Exploring Landscape through Place Names: an Interdisciplinary Approach

Dissertation
zur
Erlangung der naturwissenschaftlichen Doktorwürde
(Dr. sc. nat)
Mathematisch-naturwissenschaftlichen Fakultät
der
Universität Zürich

von

Julia Villette

aus

Frankreich

Promotionkommission
Prof. Dr. Ross Stuart Purves (Vorsitz)
Prof. Dr. Elvira Glaser
Prof. Dr. Andreas Vieli

Zurich 2021

Faculty of Science
University of Zurich

Exploring Landscape through Place Names: an Interdisciplinary Approach

Julia Villette
Geocomputation Unit
Department of Geography
University of Zurich
Winterthurerstrasse 190
CH-8057 Zurich
Switzerland

ACKNOWLEDGMENTS

I would like to express my gratitude to my supervisor Ross Purves who believed in my ability to accomplish and achieve this work. Thanks to his patience and encouragement throughout the previous four years. I would like to thank him for helping me during this journey and for his constant availability. Thanks also to the enriching exchanges, his open mindedness, flexibility and the recognition given to my social sciences background. I would like to thank my PhD committee members Prof. Dr. Elvira Glaser and Prof. Dr. Andreas Vieli. Thank you also to Linda Steiner and Stefan Wuerth for the linguistic help with the St. Gallen dataset. I would also like to thank Niclas Burenhult for sharing his Jahai data with me.

I am grateful to the members of the Geocomputation Group, for providing good fun in coffee breaks, group meetings and group excursions. It was a pleasure to share time with all of you. Thanks on a broader scale to the J-floor members, and the GIS group, who helped make lunch and breaks entertaining. I would like to express my special thanks to my office mates, Peter and Manu, for helping me in many office tasks and in understanding the administrative procedures of the university. I would also like to thank them for the nice chats and the beers shared.

A special thanks to Olga, Michelle and Raha who provided me with a home in Switzerland. Thanks for sharing sports, evenings, your sofa or just coffees. Additional thanks to Olga for supporting me in Python learning, helping me with my error codes and providing me with answers when it became too difficult for me.

Finally, I would like to thank my family who supported me along this journey particularly considering the distance involved. Thanks to Max, Thao and Lino for being the structure of my life and obliging me to balance my time … Thanks to Cathy and Sue for helping me to improve my English to make this final product possible. Finally, I am grateful to Brien Meilleur, without him I would never have started this project!

Zurich, January 2021

SUMMARY

Exploring landscape through language is of great interest since it allows the relationship that people have with their surroundings to be explored. However, landscape is a complex concept containing multiple aspects (visual, sensitive and conceptual) implying various ways to explore it through diverse disciplines (linguistic, geography, arts, etc.). It is more than just the physical aspect of the land, it is also how people perceive it. Societies used to live in a landscape and split its elements into parts to communicate about it. However, each society perceived and therefore split its landscape in its particular way, making international communications about landscape challenging. The aim of this thesis was to use the language, and more specifically place names, to investigate landscape terms and landscape conceptualizations.

Place names seem to be a universal language feature deeply linked to landscape since they are located in space. They are the name of a geographical feature. From a linguistic perspective they can take on many morphological structures. They can be monomorphemic, compounds or even sentences. Generally speaking, they are meaningful for the society which attributed the name. Therefore, using the location and potential meaning of place names, this thesis aimed to investigate the landscape through place names. To this end, three objectives were met.

First, using microtoponyms (names of unpopulated places) of the Canton of St. Gallen (Switzerland), we showed that place names contain relevant semantic information for the exploration of landscape concepts. Using a linguistic lexicon, meaningful elements were extracted from those specific place names associated with non-populated places (microtoponyms). Related to this specific type of place, our investigation highlighted that, in general, meaningful terms were used, and those terms were deeply linked to the description of the physical properties of the landscape. This result implies that exploring the semantics of place names from a bottom-up process enables the linguistic process of the act of naming to be revealed (descriptive in this case study). It allows terms used to be examined, thus providing information about which features were salient enough to be used as a name for a microtoponym. Their frequency revealed their importance in the local landscape, that is to say how often they are named in space.

Second, using four of the most common landscape terms of the canton of St. Gallen, the relationship between the semantic information of place names and the geographical aspects, derived from spatial data and using their location, was explored. The terms *Wald* & *Holz* and

Riet & *Moos* were investigated for their synonymy in order to evaluate the potential of place names to define landscape terms. It was demonstrated that combining the linguistic information of place names containing those specific terms, their physical properties (such as elevation or topographical wetness index) and their spatial distribution provide valuable information in the understanding of these landscape terms. It was thus possible to associate *Wald* and *Holz* to wooded areas and to see that *Wald* was related more to large, steep and high places, while *Holz* was related more to small and flat places close to settlements at the bottom of valleys. Both were associated with wooded areas. Nevertheless, the landcover data indicated coniferous forest linked to *Wald* and broadleaf forest to *Holz*. Regarding *Riet* and *Moos*, both terms were associated with relatively wet places such as their semantics suggested. However, it seems that the distinction in the use of one term rather than the other is dependent more on their location in Switzerland, with the frequency of *Moos* and *Ried* (as a linguistic form of *Riet*) being greater in the west of the German-speaking part of Switzerland, whereas *Riet* occurs more often in the eastern part. These results suggest that linking the name to the location allows investigation of the semantics of landscape terms in relation to meanings and usages and also helps understand how and where each term is used. That opens up the possibility of comparing the meaning associated with such concepts across borders and languages.

Third, this thesis considered the act of naming within landscape research using GIS and Jahai place names (indigenous community, Malaysia). By working directly with field linguists, and taking an interdisciplinary approach, we aimed to avoid previous critiques of the use of GIS in such studies. Our investigation of Jahai place names with GIS revealed notable facts valuable for further cultural investigations highlighting a relationship between place names, catchment areas and mythical entities. This case study demonstrated that even if place names do not contain landscape terms, since they are embedded in the landscape, they provide an opening into the understanding of the relationship of a society with its land. Understanding the system used by the Jahai to name space, allows an understanding of their relationship with their surroundings linked to entities and not to landscape features such as forest or even trees. Using GIS enabled the potential catchment areas to be linked to names, helping further field work and introducing new research questions related to landscape conceptualization. These results encourage interdisciplinary research and the use of GIS with cultural data when collaboration between researchers is possible. Combining field knowledge with the power of such analysis tools becomes a robust means to improve the understanding of indigenous societies. Overall, this thesis demonstrated the potential of place names to investigate landscape terms and landscape conceptualization. Since place names contain linguistic, geographical and cultural information, all these aspects may be used to investigate landscape from diverse perspectives. It enables a correlation between landscape terms, its referent and the concept associated to the term to be established. Moreover, considering that place names are linguistic categories identified to date in every society, there is the potential of applying this method to all societies and to any kind of place name. This thesis has demonstrated that even with place names that are not related to landscape, focusing on the referent is already a first step in understanding landscape conceptualization and opens up avenues to investigate landscape concepts.

It would be interesting for further research to effectively compare the use of landscape terms inside place names across administrative and linguistic borders offered by the geographical situation of Switzerland. Research could also examine the potential of other place names (name of cities, street names, etc.) in landscape research. I am convinced that exploring jointly the name and the location of any kind of place name provides information about the perception of landscapes or features. The potential of being able to explore and compare the system of naming of any society offers a future full of surprises in place name investigations.

CONTENT

LIST OF TABLE

1 Introduction

1.1 Motivation

The challenge of the 21st century is environmental. The beginning of the 20th century was marked by the emergence and development of ideological and scientific movements for the protection of nature (Blandin, 2009). From 1913, and the first international meeting dedicated to the protection of nature (Bern, 19th November 1913), this interest gradually spread to the whole of the western world. In 1972, the United Nations Conference on the Human Environment was held in Stockholm. This conference brought together all members of the United Nations (UN) with almost 100 states, and gave birth in the 1980s to the concept of 'sustainable development'. Indeed, in a text written in French and English entitled 'World Conservation Strategy: Living Resource Conservation for Sustainable Development', the UN called for a global consultation for the conservation and management of natural resources (IUCN and WWF, 1980). Evolving from the notion of 'nature' to 'natural resources', there is the notion of 'biodiversity' which was discussed twenty years later at the 1992 Rio Earth Summit with a convention signed by 196 countries. Under its various names, the environmental issue has become global and its implications various, including the need to exchange and communicate around these concepts of 'nature', 'natural resources', 'biodiversity', 'environment', 'landscape' and about their different components (species, ecosystems, forests etc.). This thesis aims to contribute to this challenge by improving the understanding of these environmental components.

Considering that these environmental issues were launched and fed by scientists and in particular ecologists since 1962 and the alarmist 'Silent spring' of R. Carson (Carson, 1962) it is the environment in its biological and ecological aspects, which are discussed in all these texts and treaties. However, this disciplinary delimitation quickly revealed limits because to preserve a fragile and remarkable ecosystem or species in danger, it is often on a more global scale that it is necessary to act. Therefore, in 1982, 'The International Association of Landscape Ecology' was created and five years later in 1987 the scientific journal 'Landscape Ecology'. These movements of thought considered ecological and environmental issues on a larger spatial scale and, above all, they took into consideration the relationship of humans with the environment. Human beings were no longer seen as only harmful but as part of a whole which tends towards equilibrium. Thus, to think of ecology from a larger scale, the concept of 'landscape' can be used. This allows conceptualizing the environment and the relationship of humans to nature by including historical dynamics (Blandin, 2009:46). Indeed, in 2000 landscape was thus defined as: 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe, 2000:2).

However, landscape concepts are not attributed to a specific scientific discipline and landscape components are diverse and complex such as formulated by G. Bertrand in 1978:

> 'The specificity of landscape is not so much because it is more complex and heterogeneous than regular scientific subjects, but rather the result of it straddling the metaphysical categories of nature, culture, space and society, and thus encompassing the objective and the subjective.'[1] (Bertrand, 1978:246)

Consequently, a significant problem emerges which was highlighted in the 90s with the development of Geographic Information Systems (GIS). Indeed, the need to represent geographical elements (or landscape components, features or elements) on computers brought to light very different conceptualizations of geography (Egenhofer and Mark, 1995). Therefore, it is necessary first to identify these classes of elements and second to define them. In the early 2000s, identifying and defining landscape components became the target of the American geographers David Mark and Andrew Turk (Mark and Turk, 2003a). They defined 'ethnophysiography' as the ethnoscience of landscape, following the already established 'ethnobiology' and 'ethnozoology' which explore the various modes of classification of life (Berlin et al., 1973; Rosch, 1973). They started to document and analyze the different landscape elements across societies and they published an ethnography of an Australian indigenous community, the Yindjibarndi (Mark and Turk, 2003b). They confirmed what de Saussure had already established at the beginning of the 1900s such as explained by Bailly and Séchehaye (1997):

> 'If words were responsible for representing concepts given in advance, they would each have, from one language to another, exact correspondents for meaning; this is not the case '[2] (Bailly and Séchehaye, 1997:161)

[1] In French 'La spécificité du paysage vient moins d'être plus « complexe » et plus « hétérogène » que les objets scientifiques habituels, que de chevaucher les grandes catégories métaphysiques : le naturel et le culturel, l'espace et le social, l'«objectif » et le « subjectif ».'
[2] In French ' Si les mots étaient chargés de représenter des concepts donnés d'avance, ils auraient chacun, d'une langue à l'autre, des correspondants exacts pour le sens ; or il n'en est pas ainsi.'

Consequently, since the 2000s, researchers from various disciplines, ranging from geography to linguistics and anthropology, have studied these landscape components in their diversity. It is mainly through the exploration of their linguistic expressions that these elements have been approached and specifically through two linguistic elements: landscape terms (such as ‘mountain’, ‘river’, ‘crest’, etc.) and place names (such as ‘Paris’ or ‘Schwarzberg’) (Mark and Turk, 2003a; Mark et al., 2011b). The identification of these landscape elements reveals a wide disparity of terms and associated definitions which are sometimes very difficult to understand since they refer to a concept which is not necessarily shared (Mark et al., 2008). The semiotic triangle illustrating the Piercian triadic relation of a ‘sign’, an ‘object’ and an ‘interpretant’ (Figure 1.1) was reused by Mark to illustrate this idea and to explain landscape language (Turk and Stea, 2014). Indeed, this triadic relationship has been reinterpreted by Saussure to explain the process in action between the meaning, the perception and the interpretation of a term (Bailly and Séchehaye, 1997). Therefore, this theoretical tool used to think about semiotic (philosophical study of signs) has been used to explain landscape terms and elements with the ‘sign’ as the landscape term; the ‘object’ as the physical referent associated to this term and the ‘interpretant’ as the concept, that is to say the meaning associated with it.

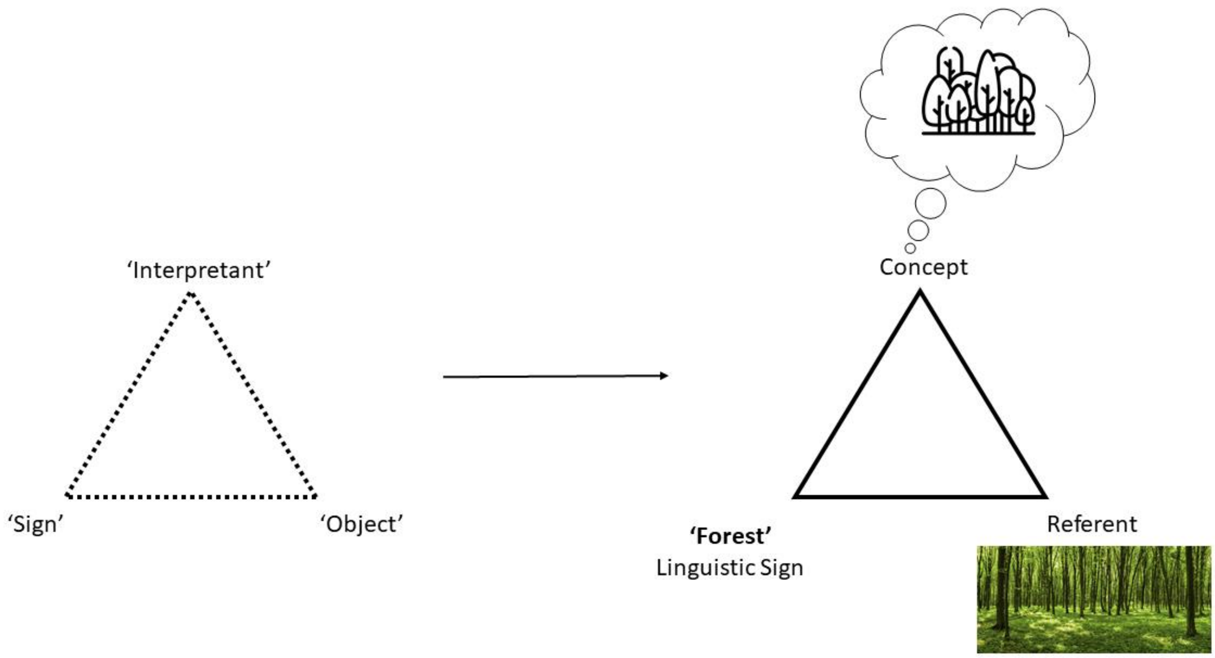


Figure 1.1 Triadic relation of a 'sign', an 'object' and an 'interpretant' and its application to landscape

However, applying this triadic relation to landscape elements is not that easy since, unlike a chair for example with its four legs, one seat and one back, they are not clear and well defined concepts. Indeed, for the sign 'Forest' there are many referents possible (as is the case for a chair), but how should the concept be defined? What ideas are shared by all the referents? To be composed of trees could be one aspect, but how many and what kind of trees? In France, for example, a series of fruit trees, no matter how many, will never be associated with a forest but with an orchard. Moreover, since landscape elements are conceptualized as objects but are elements within a continuous area, it is also challenging to identify the referent. Nevertheless, even if it seems to be a difficult task, this thesis support the idea that the exploration of the numerous referents in their diversity, could help in understanding the concept. To do so, place names, the second linguistic element used to explore landscape, will be used.

