GPS points of the outline of the campsite? What is the accuracy of the GPS coordinates? What additional data should be collected?

Campsite locations vary significantly in size. While some campsites can be overlooked and only one family stayed at time, other campsites are distributed over a larger area and five to six families stayed there at the same time. During field surveys smaller and bigger campsites were visited. *Hast*

Xat is a smaller campsite where the local informant mentioned one family – women, men and children – staying there at the same time. *Hant Quiyat* is an example for a bigger campsite providing space for about 20 to 30 families. Figure 9 shows a picture of *Hant Quiyat*. The photo illustrates that there is no obvious spot for a campsite location. The campsite is probably distributed over a larger area around these sand dunes. This is referred to in the following by campsite width. The extent of campsite locations is fuzzy; they do not have clear limitations. The campsite outline or the deriving campsite centre can hardly be detected in the field. Consequently, the spot where the GPS location was taken had to be defined in order to have consistent data collection over the survey area.

Figure 9: Standing at *Hant Quiyat* looking north (Photograph M. Henzi, 2017)

Two different methods were applied to record GPS coordinates. One point coordinate was documented per campsite name since no clear outline of campsites was found. The first approach was chosen mostly for smaller campsites where there are obvious shell accumulations indicating the campsite. An example of shell accumulations at a campsite is illustrated in figure 10. Then, the GPS location of the shell accumulation is taken as the spot to record the campsite. The second approach is used for bigger campsites or campsites where there are none or various shell accumulations. Then, the GPS coordinates of the spot where the local informant would stop and say that we have arrived at the campsite location were taken.

Once standing at a campsite location the coordinates, height above sea level and the GPS accuracy were recorded. Additionally, notes were taken on the toponym, how the informant described the place and the information he or she gave about the campsite. Then, pictures were taken of the campsite and the surroundings. Whenever possible, the pictures include the view towards north, south, east and west as well as a picture looking at the campsite from a distance of about 20 meters. The directions were determined using the compass of the GPS device. Particular characteristics of a campsite location, such as shell accumulations, were photographed. Attribute data added to each location are the date of the visit and the name of the local informant.

Figure 10: Shell accumulation at *Hast Xat* (Photograph M. Henzi, 2017)

Hills. Documenting hill names with the GPS device is different to collecting campsite locations since the names are not recorded standing on top of the hill but looking at the hill from some distance. The methodology applied to be able to identify the hills later on a map is to take notes of the location standing at and the direction where the hill is located. Both, the location as well as the direction is determined using the GPS and its compass. Additionally, pictures are taken with a digital camera to be able to verify the names after the field survey.

The figures below show four possible visual aids to locate hill names on a map and to discuss them with local informants. Here, the example of a hill range called *Yacaai* is given. The name and location of *Yacaai* was collected during a field trip. Figure 11 shows the picture taken on site with a digital camera. Figure 12 illustrates the Google Earth view of *Yacaai*. Figure 13 shows the hill range drawn on the official cartographic map of Mexico produced by the INEGI. The Google Earth Street View is represented in Figure 14.

Figure 11: Picture of the hill range called *Yacaai* (Photograph by M. Henzi, 2017)

Figure 12: Google Earth view of *Yacaai*

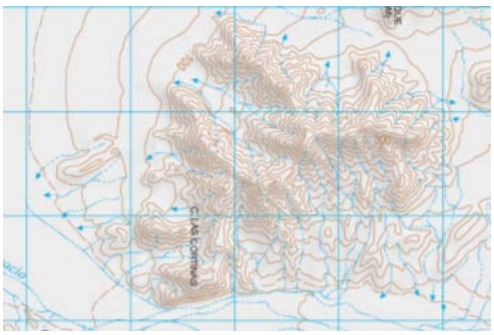


Figure 13: Official map showing *Yacaai* (INEGI)

Figure 14: Street View representation in Google Earth of *Yacaai*

A combination of Google Earth bird view and street view was mainly used to identify the mountains and hills recorded during field surveys. The Street View representation of mountains and hills was an effective tool to clarify toponyms with local informants. The importance of verifying data collected during field surveys is stressed in the following example. It is elaborated on personal field experience.

> It was during the first week of field work in January 2017 that I went on a trip with the plant monitoring and plant collecting group and a researcher investigating Seri medicinal plants. We left in a car with five Seri women to the collection site which happened to be a traditional campsite, too. Once we arrived, I gave a small introduction on the GPS and presented my project. Afterwards, an elder Seri woman, who was born in this area, told us a story she remembered about the place. I recorded the campsite location with the GPS and took notes on the story she told us. Then, we discussed the names of the surrounding hills. A difficulty in identifying the hills she mentioned consisted in the fact that the elder Seri woman talked in Seri. Consequently, a younger Seri woman translated from Seri to Spanish. After documenting and collecting medicinal plants, we went back to the village and sat together to discuss the information gathered during the trip. Part of this was me entering the location of the campsite and the surrounding hill names to Google Earth to show them how to enter GPS locations and what the outcome could look like. When adding the names of the hills to the map, I realised that one of the hill names was inconsistent with the names on the official Mexican map. They gave a

> different location for the name *Sataham*. I was curious and asked them whether there were two hills with the same name in the area. The answer was a clear no. At the same moment an elder Seri man entered the house and listened to the discussion about the hill named *Sataham*. He then looked at the map and pointed to the hill where I put the name *Sataham* from the trip and said that it was wrong and that the other location, the one from the official map, was right. A discussion between the elder woman and the man started on who was right or wrong. Through their discussion, which they held in Spanish, I was able to understand that they were talking about the same hill but did not realise it since the map was not further taken into account. The misunderstanding probably occurred during the translation from Seri to Spanish in the field.

This small excursus on a field experience illustrates the importance of crosschecking names and locations with the informant or various people since misunderstandings can occur. In the above mentioned case I decided to individually check with the two local people discussing on the location of the hill name *Sataham* a few days later. It turned out that they both agreed with the map I presented them with displaying the hill name *Sataham* at the same location as in the official INEGI map.

Water catchments. One *tinaja* was visited during field surveys and documented with the GPS. In the case of a *tinaja*, the spot used to document the location was next to the water catchment. Figure 15 shows a *tinaja*, a natural bedrock depression, at *Hast Xat* filled with rainwater.

Figure 15: *Tinaja* at *Hast Xat* (Photograph M. Henzi, 2017)

Grinding holes. In several cases there were many small grinding holes which originate from mesquite bean grinding. The grinding holes collect water during rainfall. An example of a site with grinding

holes filled with rainwater is illustrated in figure 16. In those cases the GPS location of the centre of the grinding holes was recorded. The various smaller holes were usually located within an area of about six to eight square meters. Considering the GPS accuracy of three meters, the estimation of where the centre is should not affect the accuracy of site's record.

Figure 16: Small grinding holes near *Hatajc* (Photograph M. Henzi, 2017)

Rock circles. Stone circles can be found throughout the Seri territory and were mainly used in vision quests (Bowen et al. 2004). An example of such a stone circle is shown in figure 17. It is difficult to archeologically determine who made a stone circle and even if a circle is identified by the Seri people as theirs, they are not always sure of its function since stone circles can have various purposes such as game circles for celebratory occasions, sleeping or vision quest sites (Bowen et al. 2004). According to local informants, those sites do not have their own toponyms. However, the hills on which the rock circles are located can have names. In order to document those vision rings the location of the stone circles was captured with the GPS and the name of the corresponding hill was written down. The rock circle sites are not further investigated in this thesis but have been documented for further research or application.

Figure 17: Rock circle on *Hast Heeque Cmasol* (Photograph M. Henzi, 2017)

4.2 Data processing

During data processing the different data sources, namely the demographic questionnaire, semi-structured interview and field survey, were incorporated into the same format for data description and analysis. All data are stored in an Excel spreadsheet because of its simple use to generate basic overview statistics and the possibility to import the tables directly into ArcGIS.

4.2.1 Demographic questionnaire

The answers from the demographic questionnaire were crosschecked and complemented with the audio recording and then summarised in an Excel spreadsheet.

4.2.2 Semi-structured interview

In a first step, the semi-structured interviews were transcribed. The transcription focused on the main topics. A word-for-word transcription was done of the parts of the interview that are relevant for this study. Topics that were discussed or stories that were told during the interview which are not directly related to the research were not included in the transcription.

During the transcription of the interview the mentioned toponyms are written down and the spelling is checked with the Seri dictionary (Moser & Marlett 2008). Many names written down by local informants have small spelling errors since many people are not able to read or write their language (Marlett 2011). Most toponyms could be found in the Seri dictionary by Moser & Marlett (2008). However, a few campsite names and most hill names could not be checked with the dictionary. Consequently, the spelling of those was discussed with Prof. Dr. O'Meara and also with a local informant who has good writing skills.

In a second step, the information from the interview is added to the spreadsheet. Each entry has several attributes. The attributes are a key number, name and synonymous names in Seri, name in Spanish, datum, UTM and geographic coordinates and the name of the local informant. The synonyms in Seri and the name in Spanish are extracted from the Seri dictionary wherever they are available.

4.2.3 Field survey

The data collected during field surveys is summarised in a spreadsheet, too. The spelling of the toponyms is checked and adapted to the Seri dictionary. The spreadsheet with the GPS waypoints has the same attributes as the spreadsheet with the toponyms collected in the semi-structured interviews plus the attributes of height and GPS accuracy.

4.3 Data exploration

The data exploration aims at gaining first insights into the data collected during field work. Therefore, the software ArcGIS, Excel, Google Earth and R are used. The first approach in exploring the data is to visualise them and to get an overview of their spatial distribution. While all data are considered in the section above, the data exploration and the following section on the data analysis focus on campsite toponyms and their locations. An exception is done when analysing a possible naming system since this system can appear to be valid across feature classes. Before looking at the methods applied in data analysis, the approach to explore the relation of the participants' geographic knowledge and his or her life history is described. Also, the Seri toponym ambiguity and a possible naming system are explored. Finally, data accuracy is addressed.

4.3.1 Participants' geographic knowledge and life history

Background. Based on the fact that geographic knowledge can either be learned or experienced (Vestavik 2004), it can be assumed that in general people's knowledge is bigger in areas they have experienced and are familiar with. In the indigenous context, this is supported by Riggs (2005) who states that indigenous knowledge is based on observations, experience and culture. It has also been shown that indigenous knowledge is acquired through childhood experience (Barnhardt 2005). An example reported by Kari (2003) emphasises that the knowledge of the indigenous informant is restricted to the area travelled. Therefore, the relation between the geographic locations of the recorded campsites and the area where the participant grew up, is currently living or the home area of the parents is investigated.

Implementation. The polygons representing the area where the participant grew up, is currently living and the home area of the parents have to be defined. These are represented through a buffer of 30 km around the village and are labelled as neighbourhoods. The parameter 30 km is chosen because it is the average width of the Seri residence area suggested by Bowen (1983) and the distance between the two main villages El Desemboque and Punta Chueca is about 60 km which makes a division of the two areas at 30 km, too. The buffers around the two villages are set to only include the mainland due to the physical division of the Gulf of California to the Tiburon Island. Tiburon Island is treated as a different area even if small parts of it lie within 30 km. The home area of the parents was addressed in the interviews trough *ihiizitim* 'homeland (of an extended family of ancestors), birthplace' (Moser & Marlett 2008). *Ihiizitim* was described by Moser (1963) as an ownership of an area based on the band division. It is a subdivision of the band territory and belongs to a family. The land rights are inherited trough patrilineal relations (Moser 1963). However, the answers of the question about *ihiizitim* do not seem to be related to the concept described above. People responded with for example *Hatajc* 'Pozo Coyote', *Hant Quiyat* 'El Desemboque Viejo' or

Tahejöc 'Tiburon Island' which refer to a newer concept of spatial understanding. Consequently, the region participants mentioned to be the *ihiizitim* of their parents will be referred to as homeland in the following. The homeland of El Desemboque, El Desemboque Viejo and Pozo Coyote are summarised for the analysis as one area called El Desemboque due to their geographic proximity. El Desemboque and Punta Chueca are defined as the Seri residence area (Bowen 1983) within the radius of 30 km. The homeland of Tiburon Island is defined as the whole island since the island can be contained within a circle of 30 km radius and its physical connectivity as well as participants referring to Tiburon Island as a whole suggests treating the island as a unit.

Once the polygons are defined, a spatial join of all campsite locations mentioned by each participant is calculated. This spatial join counts how many points intersect with each polygon. Due to different generalisations of the outline not all campsite locations lie within the polygons defined based on the digital elevation model introduced in chapter three. Consequently, the matching option is set to be within a distance of 400 m search radius. The 400 m buffer includes almost all campsite points without generating a significant overlay of the two neighbourhoods El Desemboque and Punta Chueca. Then, the ratio of the total campsite locations and the points counted within each polygon by participant gives the participants' geographic knowledge in relation to the defined polygons and therefore to his or her life history.

4.3.2 Seri toponyms

Background. A list with 600 Seri toponyms based on the Seri dictionary by Moser & Marlett (2008) has been presented and linguistically analysed by Marlett & Moser (2001). The toponyms collected during field work overlap to some degree with the toponym list by Marlett & Moser (2001). Therefore, a linguistic analysis could be done to compare Seri toponyms. However, this will not be the case in this thesis. The focus here is on what we gain by georeferencing places that receive proper names in Seri. Therefore, the focus is on investigating toponyms based on spatial information. This allows analysing toponym ambiguity, mainly geo/geo ambiguity meaning that two or more locations can have the same toponym (Amitay et al. 2004).

Spatial information can also provide hints about a possible naming system. It is already suspected during data collection that some kind of naming system could emerge. Different participants mention several toponyms that seem related. A similar generative naming pattern has been reported by Kari (2003) in Alaska where Athabascan place names occur in sets describing geographically related features.

Implementation. No automatic spatial processes can be applied to detect ambiguous toponyms in this case study. The fact that different informants located toponyms on the map, different locations

for one toponym are omnipresent without referring to geo/geo ambiguity but to the accuracy of the data which will be discussed in the following section. In order to detect geo/geo ambiguity a toponym has to be given to two or more locations by the same informant or it has to be checked with the interviewees giving the same toponym to different locations that they really refer to different locations. This is done in interview follow-ups during field work.

To investigate the idea of a naming system, the toponyms are sorted alphabetically and all toponyms which have a variated form are selected and displayed on a map to find a spatial relation. A variated form refers to for example *Hona*, *Hona Icaheme* and *Hona Iyat*. All three toponyms are based on the word *Hona* to which *Icaheme* and *Iyat* is added. *Icaheme* is the Seri word for camp and *Iyat* refers to a point (of a place or thing, or on the coast) (Moser & Marlett 2008). The spatial relation is investigated through visual examination. All toponyms recorded regardless of their depicting feature class are explored in this analysis since the aim is to find a design principle across features.

4.3.3 Data accuracy

Background. Data accuracy involves reflecting the acquisition and processing and some kind of ground truth data to which the collected data can be compared and accuracy measures can be calculated (Congalton & Green 2008). Ground truth data can either be collected in field campaigns or drawn from other known sources (Biggs et al. 2006).

Implementation. The accuracy of the data acquisition can be read directly from the GPS device. However, there is no source of ground truth available to compare the data to and to measure the data accuracy against. Consequently, the collected data have to be analysed in other ways. They cannot be compared to external sources but there are two possibilities for comparison. First, the data located on Google Earth during the interviews can be compared to the reference data, the overlapping campsites recorded with the GPS in the field. This is done by calculating the point distance between the campsite locations. Second, the data located on Google Earth can be compared among the participants. This reveals the degree of consensus but also provides information about the point accuracy. Therefore, the toponyms are sorted alphabetically, displayed on a map and the distance between the points furthest away from each other is measured and recorded. Then, basic statistic values are calculated and some examples which stand out in the process are illustrated to visualise data accuracy and consensus.

4.4 Data analysis

This section describes the methods used to identify and analyse the generic terms appearing in Seri campsite toponyms and the relation of the most frequent generic terms to landscape. It further presents the methods applied in search for physical characteristics of Seri campsite locations which could be of interest for further modelling.

4.4.1 Generic terms and their relation to landscape

Background. Generic terms are common nouns which are used to denote geographic features (Zelinsky 1955). Generic terms and their referential potential have been discussed in detail in the background section. The method used to identify generic parts in toponyms is often the application of a text search of known generic terms to a toponymic list (Campbell 1991; Cheng, Wang & Zhang 2011). However, it is important to consider that generic terms can be different from the landscape vocabulary when analysing toponyms (Derungs et al. 2013). One of the main issues when analysing toponyms is the lack of a standardised typology (Tentand & Blair 2011). Therefore, Tentand & Blair (2011) presented and investigated a typology based on the namer's motivation. In general, toponym typologies need to be specific and exclusive (Tentand & Blair 2011). Furthermore, Tent (2015) proposed a distinction between intensive toponymy and extensive toponymy. Intensive toponymy investigates the biography of a toponym while extensive toponymy aims at revealing toponym practices and patterns (Tent 2015). The generic analysis undertaken in this study relates to extensive toponymy and the methods used are explained in the following. Tent (2016) further argued that the names of the geographic features of capes, lakes, mountains and points are often in reverse order than it is mostly mentioned in toponymic literature. These four geographic features have, at least in English, the structure generic + specific and not the more common structure of specific + generic (Tent 2016).

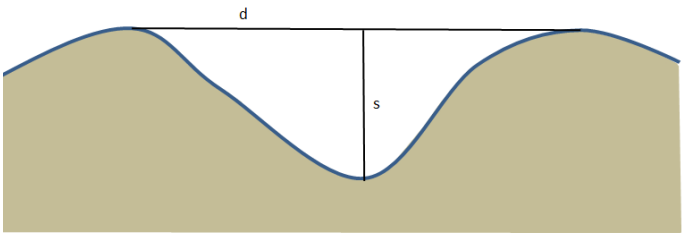
Implementation. To identify the generic terms appearing in campsite toponyms the Seri dictionary published by Moser & Marlett (2008) is used. For every toponym, each word it consists of is parsed through the dictionary to find its translation in English. Consequently, only full words are identified. The toponyms where the dictionary provides explanations about the historic development of the words present an exception. Then, the original words given in the dictionary are parsed to find generic terms. Due to the lack of knowledge of the Seri language compound words could not be analysed. In contrast to the above described method of defining a gazetteer with generic terms and then parsing for those terms in the toponyms, the approach applied here is reverse. Every part of a toponym is parsed trough the Seri dictionary to find its meaning. Furthermore, the structure of the toponyms containing generic terms is investigated. The toponyms are classified in three types: X + generic, generic + X and X + generic + X. The classification is done for all generic terms which appear

in more than eight toponyms. The number eight is chosen in order to include most common generic terms in the analysis.

Once the generic terms are identified, they can be classified. The classification is based on the terms that appear and was not decided on prior to the analysis. The terms are grouped into landscape, material, plant and animal. Landscape contains all references to geographic features such as bay, cave or peninsula. Clay, stone or seawater describe the nature of the ground and are examples for the material components. Terms which relate to plants are for instance desert ironwood, iodine bush or mangrove. Black sea turtle, multi-coloured clam or sea gull are examples of the animal classification.

The classification group landscape is further divided in order to analyse the relation of the generic terms to the geographic features. The class landscape is chosen because of the particular interest of ethnophysiography in the relation of toponyms and landscape. The two most frequent generic terms which relate to geographic features are *iyat* 'point' and *inoohcö* 'bay'. This is not surprising since the toponyms are located in a coastal area. The toponyms with the generic term *iifa* 'peninsula' are also considered in the analysis because of the geographic similarities of coastal points and peninsulas. Visual exploration is chosen as a method to investigate the relationship of the generic terms to geographical features since there are no Seri geographic definitions of these terms available which could be used for computational analysis. The aim is to describe the characteristics that could be of interest which were found at the locations containing generic terms. Coastal features can be easily distinguished on satellite images by visual examination. Therefore, the locations are displayed on the GeoEye images provided by Esri.