The expression place name or toponym, is derived from the Greek '*tópos*' ('place') and '*ónoma*' ('name'). It is defined in linguistics by Van Langendonck and Van de Velde (2016) as:

> '…a nominal expression that denotes a unique entity at the level of established linguistic convention to make it psychosocially salient within a given basic level category.' (Van Langendonck and Van de Velde, 2016:18)

More generally, it is a proper noun associated with a place (a restaurant, a city, etc.) or a geographical entity (a mountain, a valley, a river, etc.). I will use in this thesis the expression 'microtoponym' for place names associated to geographical entities, to unpopulated place. To sum up, a place name or a toponym is 'A proper noun applied to a topographic feature' (Department of economic and social affairs and Kadmon, N., 2002:26).Therefore, it contains in itself the relationship between the 'linguistic sign' and the 'referent'. Moreover, place names are often meaningful. They are not an incoherent assembly of syllables but rather an association of terms already existing and significant for the society that generated them (Gammeltoft, 2016; Nyström, 2016). It is generally in this etymological aspect that toponyms have been and are explored in linguistics. Their etymology is sought in order to determine their first meaning and then their linguistic evolution over time. Consequently, they can also be classified in various categories according to their semantics (meaning), but also to their function in the society and so on (Tent and Blair, 2011). Nevertheless, as proper nouns, they have to be considered with care because if the name refers to a general concept such as 'forest', the referent of a proper noun is unique, is located at one specific location (Van Langendonck and Van de Velde, 2016).

Most of the time and mainly because of time constraints, linguistic exploration does not consider this specific location, the geographical referent. However, it has been explored in the field of geography: historically through gazetteers and their use in map-making, and more recently through GIS (Gammeltoft, 2016) and the field of Geographical Information Retrieval (GIR) extracting and locating geographical information from text (Purves and Jones, 2011). Nevertheless, if linguists neglected the geographical aspects of place names, geographers did not often consider semantics since place names are mainly used to locate places. Therefore, this thesis want to demonstrate that both aspects of place names can be used to investigate landscape concepts.

Exploring both the linguistic and geographical aspect of place names presents some challenges. The most important is the interdisciplinary aspect and therefore the incommensurability of the methods used in these two fields. Typically, linguistics treats each toponym in its individuality using a qualitative method applied to a local scale, while geography gathers place names into large databases (gazetteers) making quantitative exploration possible at a large scale. Nevertheless, ethnophysiography brings the desire to combine these two approaches using geographical information systems (GIS). Indeed, GIS offers many possibilities for spatial data analysis where quantity is often perceived as an advantage rather than a disadvantage. They allow the exploration of geographical properties (e.g. spatial distribution, spatial auto-correlation and physical properties) and can also contain linguistic information in associated databases. However, using GIS to explore and analyze cultural data was and is still controversial. For example, some research from the field of humanities criticized having to isolate cultural data from their context in order to be able to store them in databases (Agrawal, 2002). In doing so, some are afraid of reducing the epistemological diversity (Rundstrom, 1995). Nevertheless, the purpose of this thesis is to demonstrate that the use of GIS can allowed the exploration of cultural information, especially when the goal is to explore relationships with the environment.

1.2 Organisation of the thesis

To sum up, this thesis wishes to demonstrate the potential of place names in the study of landscape concepts when place names are considered from their linguistic (name and act of naming) and geographical perspectives (physical properties and location). This thesis will therefore be structured around three main objectives:

- The first is to show that place names contain relevant semantic information for the exploration of landscape concepts.

- The second is to explore the relationship between the semantic information of place names and their geographical aspects. It will demonstrate their complementarity and the value of analyzing them together.

-The third and final objective is to evaluate the value of interdisciplinarity into landscape research and the use of GIS to investigate cultural data.

To this end, the thesis will be organized in eight chapters. *Chapter 1* being this present introduction, *Chapter 2* provides literature from relevant fields of research such as linguistics, geography and also anthropology providing the motivations to this work and formulate the research questions. *Chapter 3* presents the methodology used to explore the linguistic information contained in place-names using a dataset of microtoponyms of the canton of St. Gallen (Switzerland). *Chapter 4* and *5* are related to the geographical exploration of place names, with *Chapter 4* presenting a case study in the canton of St. Gallen and the extraction and comparison of the physical properties of four landscape terms frequently used in the microtoponyms of this canton. *Chapter 5* extends the study area to the German speaking part of Switzerland and focuses on two landscape terms in order to explore more specifically the impact of the spatial distribution of these terms. *Chapter 6* has the same objective of combining linguistic and geographical information contained in place names but this time using Malaysian place names of the Jahai community. It demonstrates how GIS can be combined with indigenous data and the new insight it brings in the exploration of landscape perception. *Chapter 7* returns to the research questions and discusses the results found and finally, *Chapter 8* concludes this thesis by summarizing the main findings and opening avenues for possible future work.

2 Background and motivation

This section is divided into five sections. The first establishes a theoretical and conceptual bridge between the notions of nature, environment and landscape. The second defines landscape and introduces the challenges inherent in this concept: identification of its constituent elements and the classifications associated with them (folk and scientific). The third provides illustrations of how language can contribute to this exploration through the linguistic elements of place names by describing their aspects connected to the act of naming, name and place. The fourth presents an overview of how place names and landscape are explored together, in geography and in social science. Finally, the fifth section details the research questions and the way in which this thesis wishes to answer them.

2.1 Environment, nature and landscape

2.1.1 From environment to landscape

From the environment to the landscape passing by nature, the conceptual displacement is not obvious because it is a journey through fuzzy and ambiguous notions. Their context of appearance and use in different spheres of society is at the origin of this confusion that requires an explanation to justify the choice of using the notion of landscape here.

Yvette Veyret (2007) explains in great detail all the developments and their relevance of the concept of environment in the field of geography. While its etymology refers to the surrounding area, the term was used in its naturalistic sense in the 18th and 19th century. The environment then referred exclusively to flora and fauna with scientists exploring their spatial distribution. At the beginning of the 20th century, the concept developed in geography with the German geographer Ratzel who explored the environment as 'milieu' and its consequences on societies. His deterministic vision would be widely criticized later. However, even if in the extreme this vision can be misinterpreted by granting to the environment all the elements which determine social life, it was rapidly moderated with the approaches developed by Paul Vidal de la Blache which gave space to each of its components (physical and cultural) without imposing a domination of one over the other. Here the environment combined both physical and cultural aspects. Then, in the 1970s the field of geography became more concerned with the spatial organization of societies and dropped the physical context from the exploration of this notion. However, a new call to structure societal and physical influences emerged again with the ecological movements embodied in the dualist vision of 'nature' vs. 'culture' opposing humans, as a separate entity, to a natural ecosystem and to a biological balance endangered by its presence. This dualistic component of the environment was constructed on the basis that the physical environment was wild, in other words 'nature' opposed to the cultural environment, 'culture'. In contrast to the beginning of the 20th century, when elements of society were added to the environmental element, the tendency of the 21st century is rather to try to integrate the environment into exploring the diversity of cultures (Bertrand and Bertrand, 2002). Finally, I observe that over its history, geography has always ended up studying the environment as a hybrid concept composed of a physical and a societal aspect:

> 'The environment is, for the geographer, a given, a perceived, a lived, a managed element, a political object' (Veyret 2007:19).

Nevertheless, it is still necessary to specify that geography is the science of the human environment implying that the 'environment' alone does not include the cultural aspect (Georges, 1970 as cited in Veyret 2007).

The environment thus deals with nature. Its recent emergence in the political domain is experienced as an institutionalization of nature as described by Charvolin, (2003:83), it is 'nature seized by the State'. Therefore, nature needs to be defined. The relatively recent publication of Philippe Descola, (2018) underlines from its title the plural aspect of nature: '*Les Natures en question*'[3]. Descola introduces nature as a European concept, which has changed and is still in conceptual development. This notion was built in Europe to define other concepts by its opposition: culture, art etc. However, today it is attested that the idea of nature is mainly European and that the term does not exist in many non-European languages just like the opposition between a wild, natural environment and a social and cultural world. While the idea of nature allowed the emergence of sciences in search of universal laws, it illustrates a 'composition of the world' specific to our cultures (Descola and Ingold, 2014:29). Indeed, historical and anthropological research has revealed that nature as an idea, a concept and a

[3] Can be translated as 'Natures in question'

term is specific to western societies. Nevertheless, everybody lives in, manages and orders their natural environment even if conceptualizations differs. Thus, to refer to this 'composition of the world', it is necessary to explore the relation of a society to this nature by considering the physical and human environment and the relationships that govern and structure this system. It is then necessary to consider the perceived, the lived, the whole and the parts, the objectivity and the subjectivity. It thus becomes clear that the term nature cannot take into account all these aspects and illustrate only one side of the picture. In accordance with that, in 2013 Descola suggested that we release our beliefs of universals on our relationship to nature and detach ourselves from our systems of understanding this relationship. It could be achieved by analyzing each part as being able to be constructed in a very distinct way (Descola, 2013). For example, in the paper of Burenhult et al. (2017), they investigate the lexical equivalent of 'forest' in six indigenous languages. They find out that for two languages (Jahai – Malaysia – and Duna – Papua New Guinea) the lexical equivalent refers to 'outside' or 'outdoor' and the treed environment is not contained in this semantic. This semantic diversity have to be taken into account for environmental policies and their applications on the ground.

2.1.2 Emergence and definition of the landscape

The aim of this thesis is to find a concept which makes it possible to consider both the physical and social aspects of the 'environment' and their relationship as suggested very recently by many researchers sensitive to the study of environmental categories (Duvall et al., 2018). In order to explore that relationship outside the limits of the notion of the 'environment' and 'nature', I propose the use of the notion of 'landscape'.

> 'Let me begin by explaining what the landscape is not. It is not 'land', it is not 'nature', and it is not 'space'.' (Ingold, 1993: 153)

Etymologically and according to Olwig (2005), landscape means the shape of the land. However, this is a much more complex notion. For Descola (2013):

> 'the notion of landscape therefore implies the existence of perceptual models functioning as an integration between salient properties of the object and diagrams of culturally parametric representations of this object' (2013: 650)[4]

[4] Original citation in French : 'La notion de paysage implique donc l'existence de modèles perceptifs fonctionnant comme une intégration entre les propriétés saillantes de l'objet et des schèmes de représentations culturellement paramétrés de cet objet'.

In 1988, Daniels and Cosgrove (1988) described it as a 'cultural image, a pictorial way of representing or symbolizing surroundings'.

According to Anthrop and Van Eetvelde (2019) landscape can be explored through the two pillars of territory and scenery. Indeed, they described that over the centuries, the concept of landscape has evolved. From this heritage of painting, it became a topic of interest for geography in the nineteenth century. Explored from a holistic perspective at this time, its exploration would be split, as geography, between physical and human approaches. From that emerged landscape research as land evaluation and classification on the one hand, and a territorial approach, land shaped and inhabited by societies, on the other hand (Antrop and Van Eetvelde, 2019). After that, landscape was compared with territory, distinguishing the sensory aspect from the experience of a place (Raffestin, 1977). This deeply human-centred vision appeared jointly with the naturalist vision which again imposed a dualist view of our environment. It was a whole made up of a natural landscape and a cultural landscape where these two aspects could be isolated and understood without their interaction. The landscape tracks a history of activities, it keeps the traces of the actions of humans on their environment and thus it is unique in each place. It bears the marks of the past and it is constantly changing (Ingold, 1993). Nevertheless, soon came the need to explore landscape from its holistic aspect as recognized by Cosgrove as a connecting term used nowadays by many disciplines such as architecture and history and combining incommensurate elements such as: 'process and form, nature and culture, land and life' (Cosgrove, 2006:52).

Indeed, since, 1990, transdisciplinary research has emerged exploring landscape through many perspectives. This is what Brabyn (2009) tried to capture by developing a system to classify landscape character. By developing a classification, he wished to open up the possibility of communication on common grounds even if he recognized the limits of his approach which considers the physical and human aspect of the landscape only under visual perception. Then he raised the limitation of this classification to capture another aspect associated with the landscape: its perception. This aspect relating to perception has become a whole field of analysis, which is deeply historical and cultural and which involves completely different referent values (Brabyn, 2009). However, these two perspectives of the landscape are not the only ones. It is necessary to add here that it was also conceptualized by an approach qualified as 'phenomenological' where the landscape would be a sensory experience of places, a space perceived through meaning and individualities (Collot, 1986; Turk et al., 2012). It is an understanding through mobilizing sensory perception implying a point of view, parts and a whole (Collot, 1986; Johnson and Hunn, 2010).

It is therefore very limiting to explore the landscape today from this traditional perspective of aesthetics or simply from a single aspect, because they are all part of the conceptual heritage of this idea even though they are very limiting when taken in isolation and exclusively (Bertrand and Bertrand, 2002; Olwig et al. , 2016). It is this diversity of the notion of landscape which interests me here. This plurality is part of the definition established by the European landscape convention:

> 'An area, as perceived by people, whose character is the result of the action and interaction of natural and / or human factors' (Council of Europe, 2000:3)

It is also recalled later by Seidl (2008):

> 'Landscape is a result of a blend of spatial features and human perception, understanding and interpretation of this space' (Seidl, 2008:35).

The difficulty then is to expand from the dualist tradition which would consider layers of natural and cultural information into their individuality in order to explore them as merged entities through their perceptions and their representations (Descola, 2013).[5]

Key messages:

- From the 18th to the 21st century the notion of environment has moved from a naturalistic sense to a dualistic aspect opposing nature to culture.
- Therefore, there is a need to explore the relationship between the natural and the cultural aspect of the environment, and for this I propose to use the notion of landscape.
- The notion of landscape is studied by interdisciplinary approaches exploring the relationship of humans with their environment through physical, perceptual and phenomenological aspects.

[5] It's maybe important to notice here that many researches have been done about the notion of '*landschaft*' in Germanic literature. However, not speaking this language, all this specific literature could not been accessed. Nevertheless, the French literature exploring the notion of '*paysage*' have been consulted.

2.2 Inherent challenges of the concept of landscape

Since the plural aspect of landscape has been recognized, its scientific exploration is a balance between first identifying and evaluating its components and second exploring the cognitive or perceptual interpretation of the environment.

To illustrate, this is what Brown and Brabyn (2012) did to their simple classification of the elements identified as a component of the landscape by adding some values such as aesthetics, economic value, history, etc. (Brabyn, 2009; Brown and Brabyn, 2012). They identified 13 of these and explored them through surveys with many participants and the use of Public Participation GIS (PPGIS). The collection and mapping of these values, in association with physical properties, allowed the relationship between values and components of the landscape to be explored, thus considering landscape from an holistic perspective (Brown and Brabyn, 2012).

These character assessment approaches of landscape go towards establishing pre-established criteria relevant to qualifying it, such as topography, soil groups, vegetation types, land uses and so on and above all assessing them through field surveys (Atik et al., 2015). This process seems important in conserving and enhancing diverse landscapes (economic, cultural, etc.). Nevertheless, the difficulty is that in order to do so it is necessary to consider components of the landscape established and recognized only by a certain society. It could work perfectly in some case as in Turkey for Atik et al. (2015), but Brabyn himself raised limitations of his approach applied to Maori conceptualizations in New Zealand (2009).

Another approach has been proposed by Backhaus et al., (2008) through their development of a landscape conceptualization model. From this model, it is possible to locate the landscape design between the four poles of: nature (physical environment), culture (cultural environment), subject (individual) and society (collective and state). According to these authors, landscape can be explored in terms of those four poles and misunderstandings are the result of distinctive positioning within them. Therefore, they emphasize that by positioning a scientific approach in this model, it is easier to communicate because it is thus clear from which perspective the landscape is considered.

These approaches are promising in the sense that they integrate plural aspects of landscape and they encourage a multidisciplinary approach to explore it from different perspectives. However, they imply identifying and considering pre-established categories considered as shared by all, which is rarely the case for landscape elements as will be explained below.

2.2.1 Definition of geographic elements

As a sensitive, culturally oriented perception of a reality, the concept of landscape involves some significant challenges, particularly with regard to the identification and classification of its components. Indeed, the interest that has emerged in the understanding of landscape design in the scientific sphere has made it possible to establish an irrefutable observation: landscape is conceptualized in distinct ways by different societies (Mark and Turk, 2003b). This diversity of conceptualization comes in part from the fact that the physical environment is a continuous element and that its separation into elements (mountain, river, etc.) is purely subjective. Indeed, separating a continuous whole, the surface of the earth, into distinctive elements, such as a mountain, a river, etc., implies the existence of a shared conceptualisation. This segmentation thus involves establishing borders and defining these 'objects' and finally, they are also largely dependent on their geographic context. All of these implications are detailed below.

2.2.1.1 From a whole to its integrative parts

Thornton (2011) wrote that the perception of the landscape and its elements depends on the interactions that one has with it. And so, he formulated:

> 'In ecological terms this means accepting that the landscape is not wholly a human construction as one born strictly of physiographic processes, but rather a dialogue between perception, embodied engagement and environmental possibility' (Thornton, 2011:279)

The cognitive process that allows the identification, in a continuous environment, of distinctive elements certainly depends on perception, but it is important to emphasize that this perception is far from being based on a unique and true bio-physical reality. This raises the question of the delimitation of these objects. This is particularly difficult in the sense that a geographic feature does not have the full characteristics of an object. It has no clearly demarcated border. Indeed, as soon as one thinks of specific cases, the strict delimitation appears very blurred. For example, when we think of the boundaries of a mountain, we think in the first place that we can identify and delimit this element very easily, but in detail, its only strict border is with the sky. This idea is very well illustrated in Smith and Mark's paper which asks ‘Do mountains exist?’ (Smith and Mark, 2003). Indeed, how can this object be defined since:

> ‘mountains do not have determinate, prominent, and complete boundaries (…) And similarly in the order of kinds: the category of a mountain is not distinguished in bona fide fashion from neighbouring categories such as a hill, a ridge, a butte, a plateau, a plain, and so on’ (Smith and Mark, 2003:142).

Nevertheless, even if some researchers have managed to illustrate this vagueness using computer modelling (Cohn and Gotts, 1996; Jones et al., 2008; Purves et al., 2005), according to Varzi (2001) ‘All geographic vagueness is purely semantic’ (Varzi, 2001). This strong statement was balanced by Mark and Smith (2004) who judiciously remark that despite the vague and immobile nature of the geographic elements by definition they remain thought and conceptualized as a vague object (Mark and Smith, 2004).

In order to go deeper we can ask what type of elements can be part of the landscape. As Europeans, we restrict this notion to the physical environment, but this is far from the case in all societies. Indeed, and as already mentioned, in many regions of the world the very distinction that we make between humans and the environment does not operate under the same laws (Descola, 2018; Descola and Ingold, 2014). Since without even talking about the delimitation and boundaries of the mountain, it is a question of the definition of this element. In many cultures it depends not only on the physical domain but also on the symbolic or social domain (Boillat et al., 2013). In addition, this perception is not only specific to a society but can also be specific to an individual and an education. A geographer will have a different perception of landscape categories than an architect or a farmer. This diversity within a similar general system of thought, within the same society, has been theorized under the name of 'naive geography', underlining the important distinction between professionalization and theorization in relation to a folk approach to geographic entities (Egenhofer and Mark, 1995).

Finally, this context of defining a geographical element must also be considered with in its geographical context, that is to say according to what surrounds it. Thus, to come back to the mountain illustration, a mountain can be defined according to the National Geospatial-Intelligence Agency as ‘an elevation standing high above the surrounding area, with steep slopes, and local relief greater than 300m.’ (Feng and Mark, 2017). However, this definition when applied in a plain region will be significant compared to the general context, but these 300 metres could be considered as insignificant in the chain of the Alps. Beyond these elements necessary for delimiting a geographical or landscape element, despite recognizing the diverse aspect of these conceptualizations, some researchers think and seek certain universals in these objects. Namely, to compare all systems according to certain bases that can contain them all, such as concave or convex shapes which are potentially universally perceived and distinguished in landscape categories (Sinha and Mark, 2010).

Therefore, identifying these elements remains an important challenge in the field of GIS as formulated by Agarwal, (2005):

> '… an important step will be to identify the geographical terms and concepts that require better definition and to formalize the inherent vagueness encapsulated in these' (Agarwal, 2005:525)

2.2.1.2 Classification of geographic elements

Understanding landscape concepts first involves identifying these components and then being able to define and position them in a system of values (Vivien, 2013). Thus, it involves the exploration of a classification system. Indeed, the arrangement of things gives much implicit information concerning the organization of knowledge and therefore provides keys to understand the whole system. According to Descola, this is the essence of anthropology and a priority in order to be able to understand humans in their social aspect (Vivien, 2013). Claudine Friedberg explains this very well, when she states that to understand folk knowledge it is necessary to explore how this knowledge is constructed and organized, that is to say identified, named and ordered (Friedberg, 1997a).

However, this classification system of the universe, meaning of each elements of the earth is a universal fact, in the sense that it is done by every society. Nevertheless, it remains singular in the sense that it is specific to each, despite being in all cases effective both from a cognitive perspective (association of idea and memorization) and from their utilitarian point of view (Friedberg, 1997b). The criteria used to assign categories are different from language to language (Haspelmath, 2010). This exploration of classificatory principles is fairly common with the developments of ethnoscience and the interest in classifying fauna and flora by traditional societies (Berlin et al., 1973; Malt, 1995). Once again, these schools of thought have been able to highlight a great diversity and revealed the difficulty of finding universals (Berlin et al., 1973).

The study of classification systems has brought to light different strategies, described according to different motivations or through distinctive notions. Descola (2005) identifies three forms: hierarchical, utilitarian or cosmological, based on type of knowledge. He associated hierarchical classification to semantic knowledge, meaning that we have to know that a tree is part of flora and so on. The utilitarian needs an encyclopaedic knowledge, such as a specific knowledge associated to the use of a specific tree such as 'oak ', only owned by some, with a botanist having a different knowledge of this tree than a carpenter. Finally, cosmological classification involves a symbolic knowledge such as knowing that for French speaking people, to pick up Descola's example, the 'oak' is the king of the forest (Descola, 2005). Tversky and Hemenway, (1983) identify three types of measures to assess these classifications, one based on the cognitive aspect, one on the behavioural aspect and the last on the communicational aspect (Tversky and Hemenway, 1983).

However, any classification system may also differ within the society itself between expert in the field concerned and novices as the usefulness of these categories differs (Malt, 1995). This is what some researchers have explored by focusing on folk conceptualization of the geographic domain (Mark et al., 1999; Smith and Mark, 2001). The interest in classifying the environment (here meaning geographical features) is more recent, and it was explored at the beginning for its cognitive aspect (Tversky and Hemenway, 1983). Some others also tried to search for universals in order to be able to model these representations of space (Smith and Mark, 2003). But just like fauna and flora, determining common classification levels perceived by all appears to be very difficult (Sinha and Mark, 2010). However, this new interest in classifying geographical features for modelling purposes, has opened a new field of reflection around this thematic by relatively diverse disciplines ranging from cognitive science (Malt, 1995; Rosch, 1973; Tversky and Hemenway, 1983), geography (Atik et al., 2015; Brabyn, 1996; Feng and Mark, 2017; Gomez Alvarez and Bennett, 2017) to computer modelling (Ballatore and Mooney, 2015; Iwahashi and Kamiya, 1995; Sinha and Mark, 2010) via linguistics (Burenhult and Levinson, 2008; Enfield, 2008; Levinson, 2003) and anthropology (Agrawal, 2002; Berlin et al., 1973; Hunn and Meilleur, 2010; Meilleur, 2019).

These explorations have failed to find universal models, partly because of the sensory aspect of the perception of the landscape (Brabyn, 2009), however, the fact remains that the exploration of these classifications provides comparable frames in some sense between societies (Brabyn and Mark, 2011). In addition, the existence of these determined classifications makes it possible to map them with the use of GIS and then to communicate about them (e.g. Atik and Swaffield, 2017).

Key messages:

- The perception of geographical elements is a cognitive process based on sensory experience
- Geographical objects do not have clear demarcated borders, they are vague objects
- Their definition varies between and within societies and are dependent on the geographical context
- Geographical elements understood in their system of values provide rich information because they are effective from a cognitive and a utilitarian perspective
- Exploring geographical elements involve exploring their classification system which varies in and between societies by following diverse strategies
- Classification is explored in many disciplines and has advantages in mapping and communicating about geographical elements

2.3 Using language to investigate landscape

2.3.1 The interest of language and place names for landscape exploration

Up to now, I have introduced the interest of studying the landscape as an environment perceived and organized by humans. I have also introduced the complexity of capturing the components of a landscape by their distinction in a whole. Finally, I have explained that these components, which can be qualified as categories, are organized by humans and understanding their organization can help us to define them.

In order to study these different classification systems, ethnosciences postulated that the cognitive system used to structure the world is also structured by language (Vivien, 2013). Sapir put forward this postulate (Sapir, 1912) and when presented in its extreme form, such as in a very short way, your thought are limited by your language, it was subsequently strongly criticized. Nevertheless, he was one of the first to formulate the relationship of language and the conceptualization of the environment and asked for care to be taken when interpreting such a relationship, indicating that cultural changes did not appear at the same rate as linguistic changes.

Aware of the difficulty of assigning clear and precise physical boundaries, the fact remains that these categories, these landscape elements, in their diversity, are expressed through language (Burenhult and Levinson, 2008; Enfield, 2008). Tuan theorized that it is through language that space is transformed into a place, that is to say, into a meaningful entity for a society.

Language transforms the invisible and the non-existent into visible and real (Tuan, 1991). It is therefore because language symbolizes and codifies concepts with words or signs, that it transforms this complex and arbitrary abstraction of reality into a subject of communication (Jordan, 2014a). Thus, it seems relevant to approach landscape from the perspective of language. Indeed, Edwardes and Purves demonstrated the potential of describing images in order to understand the meaning of this place revealing that its 'conceptualization is sensitive to locale' , thus to the geographical context (Edwardes and Purves, 2007:11 ; Purves and Derungs, 2015). Moreover, as illustrated in Figure 2.1, and explain by Haspelmath (2010):

> 'While simplistic approaches such as Swadeshlist-based comparison make the simplifying assumption of a one-to-one correspondence between lexical meaning and words, and thus between words across languages, reality is more complex: words in one language are often in semantic many-to-many relationships with words in another language. Any systematic lexical comparison of languages needs to work with a somewhat arbitrarily chosen set of standardized lexical meanings (e.g. the World Loanword Database, Haspelmath & Tadmor 2009). These lexical meanings are comparative concepts, and the meanings of individual languages are language-particular semantic categories. Neither can be reduced to the other.' (Haspelmath, 2010:668)

The interest in landscape concepts and their linguistic expressions has been formulated by Mark and Turk (2003a) who realized that landscape terms had been the subject of only rare studies. They defend the idea that by studying the terms used by different cultures in reference to the landscape, we could understand their relationship to their environment. In this quest, they define the field of research that is dedicated to this goal as ethnophysiography (Mark & Turk, 2003a). The hypothesis of this field of research was formulated as follows:

> 'The basic ethnophysiography hypothesis is: people from different language groups / cultures have different ways of conceptualizing landscape, as evidenced by different terminology and ways of talking about, and naming, landscape features.' (Mark et al., 2011b: 36)

Following on from this, the study of landscape terms and their definitions has been undertaken, often by using time-consuming methods associated with ethnography and involving surveys and questionnaires. The exploration of landscape concepts has also been carried out in various ways via anthropological approaches, notably through cartographic tools (Turk et al., 2011 ; Wartmann and Purves, 2017). They raised the importance of a multidisciplinary and even transdisciplinary approach combining the study of the semiotic triangle specific to language with GIS approaches (Turk and Stea, 2014). These studies have demonstrated the importance of language in this conceptualization and the study of terms associated with these concepts. Ethnophysiography claims that the landscape was formulated in language through linguistic elements such as generic terms (mountain, river, etc.), place names (Bohnemeyer et al., 2004; Burenhult and Levinson, 2008) or motion verbs (Burenhult and Purves, 2020).