Bay. All campsite toponyms containing the generic term bay are visualised on the map and explored manually. Then, the locations are classified as being a bay or not. This is done based on the assumption that a bay must be on the coast and that it has some curvature towards the mainland. Afterwards, the characteristics of the bays are described using the diameter and steepness of the curvature. The characteristics are visualised in figure 18. The steepness measure is not taken at the perpendicular bisector but at the steepest spot.

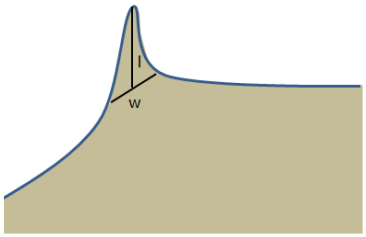


d Diameter

s Steepness

Figure 18: Characteristics describing *inoohcö* 'bay'

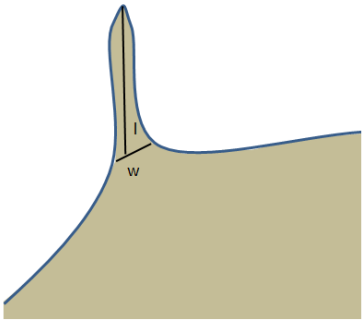
Point. The Seri term *iyat* can be translated to ‘point (of place or thing, or on the coast)’ (Moser & Marlett 2008). The characteristics are explored in a similar approach as described above. First, the locations are visualised and investigated on the map. Second, the locations are manually classified as being a point or not. Therefore, it is assumed that points are a convex form pointing towards the sea. Third, the width and the length of the coastal points are measured. An illustration of a coastal point feature and its characteristics is presented in figure 19.



l Length
w Width

Figure 19: Illustration of iyat ‘its point’

Peninsula. There are only a few toponyms which contain the generic term *iifa* ‘peninsula’. It is of particular interest to investigate the difference between *iyat* and *iifa*, referring to ‘its point’ and ‘peninsula’. Therefore, the campsite toponyms containing the generic term peninsula are displayed on the map and explored. Then, they are first visually compared to the locations which contain the generic term iyat ‘its point’ and then the measurements of the width and length which are shown in figure 20 are compared, too.



l Length
w Width

Figure 20: Representation of *iifa* ‘pensinula’

4.4.2 Campsite characteristics

Background. It remains unclear whether Seri campsite locations were chosen close to possible water resources or not (Bahre 1980; Martinez-Tagüeña 2015; Schindler 1981). Bowen (1976) reaches the conclusion that water resources play a secondary role in specifying the location of a camp. Deriving from this discussion, possible Seri campsite characteristics are investigated. The aim is to find physical characteristics that could have played an important role in deciding on traditional campsite locations. Not much has been written in literature about the factors which led to traditional campsite locations except natural resources and the material of the ground (Bowen 1976; Memmot, Birdsall-Jones & Greenop 2012). Research was also done on the significance of visibility for hunter-gatherer archaeology. For example, Lake et al. (1998) investigated the visibility of Mesolithic sites and did not find evidence that the sites were chosen according to visibility.

Multi criteria decision analysis (MCDA) is suited for spatial decision problems and evaluates multiple criteria. It is often used for land suitability problems and site selection (Malczewski 2006). There are two forms of multi criteria decision analysis: multi attribute and multi objective decision analysis. Each analysis has several combination rules. However, they will not be described in detail because they are not the focus of this study. Further information can be retrieved from Malczewski (2006).

Implementation. The approach on investigating Seri campsite characteristics is twofold. On one hand local informants are asked during the semi-structured interviews what they consider important for a campsite location and what the advantages of specific campsites are. These findings are then transcribed and evaluated.

On the other hand, possible geographic characteristics are determined and then analysed. Therefore, most probable campsite locations have to be determined. The characteristics are not based on all campsite locations recorded during field work because of the error that wrongly classified locations add. Probable campsite locations are either the locations marked with the GPS or the locations recorded during the interviews where at least two participants agree on the spot and the toponym. Consequently, the locations which have the same toponym and the two points are within a distance of 200 m to each other, and all locations not further than 500 m away, are chosen. This approach is illustrated in figure 21. In this example, the green locations are considered probable campsite locations whereas the red location is not taken into the analysis.

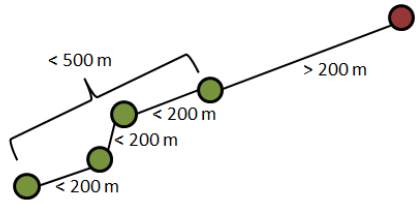


Figure 21: Illustration of approach chosen to identify most probable campsite locations

The campsites identified as most probable are shown in figure 22. They are mainly located along the coast. However, five campsite locations are further inland.

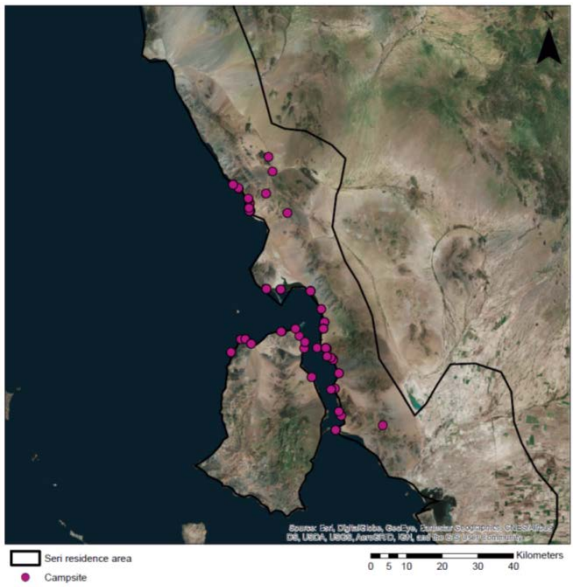


Figure 22: Most probable campsite locations chosen for the analysis

The characteristics chosen to examine are height, slope and aspect. Those characteristics can be derived from the digital elevation model in ArcGIS. Height and slope are examined because of their practical reasons for camping. Aspect is considered because of its effects on soil and vegetation. Further, Jett (1997) found that Navajo toponyms contain a few references to aspect and exposure. Therefore, aspect could be of interest to Seri campsites, too. The distance to the next water resource cannot be investigated due to missing data. There is a shapefile available for the Seri territory with all the intermittent and perennial water bodies. However, they do not include springs or tinajas. Therefore no meaningful values can be calculated from these data to contribute to the discussion on how far Seri campsites are located from water resources. The same issue of lack of data applies for including food resources and the material components of the ground into the analysis.

Once the characteristics are examined, the obtained values are used to calculate a basic multi attribute decision analysis. All three characteristics have the same weight and a Boolean combination rule is applied. Then, the pixels which correspond to the range of values obtained for height, slope and aspect are extracted using the function *Select by Attributes* and the *Raster Calculator* in ArcGIS.

5 Results

This chapter presents the results of the master thesis. It starts by describing the obtained results from applying the previously defined methodologies for data collection. Then, the toponyms and their locations are explored and analysed.

5.1 Data source description

This section presents the results from field work. This includes a description of the demographics, life history and geography of the people who participated, information gained from the semi-structured interview and a short summary of the field surveys done.

5.1.1 Participants

13 participants of which seven are male and six female were interviewed over five weeks. The sample was chosen to be heterogeneous according to demographics such as gender and age, life history and geography. It was expected and also confirmed during field work that elder people have a richer knowledge of traditional campsite locations than younger people. Nevertheless, the sample includes a few younger people, too. The demographic characteristics of the participants are summarised in table 3.

Table 3: Demographic overview of the interview participants

Age	Male	Female
21 – 40	-	2
41 – 60	4	3
61 – 80	3	1
Total	**7**	**6**

Life history and geography are closely related. They refer to peoples' past life experience and their geographic extent of knowledge. As discussed in the methodology, these characteristics are assumed to be covered by the area of where the participants spent their childhood and the area where their parents come from. Table 4 to 6 show the area where the participants spent their childhood and the homeland of their parents.

Table 4: Participants' childhood area

Childhood	
El Desemboque	10
Punta Chueca	2
Punta Santa Rosa	1

Table 5: Homeland of participants' father

***Ihiizitim* father**	
El Desemboque	5
El Desemboque Viejo	1
Pozo Coyote	1
Tiburon Island	6

Table 6: Homeland of participants' mother

***Ihiizitim* mother**	
El Desemboque	5
El Desemboque Viejo	1
Pozo Coyote	1
Tiburon Island	6

On the contrary to what tables 5 and 6 could suggest, the parents are not always from the same homeland. In two cases one parent has the homeland El Desemboque and the other parent the homeland Tiburon Island.

Most interviewees do not have prior mapping experience. In fact, the majority has not seen any kind of map before. This is shown in table 7.

Table 7: Participants' mapping experience

Mapping experience	
Has seen or used maps before	4
Has not seen maps before	9

5.1.2 Semi-structured interview

The average interview duration was longer than expected. The interview was estimated to take about an hour. In fact, the average interview was 1 hour and 50 min. However, there were also shorter interviews; three interviews were completed within 30 min. Seven interviews were in the range of 60 – 90 min., as expected. Two interviews took significantly longer and were completed over two or three sessions. The longest interview was done in four sessions and lasted 375 min., or 6 hours and 15 min. The interview took longer because the participant was able to locate 174 toponyms which are a lot more than participants located in general.

The amount of toponyms mentioned during the interviews is widely distributed. They range from 6 to 174 toponyms with an average of 41 and a median of 31 toponyms per person. Not all toponyms recorded during the interview could be located on the map. Four people did not feel comfortable with locating any toponyms, two participants located most toponyms mentioned and seven

participants were able to locate all their toponyms on the map. This gives an average of 38 and a median of 31 toponyms per person located on the map during the interview. The distribution of the number of toponyms mentioned and the distribution of toponyms located on the map is shown in figure 23.

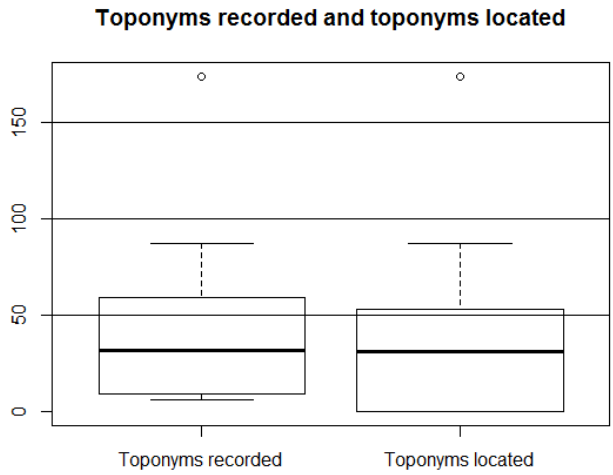


Figure 23: Distribution of toponyms recorded and located on the map during the interviews

It can be seen that most participants mentioned between 10 and 60 toponyms, the higher whisker marks almost 90 toponyms and the outlier lies at 174 toponyms. The toponyms located on the map range from 0 to 50 toponyms with the higher whisker at almost 90 toponyms and the outlier at 174 toponyms, too. In both cases the IQR, the area between the first and the third quartile, is about 50 toponyms and there is some variability in the higher range and one outlier.

Most toponyms documented are campsite names since this is the focus of this study. A few hills, arroyos, estuaries and other features were documented, too. The toponyms recorded and the belonging feature classes are illustrated in figure 24.

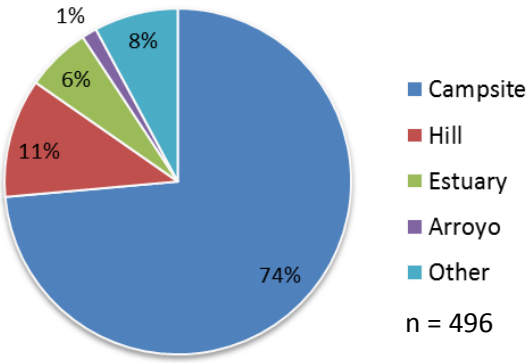


Figure 24: Toponyms recorded per feature class

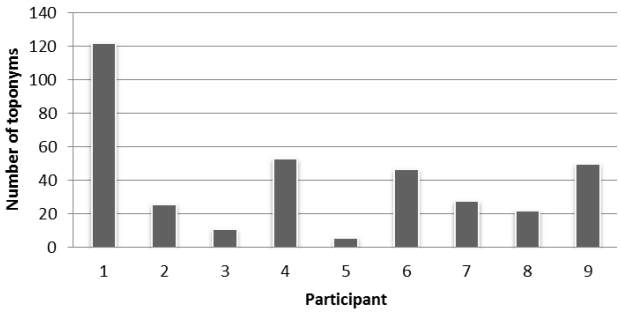


Figure 25: Contribution of each participant to the campsite toponyms

Figure 25 shows the number of campsite toponyms each participant located on the map during the interview. The four participants who did not work with the map at all are excluded from this

overview, leaving 9 participants. The diagram reveals that participant 1 mentioned a lot more toponyms than the others, followed by participant 4, 6, and 9. The lowest contribution has participant 5 with less than 10 toponyms.

The semi-structured interview did not only aim at locating toponyms but also at gaining information on related topics. One issue which is closely related to mapping is to know what kinds of features are named. In the interviews it was learned that campsites, hills and arroyos have Seri toponyms. To the question on how they oriented themselves and how they knew where to go, the answer was mostly pragmatic, something like: “My dad and my mum knew, we just followed them”. A distinct answer which refers to more recent travelling methods pointed out that there is a street going to that camp and whenever they go, they just take the car. The active fishermen could answer the question in respect to their daily business. They said that they use the mountain names for finding their fishing spots.

Every participant had the choice to work with the official Mexican topographic map, printed out at a scale of 1:50.000 or to work with satellite images in Google Earth. Interestingly, all 13 participants presented both maps to intuitively agreed that Google Earth is better readable. All nine interviewees who actually worked with the map chose Google Earth at first and stayed with this option during the whole interview. The participants’ opinions on the topographic and satellite image based maps are summarised in table 8 below. Only one positive comment was made on the topographic map; it is easier to handle for community members since only a few dispose of a computer.

Table 8: Participants' comments on the two maps presented

Topographic map (INEGI, 1:50.000)	**Satellite images (Google Earth)**
Easy to handle, we do not have laptops	Clear to read
Not good to recognize campsites	Colours help in reading
Too small	Good to localise
	Good to understand
	Very detailed
	Very real

The advantages of working with Google Earth can be shown by the fact that some people quickly started to work with the zoom function. They used phrases such as “make it broader to see everything” or “go closer to see the bushes” when working with the map. A topographic paper map does not dispose of this non-static, flexible component.

The last question investigated in the interview is what participants consider important for a Seri map, a map reflecting their understanding of their territory. Participants were asked what is important and

should be visualised on a map. Several nominations were possible. The answers are represented in figure 26. While campsite and mountain names were mentioned several times, all other propositions were only mentioned once.

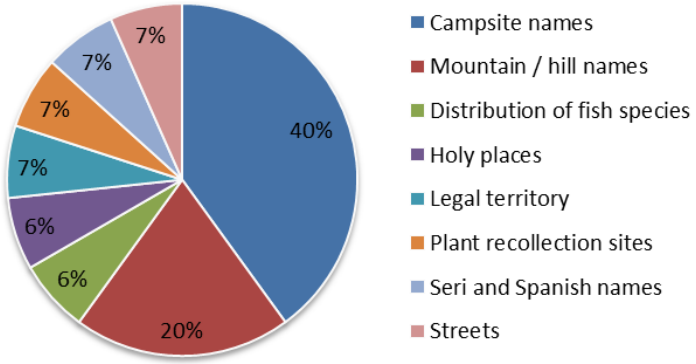


Figure 26: Things participants consider important to represent on a Seri map

5.1.3 Field survey

Two field surveys were organised. The first field survey had the aim to visit campsite locations on the beach north of El Desemboque to have a comparison to the locations referenced during the interviews. In the second field survey hill names were documented to complete the map and to get additional campsite names related to hill names and locations. Additionally, data was collected during six field trips where a plant researcher or a photographer were accompanied. At least one local informant was present during all field surveys. The field trips lasted between one and five hours, depending on the travel distance. Table 9 shows the completed field surveys in chronical order. Field survey five and six were organised specifically for this study.

Table 9: Field surveys and recorded features

Field survey	Campsite	Hill	Water catchment	Other
1	1			1
2	1		1	1
3	1	2		2
4	1	4		
5	4	1		
6	1	35		
7	1			3
8	1	1		

The feature class ‘others’ includes grinding holes, rock circles and caves.

5.2 Data exploration

This section investigates the collected data. It starts by presenting an overview of the data points and a first validation of the documented data. Then, the spatial distribution of the participants' knowledge is related to life history. This is followed by presenting the results on toponym ambiguity and the Seri naming system. Finally, the results on data accuracy and participants' consensus are illustrated.

5.2.1 Overview

An overview of the campsite toponyms located during field work is presented in figure 27. It can be seen that most locations are along the coast. Nevertheless, a few campsites are located aside the coast. This was especially the case around El Desemboque. Participants found it difficult to indicate campsite locations further inland on the map.

The area containing campsite toponyms is consistent with the Seri residence area from the 17th and early 18th century presented by Bowen (1983). Only one point, the most northern campsite, lies outside the Seri residence area. This represents a basic validation of the data points documented.

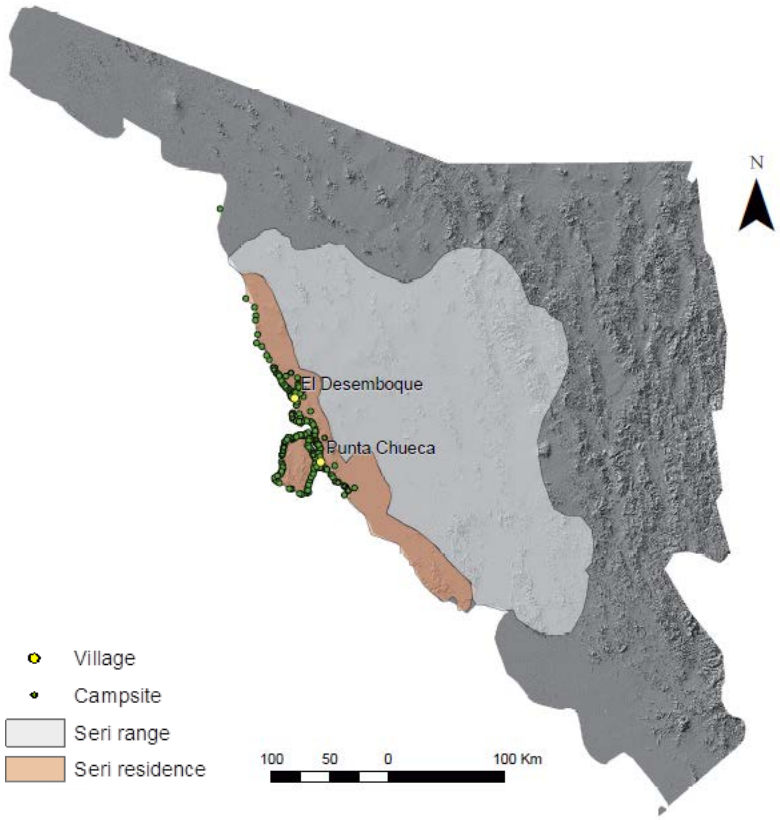


Figure 27: Campsite locations in relation to the area of Seri residence and Seri range in the 17th and early 18th century (adapted from Bowen (1983))

5.2.2 Seri campsites

The Seri traditionally lived in brush shelters and built wooden house frames (Bowen 1976). Two different house frames are illustrated in figure 28 and 29.