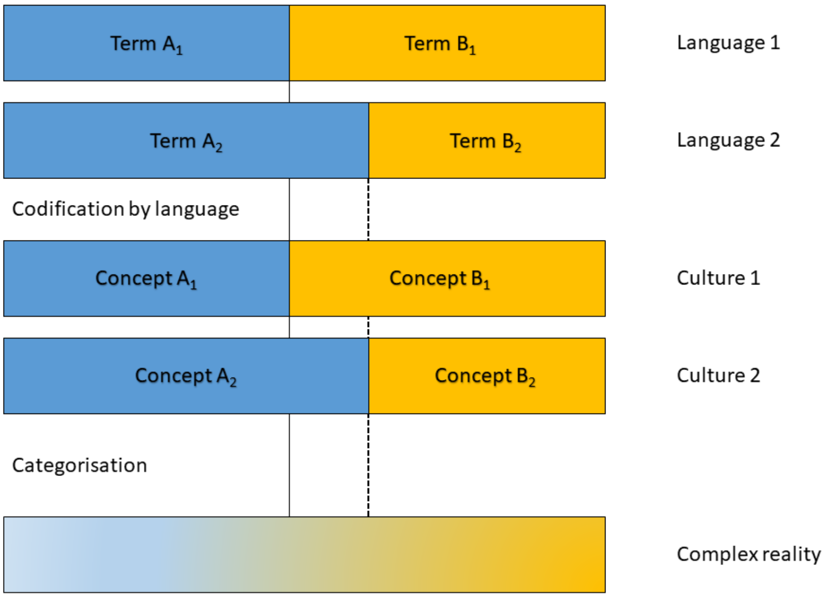


Figure 2.1 Relation language-concepts-reality (Adapted from: Jordan, 2014b:35)

In this thesis, I will focus on place names to explore landscape. Place names are also the subject of studies in linguistics and more particularly in onomastics (name studies). Through place names, the field of linguistics looks at landscape while paying attention to the name mainly, with insufficient attention to the reference (Mark et al., 2011a). The study of their meaning and semantics, at least in etymology, has nevertheless raised the important presence of landscape terms in place names and this association continues to generate interest in the specific exploration of landscape terms (Meilleur, 2019). In fact, the use of landscape terms in place names to capture these various conceptualizations and especially their cultural aspect appears obvious, especially since they allow both spatial and cultural exploration (Gammeltoft, 2016). More generally, place names appear in many studies as elements of traditional knowledge integrating various landscape elements (biotic, non-biotic and human) and ordering them in defined geographic units (Boillat et al., 2013).

This observation was formulated by the anthropologist Thornton:

> ‘Place names are a particularly interesting aspect of culture because they intersect three fundamental domains of cultural analysis: language, thought and the environment. As linguistic artefacts and distinct semantic domains in the lexicons of all the world’s languages, place names tell us something not only about the structure and content of the physical environment itself but also how people perceive, conceptualize, classify and utilize that environment.’ (Thornton, 1997a:209)

His questions brought up to date many possibilities and research questions developed by this quest for landscape understanding. They were formulated in a research guide and in a research questionnaire created by Bohnemeyer (2001) and Bohnemeyer et al. (2004):

> ‘…What places are place names employed to refer to (e.g. human settlements, landscape sites)? How are places semantically constructed for this purpose? … Which is the referential relation between landscape terms and place names?’ (Bohnemeyer et al., 2004:76)

But before addressing these questions and their relevance, place names should be defined.

Key messages:

- The cognitive system used to structure the world is also structured by language
- Language symbolizes and codifies concepts with words, therefore it seems relevant to approach landscape through it
- Ethnophysiography is a recent field collecting and exploring the diversity of landscape concepts and conceptualizations
- Using interdisciplinary approaches ethnophysiography explores landscape through landscape terms and place names
- Place names allow landscape exploration through its cultural and its physical aspects

2.3.2 Definition of place names

As already introduced in *Chapter 1*, a name is:

> '…a nominal expression that denotes a unique entity at the level of established linguistic convention to make it psychosocially salient within a given basic level category.' (Van Langendonck & Van de Velde, 2016:18)

According to this linguistic explanation, a place-name is this 'nominal expression' applied to a place as a 'unique entity' such as the synonym 'toponym' expressing literally from the Greek '*tópos*' ('place') and '*ónoma*' ('name'). According to the Glossary of Terms for the standardization of Geographical names (Department of economic and social affairs and Kadmon, N., 2002), a place name or a toponym is a:

> 'Proper noun applied to a topographic feature. Comprehensive term for geographical names and extra-terrestrial names' (Department of economic and social affairs and Kadmon, N., 2002:26)

They are mainly explored through three aspects: an **act of naming**, a **name** and a **place**. The following will describe these three aspects in detail.

An act of naming:

Naming places was undertaken by humans, for utilitarian reasons, communication and orientation (Oral and Beaucage, 1996; Rostaing, 1965). We mostly owe it to anthropology, through the study of indigenous peoples and following the legacies of Franz Boas and Edward Sapir who claimed an ethnogeography, the description of diverse uses for place names. Basso in 1988 was one of the first to focus his ethnographic study on the Apaches' place names. He highlighted an original use by indicating the symbolic aspect of these names and their use for telling stories. They replaced long speeches and mobilized personal and collective history to communicate about certain localities. Their linguistic structure is descriptive and in this they allow a visualization of each place in its specificity (Basso, 1988). In describing this very particular use of place names Basso gives us an important element of the Apache culture: places are events, they are history to tell the present. The landscape is the support of oral culture that uses space as a place of existence. Garde (2014) also explains a singular use of place names, in which they seem to be tools for interacting with the earth and its elements or occupants

(Garde, 2014). Thornton (1997a) also formulates the diversity of relationships that these names may contain:

> 'What is named is determined in part by cultural interests such as subsistence and navigation, but is also constrained by the character of the physical environment and the limits of the human perception and cognition' (Thornton, 1997a:221)

This is what many studies explored in the following years, as is the case for Collignon (2002) who conducted a study among the Inuit and who found that for them, place names tell the story of space. They are support for discourse and not for displacement; they indicate the places with resources, with dangers, the places where important things took place. They do not indicate a route (Collignon, 2002).

Humans name places that matter, whether for practical, aesthetic, emotional or spiritual reasons. Naming a place is not an arbitrary act, it is a conscious act giving full recognition to a human experience (Dugas, 1984; Hunn and Meilleur, 2010; Radding and Western, 2010; Tuan, 1975). Thus, the name provides information relating to this relationship, to the reason for the importance of this place for these populations in particular. They offer information on the perception of this space and are therefore qualified as 'condensed-narratives' by Jordan (Jordan, 2014b). They form the relationship between a place and the understanding of this space (Jordan, 2014b; Seidl, 2008).

Moreover, the act of denomination has a cognitive logic of unequivocal distinction. It must designate a place limiting possible confusion (Oral and Beaucage, 1996). In addition, place names appear as an important commemorating process for cultural or physical elements and provide a solid cognitive means of preserving this information in collective memory over time (Cogos et al., 2017). Stories and songs were also listed by Paskvan as elements in the service of toponymic memory in the Kaltag region (Alaska) (Paskvan, 2011). Hunn, (1994) in a famous article in 'Current Anthropology' even tried to correlate toponymic density and population and identifies the magic number of 500 for the amount of information an individual is able to retain. According to him, this number is correlated with the size of the society (Hunn, 1994). However, even without this universality of density which can be questioned, the cognitive importance of place names is omnipresent as illustrated by the words of Jett (1997):

> 'Probably many of the Chally names and Navajo place-names in general were also adopted to facilitate people remembering and finding features or areas where economic and ritual places, animals, and minerals might be found… as well as landmarks on routes to hunting, gathering, raiding, trading and religious-pilgrimage destinations…' (Jett, 1997)

This was what Louis (2011) observed with the Hawaiian place names that reflected the spatial knowledge of their environment. They were then transmitted in a complex cultural system involving stories allowing a cartographic memory and an oral transmission of this knowledge (Louis, 2011).

Finally, the denominational act transforms this space by its meaning and the perception that we have of it in an identity place, in a specific territory for a population (Jordan, 2012): 'A space becomes place, and a territory becomes landscape through the process of naming' (Seidl, 2008:35). It is an act widely identified as a political act (Alderman, 2008; Azaryahu and Golan, 2001), as an action of appropriation of a place and a space (Azaryahu and Golan, 2001; Giraut et al. 2008; Radding and Western, 2010). It involves relations of power over a certain geographic location (Bénézet, 2013; Berg and Vuolteenaho, 2009; Bonnemaison, 1981). Indeed, the denominational act is an 'act of memory' (Boyer, 2008). It registers for a considerable period of time the belonging of a population to a place and reminds the visitor because it allows transmission by speech (Paveau, 2008). Much later, in 2011, the study of the Tlingit by Thornton called for the understanding of these names not in their individuality and as a simple place, but as a set of significant places in a socioecological system (Thornton, 2011).

A Name:

Place names or toponyms are in linguistics defined as proper nouns 'a word that uniquely identifies an individual person, place or thing' (Department of economic and social affairs and Kadmon, N., 2002) such as Anna or Paris. They are distinguished from common nouns 'a word designating any one of a particular kind of being, place or thing' (Department of economic and social affairs and Kadmon, N., 2002) such as city or dog. Sklyarenko and Sklyarenko (2005) confront these two linguistic notions:

> 'Common nouns express concepts, and proper nouns do not express concepts. Common nouns designate objects, and proper nouns (proper names) nominate them. Common nouns generalize the idea of objects and proper nouns individualize them and so on' (Sklyarenko and Sklyarenko, 2005: 277)

Proper nouns can be assigned to elements of a very diverse nature. They can designate people, animals, buildings, countries, places, etc. It is therefore important to remember that what is common to this category is the unique reference and the desire to assign a name to make a distinction (Oral and Beaucage, 1996). Thus, toponyms are a sub-category of proper nouns.

Nevertheless, it is frequent for the same name to be assigned to two different places such as London in Canada or in England. This ambiguity has implications when exploring place names on a large scale or when taken out of context as might be the case when extracting geographic information from text (Palacio et al., 2009). This is, however, a less common problem at a local scale, even if not impossible. It is also important to note that a place can be assigned to different and therefore multiple names depending on the time or the group of people using this reference. This can be a matter of language (e.g. Genf, Geneva) or of the type of names (familiar or official, e.g. Big Apple or New York) (Jones et al., 2008; Nash and Simpson, 2012).

In written societies, names have the property of being durable, of being preserved over time (Fagúndez and Izco, 2016a; Thornton, 1997a) because they must be known and kept in order to be shared and used for travel. Nevertheless as Nash and Simpson said 'Not all place names are necessarily 'old'' (Nash and Simpson, 2012:401). Indeed, they can be new when a new place is created (new building, neighbourhood, etc.) or when a place is modified after natural events. But a name can also be modified, with agreement or not, according to political history such new land ownership by different groups in time as for example during the colonial period or during wars (Azaryahu and Golan, 2001; Nash and Simpson, 2012; Walsh, 2009).

Moreover, the analysis of the name can also relate to its semantics (i.e. its meaning, sense and etymology), as we will see later, but also to its structure (its grammatical properties). All these linguistic aspects provide valuable information about the history of these places either through the relation to past events (e.g. in: Dugas, 1984; Nash and Simpson, 2012) or through the association of multiple languages in the same name or area indicating different settlements (Dorier and Van Den Avenne, 2002 ; Fuchs, 2015; Tent, 2017). These proper names provide linguistics with a map of its history (Nash, 2015).

The semantic exploration of place names demonstrates that the verbalization of any distinctive specificity often involves significant attribution (Hedquist, 2005). Nevertheless, the meaning of proper names has been widely controversial in the field of linguistics (Hollis and Valentine, 2001; Paveau, 2008). Indeed, the origin of this 'properhood', of the status of proper nouns, depends on the unique reference and not of its significant aspect (Coates, 2006). However, it is recognized that proper nouns, and particularly toponyms, can have an associated meaning and when this meaning is understood, they are therefore qualified as transparent (Coates, 2006). Nevertheless, as Radding and Western (2010) mentioned 'a name can be transparent only in the context of the language of the namer'. The transparency of a place name can be defined from its opposition to its opacity, with opacity defined as 'a failure to analyze a form according to its historical, morphosemantic composition' (Forston 2003:659 as cited in Radding and Western 2010:396). In other words Radding and Western (2010) explained:

> 'As a place name becomes opaque and the original meaning is lost over time, the name comes to feel like a word, in that it feels like an arbitrary combination of sounds used to refer to a certain item or idea.' (p.396)

Walsh (2009) presented a typology of this transparency, indicating that several degrees can be observed. In his specific case of aboriginal toponyms, he evoked four specific situations of transparency, two of which are specific to the names of aboriginal places. We will therefore present here only the first two which can be generalized to most place names: 'Clarity' and 'Recognition'. The 'Clarity' can have different levels, from 'very clear' such as Newtown refers to a new city, 'apparently clear' such as Ashfield which could be associated with 'Ash + Field' but which is an anthroponym – a meaning referring to a person here with 'Ash', 'partly clear': such as Matraville where only '*ville*' is transparent (means city) to 'unclear' like Maraylya which implies an indigenous name but which, without specific knowledge, is completely opaque for the analyst (Walsh, 2009). The author added: 'clearly degree of clarity will depend on such factors as the level of knowledge about the semantic content of the form of the place names' (p.44). The second situation 'Recognition' concerns 'the extent to which the semantic content of a place name is recognizable' (p.45). The author emphasizes the importance of time in the ability to hold the necessary knowledge of the name. Indeed, he gave the example of the name Nightcliff which could be interpreted by 'night + cliff', but which following historical research indicates completely different semantics: Knight's Cliff. This aspect of transparency calls for caution in the interpretation of the semantics of names and the temporal factor which is important in transparency, whether through loss of knowledge of the history of the place or of the language (Walsh, 2009).

Many linguists and anthropologists have even sought to order these meanings through taxonomies basing then on many criteria. Those taxonomies are unfortunately too rarely common because of the diversity of the act of naming and consequently, they can't be used alone to compare different denominative systems. Tent and Blair, (2011) offer an exploration of numerous toponym classification taxonomies in order to develop one for their own research. Some are based on the denominational act and its motivations (Gammeltoft, 2005; Piper, 2014), others on the origins of settlement (e.g. Fuchs, 2015) or even on the type of element named (Rennick, 2005). However, despite this act of classification, it is necessary to remember that this descriptive aspect can have multiple interpretations both in meaning and in reference (Nash and Simpson, 2012). Indeed, this is what Gammeltoft identified as a main challenge in exploring geography through names, that the lexical meaning of a term may change within a toponym (Gammeltoft, 2016).

Finally, related to the grammatical properties of place names, Nash and Simpson (2012) described several aspects which have to be explored: the morphological structure (monomorphemic, compounds, reduced clauses, etc.); the morphology specific to toponyms (such as derivational affixes) and the syntactic properties of place names ('any proper name is inherently definite' (Nash and Simpson, 2012:400). Indeed, when Cablitz (2008) presented the particular case of the Marquesas islands she demonstrated, in addition to the use of certain landscape terms in place names, a very specific linguistic structure indicating the nature of the referent as an object or as a place (Cablitz, 2008).

To sum up, the name have semantic and grammatical properties which may provide information about its location. It brings us to the reference of this name.

A Place:

Since a place name is a 'Proper noun applied to a topographic feature.'(Division and Names, 2002) it makes sense to explore the properties of this feature as formulated by Nash and Simpson (2012):

> 'Several senses of the 'meaning' of a place name are to be distinguished. The most basic is its location, part of the denotation of the place name. Understanding the denotation of a place name requires working out what is denoted spatially (including landform, landmark, and built structures).' (Nash and Simpson, 2012:395)

What is denoted spatially is here the reference to a topographic feature, but it is also less specifically the reference to a place. I will thus explore these two notions.

A topographical feature can be described through its physical properties related to the definition of the geographical object, with all the limitations already introduced before, but nevertheless, through the properties of its location such as elevation, landcover and so on.

It has also been highlighted that when examining the physical properties of a place it is necessary to take into account its geographical context (e.g. Purves and Derungs, 2015).

Indeed, what is remarkable as an element in a landscape is very strongly linked to its general geographical context, e.g. the type and density of buildings or a landmark which varies depending on whether it is in Switzerland, Greenland or the Amazon forest. Similarly, the attention paid to a 300m eminence within a country with little topographical variation will be very different to that within an alpine range. It also involves the notion of 'place', which is much more than a simple portion of space, there is a feeling, an experience which constitutes the place and therefore the place name (Tuan, 1975, 1979). This is what Agnew (2011) defines according to three dimensions:

- The 'location', a portion of physical space, this is the reference, the geographic element with these ambiguities of delimitations. It is the geographical feature within its geographical context; it is for example the city of Zürich in Switzerland.
- The 'locale' which contains all the interactions and activities that take place in this location, it is what makes this space a specific, important place. To continue with the example of Zürich, it is considering that this city is one of the largest in Switzerland in terms of number of inhabitants, but also the most important economically and historically. It is a rich city open to international workers and knowledge with famous corporate banks and universities. It is also a very pleasant city at the foot of the Alps on the banks of its scenic lake and with a historical city center where churches can be admired, for example.
- And the 'sense of place', the individual experience, sensitivity, memories made in this place which are then associated with a pleasant or frightening place but especially with a place of memory for those who lived through an experience in that place (Agnew, 2011). For example, for me Zürich will always be associated with my PhD and to specific people I meet there. It constitutes my memories at Irchel campus, its roasted chestnuts in winter and that amazing view onto the mountains throughout the year.

These specificities linked to the place are found in each aspect of the toponym. Cresswell, (2004) sums up 'a place' as a way of looking at the world; it is a place and the interactions with it. It is the catalyst for spatial thought and the far-reaching element of its representation in language in the sense that it allows us to think and communicate about space (Hećimović and Ciceli, 2013; Tamisari, 2002).

To sum up, a place name must be considered as the result of a denominational process, but also as a name and as a place. This is what Rippon, (2013) calls 'the language of landscape' as an element of discourse which will speak of, for and about this place and therefore will communicate diverse information (Rippon, 2013:199).

Key messages:

- A place name or toponym is a 'proper noun applied to a topographical feature' (Division and Names, 2002:26)
- It can be defined through three aspects:
    - An act of naming: a deliberate act which designates a place without confusion for utilitarian reasons, communication and orientation. It is an act of appropriating a place.
    - A name: a proper noun implying a unique reference preserved over time which may be meaningful. Its semantics have been explored and classified in many fields of research.
    - A place: a specific location which can be explored through the physical properties of the feature and through the notion of 'place' involving a sensitive experience.

2.4 The study of place names and the landscape

The interest in studying the landscape and the relevance that place names could have for this exploration was demonstrated earlier. Indeed, by their nature these two domains of landscape and toponyms are interdisciplinary and both reflect the relationship of a society to its environment. The following thus offers an exploration of the study of these two concepts by diverse disciplines, offering reflections from both original analytical perspectives.

2.4.1 Geo-referencing information with place names

Traditionally in Europe, cartographers were the first to collect place names with the purpose of mapping them. It was a military or imperial enterprise with the map as an expression, a fixation and a recognition of this superior power above both land and territory creating an 'authorizing landscape' as formulated by Withers, (2000). Nowadays, place names are listed in gazetteers where they are associated with spatial coordinates (their location, usually the centroid of the named place) and with a type of place such as city, street, geographical elements, continents, etc. These gazetteers are the basis for various text explorations and allow, as shown by Gaio et al.(2012), the extraction of geographic information from lexicons and landscape descriptions (Gaio et al., 2012). Place names are thus used to geo-reference the information and improve the quantity and quality of the geographical information extracted

(Derungs and Purves, 2014). Automatic extraction of geographical information from textual information is represented by the field of Geographical Information Retrieval (GIR) (Palacio et al., 2009; Purves and Jones, 2011). Some researchers in this field, have explored the relationship between the frequency of toponyms in a text and the specific features of the geographical referent such as mountain names in Swiss texts (Derungs and Samardžić, 2017; Purves and Derungs, 2015). Moreover, exploring the notion of place Purves and Derungs (2015) used toponyms to associated local characteristics of place (the 'locale' according to Agnew, 2011) to a specific location. They highlighted a limitation in their approach by failing to capture the 'sense of place' aspect.

These approaches use place names to locate information related to the landscape. After which, remains the difficult task of analyzing this landscape information. Through this approach, GIS have the ability to capture all kinds of information and knowledge and to associate it specifically with each place name as an additional layer, as mentioned by Sieber and Wellen (2011:383):

> 'GIS is a database, to which diverse information and metatypes can be attached…Because it is not a map, multiple versions of geolocated annotations and descriptions can be stored.'

Therefore, it would be tempting to study the landscape categories via place names using gazetteer classifications like Feng and Mark who explore the 'mountain' category underlining several limitations (Feng & Mark, 2017). Nevertheless, it is necessary to remember here that the categories used in gazetteers reflect the landscape concepts of their designers and are far from being a universal standard (Goodchild and Hill, 2008 ; De Sabbata and Acheson, 2016). Thus, it becomes very difficult to analyze these pre-established landscape concepts and their place names because they might differ from one gazetteer to another and depending by whom and when the information was collected (Hastings, 2008; Smart et al., 2010). For example, Hastings brings the example of 'Lake Tahoe' and says that:

> '[It] is officially both a 'reservoir' (because its upper 6 feet of water are now dam-controlled) and a 'lake' (for its underlying volume).'(Hastings, 2008:1110).

He also underlines that many place aspects (place names, place type and location) are time-dependent, such as a river modified to a lake or the area of a village.

2.4.2 Place names to explore landscape through several languages

Place names by their relative universality have also been used to study a landscape concept through several languages. Indeed, Feng and Mark compared the use of the notions of mountains and hills in Indonesian and Malaysian place names (Feng and Mark, 2012). They described some relationships between the English definitions, in which mountain and hills have a very precise association at a certain altitude, and their use in toponyms on different islands. First, they found inconsistencies related to the definition of the words and the associated category of the gazetteer, indicating that one was higher than the other. They also noted inconsistencies between the official altitude and its applicability on the Indonesian Islands since the elevation range was designed for a western geographical context. By questioning these applied categories, these authors carried out a complementary study on the same territory and on the same toponyms, this time by wondering whether the category of mountain and hill was indeed the dominant category used to describe an eminence. They also explored whether these same terms were used in an equivalent manner on all the islands of the archipelago (Feng and Mark, 2017). They highlighted the gap between the use of the term in the toponym and the associated geographical category, but also between their use between the islands and therefore between populations. In addition, it seems that another local, non-generic term in Malay is more appropriate for the designation of an eminence in the local language. This questions the angle from which landscape categories are approached. Should they be studied from the linguistic information they contain or from their classification in a certain geographical and official standard?

2.4.3 The semantic of place names to explore landscape

Exploring the linguistic components of toponyms consists of exploring the semantics when possible, meaning the linguistic nature of its components (meaningful terms – adjectives, nouns, etc.; proper names – when they contain another toponym or a reference to a person, an event, etc.). This is what was achieved with the development of taxonomy in order to classify the naming principle (e.g. Gammeltoft, 2005; Tent and Blair, 2011), but it is also an approach that seeks generalities or patterns (Tent, 2015). This exploration can be oriented specifically to certain types of names, such as the exploration of hydronyms (names associated to a water feature such as a lake, a river, etc.) (Leino, 2005, 2007) or even certain types of geographical elements such as capes, lakes, etc. (Tent, 2016).

This interest was also found in anthropological studies of place names which have the advantage of paying attention to semantics and exploring meaning in conjunction with the function of the name or with its linguistic structure. This is what Cablitz (2008) did in her study on the Marquesas Islands where she related the use of landscape terms in place names and the linguistic structure of these terms (Cablitz, 2008). She demonstrated that the distinctive use of these terms as an object or place was identifiable in the structure of the word. This observation was also established by Makoudjou and Kamga, (2017) who highlighted a modification of the prefixes of place names according to the context in which that name was stated (Makoudjou and Kamga, 2017). A limitation of this research is however, that the referent itself (the geographical feature) was not studied more. Nevertheless, although these studies were more focused on the linguistic aspect of the name, the inventory of the diversity of semantics used for place names is welcome and highlighted a close relation with the semantics and the place designated by its properties or its history (Cablitz, 2008). This is also the finding of Senft (2008) in his study on place names and landscape terms in the Trobriand Islands. He described a variety of landscape terms for environments that are of particular interest to the population such as the sea with specific terms for currents, reefs, canals and also for garden related terms expressing types of soils etc. His study also indicates that these terms are not reused in place names and finds relatively little transparency in the semantics of these names. However, when these names are transparent, they reflect with important cultural traits and specificities the place indicating a certain relationship to the environment (Senft, 2008).

Hu and Janowicz (2018) combined studying categories or names and exploring the semantics of names of points of interest such as hotels, restaurants etc. (Hu and Janowicz, 2018). They examined the meaning of the terms used to designate these particular places in search of specificity by type of place, such as hotels, garages or restaurants, or by location. It turns out that more specific terms, in relation to the locality, are associated more with a certain type of place such as garages, while more general terms are associated with restaurants. They also found that the terms used followed the first law of geography, meaning that they were more similar within a limited radius and differed the further one moved away (Hu and Janowicz, 2018). Finally, they demonstrated a spatial character of the semantic distribution of terms in toponyms.

Semantics was also used by Atik and Swaffield, (2017) in order to add a cultural character to the definition of the specificity of New Zealand landscapes. They used toponyms as an indicator of a denotational meaning – meaning related to the reference. They classified place names as being associated with a landscape characteristic, a plant or an event and this, in relation to the type of place such as a mountain, a lake, etc. The results of this study are very interesting in the sense that they provide complementary information to the purely physical character of the initial landscape (Atik and Swaffield, 2017). It may nonetheless be important to point out that, here again, the landscape categories used are not questioned although are potentially different for the indigenous Maori.

2.4.4 Place names and their physical properties

Using physical properties, Derungs and Purves used topography to identify the nature of the toponym (such as type of referent, city or mountain) and using that information they were able to disambiguate the location of the toponym (Derungs and Purves, 2012). A year later they also compared the use of the terms *Horn*, *Spitze* and *Berg* in their current usage and in place names as a reference to an eminence - mountain type (Derungs et al., 2013). For this, they compared the morphological properties of these features to study their similarity and explored the use of these terms in a textual corpus relating to descriptions of mountains.

Their results presented in Figure 2.2 by a Self Organizing Map (SOM) representation illustrate that *Horn* and *Spitze* refer more or less to the same physical properties and to a specific reference (dark area in the same side of the square) while *Berg* does not refer to any particular type (no evident pattern of the dark area). Within further investigation, they demonstrated that each terms have to be explored individually. Finally, they showed the relevance of using digital data to answer questions that are related to the humanities and demonstrated the potential of using GIS for this (Derungs et al., 2013). Zeini et al. (2018) adopted a similar approach by analyzing the spatial distribution pattern of specific place name categories based on meaning. They reveal influences of the physical and cultural environment on the process of naming and provide elements to explore the pattern of settlements (Zeini et al., 2018).

These studies provide a few illustrations that demonstrate the interest of using GIS and quantitative analysis on linguistic data which are not usually explored through their geographical aspect and thus reveal the acquisition of new knowledge (e.g. Luo et al., 2007). In a more abstract way Dahinden (2014) explores the similar endings of place names and their spatial distribution. He reveals non-random distributions and once again brings new lines of thought to the spatial distribution of linguistic elements beyond administrative boundaries (Dahinden, 2014).

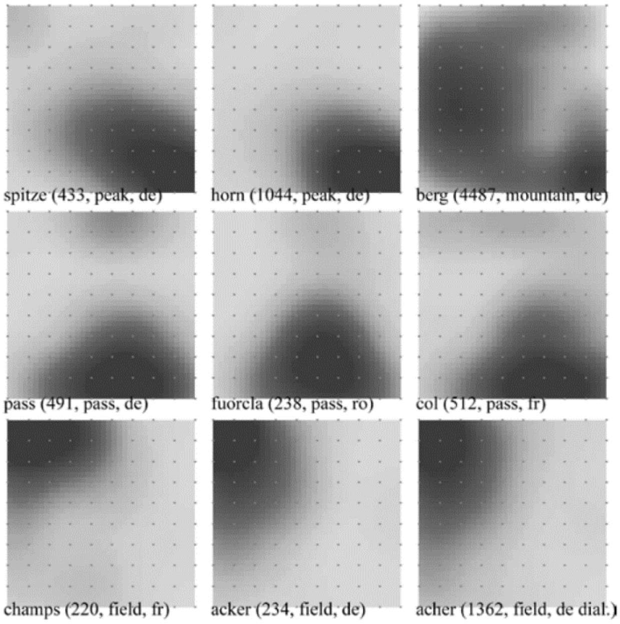


Figure 2.2 SOM representation of the topographic vectors for nine frequent generic parts in Switzerland (Reprinted by permission from Springer: Derungs et al., 2013:11)

2.4.5 Exploration of place names for historical landscapes

Diverse strategies have been used to explore historical landscapes through place names. As an illustration, Seidl, (2008) indicates in her research carried out on the names of unpopulated places (field names, cadastral or parcel names - microtoponyms) that their reference is very strongly linked to the use of the land. Without even talking about their meaning, the delimitation of the named area is strongly correlated with the 19th century land use map (Seidl, 2008). She raised the historical character and the longevity of such names and then the potential to use them to inform historic landscapes. She also noticed how difficult it was to collect the data in its entirety and to cross-reference information with individual interviews.

Using another strategy, a research group explored the history of Chinese settlements in Guangdong Province through the distribution of place names. The location of toponyms allows different geographic strategies of settlements of different ethnicities to be investigated by exploring physical properties such as distance to roads, altitude, distance to water points etc. (Qian, Kang, and Wang, 2016). These investigations combine the use of GIS tools with linguistic data based on the ethnic origin of place names (Wang et al., 2006). They demonstrate the potential of place names as a receiver of very diverse historical information depending on the aspect used (location, ethnic origin, etc.). The use of GIS enables different sources of information to be combined and their relationships to be analyzed in order to provide elements of understanding of the history of the settlement as well as of the historical establishment of languages in a territory (Zhu et al., 2018).