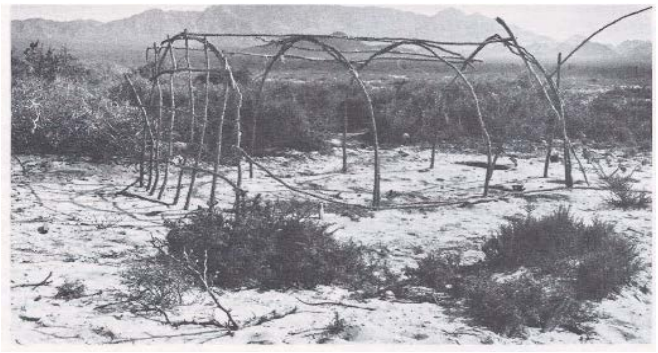


Figure 28: Traditional Seri house frame (Son I:16:3) (Bowen 1976)

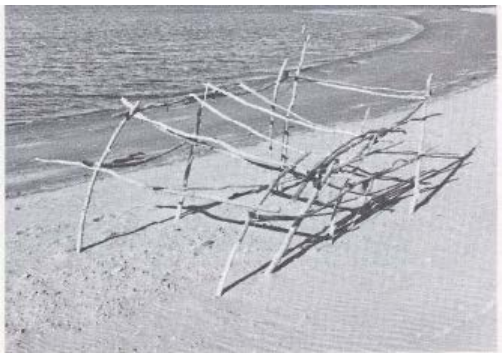


Figure 29: Traditional Seri house frame (Son I:16:2) (Bowen 1976)

Eleven campsite locations were visited during field surveys. The visits showed that campsite locations can be quite distinct; they differ in size, form and visibility. These characteristics are shown in the following by exemplarily describing three different campsites.

The first campsite is *Hastaacoj Icaheme* which is located on the mainland, about 12 km from the beach in a flat area. Figure 30 shows the campsite located on the foot of a hill. Therefore, its form is rather long and thin. The campsite is protected by two hills, illustrated in figure 31. Consequently, the campsite location has small visibility. There are also some cactuses and bushes in the area which reduce visibility even more.

Figure 30: Picture of *Hastaacoj Icaheme* looking northwest (Photograph M. Henzi, 2017)

Figure 31: Location of *Hastaacoj Icaheme*

The next campsite described is *Hant Quiyat,* shown in Figure 32. *Hant Quiyat* is a big campsite where, according to a local informant, up to 30 or 40 families stayed at the same time. *Hant Quiyat* is located on the mainland, next to the coast and close to a big arroyo. The visibility at *Hant Quiyat* is very high. Except from a few bushes, there is not much around that could affect visibility. Due to its

location on flat terrain and the absence of near physical obstacles, apart from the sea, the campsite is distributed over a large area which could have a roundish form. The surroundings of *Hant Quiyat* are illustrated in figure 33. Due to the size of *Hant Quiyat*, two locations were marked with the GPS during the field survey.

Figure 32: Picture at *Hant Quiyat* looking north (Photograph M. Henzi, 2017)

Figure 33: Location of *Hant Quiyat*

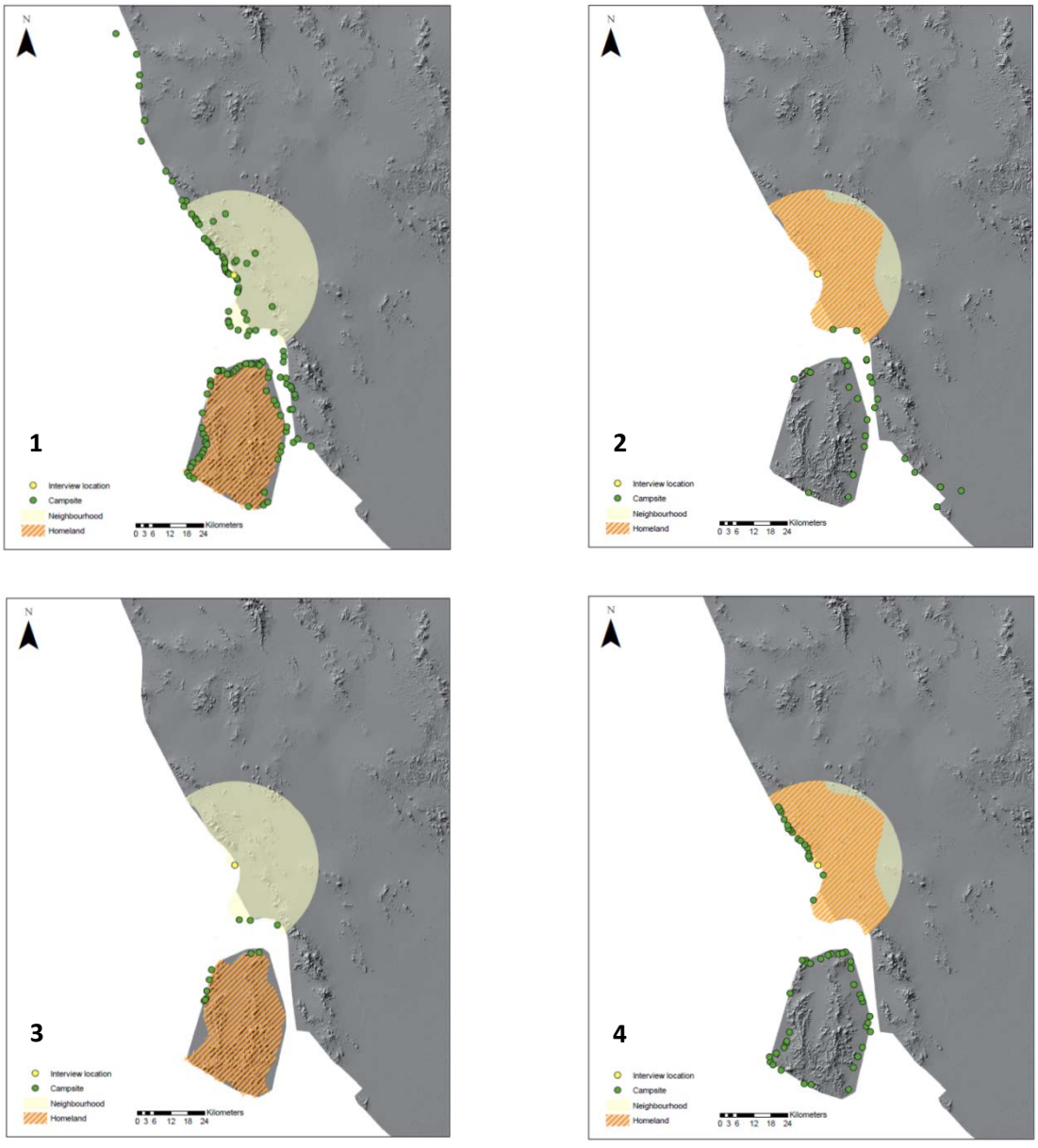
To complement the illustration of Seri campsite locations visited during field surveys a description of campsite on Tiburon Island is given. It is located close to a hill which is called *Heeme*. It is assumed that the hill name also includes the campsite name. The campsite is located between this hill and the sea. An impression of *Heeme* is given in figure 34. The visibility at Heeme is quite high. However, it is restricted towards or from inland due to the hill *Heeme* and other hills in the area. This is illustrated in figure 35.

Figure 34: Picture taken at *Heeme* looking east (Photograph M. Henzi, 2017)

Figure 35: Location of *Heeme*

5.2.3 The relation of geographic knowledge and life history

An interesting illustration is the mapping of the data given by each participant in relation to the location where they spent their childhood, live nowadays and to the homeland as it is shown in the nine maps in figure 36. The maps illustrate for each participant the interview location, the current neighbourhood, the homeland and the documented campsites. This is used to calculate the relation between the participant's geographic knowledge and life history.



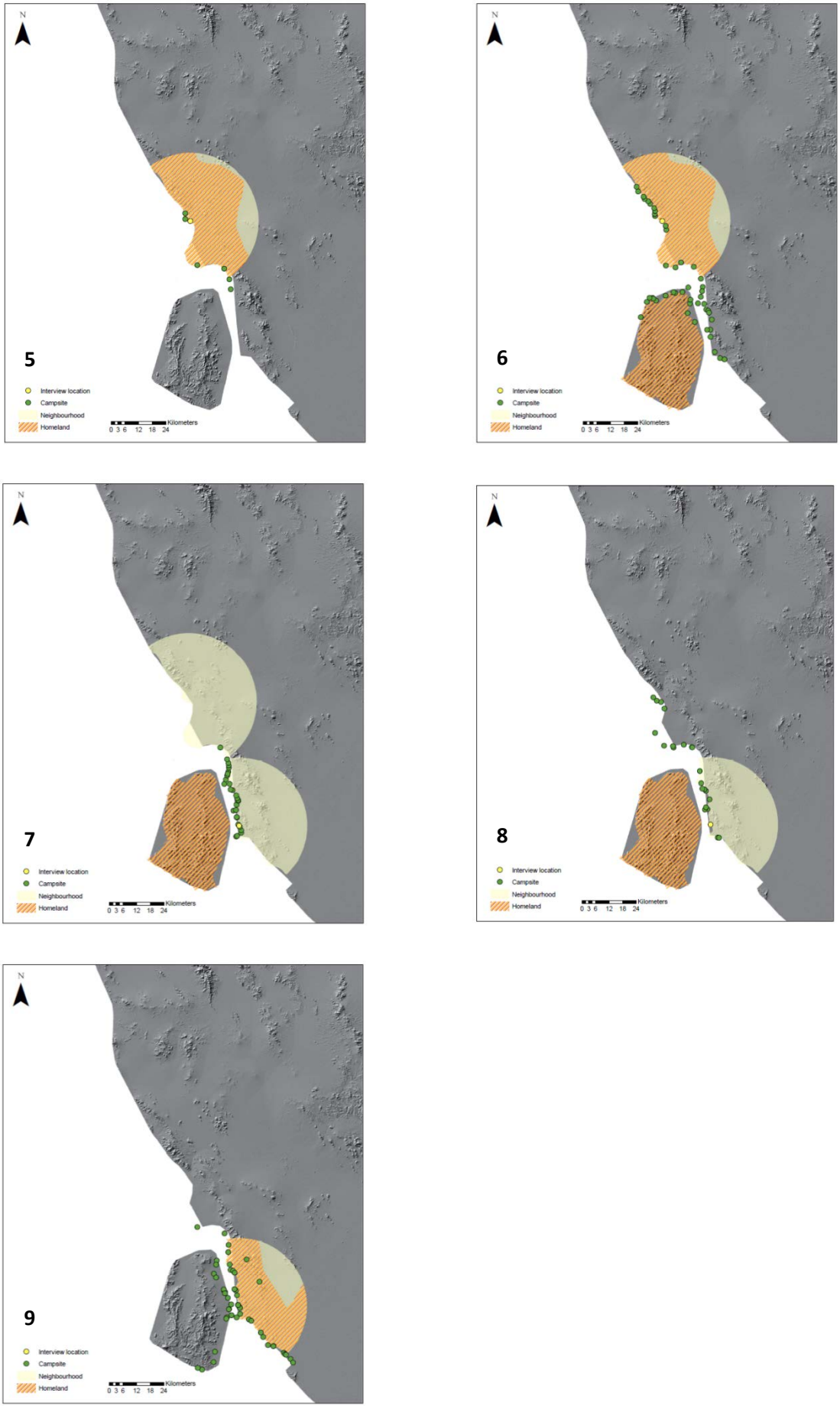


Figure 36: Participants' area of knowledge in relation to life history

The nine maps showing the campsite locations and the life history of each participant suggest that life history can be an indicator for the geographic area of knowledge in some cases. Table 10 gives an overview of the percentages of mentioned campsites lying within each life history area. It confirms what the maps suggest. Life history can be an indicator but is not a premise. The percentage of points lying within the life history polygons is quite diverse; it ranges from 7.7% to 96.4%. The best indicator in this case study is the current living area with an average of almost 45%. The homeland and the childhood area are about the same with 35.9% and 34.5% respectively.

Table 10: Campsite locations and the relation to life history

	Childhood area	Living area	Homeland
Participant 1	36.8%	36.8%	37.6%
Participant 2	7.7%	7.7%	7.7%
Participant 3	27.3%	27.3%	63.6%
Participant 4	32.1%	32.1%	32.1%
Participant 5	66.7%	66.7%	66.7%
Participant 6	31.9%	31.9%	61.7%
Participant 7	3.6%	96.4%	0%
Participant 8	50%	50%	0%
Participant 9	54%	54%	54%
Average	**34.5%**	**44.8%**	**35.9%**
Median	**32.1%**	**36.8%**	**37.6%**

It seems that life history can explain in average between 35% and 45% of the campsite locations given by each participant. The median lies between 32% and 38%. In the case of participant 1, where the neighbourhood is not the same area as the homeland, the life history explains 73.6% of the data. Consequently, life history seems to be a possible indicator for geographic knowledge. It has to be relativised, though. Table 11 shows the percentage of points lying within each of the polygons for all participants. It therefore indicates the chance of a point being within a polygon regardless of the participant's life history. All polygons defined contain in average 30% of the data. The median lies at 29%. This leaves only a gain of 5% to 15% which can be explained through the participant's life history.

Table 11: Campsite locations in relation to all areas

Homeland El Desemboque	Homeland Punta Chueca	Homeland Tiburon Island	Neighbourhood El Desemboque	Neighbourhood Punta Chueca	**Average**	**Median**
27.3%	30.1%	29.1%	28.4%	34.6%	**29.9%**	**29.1%**

5.2.4 Toponym ambiguity

Not many ambiguous toponyms were encountered in the Seri language during this study. Actually, no geo/geo ambiguity can be reported for campsite toponyms and only one for toponyms in general.

The toponym *Slootxöla Iime* depicts two distinct locations. *Slootxöla* referes to an evil spirit and *Iime* is the home or a place to live (Moser & Marlett 2008). Consequently, *Slootxöla Iime* refers to a place where an evil spirit lives. The two toponyms and their locations are shown in figure 37.

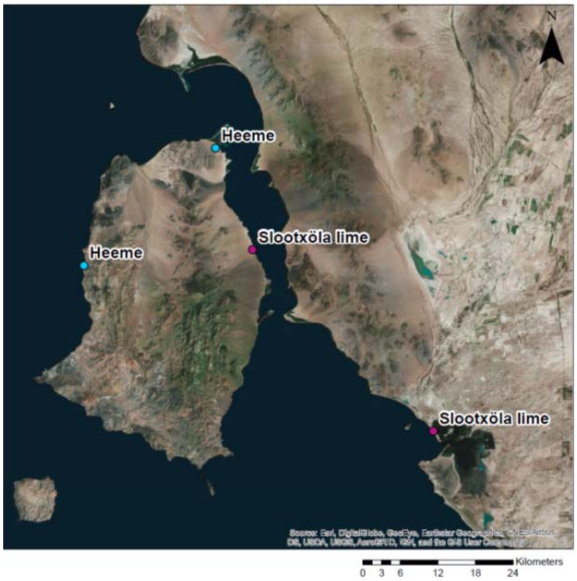


Figure 37: Seri toponym ambiguity: *Heeme* & *Slootxöla Iime*

An interesting case is represented by the toponym *Heeme* which is also illustrated in figure 37. The *Heeme* located on the western part of the Tiburon Island refers to a campsite location while the *Heeme* on the northern end of Tiburon Island refers to a hill. However, the hill toponym implicitly includes the campsite location on the foot of the hill. Consequently, *Heeme* could indirectly be an ambiguous campsite toponym. This example illustrates the importance of ontology in order to understand what the toponym *Heeme* can refer to and what it includes.

5.2.5 Naming pattern

Numerous findings suggest a spatially related naming pattern in Seri toponymy. They show that toponyms can be related between arroyos, campsites, caves, coastal points, estuaries, hills and water resources. A few examples across feature types are illustrated in figure 38.

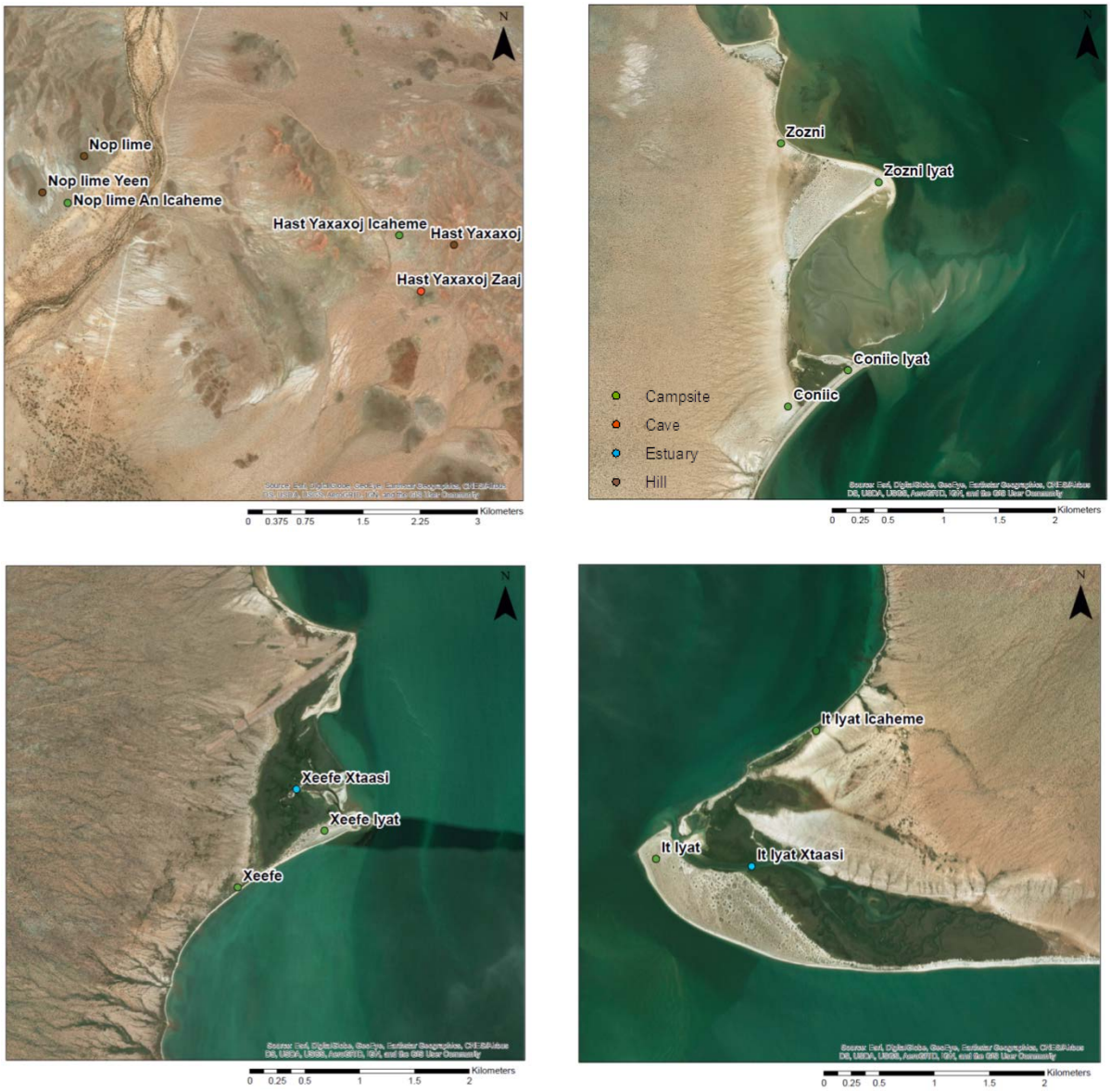


Figure 38: Illustration of the Seri naming system

The four maps show different examples of toponyms being related across and within feature classes. Toponym variation within feature class can be seen in the first map with *Nop Iime* and *Nop Iime Yeen*. Both names refer to a hill, former being the face of the hill since *Yeen* means 'face' (Moser & Marlett 2008). It is similar in the case of for example *Coniic* and *Coniic Iyat* as it is illustrated in the second map. Both toponyms refer to campsites. The second toponym is the campsite which is located at the point of the coast next to *Coniic*. Toponym variations can also be used across feature classes as it is illustrated in the third map. The campsite name *Xeefe*, the campsite name *Xeefe Iyat* and the estuary name *Xeefe Xtaasi* are related by *Xeefe*. The same principle applies to the fourth map. However, this system does not apply to all toponyms and features. The estuary which can be detected in the second map, next to *Coniic* and *Coniic Iyat*, is not labelled. According to the design system, its name could be *Coniic Xtaasi*. In fact, this estuary name exists in the Seri dictionary

(Moser & Marlett 2008). It is unclear why this estuary was not named by any participant during the mapping process and if the estuary is indeed called *Coniic Xtaasi*. However, it is highly probable. The detected design principle in labelling features could be used to complete the map with known toponyms that have not been located yet.

There are a handful counter examples in the data. The campsite *Tacata* is about 20 km away from *Tacata Inoohcö*, which is the 'bay' of *Tacata*. The examples have to be relativised though. The single parts were all given by different participants. The spatial difference in the locations could emerge due to the inaccuracy of the data or toponym ambiguity. In the case of *Tacata*, the Seri dictionary knows indeed two translations which could refer to different locations (Moser & Marlett 2008). No pair of names given by one participant has been found that is not spatially related. On the other hand, the examples which support the naming system are either given by one participant or could be detected across participants. In total, 22 toponym pairs appear in the data including 59 toponyms. This means that almost 20% of the toponyms collected are involved in the naming system.

5.2.6 Data accuracy and consensus on campsite locations

Acquisition and processing accuracy. The data acquisition accuracy is very good since the locations are recorded with a GPS accuracy of 3 m. During data processing the accuracy of the data remains the same.

Data accuracy. Four campsites which were recorded with the GPS overlap with the data collected in the interviews. The first GPS point was located in Google Earth by four participants, the other three GPS points overlap with only one participant who happens to be the same in all three cases and who is also the informant that indicated the campsites in the field. Two examples of the comparison between GPS points and Google Earth campsite locations are illustrated in figure 39. The map on the left shows the campsite *Hant Quiyat*, which is El Desemboque Viejo. El Desemboque Viejo is a big campsite where about 30 families lived. The two GPS locations represent the spots that were visited with the informant. It is possible that the three Google Earth locations close to the GPS waypoints are also within the campsite since no clear boundaries of the campsite can be drawn. The map on the right shows the campsite *Xnapofc Iyat*.

Figure 39: Comparison of GPS and Google Earth campsite locations

The distances calculated between the GPS waypoints and the Google Earth locations from all four locations are listed in table 12.

Table 12: Distances between GPS waypoints and Google Earth locations

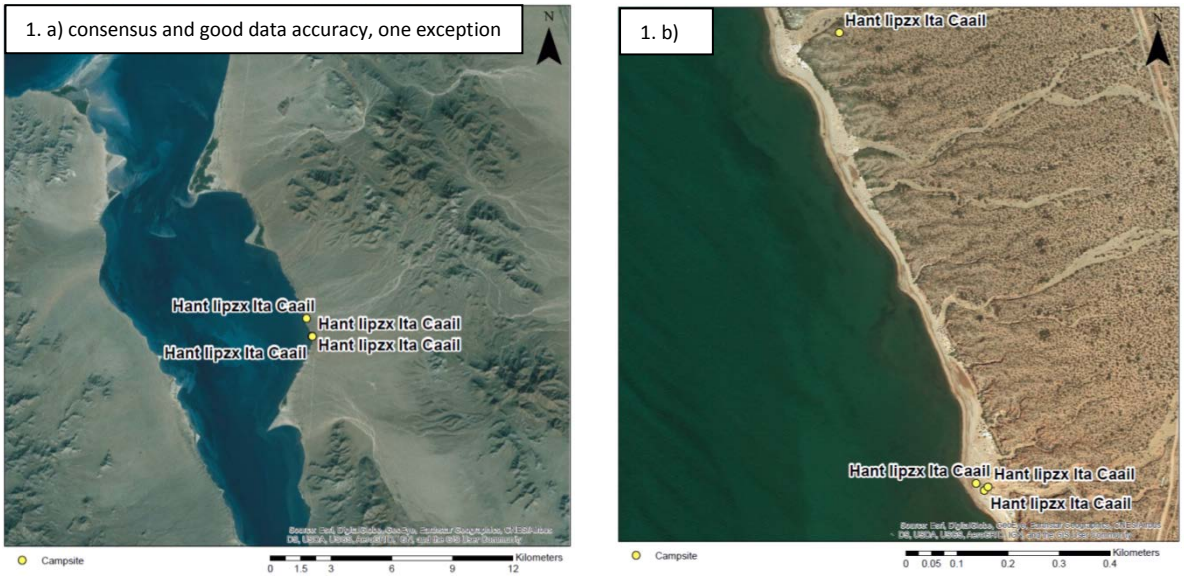
Hant Quiyat	[m]
Minimum distance	140
Maximum distance	710
Sataham Quipcö	
Distance	330
Xnapofc Iyat	
Distance	80
Xtaasitoj Cmoiilc	
Distance	90

Data accuracy and consensus. 225 unique campsite toponyms were recorded in the interviews. It is not clear whether those names refer to 225 unique campsites or less. Due to the naming variations it could be that for example *Hona* and *Hona Iyat* are one camp. Further investigation on Seri campsite ontology is needed to clarify the concept of campsites. For simplification, the unique names are treated here as having unique locations. Of the 225 toponyms, 79 are mentioned by more than one participant. The exact counts are displayed in table 13. The minimum distance measured between the overlaying toponyms is 60 m. The maximum distance is 22660 m. The average lies at 2680 m and the median at 1290 m.

Table 13: Count of toponyms mentioned by one or more participant

Count Participants	Count Toponyms
1	146
2	46
3	14
4	10
5	5
6	1
7	2
8	1
9	0

It is difficult to determine to what degree the discrepancies originate in point inaccuracy from manual drawing in Google Earth with different scales and in disagreement on the actual location. Four interesting examples are explained in figure 40 to illustrate the suggested difference between data accuracy, campsite width and consensus on the location. The maps on the left provide an overview of the four examples at the same scale. Whenever possible, a second map is drawn to the right to show the idea of consensus, data accuracy and campsite width in more detail.



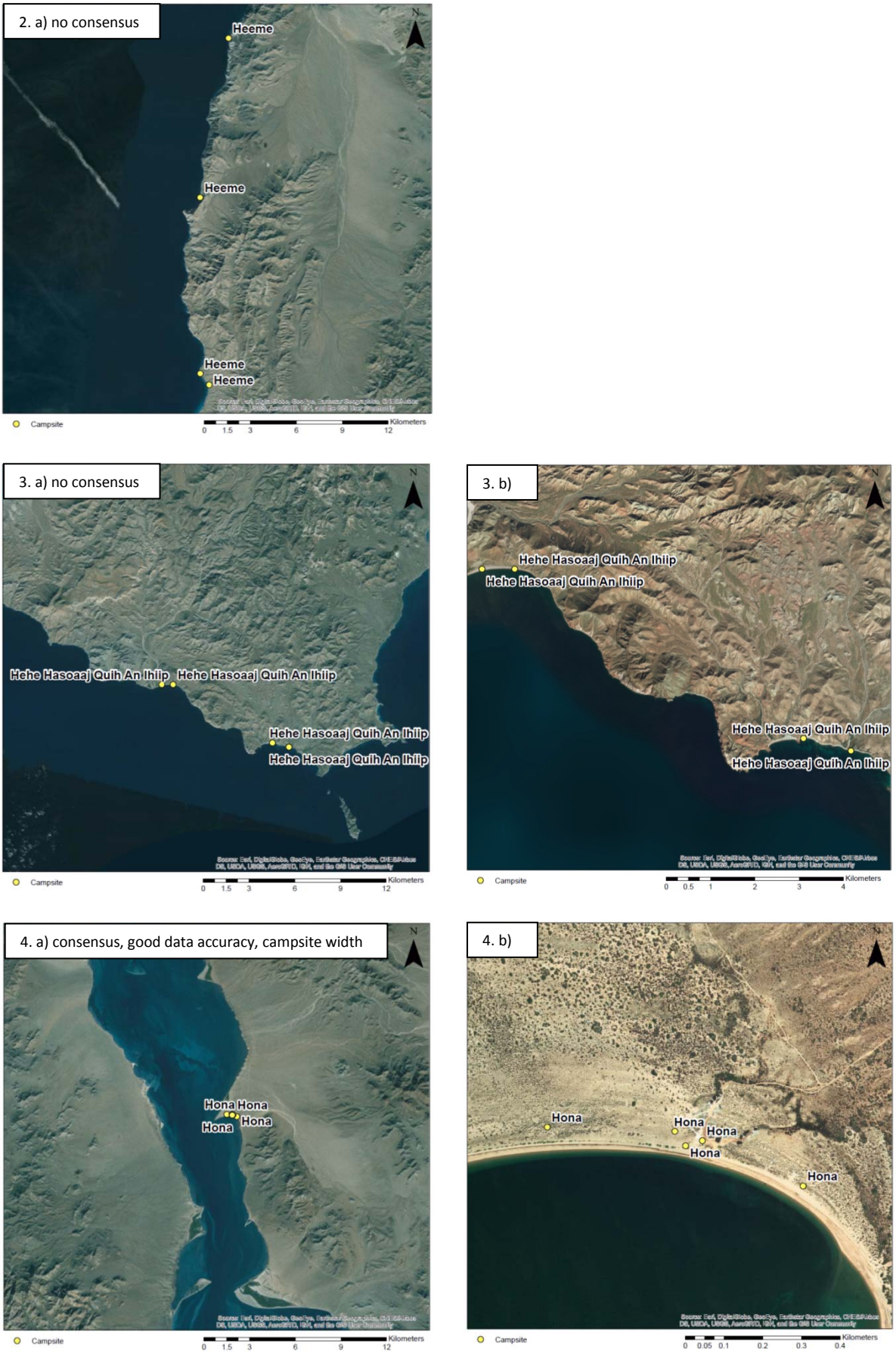


Figure 40: Examples on data accuracy, campsite width and consensus

The first map shows the four locations for *Hant Iipzx Ita Caail* and is an example of good data accuracy but some disagreement on the campsite location. Three informants agree on the location and are able to locate it with an accuracy of about 20 m on the map. This accuracy is probably within the range of the campsite width. However, one informant identifies the campsite at an arroyo further north at a distance of 940 m to the others. In the second map below the informants give four different locations for the campsite *Heeme*. The four points clearly illustrate that the informants do not agree on where *Heeme* is located. Two of them agree on a general area. This is an example for a small consensus. The third map showing the locations for *Hehe Hasoaaj Quih An Ihiip* provides an additional combination of mentioned factors. There is clearly no consensus on the location of the campsite. It could be summarised that the campsite is located either to the left or to the right of a mountain which is either to the left or to the right of a big arroyo. The last map on the bottom showing the campsite *Hona* illustrates consensus among five informants on the location with good data accuracy. The campsite is located on the southern part of the peninsula. Both extreme points are located within a distance of 330 m to the three centre points. The centre points are put at a distance of about 50 m to each other. The centre points show that three informants were able to locate the campsite accurately on the map. The two outer points could either show a small inaccuracy in data collection or they could still be within the campsite width.

5.3 Data analysis

The results of the toponym data analysis are shown in this section. First, the generic terms in Seri campsite toponyms are presented. Second, the relation of those generic terms to landscape is illustrated. Third, the findings on Seri campsite characteristics are explained.

5.3.1 Generic terms appearing in Seri campsite toponyms

The list with Seri toponyms based on Marlett & Moser (2001) and pers. comm. (O'Meara 2016) contains 201 campsite toponyms. 229 toponyms were recorded in this study either in interviews or in field surveys. Only 15.3% of the toponyms collected are identical to the ones mentioned on the list. Therefore, the two toponym collections are compared in the following concerning their generic parts. The amount of toponyms containing generic terms is similar. 64.7% of the previously provided campsite toponyms and 62.9% of the newly collected campsite toponyms contain generic terms. The classification of the generic terms is displayed in table 14. It is shown that most generic terms relate to landscape features or material character, followed by references to plants and animals. The generic terms classified as landscape are listed in table 15. The generic terms classified as material components are shown in table 16.

Table 14: Classification of generic terms appearing in Seri campsite toponyms

	Landscape	Material	Plant	Animal
Toponyms based on Marlett & Moser (2001)	27.6%	37.2%	25%	10.2%
Toponyms recorded in this study	39.5%	30.8%	15.7%	14%

Table 15: Generic terms classified as landscape

Caail 'dry lake, playa'	*Hant iipzx* 'arroyo'	*Ihiyax* 'point, tip, edge'	*Iifa* 'peninsula'
Inoohcö 'bay'	*Itaaij* 'shoreline'	*Iyat* 'its point'	*Xatj* 'reef'
Xtaasi 'estuary'	*Yaayam* 'low hill'	*Zaaj* 'cave'	

Table 16: Generic terms classified as material components

Casiime 'clay with calcite and iron'	*Hacoocj* 'certain gray-green clay'	*Hant* 'ground, land'
Hanteezj 'clay, mud'	*Hast* 'rock, stone'	*Hax* 'water'
Iix 'water'	*Xepe* 'seawater'	*Xpaahjö* 'hematite'

The generic terms classified as plants and animals can be found in the appendix since they are not further relevant for this study.

In the following, the results of the structure of the toponyms containing generic terms are presented. Figure 41 illustrates where the generic term is located within the toponym. The three possible structures are X + generic, generic + X and X + generic + X.

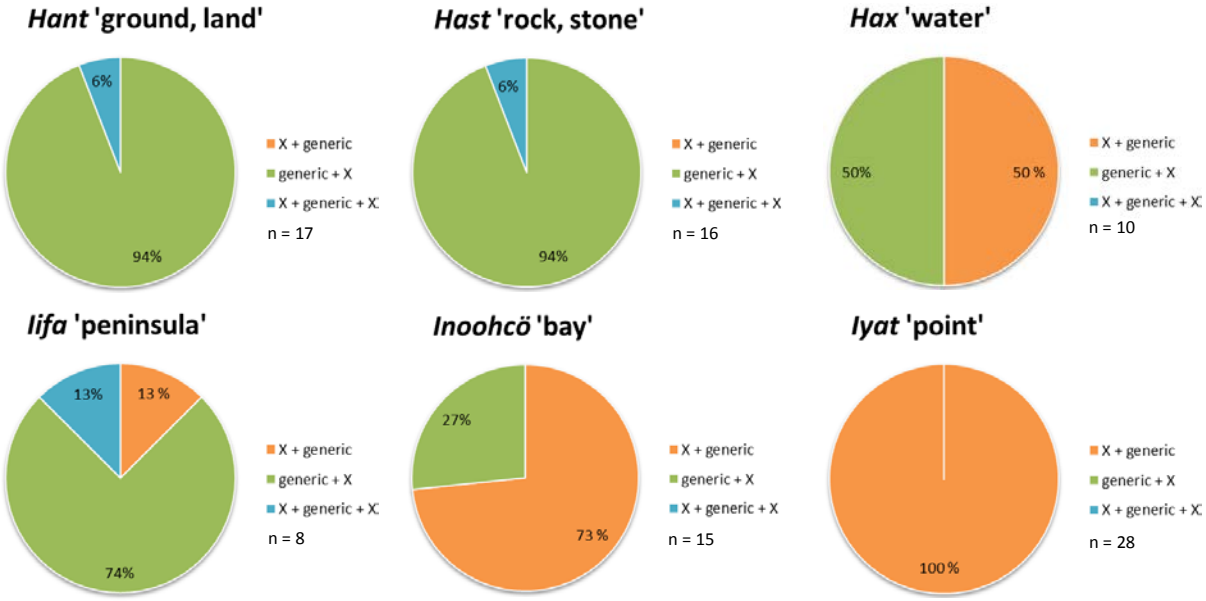


Figure 41: Location of generic terms within toponyms

The six generic terms investigated show clear differences. *Hant* 'ground, land' appears 17 times in the campsite toponyms and has mostly the structure generic + X. It is almost identical to *hast* 'rock, stone' which has a count of 16. The third toponym referring to material components is *hax* 'water. It has a count of 10 and has the two structures X + generic and generic + X. *Iifa* 'peninsula' only appears

8 times in the toponym sample but has the biggest diversity and covers all three structures. The generic term *inoohcö* 'bay' has a count of 15 and has mostly the structure X + generic. *Iyat* 'point' has the highest count and shows the clearest structure. It appears 28 times in the campsite toponyms and has the structure X + generic.

The generic terms are summarised to material components (*hant*, *hast*, *hax* – 43 toponyms) and landscape (*iifa*, *inoohcö*, *iyat* – 51 toponyms) in figure 42. Then, the following structures are most frequent for each class.

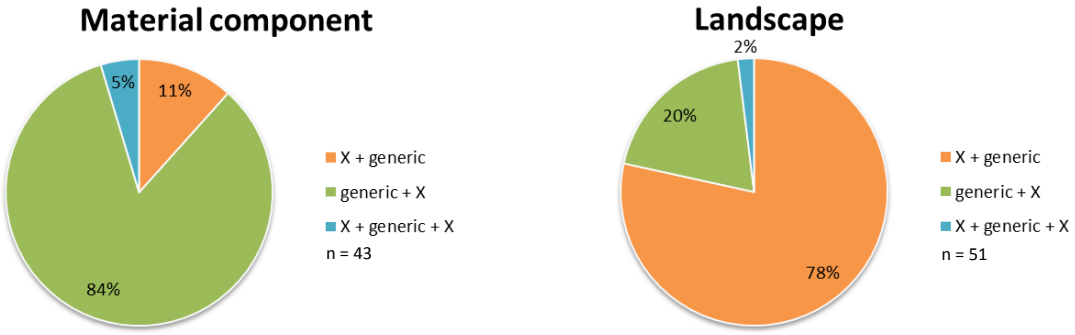


Figure 42: Toponym structure of grouped generic terms

5.3.2 Generic terms and their relation to landscape

The relation of the three most frequent generic terms to landscape is presented in the following.

***Inoohcö* 'bay'.** All campsite toponyms which contain the generic term *inoohcö* 'bay' are located on the coast. Due to the highly twisting coastal area a curvature towards the mainland can always be found depending on scale. Therefore, possible characteristics describing *inoohcö* 'bay' are explored. The diameter and steepness of *inoohcö* 'bay' are diverse. The findings on the characteristics of *inoohcö* 'bay' are summarised in table 17.

Table 17: Characteristics of *inoohcö* 'bay'

***Inoohcö* 'bay'** (n = 15)	**Diameter [m]**	**Steepness [m]**
Range	110 – 4770	20 – 1700
Average	1612	350
Median	782	316

Figure 43 illustrates two interesting aspects of the investigation on the generic term *inoohcö* 'bay'. The map on the left shows two campsite toponyms containing the generic term *inoohcö* 'bay'. The one on the right, *Xoop Cacöla Quih Inoohcö*, is situated in a small bay within a bigger bay. It cannot be determined to which bay the generic term refers to, if it only refers to one. The map on the right

shows that not all campsite toponyms which are located within a bay contain the generic term *inoohcö* ‘bay’.

Figure 43: Examples of the generic term *inoohcö* ‘bay’

***Iyat* ‘its point’.** All toponyms which contain the generic term *iyat* ‘its point’ are located on a coastal point. The points have different sizes and are not equally salient as it is shown in figure 44 and summarised in table 18.