Place names have also been used to locate specific historic landscape features. Conedera et al., (2007) used GIS and place names to reconstruct the historic landscape of southern Switzerland and tried to understand the use of place names with reference to the term 'burnt'. Using the connection of morphological properties and historical knowledge of the land-use, they highlighted a probable use of eco-clouding (action of burning a field to fertilize it or to stop the natural evolution of this field into a bush and a forest) where collective memory and/or physical properties no longer have any current traces and for which no other explanation is known. This makes it possible to reveal forgotten landscape practices that are still present in the toponymic landscape (Conedera et al., 2007). Similarly, Calvo-Iglesias et al., (2012) used place names as an indicator of the presence of agrarian land in Galicia (Spain). They identified the toponyms as an indicator of low value for predicting the current agrarian lands with 88.8% agreement between the names and the land. However, they highlighted an agreement greater than 97% with the historical fields supporting the idea that place names are strong indicators of this historical use in a long-term time period (Calvo-Iglesias et al. 2012). This is the observation made by Fagúndez and Izco, (2016b) when exploring place names with reference to wetlands such as marshes, and raises the limitations on the use of toponyms to attest the current presence of certain types of landscapes, particularly when these places change considerably over time, for example in terms of use rather than topography (Fagúndez and Izco, 2016b).

It is the very nature of the toponyms that is questioned by these researchers who recall the broad possible meanings of place names, the sometimes unclear or ill-informed designation of their reference and the change in their environment over time (Fagúndez and Izco, 2016b, 2016a). In this historical consideration, Qian et al. (2016) explored toponyms to trace the spatial distribution of ethnic groups in Guangdong province (China). They used the toponyms as historical data to analyze the population of this province according to the ethnic groups (Qian, Kang, and Weng, 2016).

2.4.6 Place names and landscape features of interest

The same research group also explored which geographical elements were present in toponyms and demonstrated a divergent interest in the mountains or the proximity of water points according to ethnicity (Qian, Kang, and Weng, 2016). Similarly, Tent (2017) focused on the origin of place names in the context of colonization in Australia, New Zealand and the Fiji Islands (Tent, 2017). He explored the percentage of indigenous names or names introduced by English settlers, depending on the nature of the element named. He observed marked variations with very few names introduced on the Fiji islands, a very large proportion in Australia and a certain parity in New Zealand. He attributed those disparities to the way in which colonization unfolded as well as to the linguistic power and the number of the indigenous societies. The great Australian disparity did not allow indigenous coalition during colonization, while the Maori limited the introduction of English names. The exploration of these toponymic origins was linked to elements that were classified as natural (maritime, terrestrial water, relief, vegetation and desert) or unnatural (built, civic). He then highlighted that indigenous names are dominant when the elements have a greater importance for the indigenous society, and vice versa. He thus found many names introduced for the places built by the colonists and also, in this case with a certain degree of negotiation, for the maritime places. Indeed, the colonists colonized these countries by the sea, therefore these references were also very important for them and they thus introduced many of these names. This can be remarked for the Fiji islands even though the percentage remains low, 11.6% of names introduced for the marine places, it remains the second type of place containing the most names introduced; the first being cities, which were built by the colonists themselves. Consequently, despite the weak power of appropriation of space, these places were the most marked by non-indigenous names (Tent, 2017). This study provides a new landscape perspective through place names, without giving very precise information on the landscape categories. It indicates the types of places which are important in terms of identity for these indigenous peoples and shows once again the disparities linked to the context. Furthermore, this work alerts to the power of interpretation and shows that many factors should be considered when exploring place names.

This is what Nash (2017) also demonstrated with his study of toponyms and the island specificities of the names of Australian islands. He encouraged the exploration of toponyms to capture local understanding of places and calls for collaboration between different disciplines (geography, linguistics, history, toponymy) in order to provide the best possible interpretation (Nash, 2017).

2.4.7 Place names and relationship with the environment

The following section identifies the studies of numerous anthropologists carried out both on the Amerindian peoples and on island populations (for example: Ottino-Garanger and Ottino-

Garanger, 2017). Among them is the renowned work of Thornton, who describes in two articles the organization of Tlingit geographical knowledge (Alaska) by exploring the distribution of their place names (Thornton, 1997a, 1997b). Many anthropologists who explore place names formulated the postulate which was later taken up by ethnophysiography supporting the potential of place names to explore human/environment relationships, asking not only what is significant but also how it is perceived and organized (Fair, 1997; Jett, 1997; Johnson, 2000; Thornton, 1997a). From all of these studies, a diversity of conceptions of landscape and of relationships to the environment was captured thanks to the rich potential of place names. Thus, Johnson (2000) describes the place names of the Gitksan in British Columbia and uses them to classify the landscape elements as places or as an ecological resource. She used this information to understand how the Gitksan perceived landscape elements and also how they used these places via certain semantics (Johnson, 2000).

Kari (1989) pursued the same approach by studying different peoples and place names of the Athabaskan linguistic family in Alaska, data described previously by Sapir. He conducted a remarkable study on the linguistic aspects of these names, their structure and their meaning and explored them in relation to the environment, to space as it was perceived by the respective peoples. The results of this study mixing qualitative information with quantitative analyzes allowed neighbouring peoples to be compared, such as the Inuit or the Apaches. They showed distinct environmental relationships simply by exploring place (Kari, 1989; Key et al., 2019). Unfortunately, all of the data collected are not digitalized and are therefore available to ethnologists alone or have to be gathered through the writings of these scientists (when published). Nevertheless, this study clearly demonstrates the potential of place names for such an interpretation even though this kind of research requires considerable time, often corresponding to the entire career of a researcher.

In all of these approaches, it has been demonstrated that there is a great potential to explore toponyms through either a geographical, anthropological or a linguistic aspect. They also demonstrate the potential of using GIS as a tool to explore and illustrate such data with the possibility of combining physical and linguistic information.

Key messages:

- Place names are used to :
    - Explore information in text and geo-reference it
    - Explore landscape concepts through several languages
    - Explore landscape through their semantics
    - Explore the physical distinction between landscape concepts
    - Explore historical landscapes
    - Identify landscape features of interest
    - Explore the relationship with the environment

2.5 Research gap and research questions

I have demonstrated in the above the importance of considering the multiple aspects of place names to understand a cultural landscape. This observation is not recent, and it was formulated at the beginning of the 20th century by Ratzel, and then highlighted by Durkheim to consider the social aspect to understand geography and conversely to understand geography to approach the social domain (Durkheim, 1900). Certainly, at that time even though this observation was made, there was no established protocol for such research. Since then, anthropology has succeeded in taking into account the diverse and varied aspects of a society, and exploring how they are structured has brought to light key elements of understanding. Here I wish to approach the landscape in its totality and I wish to do so via place names, which as I have demonstrated, have a certain potential for this specific exploration. I am convinced that this implies an interdisciplinary approach combining various methodologies. Nevertheless, as demonstrated before, place names are usually studied, even when it's with an interdisciplinary approach, from one of its three perspectives: the name, the geographical referent or the cultural settings. Few studies related to landscape explore two aspects and even less, all of them.

Therefore, I wish to apply what Tent (2015) defines as an extensive approach to toponyms, that is to say looking for meaningful patterns which hold information about concepts and their uses at a local level but also overall (i.e., as a system and not individually) (Tent, 2015).

Thus, the first objective of this research is to demonstrate that place names, despite their status as proper nouns/names, contain linguistic information relevant to exploring landscape concepts, and that this exploration would be more effective through using Geographic Information Systems. Thus, in order to meet this objective, I wish to address the following questions formulated on the assumption that linguistic information is contained in the semantic baggage of these names:

- RQ1: What linguistic information relating to the landscape is contained by place names?
- RQ2: How is the semantics of place names relevant to exploring landscape concepts?

The second objective of this research is to explore the relationship between linguistic, i.e. semantic, information of place names and their physical properties using GIS. This is to demonstrate their complementarity and the interest of analyzing them jointly. For this, I have formulated the following questions:

- RQ3: How can the relationship between the semantics of place names and the physical properties of designated places be investigated?
- RQ4: To what extent does spatial distribution influence the semantics used in place names?

Finally, the third objective wishes to consider the denominative act and the social function of place names in landscape investigations. Thus, I wish to answer the following questions:

- RQ5: How can the cultural settings of place names be analyzed with their linguistic and physical properties?
- RQ6: What are the benefits of considering the name, the referent and the cultural settings of place names in landscape research?

3 Linguistic aspects of microtoponyms and landscape investigation [6]

The background section has demonstrated the value of exploring landscape through place names. This has been carried out by linguists, anthropologists and geographers highlighting that place names contain semantic (e.g. landscape terms) but also structural information (e.g. they can be sentences or compound words) that are useful in exploring the notion of landscape (e.g. Mark et al., 2011a).

However, the question arises as to whether this exploration can be carried out in a more efficient way, in a shorter time and with more data. This would allow data mining over much larger territories across countries rather than being limited to regions. For research conducted at such scales, it seems important that it is replicable and applicable to the entire linguistic diversity of toponyms (monomorphemic – Zürich - , compounds – Obersee: Ober + See - , sentences reduced clauses – Côte d'Azur - , etc.). Indeed, developing a reproducible methodology could help to establish a framework of comparison providing significant benefits such as improving communication about environmental issues or exploring the geospatial world (Smith and Mark, 2003). The following statement by Burenhult and Levinson (2008:140) also highlights the benefits of such an approach:

> 'Even in this small sample of languages, the cross-linguistic approach allows for a comparison of landscape terms and place names in (a) similar and different ecologies and (b) similar and different subsistence systems. For example, we are in a position to compare the categorical systems of unrelated languages in similar as well as varying ecologies. Also, we can compare systems used in similar subsistence situations but in unrelated languages and vastly different environments.'

Using place names to explore landscape terms allows a term to be related to a referent and therefore to some physical reality such as a 'wood' with an area of trees. Thus if the term wood is not shared between languages, but wooded areas are, exploring how these areas are named

[6] This chapter is based on Villette & Purves (2018)

could help to make a connection with the term 'wood'. Establishing this relationship could improve communication and exchanges through languages when terms related to the landscape are involved (Smith and Mark, 2003; Wismann, 2014). Thus, it is necessary first to capture the linguistic information (the structure and the semantics) contained in place names. The objective of this chapter is therefore to explore the nature of this linguistic information and its potential for landscape studies when considering a large amount of data.

To this end, a bottom-up approach will be presented, exploring the linguistic specificity of place names at a large scale. A case study of the microtoponyms (names of unpopulated places, *Flurnamen* in German) of the Swiss Canton of St. Gallen (17'598) will illustrate the proposed methodology using computational power to extract this information. In addition, the extracted information will be analyzed to determine its relevance for landscape exploration through the specific case of four landscape terms (*Wald*, *Holz*, *Riet* and *Moos*). The study area and the dataset used will be presented first. This will be followed by a description of the methodology used to extract the landscape terms and to analyze them in both the microtoponym dataset and the sample with only microtoponyms containing the four landscape terms. Finally, the results will be presented and discussed regarding the utility of a linguistic analysis of microtoponyms in the understanding of landscape terms.

3.1 Study area and data

3.1.1 Canton of St. Gallen (Switzerland)

The study area is the canton of St. Gallen located in Switzerland. This administrative unit created in 1803 is located in the northeast part of the country. It is bordered to the north by Lake Constance (a natural border with Germany), to the east by the Rhine (which separates it from Austria and Liechtenstein), to the south by the cantons of Grisons, Glarus and Schwyz), and to the west by the canton of Zurich (Figure 3.1). It contains within its borders the enclaved cantons of Appenzell Innerrhoden and Appenzell Ausserrhoden. The canton of St. Gallen covers an area of 2,030 km^2 with an elevation varying from 396 m at Lake Constance to 3,248 m at the top of Ringelspitz. Today, 46.5% of the territory is used for agriculture, 30.5% is forested and urban areas cover 10% (St. Gallen statistics, 2017).The canton of St. Gallen, with its eponymous capital, has just over 500,000 inhabitants, with more than 80% of them living in urban areas. The official language of the canton is German, but as in the whole of German-speaking Switzerland the inhabitants use local dialects in oral communication under the umbrella term of Swiss-German (St. Gallen statistics, 2017). However, it is important to underline that historically, Romansh was spoken in the south of the canton and for this reason both Swiss-German dialect forms and Romansh toponyms are found besides standard German toponyms in the canton.

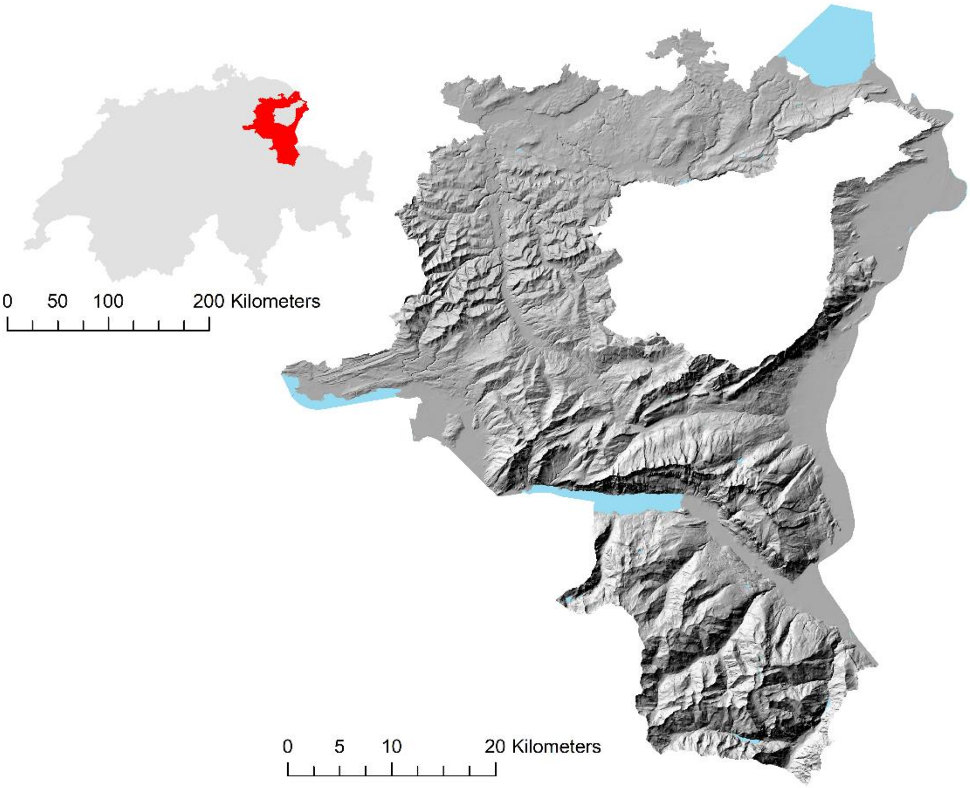


Figure 3.1 Canton of St. Gallen (Switzerland)

3.1.2 Microtoponyms dataset

The varied topographic and linguistic characteristics of this canton make it very interesting to investigate landscape concepts. Moreover, the choice of the study area was made in the first place because a very precise dataset was provided by the canton and due to financial support from the Swiss National Science Foundation (SNF) through the project 'Local Toponyms of the canton of St. Gallen' No. 100015_182626. Indeed, toponymic research is an extremely active scientific field in Switzerland and it has been supported for many decades by the SNF with regard to collecting place names and investigating their linguistics properties.