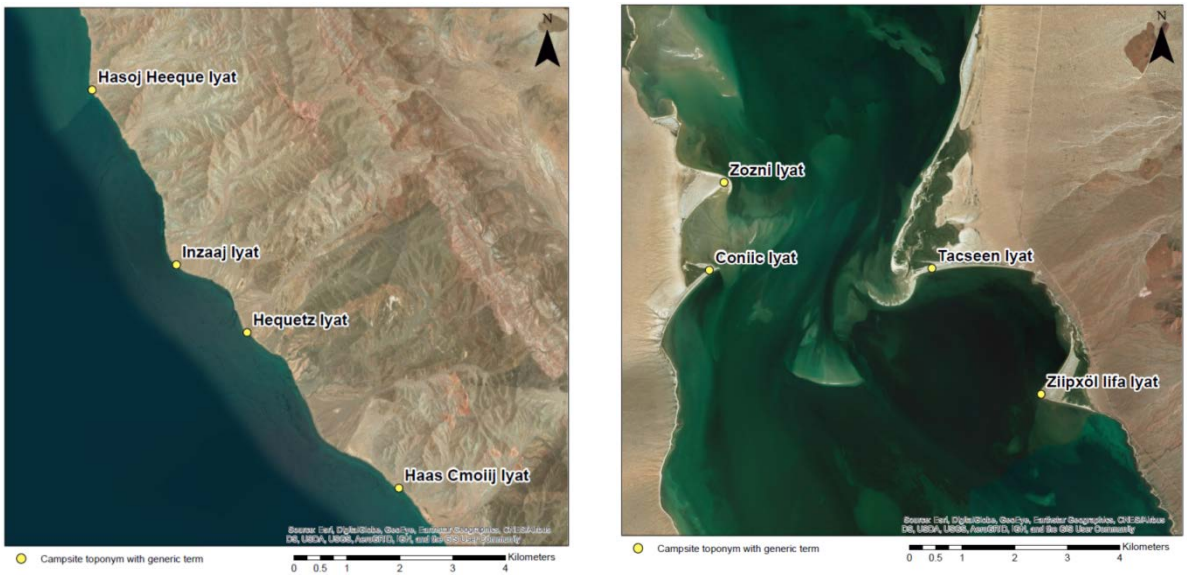


Figure 44: Examples of the generic term *iyat* ‘its point’

Table 18: Characteristics of *iyat* 'its point'

***Iyat* 'its point'** (n=28)	**Diameter [m]**	**Steepness [m]**
Range	130 – 3460	30 – 7100
Average	1200	1420
Median	770	630

The toponyms which contain the generic term *iyat* 'its point' are mostly, but not always, located on the outer most spot. This is illustrated in figure 45. The generic term *iyat* 'its point' appears in this toponym sample only on coastal points. However, it could also apply to other point features such as mountain peaks. There are also many campsite locations situated at a coastal point which do not have the generic term *iyat* 'its point' in the toponym.

Figure 45: Locations of campsite toponyms containing the term *iyat* 'its point'

***Iifa* 'peninsula'.** The toponyms which contain the generic term *iifa* 'peninsula' are all located on the coast on a peninsula or point like feature. They are very distinct in their form. Two examples are presented in figure 46. There is no apparent distinction between the generic terms *iyat* 'its point' and *iifa* 'peninsula'. This is underlined by the fact that two out of the eight toponyms containing the term *iifa* 'peninsula' also contain the term *iyat* 'its point' such as in *Ziipxöl Iifa Iyat*. The characteristics found for iifa 'peninsula' are shown in table 19.

Figure 46: Examples of the generic term *iifa* 'peninsula'

Table 19: Characteristics of *iifa* 'peninsula'

***Iifa* 'peninsula'** (n=8)	**Diameter [m]**	**Steepness [m]**
Range	200 – 1600	55 – 10450
Average	980	1670
Median	620	330

In the previous section, a Seri naming system was proposed. This naming system nicely illustrates the relation of toponyms to landscape. It was shown that generic terms are used to create toponym variations such as *Xeefe* and *Xeefe Xtaasi*. These generic terms are used to denote feature classes. Consequently, the toponym *Xeefe Xtaasi* 'Xeefe's estuary' is an estuary name. This relation can be shown for arroyos, campsites, caves, estuaries, hills and waterholes. No exceptions have been found so far. The generic term used to create sets of names seem to denote the referenced feature class.

5.3.3 Seri campsite characteristics

The interviews revealed that traditional campsite locations were chosen according to natural resources. Water and food supplies are the only characteristics mentioned when asked for the advantages of campsite locations. Consequently, the Seri changed campsites according to seasonality and its food supplies. However, there is no possibility to verify a relation of Seri campsite locations to natural resources in this project due to the lack of data on natural resources in the Seri territory.

The characteristics chosen to explore for Seri campsite toponyms are analysed regarding the most probable campsite locations. 40 toponyms fulfilled the defined criteria of being probable locations. These 40 toponyms and the 10 recorded sites resulted in 95 campsite points which are considered to

Height. The height at which the campsites are located ranges from 0 to 192 m a.s.l. However, most campsites are between 0 and 10 m a.s.l. height since they are mainly located along the coast. In fact, 92% of the campsites are below 10 m a.s.l. height.

Slope. The slope at which the campsites are located varies between 0° and 30.5°. 82% of the data are at a location with less than 5° slope.

Aspect. The campsite locations cover all aspects. Most often are southwest with 24%, northwest with 16% and west with 15% of the data.

Based on the above mentioned characteristics, a simple multi criteria decision analysis (MCDA) was calculated. The criteria used in deciding whether a pixel is suited as a campsite location or not are height < 192 m and slope < 30.5°. The result of this analysis is shown in figure 47 in gray. It illustrates that the northeaster part of Tiburon Island is more suited for camping than the southwestern part. It further shows that the coastline has sections which are suited for camping and others which are not.

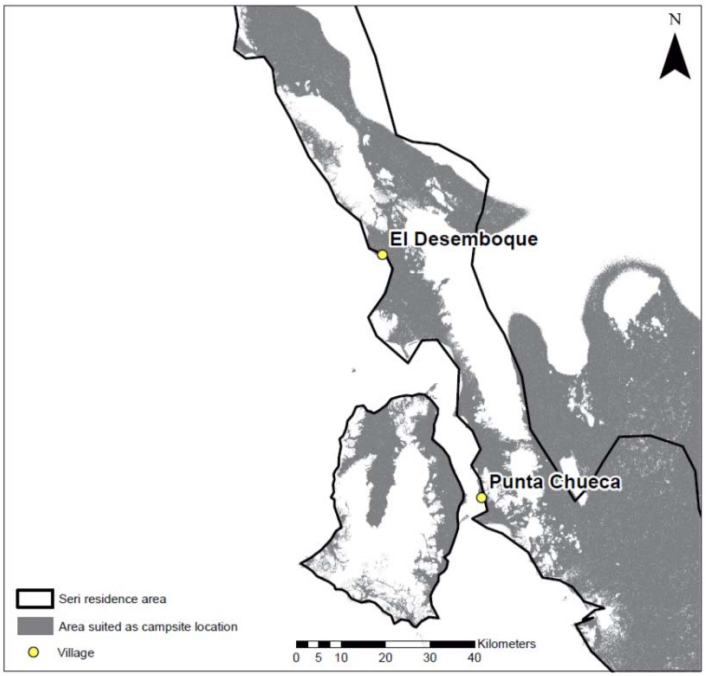


Figure 47: Area suitable for campsite locations considering height, slope and aspect

Figure 48 shows the area near El Desemboque. Nevertheless, the campsites documented during this project are located all-over the coastline, shown in figure 49. The campsite locations seem to be evenly distributed along the coastline. There is no apparent relation of the recorded campsite locations to the area which is regarded as being suitable for camping in this analysis.

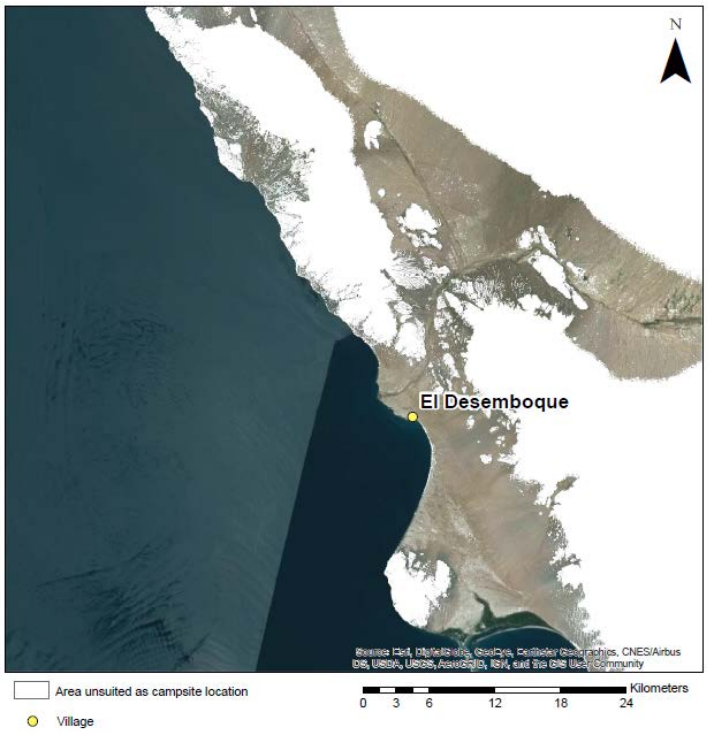


Figure 48: Area suited as campsite location near El Desemboque

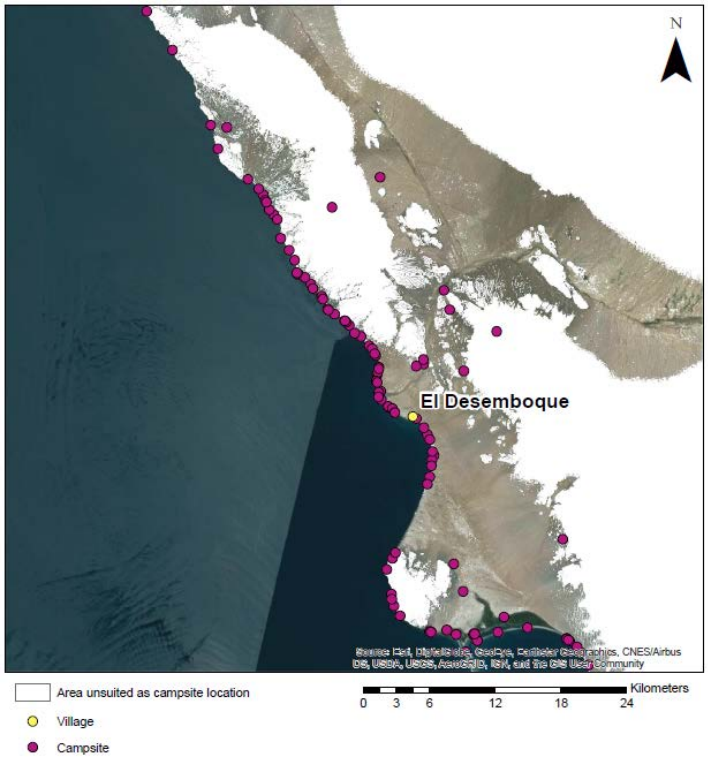


Figure 49: Area suited as campsite location and the locations recorded near El Desemboque

6 Discussion

This chapter critically discusses the results illustrated above, reviews them in the Seri context and relates them to scientific literature. Main topics include the documentation of campsite locations, generic terms in toponyms, the relation of generic terms to landscape and geographic campsite characteristics. The discussion is then used to answer the four research questions presented in the second chapter.

6.1 Recording Seri campsite toponyms

The methods used for data collection include a semi-structured interview and field surveys. The two methods are discussed at the beginning of this section. Then, the influence of ontology on data analysis and data accuracy is addressed. Finally, the discussion on documenting Seri campsite toponyms is summarised by answering the first research question.

6.1.1 The semi-structured interview as a method to collect toponym data

The semi-structured interview helped in the documentation of many toponyms. Participants were chosen in order to have a heterogeneous sample in gender, age range, life history and geography. This proved to be a useful approach in exploring the different groups and their knowledge. However, people's knowledge is highly individual. The results show that the number of toponyms recorded per participant varies greatly. Consequently, choosing the participants affects the data collection and therefore the outcome of the study as it has been stated by Coyne (1997) for qualitative research. In the following, four relevant aspects of the semi-structured interview are discussed.

Participants' demographic characteristics. Gender and age seem to have an influence on the amount of campsite toponyms known by a participant. Life history and geography referring to the places the participant has experienced or is currently living did not prove to be relevant. Despite literature suggesting a relation between geographic knowledge and life history (Barnhardt 2005; Kari 2003; Riggs 2005), no such relation could be found in the data. It seems that the knowledge individual people have depends on their interest in tradition and their ability to visit those sites. This is supported by the fact that men knew more campsite toponyms than women which could be due to their activities outside the village. Additionally, three pairs of siblings were interviewed. The collected data show that they do not know the same amount of toponyms even though they have very similar backgrounds and life histories. This led to the assumption that knowledge depends on personal interest.

Sample size. 13 participants were interviewed of which nine contributed to the toponym mapping. The number of informants lies within the sample size range proposed by Denscombe (2014) for an

explorative study. The pursued saturation of theoretical sampling which has been introduced in the methodology chapter has been reached in different aspects. First, the concept of knowledge distribution among gender and age was identified after the first few interviews and remained the same throughout the study. Additional interviews underlined this concept but did not add new information. Second, the probable naming system of Seri toponyms was already suspected after about four or five interviews. Subsequent interviews did not reveal any new concepts.

However, no saturation could be reached in terms of toponyms. Every participant added toponyms to the map which had not been recorded yet. Nevertheless, the concepts learned are not expected to change substantially by recording more toponyms. This is also confirmed by the comparison of the toponyms recorded in this study with the toponym list based on Marlett & Moser (2001). The toponyms are highly different, only 15% of the two lists overlap. Despite this difference, the amount of generic terms and their classification are very similar.

Even though additional interviews could add more toponyms to the map, the study will be limited at some point by informants able and willing to participate. This has been experienced in the town El Desemboque where 10 participants were interviewed. The feeling of having exhausted the potential of possible participants who could contribute to the study started to emerge. A few candidates were not interested in participating, others were not targeted due to the theoretical sampling approach.

Amount of data collected. Hedquist et al. (2014) report having collected 282 toponyms by interviewing 15 participants. In this study nine participants contributed about 320 unique toponyms. Thus, more on average compared to Hedquist et al. (2014). On one hand, it is expected from people with a hunter-gatherer background to know their territory very well (O'Meara 2010). This could also be the reason for knowing many toponyms. On the other hand, Hedquist et al. (2014) do not state how the participants of their study were chosen. Consequently, it could be that theoretical sampling is better suited for toponym recording than other sampling methodologies such as random sampling since theoretical sampling allows choosing the participants in an ongoing process. This gives the possibility of including knowledge gained during the study and can therefore lead to more productive interviews than following a predefined scheme.

Type of map. Most studies collecting toponym data report working with topographic paper maps (Aporta 2009; Henshaw 2006). In this project people were given the opportunity to choose between a topographic paper map at 1:50.000 and working with Google Earth. The participants all preferred Google Earth. They responded well to working with satellite images, its visual resemblance to reality and the possibility of changing scale. The fact that people liked Google Earth as well as the numerous toponyms which were recorded in this study suggest further investigation on working with Google

Earth in indigenous toponym studies. However, the approach has two limitations in the field: a laptop and a charger are needed. The satellite images of the area required for the study can be cached beforehand.

6.1.2 Field survey as a method to collect toponym data

Doing field survey and collecting GPS points of place names and trails is quite popular in the literature (Henshaw 2006). The collection of GPS points is seen as being a flexible and accessible way of gathering data. Consequently, field surveys to document toponyms are applied as a method in this study. However, field experience revealed numerous aspects of field surveying which have not been fully discussed in the literature.

First of all, field surveys require planning. The field trips done in this study took mostly about half a day. This cannot be done spontaneously. Informants have to be asked in advance on which day they have the time and possibility to leave town. The planning was one of the main obstacles concerning field work since it was done in a culture with a day-to-day thinking. Life is arranged more spontaneously, depending on what comes up. Consequently, it is easier to get participants for interviews than for field surveys because they can decide in the moment whether it fits their schedule or not. Most field trips that were planned and agreed on had to be cancelled or postponed.

Second, there are numerous external factors which cannot be influenced. Weather conditions have to be favourable in order to do field surveys. For example, if it rains in the Seri territory the arroyos fill with water and get muddy. Consequently, they cannot be passed by car for several days. An additional factor is the age and health condition of the informant. In this case study, it is the elder people who have visited the campsites in their past and therefore know much more on toponyms and their locations than younger people. However, they are not always able to walk in the desert to places that cannot be reached by car. This leads to another factor: accessibility. There were not many locations that could be reached either by car or within reasonable walking distance.

The third factor encountered in field work is safety. Only if all conditions are good field work can be completed without safety restriction. The main factor concerning safety issues met in field work was the hunters since it was hunting season. Therefore, it was often too dangerous to leave town and to go on field trips.

The above mentioned aspects have great influence in achieving field surveys. Despite the difficulties to conduct field surveys, they have several advantages. Being at specific locations and seeing them in reality seemed to trigger a lot of information from the local informants. For example, one participant mentioned six campsite names and five hill names during the interview. Once being in a car and driving around, the same participant was able to document 35 hills and their names along the road.

An additional advantage of field surveys is that locations can be experienced by the researcher. This is related to Johnson (2012) who has proposed a place-based approach for community mapping. He argues that in order to understand indigenous knowledge one has to engage with a community and its places. Seeing places in their context and experiencing the location can help in understanding the ontology.

6.1.3 The influence of conceptualisation

Ontology addresses the human perception of the surrounding (Mark & Turk 2003). It is known that the representation of the way people think about spatial information in a geographic information system is limited (Egenhofer & Mark 1995). For representing Seri campsite locations, it had to be chosen between point and polygon features. It was decided to use point features because of statistical reasons and personal experience from visiting the sites during field surveys. Therefore, this study is limited by Seri campsite ontology. No specific research was done on how the Seri perceive and define campsite locations. Consequently, a problem arose during data exploration. Are the names *Heeme* and *Heeme Iyat* 'Heeme's point' referring to the same campsite or not? Is one name and its location contained by the other? Additionally, it may be that the campsite locations change slightly over the years. Maybe they camped in a certain area every year but not at the exact same spot. This could be supported by the fact that the Seri people liked to camp on sand dunes (Bowen 1976). Dunes are not static. Due to wind and rain erosion they can change their forms and locations over the years. Knowing the ontology of Seri campsites is of great interest to represent and explore them as well as to measure data accuracy. The issue of data accuracy will be discussed in the following.

6.1.4 Data accuracy

It was mentioned in the previous chapter that this study suggests a distinction between accuracy, width and consensus. Accuracy refers to the participants being able to mark campsite locations on a map whereas consensus addresses probable differences in data locations due to disagreement on the actual location. Width addresses the occurrence of different campsite sizes. Therefore, some locations which are actually located within a campsite seem to suggest data inaccuracy due to the distance at which they are located to each other.

The comparison of four GPS waypoints with the data points collected in Google Earth was presented in the results. However, four locations are not enough to form an opinion about data accuracy. They provide some valuable information though. On one hand the data showed that only one participant was probably mistaken with the location in these examples. All other data points were within a distance of 80 m to 330 m. These numbers could either provide information about the data accuracy or give a hint about the extent of campsites. It should be further mentioned that all four locations are

within an hour drive from El Desemboque and therefore close to the village. It is possible that the differences between GPS waypoints and Google Earth locations increase with increasing distance. On the other hand, the GPS waypoints illustrate that they should not be handled as ground truth. The locations are based on the knowledge of one informant. It is unknown if other informants would point to the same spot in a field survey. Additionally, the field trip and the later visualisation of the GPS waypoints showed that all campsite locations are exactly located next to the road. Two reasons can be thought of. The roads were built long after the campsites existed. Maybe the roads were directed towards the traditional campsite locations. On the other hand, it may be possible that the boundaries are fuzzy and therefore it is more convenient to stop next to the road to indicate a campsite location than to walk a few hundred meters.

An additional difficulty is the absence of available ground truth data. However, it can be shown that of 225 unique campsite names recorded during the interviews 79 are mentioned by more than one participant. Of those 79 campsite names 40 campsites are located by at least two participants within a distance of 200 m. This means that participants agreed on the location and were able to locate it within a range of 200 m in half of the toponyms they have in common. It should further be considered that data accuracy of the collected toponyms does not have to be the same for all locations. They were recorded from different people at different scales due to the zooming function of Google Earth.

It is not clear whether the differences between the GPS waypoints and the Google Earth points as well as within the different Google Earth points are due to data inaccuracy, lack of consensus or campsite width. Consequently, no exact measures can be calculated for data accuracy at which campsite locations were documented in Google Earth. Based on data accuracy, width and consensus campsite locations are not clearly defined but probably in a certain area around the point features located on the map. Therefore, the resolution of the digital elevation model of 30 m does not limit data accuracy.

6.1.5 Summary on recording Seri toponyms

The first research question covers the above mentioned aspects of the chosen methods to collect data, campsite ontology and data accuracy.

RQ 1) How can Seri campsite toponyms be located in space? How much information can be gathered by semi-structured interviews and field surveys?

Seri campsite toponyms can be located in space by semi-structured interviews and field surveys. Using Google Earth as a base map for referencing toponyms was chosen by the participants over a topographic paper map at 1:50.000. The information from semi-structured interviews and field

surveys complement each other. While more interviews could be completed and more data could be collected in interviews, field surveys added interesting aspects on the locations as well as triggered information and interesting stories from the informants. On average, 38 toponyms and a median of 31 campsite toponyms were located per person on the map while each field trip added one campsite toponym. Additionally, the information collected during the semi-structured interviews revealed interesting facts about the connection of traditional knowledge to demographic characteristics and a proposed naming system. However, the informants chosen to participate in the study have an influence on the data collection. In the Seri case, participants' gender and age seemed to have the biggest influence on their knowledge. The Seri daily activities depend on gender. While most women stay in the village or visit sites close by for plant recollection, the men leave the village in boats to go fishing and still come in contact with some traditional sites. The fishing could be one of the reasons why most campsite locations are located along the coast and do not seem to be related to participants' life histories. The experience the Seri gain nowadays on sea is different to their traditional nomadic experience. Age plays a significant role in traditional knowledge, too. The Seri became sedentary during the 20th century, especially in the second half (Burckhalter 2000; Marlett & Felger 2014). Consequently, the younger community members have not lived the traditional way of live and have therefore not used or visited traditional campsites.

6.2 Generic terms in Seri campsite toponyms

This section discusses the methodology and results of the analysis of generic terms in Seri campsite toponyms. It reflects the method applied to identify generic terms. Further, the classification of the generic terms is put into the Seri context and the representativeness of the toponym sample is discussed. The findings are then used to answer the second research question.

6.2.1 Generic terms

The analysis done in this study focuses on Seri campsite toponyms. It therefore only considers one feature type: campsites. This is different from many toponym analyses done in the literature which investigate toponyms in general and report finding generic terms referring to feature classifications such as hill, river or settlement (Qian, Kang & Weng 2016; Zelinksy 1955). However, it has been argued that toponyms can provide information specifying the character of a geographical feature (Jordan 2009). This additional information toponyms may give can be identified in its generic parts (Jordan 2009; Tentand & Blair 2011; Zelinsky 1955). The data analysis suggests that 62.9% of the campsite toponyms contain at least one generic term. It was mentioned in the methodology section that only full words are considered for identifying generic terms. This approach does not reveal all generic terms because compound words are not considered. However, this methodology was

implemented since it allows doing a consistent and reproducible data analysis without knowledge of the Seri language. Consequently, it can be argued that the amount of campsite toponyms containing generic terms is expected to be even higher than it was calculated in the study.

6.2.2 Generic terms and their classification

Hunter-gatherers strongly depend on the knowledge of the ecology and geography of their area (O'Meara & Bohnemeyer 2008). Regarding the semi-nomadic hunters-gatherers background of the Seri it is not surprising that the generic terms relate to material components, landscape, plants and animals. These terms are part of the natural Seri environment. In a study of European place naming practices along the Australian coast, Tent & Slatyer (2009) found that 26.6% of the Dutch, 35.1% of the English and 15.6% of the French place names described topography or vegetation. In contrast, this study suggests that more than 60% of the Seri campsite names refer to topography or vegetation. The higher number for the Seri case could show the importance of the Seri as hunter-gatherers to know their territory and the practice of storing local knowledge in place names.

The analysis of the structure of the toponyms showed some diversity. While most toponyms having generic terms related to material components have the structure generic + X, the toponyms having generic terms related to landscape have the structure X + generic. Furthermore, the toponyms containing the generic terms *hant* 'ground, land' and *hast* 'rock, stone' show an almost identical pattern, namely generic + X. Both generic terms are part of the material components which are used to form complex landscape terms (O'Meara 2010). Therefore, it is not surprising that they share the structure. However, this is not supported by the generic term *hax* 'water' which is also one of the generics used in complex landscape terms. The toponyms having the term *hax* 'water' apply to two structures: X + generic and generic + X. The toponyms with the generic term *iyat* 'point' have the clearest structure. All 28 toponyms have the order X + generic. This is the reverse of what Tent (2016) found for toponyms with the generic term point in Australia and New Zealand.

6.2.3 Representativeness of collected campsite toponyms

The campsite toponyms gathered during this study are not expected to be a complete list. In the contrary, there are probably still many toponyms missing. This is supported by the comparison of the toponymic list provided by Prof. Dr. O'Meara based on Marlett & Moser (2001) and the toponym list recorded during this study. It has been shown that only 15.3% of the toponyms overlap. The lists are of unequal sizes. The produced list in this study contains 225 campsite toponyms whereas the list by Prof. Dr. O'Meara based on Marlett & Moser (2001) contains 765 toponyms. Nevertheless, the percentages of toponyms having generic parts are very similar with 64.7% and 62.9%. This suggests, even though neither list is complete, that they are representative samples of Seri campsite toponyms.

6.2.4 Summary on generic terms in Seri campsite toponyms

The findings and discussion on generic terms is summarised by answering the second research question.

RQ2) Do Seri campsite toponyms contain generic parts and to which categories do those generic parts belong?

More than 60% of the Seri campsite toponyms contain one or more generic terms. The generic terms refer to the natural Seri environment. Most often material components and landscape features are mentioned. Second and third are plant and animal terms. Therefore, the generic terms in Seri campsite toponyms seem to specify the character of the campsite location.

6.3 Relation of generic terms to landscape

This section discusses the generic terms in relation to landscape. First, three generic terms classified as landscape references are investigated. Then, the importance of generic terms in the naming system is discussed. Finally, the findings are summarised by answering the third research question.

6.3.1 Investigation of *inoohcö* 'bay', *iyat* 'point' and *iifa* 'peninsula'

The three generic terms *inoohcö* 'bay', *iyat* 'point' and *iifa* 'peninsula' were investigated in more detail. The results contribute to the research area of ethnophysiography and support the assumption that toponyms have referential potential since no counter examples could be found. All locations having a toponym with a generic term fulfil the requirements to denote the corresponding landscape feature. This means for example no campsite toponym with the generic term *inoohcö* 'bay' is found in an inland area. The three landscape features *inoohcö* 'bay', *iyat* 'its point' and *iifa* 'peninsula' have been described by some characteristics. These showed that *inoohcö* 'bay' can be quite distinct in size. Toponyms having the generic term *inoohcö* 'bay' are located within small and big bays. Further research is needed to determine how *inoohcö* 'bay' is conceptualised by the Seri people and whether this corresponds to the findings the toponyms propose or whether different terms exist for different sizes of *inoohcö* 'bay'. The descriptions of *iyat* 'its point' and *iifa* 'peninsula' suggest no obvious distinction in classification. The characteristics of *iyat* 'its point' and *iifa* 'peninsula' are similar and sometimes both generic terms can be found within the same toponym. It has to be considered that the proposed characterisation of the landscape features is based on the toponym locations containing generic terms and not on landscape terms given to those features. The aim is not to describe Seri landscape ontology. However, this approach nicely illustrates the relation of generic terms in toponyms and their surroundings. The results show that generic terms can be identified on a map to its underlying referent.

Additionally, perceptual scale has to be considered. The coastal area of the Seri territory is highly tortuous. Consequently, bays and coastal points can be seen almost everywhere on a map. The question is whether they are perceived by the Seri people standing in their environment as such features or not. It has been argued by Cablitz (2008) that Marquesan's landscape categorisation depends on the ability to perceive an entity as its own and in its totality. This relates to Smith & Mark (2003) who found that the classification of geographic features often depends on size or scale.

6.3.2 Seri naming system and its relation to landscape

The proposed Seri naming system is mainly based on adding generic terms to toponyms. For example, the toponym *Xeefe* has the variations *Xeefe Xtaasi* 'estuary of Xeefe' and *Xeefe Iyat* 'point of Xeefe'. In both cases a generic term is added to the toponym *Xeefe*. This naming system shows the strong relation of toponyms to landscape.

It has been argued that more than 60% of the Seri campsite toponyms contain generic terms. Even higher numbers are achieved in toponyms referring to other feature classes. Marlett & Felger (2014) have argued that there are ten estuaries in the present-day Seri territory of which all estuary toponyms use the term *xtaasi* 'estuary'. This study recorded 17 estuary toponyms and confirms the finding that all estuary toponyms have the generic term *xtaasi* 'estuary' in their names. Consequently, the estuary toponyms highly denote their referent.

6.3.3 Summary on generic terms and their relation to landscape

The above discussed aspects on the relation of generic terms to landscape are summarised by answering the third research question.

RQ3) To what extent can generic parts of Seri campsite toponyms be related to landscape?

The results suggest a transparent relation between generic terms of Seri campsite toponyms and landscape. The three generic terms *inoohcö* 'bay', *iyat* 'point' and *iifa* 'peninsula' investigated in detail clearly have referential potential and fulfil all criteria to denote the corresponding landscape feature. However, an even stronger relation can be shown by looking at toponyms in general and the proposed naming system. The example of Seri estuary toponyms illustrates that all toponym use the generic term *xtaasi* 'estuary' and therefore the toponyms clearly denote the feature class.

This study described landscape characteristics of the landscape terms *inoohcö* 'bay', *iyat* 'point' and *iifa* 'peninsula' based on toponyms and their location. However, these findings should be compared to an ontological study to clearly provide an answer in how far generic terms are related to landscape in Seri toponymy.

6.4 Geographic characteristics of Seri campsite locations

This section reflects the methodology used to decide on most probable campsite locations. It further discusses the findings on the characteristics of Seri campsite locations and answers the fourth research question.

6.4.1 Deciding on most probable campsite locations

The approach used to decide on most probable campsite locations is based on participants' consensus on toponym locations. The previous discussed influence participants have on the data collection and therefore on the outcome of the analysis is reduced by not including all toponyms documented in the study.

Buffers were added to the campsite points since the campsites have a certain area. However, different buffers would be needed in order to represent the campsites properly. Some locations on widely open spots demand circular buffers, campsites located on the foot of a hill ask for a long, but thin buffer. By adding buffers to the campsite points, wrongly classified pixels could be added, too. Especially, since not much is known about the campsite areas and its forms. As a result, only the data points where the campsite was located during the study were taken into the analysis. Consequently, not the whole campsite area is covered but a subset of it. This reduces the error of commission. It is taken into account that the error of omission is quite high though. However, it is assumed that the whole campsite area has similar characteristics in terms of height, slope and aspect. Therefore, the error of omission should not limit the analysis.

6.4.2 Describing Seri campsite locations: height, slope and aspect

The advantages of traditional Seri campsite locations mentioned by the participants in the interviews are their proximity to natural resources. This could not be included in the analysis due to lack of data. Even though the INEGI provides a shapefile with intermittent and perennial bodies of water and flowing water, there are no data available on springs and *tinajas* in the Seri territory (Bahre 1980). Data on food resources are also missing. Therefore, it was decided to investigate other possible geographic characteristics which can be deduced from the digital elevation model. The study by Lake et al. (1998) investigated the visibility of Mesolithic sites and thereby tried to find characteristics describing these archaeological sites. Even though they could not show a significant difference between the sites and random points, the visibility could be explored for Seri campsite locations. However, it was not done in this project because the documented campsites are mostly located along the coast and therefore their visibility is expected to be similar. The characteristics chosen are based on an explorative approach. Height, slope and aspect are investigated to decide whether they could be of interest for traditional campsite locations or not. However, height, slope and aspect did not prove to be relevant criteria.

Heigth. The campsites are mostly located at a height below 10 m a.s.l. However, height cannot be seen as a campsite characteristic in this case but is rather based on the fact that most campsites recorded in the interviews are located along the coast and therefore only reach heights of about 10 m a.s.l. This is supported by the example of *Hast Xat*, a campsite further inland visited in a field survey, which is located at a height of 192 m a.s.l. Consequently, even though most campsites recorded in this project are at a height of below 10 m a.s.l. it is not a campsite characteristic. The data could suggest a different upper height boundary if more campsites were recorded in the mountainous areas.

Slope. Slope was expected to be a significant criterion in choosing campsite locations due to practical reasons. Even though most campsites have slopes below 5°, slopes up to 30.5° are reached. This could be based on the resolution of the digital elevation model. There are many sand dunes along the coast, which have been reported to be preferred campsite locations (Bowen 1976). Sand dunes have flat tops which are suitable for camping and steep sides. Therefore, it is not surprising that slopes of 30° were found examining the campsite locations in a digital elevation model of 30 m resolution.

Aspect. Aspect does not seem to be of any importance for traditional campsite locations. This finding has to be put in the context of the local geography. Most locations considered for this analysis are along the coast. This coast is a highly twisted and slightly wavy. Consequently, aspect is constantly changing. There are no larger areas having one specific aspect. However, aspect could be of interest when analysing campsite locations in the mountain area.

The idea of using multi criteria decision analysis (MCDA) to determine probable campsite areas in the Seri territory emerged at the beginning of this project. However, once the data were collected and it became apparent that most campsites recorded are located along the coast it was expected that the analysis would not lead to useful results. This assumption could be confirmed. Additionally, there are no references in the literature to assume that height, slope and aspect played a role in traditional Seri campsite locations. The characteristics were chosen based on logical assumptions, such as it is more comfortable to sleep in a flat area, to explore there relevance in Seri campsite locations. Consequently, the explorative approach showing that height, slope and aspect are of no relevance for the Seri campsite sample used in this analysis is not unexpected.

6.4.3 Summary on Seri campsite characteristics

The explorative research on Seri campsite characteristics leads to the following answer of the fourth research question.

RQ4) Are there specific characteristics of Seri campsite locations?

According to the informants asked in the semi-structured interviews traditional Seri campsite locations are chosen because of their proximity to water and food resources. The analysis of the characteristics height, slope and aspect showed no relevance for the campsite sample. This is not surprising since most campsite locations considered are located along the coastline. Further, looking at all campsite locations recorded during this study it seems that they are not clustered according to some characteristics but rather evenly distributed along the coastline.

There are several reasons why the campsites documented in this project are mainly located along the coast. First, the resources of the sea were a big contribution to the Seri diet (Bowen 1976; Marlett & Felger 2014). Consequently, it is reasonable that there are many campsites close to the sea. Second, history shows that the Seri were more and more displaced from their territory by the Mexicans and therefore concentrated on the coastal area as well as on Tiburon Island (Burckhalter 2000; Marlett & Felger 2014). Third, a few participants mentioned that they knew campsite locations further inland. However, they were not able to locate them on the map since it was easier to orientate in the coastal area.

It is less obvious why the locations are almost evenly distributed along the coast and do not show any pattern. Even though the coastal area is sandy in many parts, there are also rocky areas as for example in the southern part of Tiburon Island. This change in ground cannot be detected in the recorded campsite locations. Additionally, it is known that the tidal changes have an effect on the possibility to collect sea food in the shore area (Marlett & Felger 2014). The suitability of a coastal area to collect those natural resources depends on whether the coastal area is steep or flat. However, this does not seem to have an influence on Seri campsite locations.

6.5 Reciprocity

Reciprocity is a key aspect of field work. It emphasises the mutual and cooperative exchange between the researcher and the participants of a study (Brereton et al. 2014). However, there are no general rules on how reciprocity can be achieved since appropriate and sufficient returns depend on individuals' perceptions (Gouldner 1960). Despite the undefined comparison of giving and returning, not all researchers pay enough attention to reciprocity and studies are often more beneficial for the researcher than for the researched (Zinn 1979).

During field work, different forms of reciprocity were used to the author's best intentions and knowledge. The awareness of possible issues related to the different backgrounds and cultures and approaching people with respect and honest interest was the first step towards a sustainable relationship between the researcher and the community. Before starting the interviews, the

governor and a representative from the elder council were approached to present the research and to ask for permission.

Then, a mixture between monetary and non-monetary reciprocity was aimed for. Participants were paid a recompense for their time. Additionally, small presents such as chocolates were brought to the field to thank people for their participation and for small favours. Assessing from peoples' reactions and also from discussing with local informants, monetary payment is expected in the community due to previous experience with other researchers. However, small presents are gladly accepted and seem to have more personal value. This social interaction of showing appreciation is also practiced by the community. Before leaving the village of El Desemboque, I was honoured to receive a handmade basket and a shell necklace.

An additional form of reciprocity was to show interested individuals how to use a GPS and display the coordinates in Google Earth to get a basic map. Even though this form of reciprocity was thought to be a big contribution to the community in the preparation of field work, it turned out to be more informational than having reciprocity character. This could be due to the fact that different projects took place in this community where interested people learned how to use GPS devices. However, there are no GPS devices and only a few laptops available in the community itself. Consequently, the motivation to pursue GPS mapping is understandably small since I was not able to leave them any GPS devices either.

The last form of reciprocity is still due to be accomplished. The data recorded will be used to create a map of the Seri territory displaying the Seri toponyms documented in this project. This map will then be printed out and brought back to the Seri community in November 2017 by Prof. Dr. O'Meara. The map is a means to preserve traditional Seri knowledge. This form of reciprocity was asked for by many participants since valuable information on the Seri culture is constantly being lost. A still open question is how to leave the digital data with the community for them to manage. This was also discussed with several local informants. There is no structure in the community on how to preserve data which is further limited by the absence of computers. Consequently, it was decided to return the map to the community in a printed version to start with. Additionally, the data can be given to a few individuals in the Seri community for their personal hold.

7 Conclusion

The Seri and the Seri toponyms have shown to be an interesting and still unexplored research area. A lot of information on Seri toponyms was documented and analysed during this study. This chapter now presents the achievements and findings of this thesis. Finally, unresolved questions which need further in depth research will be addressed at the end.

7.1 Achievements

The accomplishments and contributions of this thesis are listed below.

- Five weeks of field work were done from the 16.01.17 – 20.02.17 in the two Seri villages El Desemboque and Punta Chueca, Sonora, Mexico.
- A methodological approach on how to collect indigenous toponyms was developed and implemented for the Seri case study. The methods include a semi-structured interview and field surveys. The critical discussion and reflection of the methodological approach, as well as the stated benefits and limitations, provide useful information for further toponym studies.
- An overview of the spatial distribution of a Seri campsite sample was given. This overview is an initial documentation of Seri campsites and their toponyms which can help to properly limit the research area or plan field work in further studies.
- The relation of participants' geographic knowledge and life history was explored.
- Toponym ambiguity was analysed for Seri campsite toponyms.
- A generic analysis of Seri campsite toponyms was completed. It investigated in how far generic terms are used in creating place names.
- A transparent naming system was detected which showed that generic terms are used to create toponym patterns.
- A detailed investigation of the toponyms having the generic landscape terms *inoohcö* 'bay', *iyat* 'its point' and *iifa* 'peninsula' was completed in order to identify whether those generic terms denote landscape features.
- The research done on Seri toponyms is a contribution to the ethnophysiographic research area since toponyms constitute one of the seven ethnophysiographic dimensions.
- A basic analysis covering three geographic characteristics was done in order to explore their importance for Seri campsite locations.
- Due to this thesis the Seri community will be provided with a map of their territory showing toponyms of their former campsite locations.

7.2 Findings

This project investigated two methodological approaches on how to document indigenous toponyms in the Seri case study. It turned out that semi-structured interviews and the satellite images of Google Earth provide a useful framework for collecting toponym data. Field surveys are a good way to complement the data and to get to know the local context. They further give an additional information source which can be used for data comparison to confirm information on data accuracy. However, considerably more toponyms and locations can be collected in interviews than in field surveys. It was also shown that traditional knowledge is highly individual. Therefore, it is crucial to identify the characteristics which influence participants' knowledge in order to select and address mainly those participants with the most valuable expected contributions for the given study.