Consequently, many research groups have already produced quite complete investigations of the cantonal toponyms providing their associated etymology. The results of such investigations are stored online or for some cantons in the respective cantonal book *Namenbuch*. Nowadays, this information is freely accessible via the ortsnamen.ch website with the additional possibility of viewing the geo-referenced data on a map (Ortsnamen, 2020). Regarding the toponyms of the canton of St. Gallen, for several years a team of linguists has been working on the above-mentioned SNF project. From 2009 to 2015, they were working on settlement names of the canton and the results are documented in ortsnamen.ch. Since 2016, they have focused on *Flurnamen*[7], toponyms which refer to unpopulated places (Ortsnamen, 2020). As my PhD is part of this specific subproject, the St. Gallen *Flurnamen* that is explored further in this chapter constitutes a key dataset of this thesis. Nevertheless, *Flurnamen* does not have a direct English translation. Thus, for language convenience I will use the term 'microtoponyms' in reference to these specific place names. In fact, the data provided by the canton consists of all the names assigned to each parcel (plot of land) in the canton. They form the most precise nomenclature of the territory presently digitalized and accessible, justifying the precision of 'micro' associated with these toponyms. Moreover, since this cantonal dataset of microtoponyms refers to non-populated places, the assumption was made that their semantic will be more correlated to the landscape than names of populated places. In addition, in order to investigate landscape terms using the conceptual framework of the triadic triangle it was obvious to use place names referring to landscape features and not populated places.

Each microtoponym of this dataset is digitized, and associated with a georeferenced polygon. Thus, each portion of the territory is associated with a name, often associated with administrative property rights. Therefore, even the perimeter of an urban area is segmented into distinctive plots producing a spatially continuous database. It is also important to notice that these names were first collected by the municipalities and then transmitted and merged by the canton. This implies a visible disparity in the collection of names such as illustrated in Figure 3.2 where it seems that in some cases the density of names collected is correlated to the municipal boundaries. Indeed, while land-cover does not change between these municipalities, Flums has much larger polygons than Quarten at their southern mountainous boundary. Whatever the reason for this disparity, it seems likely that it is the result of a combination of environmental and social factors. In total, the microtoponym database consists

[7] Terms in another language than English will be written in italics with their own linguistic characteristic such as with a capital letter for German nouns.

of 17,598 individual polygons associated with names, with an average area of 11.2 ± 2.3 hectares.

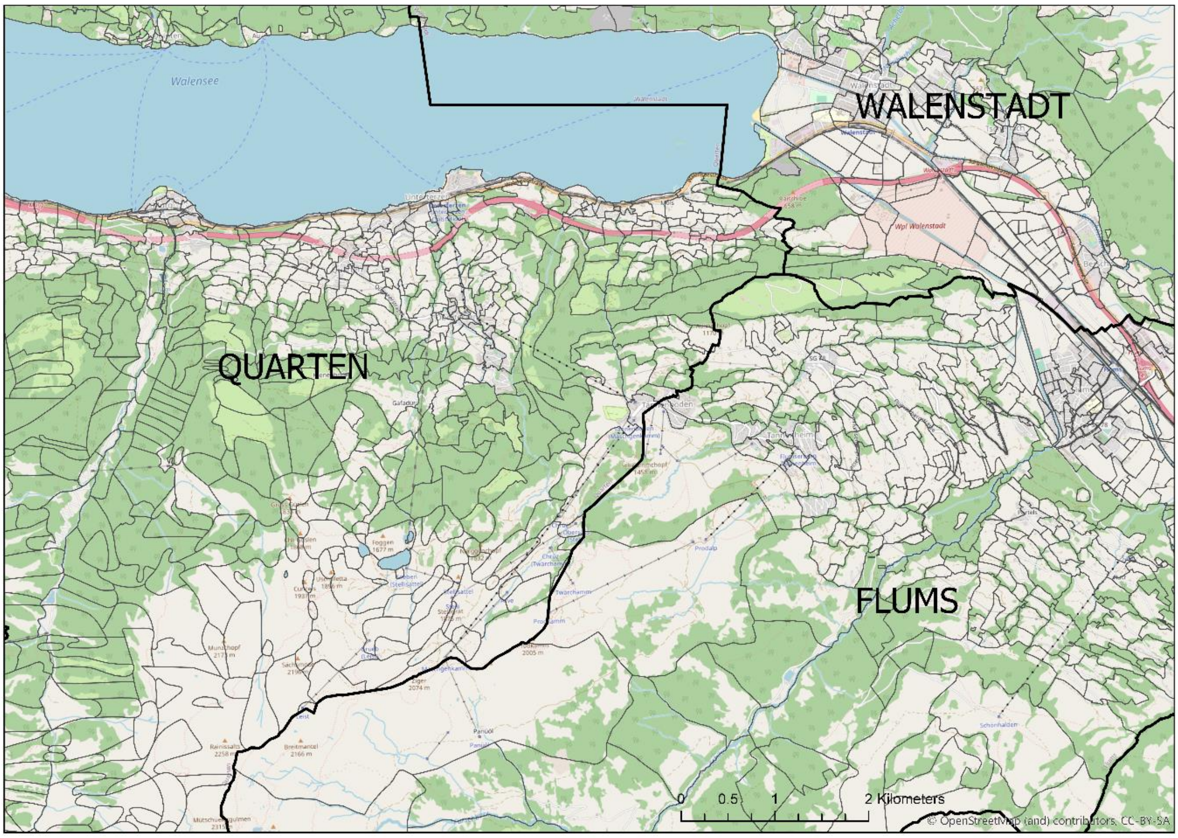


Figure 3.2 Municipal boundaries and microtoponym polygons in the South-Eastern part of lake Walensee (Switzerland, canton of St Gallen). ©Openstreetmap

3.1.3 Lexicon of meaningful elements

The linguists involved in this project are in charge of determining the etymology of microtoponyms. Based on available historical documents (such as the first maps, administrative registers and archive documents), they are researching the history of each individual name in order to identify its first meaning. Over time a toponym can undergo many modifications. The name of a place could change for political reasons. For example names can be modified in order to establish a new identity following the conquest of new territories or following war or religious domination (e.g. Azaryahu and Golan, 2001). A name of a place can also be modified for cultural reasons. For example, macro approaches to language such as during the process of place name collections, may favor a common speech form instead of preserving local dialectal variation (Tulloch, 2006). However, nowadays, the political will of preserving dialects can lead to the opposite, encouraging the collection of local names and changing the name back to its previous form/version. Moreover, a new denomination can be given following a major event (for example a name of a street can be modified after the death of a famous person who used to live their) (Nyström, 2016). A modification of a toponym can also be the result of a change in the referent, for example, a hospital becoming a university can lead to a modification of the name of the building. When this history can be retraced, most of the time linguists can determine the original meaning of place names based on the oldest source available. When a name is modified because of the evolution of the language, this etymological investigation can help to attribute meaning to names that are no longer transparent and make it possible to analyze a much larger quantity of data.

Within the 17,598 microtoponyms explored here, 54% (9,489) of them are unique. They constitute a huge amount of data to investigate for the team of linguists and it takes years to look at them all individually. However, St. Gallen microtoponyms are composed of a limited number of morphemes, as each language is composed of a limited number of words. Therefore, during etymological research related to projects of creating books of regional names (Namenbuch), a lexicon with morphemes found many times inside place names has been created. This lexicon (Figure 3.3) contains these morphemes, associated with their probable etymologies established from the analysis of historical documents. Since, in the lexicon the morphemes are associated to an etymology, I will call them 'Meaningful Elements' (ME).

98% of St. Gallen microtoponyms are in Standard German or Swiss German and the last 2% are Romansh. The German-based St. Gallen microtoponyms can have the linguistic structure of a single word such as *Riet* or use compounds such as Schwarzberg where *Schwarz* ('black'[8]) and *Berg* ('mountain') can be isolated. Thus, these elements can be indexed in this lexicon, illustrated in Figure 3.3 for *Berg*. For this entry, this figure illustrates that it can be associated with several spellings (*Bärg* and *Berg)*, without modifying the etymology. It is also important to notice that for some ME, several etymologies can be found. For example, *Schwarz* can refer to the color, but also to a family name or to its metaphorical association with dark connotations (evil, death, curse etc.).

The lexicon created by the linguists is composed of 3,378 meaningful elements. These ME could refer to generic landscape terms (e.g. *Berg* or *Wald* ('forest')), adjectives (e.g. *lang* ('long') or *rot* ('red')), or spatial expressions (e.g. *ober* ('upper')). It is important to note here that this lexicon is not exhaustive because it contains only the recurring terms present in the microtoponyms of the canton. Therefore, some rare elements are not included. In addition, it

[8] A possible translation of each ME will be provided the first time the term is used.

should be noted that a single microtoponym may contain one or more of these elements, with only some of them present in the lexicon.

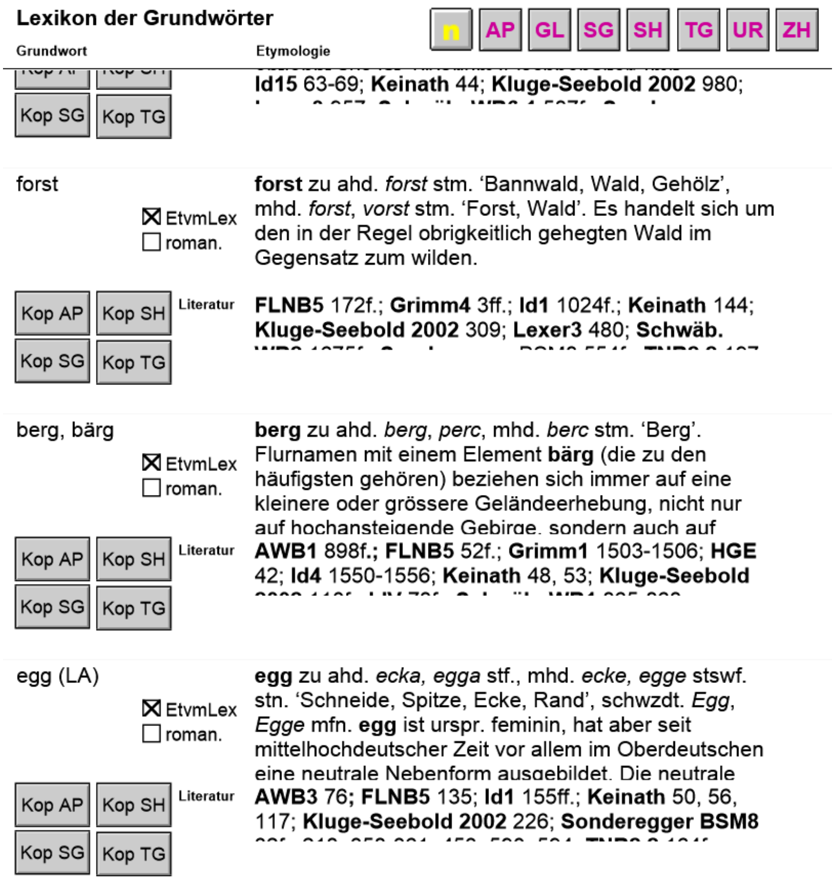


Figure 3.3 Screenshot of the database of the linguistic lexicon of ME built and used by linguists working on the project 'Local Toponyms of the canton of St. Gallen'

3.2 Methodology: extracting semantic information from microtoponyms

Using this database of microtoponyms and this etymological lexicon, I will present in the following the methodology that has been developed to extract semantic information from microtoponyms. Firstly, I will detail the extraction of ME and the computation of their frequency inside the microtoponym dataset of the canton. Secondly, I will explore compounds, the way meaningful elements are associated with each other inside the microtoponyms. Finally, I propose a case study with only a selection of landscape terms (the ME *Wald*, *Holz* ('wood'), *Riet* ('reed') and *Moos* ('bog')) to which I applied the same first steps of my methodology and to which I added a taxonomic classification of these ME to allow their semantic analysis at a broader scale.

3.2.1 Extraction of meaningful elements

The approach used to extract ME, aimed to perform string matching between the ME of the lexicon and each microtoponym of the dataset. Each correspondence is then counted in order to establish the frequency of the ME and allow a statistical exploration of the data generated. However, in order to improve the matching quality, this principle required some adjustments. For example, it was necessary to remove from the lexicon any two-letter elements such as prefixes, suffixes and diminutive forms (ab, an, li etc.) because they generated too many errors. The lexicon was also ordered by length and alphabetically. Then the matching process illustrated in Figure 3.4 can start.

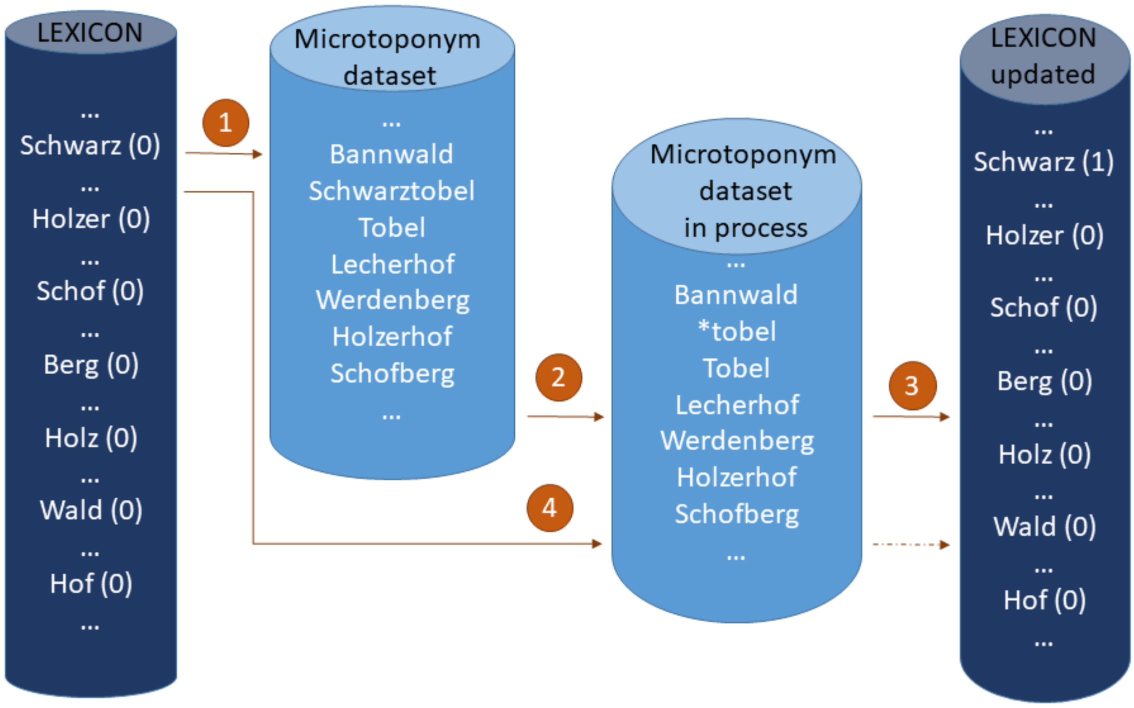


Figure 3.4 Matching process between the lexicon and the microtoponym dataset

This iterative process seeks a match for each ME of the lexicon, one by one, in all the microtoponym dataset. The process starts with the longest ME 'Schwarz' in Figure 3.4 and looks for a match with each microtoponym of the dataset. If there is a match (such as with the microtoponym 'Schwarztobel') the second step involves modifying the dataset with a star (*) instead of the ME in the microtoponym ('Schwarztobel' become '*tobel' after a match with the ME 'Schwarz'). In the third step, the lexicon is updated with the number of matches of this

ME, in our example the ME 'Schwarz' is then associated to the value 1 since it matched once within the microtoponym 'Schwarztobel'. After this, the same process is applied to the next ME of the lexicon, and so on until the last ME.