The influence of local concepts and their implications on data representation and analysis was shown. To understand the local perception of spatial information is essential in conducting research and drawing conclusions from the results.

The findings on generic terms in campsite toponyms confirm that toponyms have referential potential and that generic terms can denote landscape features. More than 60% of the Seri campsite toponyms contain at least one generic term. Those generic terms are related to material components, landscape terms, animals or plant names. Consequently, the generic terms in campsite toponyms refer specifically to the natural environment.

This project further detected a naming pattern based on generic terms. The transparent naming system emphasises the denotation character of generic terms in toponyms. It was confirmed that all estuary names have the generic term *xtaasi* 'estuary' and therefore clearly possess referential character. The naming pattern was shown to apply also for *hant iipzx* 'arroyo', *icaheme* 'campsite', *zaaj* 'cave', *iyat* 'its point' *xtaasi* 'estuary', *hast* 'hill' and *hax* 'water resource'.

Information gained in the interviews revealed that campsite locations were chosen according to their proximity to water and food resources. An analysis on height, slope and aspect showed no relevance for the Seri campsite locations.

7.3 Future work

Future work should address Seri landscape and campsite conceptualisations to properly understand and represent the conceptualisations of those features. Moreover, this first attempt of drawing a Seri map showing their previous campsite locations with the corresponding toponyms should be made available to the Seri community in order to continually adjust, complete and discuss the present map. Already in November 2017 there will start a follow-up to develop and complete this map. An effort

should be made in collecting more Seri toponyms and their locations to complete the map and to have more data available to investigate the proposed naming pattern and the relations of generic terms to landscape.

Future work should also address the geographic characteristics of Seri campsite locations in order to build a prediction model of campsite locations. Therefore, a documentation of water and food resources of the Seri territory is needed to investigate the relation of Seri campsite locations to natural resources. Other characteristics should also be explored. By finding a model with which to predict, at least to a certain extent, other possible campsite locations an important foundation would be lied for further linguistic and geographic research. Having maps at hand with possible locations could accelerate community workshops by matching known toponyms to identified locations. It could also give a basic verification tool facilitating the comparison of the data acquired in field work with data predicted by the model. Thus, by achieving a model with which to predict campsite locations a time and cost intensive process of field work and community mapping could be accelerated and validated. This would not only be useful for the Seri case but could be applied to other toponym studies around the world. By adjusting and changing the defined characteristics the model could be adapted to any case study.

The explored approach on collecting toponym data using Google Earth seems to be promising. The participants responded well to the satellite images and the interactivity of Google Earth. However, the appropriateness of this new approach needs to be verified in other contexts. Nevertheless, this study suggests that research on the use of Google Earth in toponym and community mapping studies could bear fruits in the future.

References

Aggens, L. (1983). Identifying different levels of public interest in participation. Public Involvement and Dispute Resolution, 1. *IWR Research Rep*, 82-R1.

Albin, V. (2003). What's in a name: Juliet's question revisited. Translation Journal 7(4). Retrieved November 03, 2016, from http://translationjournal.net/journal/26names.htm.

Alford, R. D. (1988). Naming and identity: A cross-cultural study of personal naming practices. HRA Flex Books.

Algeo, J. (1973). On defining the proper name. University of Florida Press.

Amitay, E., Har'El, N., Sivan, R., & Soffer, A. (2004). Web-a-where: geotagging web content. In *Proceedings of the 27th annual international ACM SIGIR conference on Research and development in information retrieval*, 273-280. ACM.

Aporta, C. (2003). New ways of mapping: Using GPS mapping software to plot place names and trails in Igloolik (Nunavut). *Arctic*, 321-327.

Aporta, C. (2009). The trail as home: Inuit and their pan-Arctic network of routes. *Human Ecology*, *37*(2), 131-146.

Bahre, C. J. (1980). Historic Seri residence, range, and sociopolitical structure. The Kiva, 197-209.

Bailey, K. (2008). *Methods of social research*. 4th ed., The Free Press, New York.

Barnhardt, R. (2005). Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology & education quarterly*, *36*(1), 8-23.

Barriball, K. L., & While, A. (1994). Collecting Data using a semi-structured interview: a discussion paper. *Journal of advanced nursing*, *19*(2), 328-335.

Bassett, T. J. (1994). Cartography and empire building in nineteenth-century West Africa. *Geographical Review*, 316-335.

Basso, K. H. (1996). Wisdom sits in places: Landscape and language among the Western Apache. UNM Press.

Basurto, X. (2006). Commercial diving and the Callo de Hacha fishery in Seri territory. Journal of the Southwest, 189-209.

Beierle, T. C. (1999). Using social goals to evaluate public participation in environmental decisions. Review of Policy Research, 16(3-4), 75-103.

Berkenkotter, C., & Huckin, T. N. (2016). *Genre knowledge in disciplinary communication: Cognition/culture/power*. Routledge.

Biggs, T. W., Thenkabail, P. S., Gumma, M. K., Scott, C. A., Parthasaradhi, G. R., & Turral, H. N. (2006). Irrigated area mapping in heterogeneous landscapes with MODIS time series, ground truth and census data, Krishna Basin, India. *International Journal of Remote Sensing*, *27*(19), 4245-4266.

Bowen, T. G. (1976). Seri prehistory: The archaeology of the central coast of Sonora, Mexico (No. 27). Univ of Arizona Pr.

Bowen, T. (1983). Seri. In Handbook of North American Indians, 10, 230-249. Southwest.

Bowen, T., Felger, R. S., & Hills, R. J. (2004). Chollas, circles and Seris: Did Seri Indians plant cactus at Circle 6. *Desert Plants*.

Brereton, M., Roe, P., Schroeter, R., & Lee Hong, A. (2014). Beyond ethnography: engagement and reciprocity as foundations for design research out here. In *Proceedings of the 32nd annual ACM conference on Human factors in computing systems*, 1183-1186. ACM.

Britten, N. (1995). Qualitative research: qualitative interviews in medical research. *Bmj*, *311*(6999), 251-253.

Brody, J. L., Cluck, J. P., & Aragon, A. S. (1997). Participants' understanding of the process of psychological research: informed consent. *Ethics & Behavior*, *7*(4), 285-298.

Burckhalter, D. (2000). The Seri Indians Today. Journal of the Southwest, 384-402.

Burenhult, N. (2009). Landscape terms and toponyms in Jahai: a field report. *Working Papers in Linguistics*, *51*, 17-29.

Burenhult, N., & Levinson, S. C. (2008). Language and landscape: a cross-linguistic perspective. Language Sciences, 30(2), 135-150.

Byrnes, G. (2001). Boundary markers: Land surveying and the colonisation of New Zealand. Bridget Williams Books.

Cablitz, G. H. (2008). When “what” is “where”: A linguistic analysis of landscape terms, place names and body part terms in Marquesan (Oceanic, French Polynesia). *Language Sciences*, *30*(2), 200-226.

Campbell, J. C. (1991). Stream generic terms as indicators of historical settlement patterns. *Names*, *39*(4), 333-366.

Carmichael, D. L., Hubert, J., Reeves, B., & Schanche, A. (2013). *Sacred sites, sacred places* (Vol. 23). Routledge.

Cassell, J. (1980). Ethical principles for conducting fieldwork. *American anthropologist*, *82*(1), 28-41.

Chambers, R. (2006). Participatory mapping and geographic information systems: whose map? Who is empowered and who disempowered? Who gains and who loses?. *The Electronic Journal of Information Systems in Developing Countries*, *25*.

Cheng, G., Wang, F., Lv, H., & Zhang, Y. (2011). A new matching algorithm for chinese place names. In *Geoinformatics, 2011 19th International Conference on*, 1-4. IEEE.

Choguill, M. B. G. (1996). A ladder of community participation for underdeveloped countries. Habitat international, 20(3), 431-444.

Coates, R. (2006). Properhood. Language, 356-382.

Coyne, I. T. (1997). Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries?. *Journal of advanced nursing*, *26*(3), 623-630.

Cohen, S. B., & Kliot, N. (1992). Place-names in Israel's ideological struggle over the administered territories. Annals of the Association of American Geographers, 82(4), 653-680.

Congalton, R. G., & Green, K. (2008). *Assessing the accuracy of remotely sensed data: principles and practices*. CRC press.

Connor, D. M. (1988). A new ladder of citizen participation. National Civic Review, 77(3), 249-257.

Denscombe, M. (2014). *The good research guide: for small-scale social research projects*. McGraw-Hill Education (UK).

Derungs, C., Wartmann, F., Purves, R. S., & Mark, D. M. (2013). The meanings of the generic parts of toponyms: use and limitations of gazetteers in studies of landscape terms. In International Conference on Spatial Information Theory, 261-278. Springer International Publishing.

Dickert, N., & Sugarman, J. (2005). Ethical goals of community consultation in research. *American journal of public health*, *95*(7), 1123-1127.

Diercks, W. (1988). Mental Maps. Linguistisch-geographische Konzepte. *Zeitschrift für Dialektologie und Linguistik*, 280-305.

Draucker, C. B., Martsolf, D. S., Ross, R., & Rusk, T. B. (2007). Theoretical sampling and category development in grounded theory. *Qualitative health research*, *17*(8), 1137-1148.

Egenhofer, M. J., & Mark, D. M. (1995). Naive geography. In *International Conference on Spatial Information Theory*, 1-15. Springer Berlin Heidelberg.

Ellen, R. F., & Fukui, K. (1996). Redefining nature: ecology, culture, and domestication.

Faden, R. R., & Beauchamp, T. L. (1986). *A history and theory of informed consent*. Oxford University Press.

Feld, S. (1997). The Anthropology of Landscape: Perspectives on Place and Space. *Journal of the Royal Anthropological Institute*, *3*(3), 610-613.

Flory, J., & Emanuel, E. (2004). Interventions to improve research participants' understanding in informed consent for research: a systematic review. *Jama*, *292*(13), 1593-1601.

Fontana, A., & Frey, J. (1994). The art of science. *The handbook of qualitative research*, 361-376.

Fox, J. (2002). Siam mapped and mapping in Cambodia: boundaries, sovereignty, and indigenous conceptions of space. *Society &Natural Resources*, *15*(1), 65-78.

Geertz, C. (1973). The interpretation of cultures: Selected essays (Vol. 5019). Basic books.

Gibson, J. J. (2014). *The ecological approach to visual perception: classic edition*. Psychology Press.

Gluck, M. (1996). Geospatial information needs of the general public: Text, maps, and users' tasks. Geographic information systems and libraries: patrons, maps, and spatial information [papers presented at the 1995 Clinic on Library Applications of Data Processing, April 10-12, 1995].

Gould, P. R., & White, R. (1966). *On mental maps*. Department of Geography, University of Michigan.

Gouldner, A. W. (1960). The norm of reciprocity: A preliminary statement. *American sociological review*, 161-178.

Grounds, R. A. (2001). Tallahassee, Osceola, and the hermeneutics of American place-names. *Journal of the American Academy of Religion*, *69*(2), 287-322.

Gruber, T. R. (1993). A translation approach to portable ontology specifications. Knowledge acquisition, 5(2), 199-220.

Gruenewald, D. A., & Smith, G. A. (Eds.). (2014). Place-based education in the global age: Local diversity. Routledge.

Giaretta, P., & Guarino, N. (1995). Ontologies and knowledge bases towards a terminological clarification. Towards very large knowledge bases: knowledge building & knowledge sharing, 25, 32.

Hajdú, M. (2003). The History of Onomastics. *Onomastica Uralica*, *2*, 7-45.

Hanna, P., & Vanclay, F. (2013). Human rights, Indigenous peoples and the concept of Free, Prior and Informed Consent. *Impact Assessment and Project Appraisal*, *31*(2), 146-157.

Hećimović, Z., & Ciceli, T. (2013). Spatial intelligence and toponyms. In Proceedings of the 26th International Cartographic Conference, Dresden, Germany, 25-30.

Hedquist, S. L., Koyiyumptewa, S. B., Whiteley, P. M., Kuwanwisiwma, L. J., Hill, K. C., & Ferguson, T. J. (2014). Recording toponyms to document the endangered Hopi language. *American Anthropologist*, *116*(2), 324-331.

Hernandez, D. (1994). *Qualitative representation of spatial knowledge* (Vol. 804). Springer Science & Business Media.

Hills, J. (2000). Seri maps. Journal of the Southwest, 577-582.

Hine, C., & Hills, J. (2000). Seri concepts of place. Journal of the Southwest, 583-588.

Hockett, C. F. (1958). A course in modern linguistics. Language Learning, 8(3-4), 73-75.

Hollis, J., & Valentine, T. (2001). Proper-name processing: Are proper names pure referencing expressions?. Journal of Experimental Psychology: Learning, Memory, and Cognition, 27(1), 99.

Hunn, E. (1994). Place-names, population density, and the magic number 500. *Current Anthropology*, *35*(1), 81-85.

ICOS (n.d.). List of Key Onomastic Terms, 1-11. Retrieved October 27, 2016, from http://icosweb.net.

INSPIRE (2014). INSPIRE Data Specification on Geographical Names – Technical Guidelines 3.1, 1-98. Retrieved October 27, 2016, from http://inspire.ec.europa.eu.

Jakir, Ž., Hećimović, Ž., & Štefan, Z. (2011). Place Names Ontologies. In Advances in Cartography and GIScience. Volume 1, 331-348. Springer Berlin Heidelberg.

Jett, S. C. (1997). Place-naming, environment, and perception among the Canyon de Chelly Navajo of Arizona. *The Professional Geographer*, *49*(4), 481-493.

Johnson, J. T. (2012). Place-based learning and knowing: critical pedagogies grounded in Indigeneity. GeoJournal, 77(6), 829-836.

Jones, C. B., & Purves, R. S. (2008). Geographical information retrieval. International Journal of Geographical Information Science, 22(3), 219-228.

Jordan, P. (2009). Some considerations on the function of place names on maps. In Proceedings of the 24th international cartographic conference (ICC2009), Santiago, Chile, 15-21.

Kadmon, N. (2002). Glossary of Terms for the Standardization of Toponyms. United Nations Department of Economic and Social Affairs Statistical Division, United Nations Group of Experts on Toponyms, 1-261.

Kari, J. (2003) Dena'ina place names and territorial knowledge. *Shem Pete's Alaska: The Territory of the Upper Cook Inlet Dena'ina. University of Alaska, Fairbanks*.

Kelley, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care*, *15*(3), 261-266.

Kettiger, D. (2004). Gemeindefusion: ein Thema mit vielen Facetten. PuMaConsult.

Krueger, R. A., & Casey, M. A. (2014). *Focus groups: A practical guide for applied research*. Sage publications.

Laituri, M. (2002). Ensuring access to GIS for marginal societies. *Community participation and geographic information systems*, 270-282.

Lake, M. W., Woodman, P. E., & Mithen, S. J. (1998). Tailoring GIS software for archaeological applications: an example concerning viewshed analysis. *Journal of Archaeological Science*, *25*(1), 27-38.

Lasker, R. D., & Weiss, E. S. (2003). Broadening participation in community problem solving: a multidisciplinary model to support collaborative practice and research. Journal of Urban Health, 80(1), 14-47.

Leidner, J. L. (2007). Toponym resolution in text: annotation, evaluation and applications of spatial grounding. In ACM SIGIR Forum, 41(2), 124-126. ACM.

Leopold, A. S. (1950). Vegetation zones of Mexico. Ecology, 31(4), 507-518.

Levinson, S. C. (2008). Landscape, seascape and the ontology of places on Rossel Island, Papua New Guinea. *Language Sciences*, *30*(2), 256-290.

Lewis, M. P. (ed.), 2009. Ethnologue: Languages of the World, Sixteenth edition. Dallas, Tex.: SIL International. Retrieved October 12, 2016, from http://www.ethnologue.com.

Liebermann, S., & Coulson, J. (2004). Participatory mapping for crime prevention in South Africa-local solutions to local problems. *Environment and Urbanization*, *16*(2), 125-134.

Longhurst, R. (2003). Semi-structured interviews and focus groups. *Key methods in geography*, 117-132.

Malczewski, J. (2006). GIS-based multicriteria decision analysis: a survey of the literature. *International Journal of Geographical Information Science*, *20*(7), 703-726.

Mark, D. M., Smith, B., & Tversky, B. (1999). Ontology and geographic objects: An empirical study of cognitive categorization. In *International Conference on Spatial Information Theory* (pp. 283-298). Springer Berlin Heidelberg.

Mark, D. M., & Turk, A. G. (2003). Landscape categories in Yindjibarndi: Ontology, environment, and language. In International Conference on Spatial Information Theory (pp. 28-45). Springer Berlin Heidelberg.

Mark, D. M., Turk, A. G., & Stea, D. (2007). Progress on Yindjibarndi ethnophysiography. In International Conference on Spatial Information Theory, 1-19. Springer Berlin Heidelberg.

Mark, D. M., Turk, A. G., & Stea, D. (2010). Ethnophysiography of arid lands. Landscape ethnoecology: Concepts of biotic and physical space, 27.

Mark, D. M., Turk, A. G., Burenhult, N., & Stea, D. (Eds.). (2011). Landscape in language: An introduction. *Landscape in language: Transdisciplinary perspectives,* 4, 1-24.

Marlett, S. A. (2000). Why the Seri language is important and interesting. Journal of the Southwest, 611-633.

Marlett, S. A. (2007). Las relaciones entre las lenguas "hokanas" en México: ¿Cuál es la evidencia?. *Memorias del III Coloquio Internacional de Lingüística Mauricio Swadesh*, 165-192.

Marlett, S. A. (2011). The Seris and the Comcaac: Sifting fact from fiction about the names and relationships. Work Papers of the Summer Institute of Linguistics, University of North Dakota Session, 51, 1-20.

Marlett, C. M., & Felger, R. S. (2014). *Shells on a desert shore: mollusks in the Seri world*. Tucson: University of Arizona Press.

Marlett, S. A., & Moser, M. B. (2001). Presentación y análisis preliminar de 600 topónimos Seris.(documento no publicado) Ciliacán. *Sinaloa: ILV*.

Martínez-Tagüeña, N. (2015). And the Giants Keep Singing: Comcaac Anthropology of Meaningful Places (Dissertation, Faculty of the School of Anthropology, University of Arizona).

Mason, J. (2002). *Qualitative researching*. 2nd edition, Sage, London.

Maurel, D., Vitas, D., Krstev, C., & Koeva, S. (2007). Prolex: a lexical model for translation of proper names. Application to French, Serbian and Bulgarian. Bulag-Bulletin de Linguistique Appliquée et Générale, 55-72.

Meiring, B. A. (1993). The syntax and semantics of geographical names. *Hattingh et al Pretoria: Department of Geography: University of Pretoria*.

Memmott, P., Birdsall-Jones, C., & Greenop, K. (2012). *Why are special services needed to address Indigenous homelessness?*. University of Queensland.

Mill, J. S. (1843). A System of Logic: Ratiocinative and Inductive: Vol. I (Vol. 1). Library of Alexandria.

Molinari, F., & Ferro, E. (2009). Framing Web 2.0 in the process of public sector innovation: Going down the participation ladder. European Journal of ePractice, 9(1), 20-34.

Montello, D. R. (1995). How significant are cultural differences in spatial cognition?. In International Conference on Spatial Information Theory, 485-500. Springer Berlin Heidelberg.

Moseley, Ch. (ed.). (2010). Atlas of the World's Languages in Danger, 3rd edn. Paris, UNESCO Publishing.

Moser, E. (1963). Seri bands. The Kiva, 14-27.

Moser, M. B. (1970). Seri: from conception through infancy. *Kiva*, *35*(4), 201-210.

Moser, C. A., & Kalton, G. (1971). Survey methods in social investigation. *Survey methods in social investigation.* 2nd ed, Heinemann Educational Books Ltd., London.

Moser, M. B., & Marlett, S. A. (2008). Comcáac quih yaza quih hant ihíip hac: Dictionary Seri-Spanish-English. Primera edición (versión electrónica). Retrieved August 16, 2016, from www.sil.org/mexico/seri/G004-Diccionario-sei.htm.

Narayan-Parker, D. (1993). *Participatory evaluation: Tools for managing change in water and sanitation* (Vol. 207). World Bank Publications.

Nash, C. (1999). Irish Placenames: Post-Colonial Locations. Transactions of the Institute of British Geographers, 24(4), 457-480.

Nietschmann, B. (1995). Defending the Miskito Reefs with maps and GPS. Cultural Survival Quarterly, 18(4), 34-37.

Noor, K. B. M. (2008). Case study: A strategic research methodology. *American journal of applied sciences*, *5*(11), 1602-1604.

O'Connor, L., & Kroefges, P. C. (2008). The land remembers: landscape terms and place names in Lowland Chontal of Oaxaca, Mexico. Language Sciences, 30(2), 291-315.

Olson, R., Hackett, J., & DeRoy, S. (2016). Mapping the Digital Terrain: Towards Indigenous Geographic Information and Spatial Data Quality Indicators for Indigenous Knowledge and Traditional Land-Use Data Collection. *The Cartographic Journal*, 1-8.

O'Meara, C. (2010). Seri landscape classification and spatial reference. Doctoral dissertation, Faculty of the Graduate School of the University at Buffalo, State University of New York.

O'Meara, C. (2014). Lugares, estrellas y vientos: descripciones de rutas y narraciones del paisaje en seri. Universidad Nacional Autónoma de Mexcio, 247-270.

O'Meara, C., & Bohnemeyer, J. (2008). Complex landscape terms in Seri. Language Sciences, 30(2), 316-339.

Papadias, D., & Sellis, T. (1994). Qualitative representation of spatial knowledge in two-dimensional space. *The VLDB Journal*, *3*(4), 479-516.

Parker, B. (2006). Constructing Community Through Maps? Power and Praxis in Community Mapping. The professional Geographer, 58(4), 470-484.

Pearce, M., & Louis, R. (2008). Mapping indigenous depth of place. American Indian Culture and Research Journal, 32(3), 107-126.

Perkins, C. (2013). Community mapping. The Cartographic Journal.

Pocock, D. C. D. (1976). Some characteristics of mental maps: an empirical study. Transactions of the Institute of British Geographers, 493-512.

Qian, S., Kang, M., & Weng, M. (2016). Toponym mapping: a case for distribution of ethnic groups and landscape features in Guangdong, China. *Journal of Maps*, 1-5.

Rabionet, S. E. (2011). How I learned to design and conduct semi-structured interviews: An ongoing and continuous journey. *The Qualitative Report*, *16*(2), 563.

Radding, L., & Western, J. (2010). What's in a name? Linguistics, geography, and toponyms. *Geographical Review*, *100*(3), 394-412.

Riggs, E. M. (2005). Field-based education and indigenous knowledge: Essential components of geoscience education for Native American communities. *Science Education*, *89*(2), 296-313.

Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology*, *11*(1), 25-41.

Romano, J. P., & Siegel, A. F. (1986). Counterexamples in probability and statistics. CRC Press.

Rosenthal, J., Bannister, K., Berlin, B., Berlin, E., Brush, S., Field, L. & Simonelli, J. (2006). Politics, culture, and governance in the development of prior informed consent in indigenous communities. *Current Anthropology*, *47*(1), 119-142.

Rose-Redwood, R., Alderman, D., & Azaryahu, M. (2010). Geographies of toponymic inscription: new directions in critical place-name studies. *Progress in Human Geography*, *34*(4), 453-470.

Rose-Redwood, R., & Alderman, D. (2011). Critical interventions in political toponymy. *ACME: An International E-Journal for Critical Geographies*, *10*(1), 1-6.

Ryen, A. (2003). Cross-cultural interviewing. *Inside interviewing: New lenses, new concerns*, 429-448.

Sauer, C. O. (1934). The Distribution of Aboriginal Tribes and Languages in Northwestern Mexico: By Carl Sauer (Vol. 5). Berkeley: University of California Press.

Schindler, S. M. (1981). The material culture and technoeconomic system of the Seri Indians: an experimental reconstruction. Southern Illinois University at Carbondale.

Schlossberg, M., & Shuford, E. (2005). Delineating "public" and "participation" in PPGIS.

Schwandt, T. A. (2014). *The Sage dictionary of qualitative inquiry*. Sage Publications.

Sheridan, T. (1977). The impact of the spanish empire on the seri indians of northwestern New Spain. A working paper, the University of Arizona, Tucson, AZ. USA.

Sheridan, T. (1999) Empire of Sand. The Seri Indians and the Struggle for Spanish Sonora, 1645-1803, the University of Arizona Press, Tucson, Az, USA.

Sieber, R., & Wellen, C. (2011). The role of geospatial technologies for integrating landscape in language. *Landscape in Language: Transdisciplinary Perspectives*, 4, 381-393.

Sinha, C., & De López, K. J. (2000). Language, culture, and the embodiment of spatial cognition. *Cognitive linguistics*, *11*(1-2), 17-42.

Sinha, G., & Mark, D. (2010). Toward a foundational ontology of the landscape. Extended Abstracts of GIScience, 2010.

Sitzia, J., & Wood, N. (1998). Response rate in patient satisfaction research: an analysis of 210 published studies. *International Journal for Quality in Health Care*, *10*(4), 311-317.

Smith, B., & Mark, D. M. (2003). Do mountains exist? Towards an ontology of landforms. Environment and Planning B: Planning and Design, 30(3), 411-427.

Smith, J. A., & Osborn, M. (2015). Interpretative phenomenological analysis as a useful methodology for research on the lived experience of pain. *British journal of pain*, *9*(1), 41-42.

Stocké, V., (2014). Persönlich-mündliche Befragung. In: Baur, N., & Blasius, J. *Handbuch Methoden der empirischen Sozialforschung*. Springer VS.

Strauss, A. L. (1987). *Qualitative analysis for social scientists*. Cambridge University Press.

Strawson, P. F. (1950). On referring. Mind, 59(235), 320-344.

Strübing, J. (2014). Grounded Theory und Theoretical Sampling. In *Handbuch Methoden der empirischen Sozialforschung*, 457-472. Springer Fachmedien Wiesbaden.

Swiggers, P. (1982). La Nature du nom propre: Un point de vue guillaumien. Onoma, 26(1-3), 45-47.

Talmy, L. (1983). How language structures space. In *Spatial orientation* (pp. 225-282). Springer US.

Tentand, J., & Blair, D. (2011). Motivations for naming: The development of a toponymic typology for Australian placenames. Names, 59(2), 67-89.

Tent, J. (2015). Approaches to research in toponymy. *Names*, *63*(2), 65-74.

Tent, J. (2016). Antecedent Generics: How Capes, Lakes, Mounts, and Points Are Named in the Antipodes. *Names*, *64*(3), 148-157.

Tent, J., & Slatyer, H. (2009). Naming places on the 'Southland': European place-naming practices from 1606 to 1803. *Australian Historical Studies*, *40*(1), 5-31.

Tichelaar, T. (2002). Toponymy and language. *Training course on toponymy: Enschede, Frankfurt am Main, August 12-23.* DGSD-UNGEGN.

Tilley, C. (1994). *A phenomenology of landscape: places, paths, and monuments*. Oxford: Berg.

Tobias, T. N. (2000). Chief Kerry's moose: a guidebook to land use and occupancy mapping, research design, and data collection.

Turnbull, D. (2003). Masons, tricksters and cartographers: Comparative studies in the sociology of scientific and indigenous knowledge. Taylor & Francis.

UNESCO (2016). Islands and Protected Areas of the Gulf of California. Retrieved November 25, 2016, from http://whc.unesco.org/en/list/1182.

United Nations (n.d.). Functions and powers of the General Assembly. Retrieved November 13, 2016, from http://www.un.org/en/ga/about/background.shtml.

United Nations General Assembly (2008). United Nations Declaration on the Rights of Indigenous Peoples. 1-44.

Vuolteenaho, J., & Berg, L. D. (2009). Towards critical toponymies.

Wang, B., & Situ, S. J. (2007). Analysis of spatial characteristics of place names landscape based on GIS technology in Guangdong Province [J]. *Geographical Research*, *2*, 003.

Wiedemann, P. M., & Femers, S. (1993). Public participation in waste management decision making: Analysis and management of conflicts. Journal of Hazardous Materials, 33(3), 355-368.

Williams, D. R., & Stewart, S. I. (1998). Sense of place: An elusive concept that is finding a home in ecosystem management. *Journal of forestry*, *96*(5), 18-23.

Worboys, M. F., & Duckham, M. (2004). GIS: a computing perspective. CRC press.

Zabeeh, F. (2012). What is in a name?: An inquiry into the semantics and pragmatics of proper names. Springer.

Zelinsky, W. (1955). Some problems in the distribution of generic terms in the place-names of the Northeastern United States. Annals of the Association of American Geographers, 45(4), 319-349.

Zinn, M. B. (1979). Field research in minority communities: Ethical, methodological and political observations by an insider. *Social Problems*, *27*(2), 209-219.

Appendix

Appendix A – Informed consent

CONSENTIMIENTO PARA PARTICIPAR EN LA INVESTIGACIÓN DE LOS TOPÓNIMOS SERIS

SI TIENE PREGUNTAS RESPECTO DE ESTA INVESTIGACION, CONTACTE a

- Martina Henzi, Instituto de Geografía de la Universidad de Zurich, Winterthurerstrasse 190, 8057 Zürich, Suiza, correo electrónico: martina.henzi@geo.uzh.ch

- Dra. Carolyn O'Meara, Seminario de Lenguas Indígenas, Instituto de Investigaciones Filológicas, Universidad Nacional Autónoma de México, Circuito Mario de la Cueva, Ciudad Universitaria, 04510, México, D.F., Tel. Seminario: (55)-5622-7489, correo electrónico: ckomeara@unam.mx.

Este folleto de información explica las condiciones de esta investigación. Por favor léalo detenidamente. Puede preguntar sobre lo que no entienda. Si no tiene preguntas ahora, puede preguntar después.

PROPOSITO: Usted está invitado a participar en una investigación sobre los topónimos (nombres propios de un lugar) seris. El propósito de este estudio es aprender y localizar los nombres que tiene el área para ubicarlos en un mapa.

PROCEDIMIENTO: Es posible que le solicitaré que participe en las siguientes tareas:

- entrevista sobre los topónimos del area seri que será grabado en audio
- ayudando en la transcripción de grabaciones en audio
- posiblemente en sesiones posteriores
- posiblemente en estudios del campo

DURACION: Le solicitaré que participe en una entrevista. La entrevista tomará no más que dos horas.

RIESGOS Y BENEFICIOS: No existen riesgos asociados con su participación en este estudio. Con su contribución al conocimiento científico de sus topónimos puede ayudar al desarrollo de materiales cartográficas, contribuir a la documentación de su idioma y su región.

CONFIDENCIALIDAD: Su privacidad será mantenida en todos los datos escritos y publicados en relación con este estudio menos que usted desea lo opuesto. En ciertas ocasiones, sus discursos serán grabados en audio y es posible que sean citados en publicaciones científicas, sin embargo me aseguraré de que estas citas aparezcan de tal forma de no revelar su identidad aunque usted lo desea.

PAGO: Usted recibirá 50 pesos por cada hora de su participación.

COLABORACION CON ESTE ESTUDIO: Su participación es voluntaria. Usted tiene el derecho a negarse a responder cualquier pregunta en particular. Eso no afectará su pago. Si

quiere tomar un descanso o dejar de participar en cualquier momento, no afectará su pago en el estudio.

1. Puede ser que queramos presentar sus datos en un congreso o seminario académico o en un salón educacional. ¿Será esto permisible en cuanto a grabaciones de audio; notas escritas? ¿Sí o no?
   En el caso que sí, ¿Quiere que mencionamos su nombre públicamente por esa razón? ¿Sí o no?

2. Puede ser que queramos usar sus datos para crear materiales pedagógicos. ¿Será esto permisible en cuanto a grabaciones de audio; notas escritas? ¿Sí o no?

3. Puede ser que queramos usar sus datos en publicaciones académicas. ¿Será esto permisible en cuanto a grabaciones de audio; notas escritas? ¿Sí o no?

Declaración de consentimiento: Me han informado del propósito de este estudio, de sus procedimientos, posibles beneficios y riesgos, y he recibido una copia de este formulario. Me han dado la oportunidad de preguntar cualquier duda antes de consentir, y me han dicho que puedo preguntar por cualquiera otra duda an cualquier momento. Voluntariamente estoy de acuerdo en participar en este estudio.

_____
Nombre en letra de molde del participante

_____ _____
Firma del participante Fecha

_____ _____
Firma de la investigadora Fecha

Appendix B – Demographic questionnaire

Cuestionario demográfico para los participantes del estudio sobre topónimos seris

1. ¿Cuál es su nombre completo? _____

2. ¿Cuál es su sexo?

□ Masculino

□ Femenino

3. ¿Cuántos años tiene? _____

4. ¿Cuántos años/ grados/ semestres de educación ha cumplido?

_____ grados / años en la primaria

_____ grados / años en la secundaria

_____ semestres en el bachillerato/ la preparatorio

_____ semestres en la universidad

Si estudió, díganos qué estudió y en qué año:

Carrera _____

Años (por ejemplo 1984-1989) _____

5. ¿Cuánto tiempo tiene viviendo en el territorio Seri?

_____

6. ¿En cuál área pasó su infancia?

_____

7. ¿De cuál área (*ihíizitim*) son su padre y madre?

padre: _____

madre: _____

8. ¿Cuál idioma habla usted en su hogar?

□ Seri (*Cmiique Iitom*)
□ Español
□ Otra: _____

9. ¿Sabe usted hablar y escribir las siguientes idiomas?

Seri (*Cmiique Iitom*)

□ Hablo muy bien	□ Escribo muy bien
□ Hablo bien	□ Escribo bien
□ Hablo un poco	□ Escribo un poco
□ No lo hablo	□ No lo escribo

Español

□ Hablo muy bien	□ Escribo muy bien
□ Hablo bien	□ Escribo bien
□ Hablo un poco	□ Escribo un poco
□ No lo hablo	□ No lo escribo

10. ¿ Ha visto alguna vez las mapas oficiales de México producido por el Instituto Nacional de Estadística y Geografía de México (INEGI) o cualquier otro tipo de mapa?

□ Sí
□ No

Si ha usado mapas, díganos con qué frecuencia las usa:

□ casi diario	□ sólo de vez en cuando	□ casi nunca
□ bastante	□ muy poco	

Appendix C – Semi-structured interview

Entrevista semi-estructurada sobre topónimos seris

Entrevista núm. _____

Nombre del participante _____

Fecha _____

Lugar _____

Duración _____

Topónimos en general

- Usted dijo que nació/ no nació en el territorio seri.
    - Me puede decir dónde nació exactamente?
- Dónde ha vivido?
- Me puede describir un día común en su vida (o un día común cuando era más joven)?
    - Cuál es/ fue su ocupación?
    - Esta dentro del pueblo?
    - Si sale del pueblo: Me puede describir el sitio? Como se llama?
- En cuales ocasiones sale/ salió usted del pueblo El Desemboque?
    - Y para dónde va?
    - Cuál es el nombre?
    - Que hace en este lugar?
    - Me puede describir el sitio?
    - Con cuál frecuencia visita ese lugar?
    - Cuando visita ese lugar (estación, mes)?
    - Me puede decir por qué se llama así?
- Me puede describir la ruta para llegar allí? Cómo se orienta? Por cuales 'nombres' pasan? Cuanto tiempo necesita para llegar alli (desde dónde)?

Topónimos de campamentos

- Me puede decir los nombres de los campamentos que usted conoce?
- En cuales campamentos ha usted (o su familia) dormido?
    - Nombre? Lugar en el mapa?
    - Que hicieron en este lugar?
    - Me puede describir el lugar?
    - Me puede decir por qué se llama así?
    - Cuales son las ventajas de ese campamento? Por qué es bueno?

Quiero mostrarle el mapa oficial de INEGI y el mapa de Google Earth.

- Como le parece estos dos mapas? Cual prefiere?

Información adicional

Quiere añadir algo a nuestra conversación? Un lugar que recuerda de cual aún no hemos hablado o otra información que piensa es importante saber para hacer un mapa del territorio seri (nombre de una montaña, una tinaja o algo diferente).

- Que sería importante para usted en un mapa seri? Cómo sería un mapa seri?
- Son algunos de los lugares que me ha mostrado secretos y no quiere que los anote en el mapa?
- Como fue para usted trabajar con el mapa de Google Earth/ INEGI?
- Ha usted trabajado con un GPS? Sabe usarlo? Esta interesado en aprenderlo?

Appendix D – Classification of generic terms

Material

Seri generic term	English translation (Moser & Marlett 2008)
Casiime	Clay with calcite and iron
Hacoocj	Certain gray-green clay
Hant	Ground, land
Hanteezj	Clay, mud
Hast	Rock, stone
Hax	Water
Iix	Water
Xepe	Sea water
Xpaahjö	Hematite

Landscape

Seri generic term	English translation (Moser & Marlett 2008)
Caail	Dry lake, playa
Hant iipzx	Arroyo
Ihiyax	Point, tip, edge
Iifa	Peninsula
Inoohcö	Bay
Itaaij	Shoreline
Iyat	Point (of place or thing, or on the coast)
Xatj	Reef
Xtaasi	Estuary
Yaayam	Low hill
Zaaj	Cave

Plants

Seri generic term	English translation (Moser & Marlett 2008)
Comitin	Desert ironwood [Olneya tesota]
Haaca	White crucillo, lotebush [Ziziphus obtusifolia]
Haas	Western honey mesquite [Prosopis glandulosa var. torreyana]
Hahjö	Desert wolfberry, boxthorn [Lycium spp.]
Hesen	Desert ironwood (in ist dry state) [Olneya tesota]
Mojepe	Sahuaro [Carnegiea gigantea]
Pajoocsim	Saltwort [Batis maritima]
Pnaacoj	Mangrove [Laguncularia, Avicennia, Rhizophora]
Sea	Teddybear cholla [Cylindropuntia bivelovii]
Seepol	A common small coastal shrub [Frankenia palmeri]
Tacs	Iodine bush [Allenrolfea occidentalis]
Xat	A tiny cool-season annual in the stonecrop family [Crassula connata]
Xoop	Elephant tree [Bursera microphylla]
Xpanaams	Eeaweed, marine alga
Yamaasa	lichen, soil algae, moss
Ziipxöl	Foothill palo verde [Cercidium microphyllum]

Animals

Seri generic term	English translation (Moser & Marlett 2008)
Caasquim	Flounder [Paralichthys aestuarius]
Caay	Horse
Camatni	Cortez electric ray [Narcine entemedor]
Comcaii inoosj	Large nerite [Nerita scabricosta]
Copni	Carpenter bee [Xylocopa spp.]
Haan	Smooth Pacific venus clam [Chione fluctifraga]
Haxöl	Multicolored clam [Protothaca grata]
Haxt	Large oyster [Crassostrea corteziensis]
Haxz	Dog [Canis familiaris]
Heepni	Spiny-tailed iguana [Ctenosaura spp.]
Honc	Sea gull [Larus spp.]
Mojet	Bighorn sheep [Ovis canadensis]
Moosni	Black sea turtle [Chelonia mydas]
Naapxa	Turkey vulture [Cathartes aura]
Nop	Bobcat [Lynx rufus]
Sleecoj	Heron
Stacj	Rock oyster [Saccostrea palmula]
Taca	Finescale triggerfish [Balistes polylepis]
Xapoo	California sea lion [Zalophus californicus]
Zamt	Swimming crab, Pacific blue crab [Callinectes bellicosus]
Ziic	Bird
Zixcam	Fish

Personal declaration

I hereby declare that the submitted thesis is the result of my own, independent work. All external sources are explicitly acknowledged in the thesis.

_____ _____

Martina Henzi