As described earlier, a microtoponym can contain several ME from the lexicon. It is therefore essential to delete only the part of the microtoponym for which there was a correspondence and to keep the rest of the microtoponym for a possible match with another ME as illustrated by the microtoponym Schwarztobel. Moreover, by exploring the number of stars (*) inside the microtoponym dataset at the end of the process, it is possible to know how many ME were found inside each microtoponym. Figure 3.4 provides an example explaining the choice of ordering the lexicon by length and alphabetical order as previously mentioned. For the example of the microtoponym Holzerhof we can consider that the lexicon contains the ME *Hof* (farm), *Holz* and *Holzer* ('wood cutter'). If the lexicon goes through the microtoponym list in alphabetical order, a match would be found with the ME *Hof* and *Holz* instead of the expected correspondence with *Hof* and *Holzer*. In order to avoid these errors, the lexicon was classified by length and the matching process started from the longest terms to the shortest. Understanding that process also helps to illustrate the necessity of deleting two-letter elements. Indeed, this matching process implies that two-letter ME seek a match inside the microtoponym dataset at the end of the process where only stars and rare ME not registered inside the lexicon remain. In general, the matching found with these two letter elements was with part of morphemes and not with the expected preposition and at the right position inside the microtoponym. For example, the diminutive form 'li' would match with the not registered morpheme '*berlig*' or the prefix 'ab' with the morpheme '*elabria*'. Since my matching process does not consider the position of these elements (at the end of a morpheme for suffixes and diminutive forms ; at the beginning for prefixes), I consequently made the decision not to consider these elements when only a manual step and a linguistic expertise could generate a correct match.

At the end of the matching process, the microtoponym dataset provides information about the number of matches per microtoponym and also about the elements absent in the lexicon. The lexicon updated with the number of matches allows the exploration of the ME frequency inside the microtoponym dataset.

3.2.2 Exploring the associated meaningful elements

The first step extracted the meaningful elements present in the microtoponyms and counted their occurrence. However, place names may have various morphological structures. They can be monomorphemic (example *Riet*), consist of compounds (example Schwarzberg), or consist of reduced clauses (as in American languages described by Basso (1988)) or of phrases (example of the French place name Côte d'Azur ('coast of blue')) (Nash and Simpson, 2012:399). Related to our study area, Nash and Simpson also indicated that:

> 'In many European languages there are binomial place names, with generics as part of the name (e.g. Loch Lomond, Lake Windermere, Bodensee, where loch, lake and see are generics denoting water features)' (Nash and Simpson, 2012:399).

Indeed, in our database, many microtoponyms consist of compounds, and as suggested by Nyström (2016), this association of morphemes is meaningful. He underlines that when a name includes a 'lexical intelligibility', in other words that it is transparent, it leads to certain assumptions about the place because there is a relation with the 'non-proprial part' of the name (i.e., meaning to the common words used in it). For example, it would be logical to expect that the place called Schwarzberg was an eminence in the landscape with a dark coloration. This morphological structure was explored by Leino (2007) who describes the use of 'common words' as an association of an 'identifying element' with a 'type of place' (Leino, 2007). He describes how the analysis of the identifying lexical element can provide information about the act of naming in regard to his case study of Finnish lakes. In his study, he identified and analyzed four linguistic aspects for these 'identifying elements'. They can be adjectives and therefore the name is motivated by a notable feature of the type of place. They can be nouns, when the name relates to the use or the shape or a near-by feature. They can also be nouns in a genitive case, as a reference to a person or another place or, finally, a verb. In these situations, the name usually relates to the use of the place. This way of exploring and categorizing place names is called a 'word semantic classification', which is a classical linguistic analysis in word composition in German, in opposition to a 'name semantic classification' (Gammeltoft, 2005). Gammeltoft (2005) underlines that the word semantic classification analyzes the elements of the names (i.e., the 'specific' and the 'generic' – equivalent to Leino's (2007) 'identifying element' and 'type of place' , respectively) as separate units instead of as the sum of characteristics. Therefore, some part of the semantic information of the place name is missing. Based on these ideas, the association of ME inside microtoponyms will also be explored.

To explore these associations inside the microtoponyms of the canton, I kept the 26 most frequent ME of the microtoponym dataset grouping together: natural features (e.g. *Berg*, *Wald*), cultural features (e.g. *Hof*, *Dorf* (village)), adjectives (e.g. *lang*, *neu* (new)), spatial expressions (e.g. *ober*, *hinder* (behind)) and animals (e.g. *Geiss* (goat)). I then isolated the microtoponyms in which they appeared and explored their associated ME for each of the 26 elements. The first step was to search for and count the matches with the ME of the lexicon based on the method previously described (Section 3.3.1) for each of the 26 elements. Second, in order to represent their frequency independently of the general distribution, to see if a term appears more than by chance, the χ-value for each frequency of ME combination was calculated.

The χ-value assumes that the data are independent and compares the real data ('Observed' value) with what would be expected with independent, randomly distributed data ('Expected' value). Then the significance of this value, namely the data observed that appear more or less frequently than the expected value, can be evaluated with the χ-squared (Ebdon, 1991).

The χ-value was calculated according to the following equation (*3.1*):

(*3.1*)

$$\chi = \frac{Observed - Expected}{\sqrt{Expected}}$$

With for this specific exploration:

$$Observed = number\ of\ occurrences\ of\ the\ combination\ A + B$$

And

$$Expected = \frac{Total\ nbr\ of\ occurrences\ of\ A}{Total\ nbr\ of\ microT.} x \frac{Total\ nbr\ of\ occurrences\ of\ B}{Total\ nbr\ of\ microT.} x\ Total\ nbr\ of\ microT.$$

3.2.3 The case study of Wald, Holz, Riet and Moos microtoponyms

The method presented above enables the meaningful elements present in the microtoponyms of the canton of St. Gallen to be extracted and analyzed statistically.

In addition, I chose to apply this methodology to the specific case of landscape terms inside these microtoponyms. For this, I explored two pairs of ME related to landscape terms: *Wald* and *Holz* and *Riet* and *Moos.* In the Schweizerisches Idiotikon (Idiotikon, vol. 15 p.1467), *Wald* is described with the plural form *Wäld* and the diminutive *Waldi* or *Waldli* etc. and it is defined as a synonym of *Holz*. It can be translated by 'forest' or 'wood' in English, and '*forêt*' or '*bois*' in French (Leo, 2020). *Holz,* is associated with the plural form *Hölzer* and it is defined as '*Wald*' as a first meaning and with other ideas such as wood as a material, a tree trunk or trees (Idiotikon, vol. 2 p.1246). It is translated by 'wood' or 'timber' in English and by '*bois*' in French (Leo, 2020). It is thus clear that they both refer to a wooded area. *Riet,* is associated to the plural form *Rieder* and to the *Ried* form in some Swiss cantons (indicated as restricted to Bern) and to the diminutive form of *Rietli or Riedli* (Idiotikon, vol. 6 p.1729). It is defined with two possible meanings: 1. as '*Bezeichnung verschiedener Riedpflanzen. Schilf, Phragmites comm.*'[9] And 2. '*Ried*' as '*'locus e silva excisus', darnach: 'ausgereuteter Platz im Wald*''[10] (Idiotikon, vol. 6 p.1730). The first meaning is translated as 'reed' in English and by '*roseau*' in French and the second refers to the act of clearing an area of trees. *Moos,* found in its historical form as '*Mos*' (Idiotikon, vol. 4 p.470) is defined as *'Moor, feuchtes, sumpfiges Land, auf dem nur kurzes Streugras wächst. Syn. Riet* [11] *.*'. It is translated as 'marsh' in English and as '*marais*' in French. *Moos* is even indicated as a synonym of *Riet.* It is clear that in this case, this definition ignores the second possible meaning of *Riet* when it could take the form of *Ried* in the canton of Bern.

These two pairs are illustrations of two kinds of semantic aspects. First, synonymy, they could define the same thing or be used in the same context (for example *Wald* and *Holz* refer to trees or wooded areas). Therefore, I could explore whether it was the case when they were used inside microtoponyms. Second, *Riet* and *Moos* illustrate the synonymy aspect, and in the canton of Bern the multiplicity of meanings. This chapter will explore only the first case of synonymy.

In order to explore the four landscape terms, the first step was to extract the microtoponyms with *Wald*, *Holz*, *Riet* and *Moos* in order to isolate these microtoponyms from the cantonal dataset. Using the matching process developed and described before I created four datasets:

- *Wald* dataset: With microtoponyms containing the ME *Wald* or *Wäld* (including therefore longer forms such as Waldli, etc,).
- *Holz* dataset: With microtoponyms containing the ME *Holz* or *Hölz.*

[9] 'Designation of various reed plants. Reed, Phragmites comm.'
[10] 'locus e silva excisus', after that: 'cleared out place in the wood'
[11] 'Bog, wet, swampy land on which only short litter grass grows. Syn. Riet.'

- *Riet* dataset: With microtoponyms containing the ME *Riet* or *Ried*.
- *Moos* dataset: With microtoponyms containing the ME *Moos*, *Mos*, *Möös* and *Mös*.

In a second step, I applied the same matching process with the lexicon for each of these datasets (Figure 3.4). Therefore, I was able to extract for each dataset the list of matches of ME. I will call them the 'Associated ME' since they are explored as associated to *Wald*, *Holz*, *Riet* or *Moos*.

In order to analyze the semantic information using descriptive statistics, I classified the associated elements. To this end, I first translated them into English using Google translator and then I used a taxonomy established by Gammeltoft in 2005 (Table 3.1). It's important to notice that I translated the etymology (written in German by linguists) to a single or few English terms even when the etymology was a description. However, when the classification of this term was not straightforward, I came back to this description.

Following this classification, two annotators independently classified all the ME associated with *Wald*, *Holz*, *Riet* and *Moos*. Following that, they pooled their attribution choices and then explored together the cases where their classifications diverged. In most cases, the discrepancies were due to the ambiguity of the terms and their possible metaphorical use. For example, certain plants such as the ME *Mad* ('hay') may be associated with a use or with an agricultural practice which could correspond to 'Plant-growth' but also to 'Usage'. There were also references to what could be a building such as a castle but which, in some associations, instead refers to the form of fortification of the natural element. The etymological descriptions of the lexicon when these ME are considered inside toponyms were therefore used to find a consensus for the majority of the disagreements. Cases which did not correspond to any category were classified in an additional class 'Don't know'. In the example provided for this category, an etymological explanation of the microtoponym Platzwald could have been found, however, since I considered only the ME which were part of the name, we did not find a consensus to classify '*Platz*'.

3.3 Results and interpretation: what the name can tell us about the landscape?

I have presented above the matching process as well as the approach used to explore the associated ME. The results of each step will be presented as follows illustrating firstly the results related to the microtoponym dataset of the entire canton and secondly the specific case study of the microtoponym datasets containing the four landscape terms *Wald*, *Holz*, *Riet* and *Moos*.

3.3.1 The semantic information of St. Gallen microtoponyms

3.3.1.1 Frequency of ME in St. Gallen dataset

The microtoponym database linked to the lexicon revealed a match with at least one ME in 86% of the microtoponyms. This corresponds to 1,409 different ME of the lexicon matching with 15,153 microtoponyms demonstrating as expected the relevance of this lexicon in the list of St. Gallen microtoponyms.

This confirms that a very limited number of elements are used for a large number of names suggesting that the specificity of a name depends more on the combination of terms or its use in a restricted territory rather than the specificity of the meaningful element.The following figures (Figure 3.5 and 3.6) illustrate this matching between lexicon and the microtoponyms of St. Gallen related to their rank and frequency. It should be noted that in Figure 3.5 illustrating the rank of the most frequent microtoponyms of St. Gallen, nine of the microtoponyms in the top 10 are made up of a single meaningful element (Oberdorf is the exception). However, there is a slight difference in semantics between the most frequent microtoponyms of the canton and the most frequent meaningful elements, presented in Figure 3.6. The difference is greater with microtoponyms that can appear similarly almost a hundred times than those whose occurrence is several hundred, for example the ME Berg occurring almost a thousand times. In addition, Figures 3.5 and 3.6 illustrate the frequency of microtoponyms and significant items as a function of their order on a logarithmic scale. This makes it possible to report the order of magnitude of all of the data on a single graph. They both show a relatively linear progression, which in this case of linguistic exploration, shows a certain correlation to Zipf's law. Zipf's law was developed based on an empirical observation of language and then was subsequently verified mathematically. It postulates that the frequency of occurrence of a word in a text is a function of its rank (Zipf, 1935; Piantadosi, 2014). Thus, the most frequent term appears twice as many times as the second most frequent term and so on. This law is illustrated by the following equation:

(3.2)

$$f(n) = \frac{K}{n}$$

Where K is a constant and n the rank of appearance of the term

Gammeltoft classification	***Example of ME***	***Example of microtoponyms***
I. Relationship		
a. Topographical		
i. Characterization of the location in relation to name-bearing location	Sax ('place name')	Saxerriet
ii. Characterization of the location in relation to a non-name-bearing location	Berg ('mountain')	Bergholz
iii. Characterization of the location by means of its relative position	Ober ('above')	Oberwald
b. Institutional and administrative	Chloster ('monastery')	Chlostermoos
c. Association to a person	Frau ('women') Frank ('family name')	Frauenholz Frankenholz
d. An external event	Maie ('May/Maypole')	Maieriet
II. Quality		
a. Size	Gross ('big')	Grossmoos
b. Shape	Schiben ('disk')	Schibenwald
c. Color	Rot ('red')	Rotmoos
d. Age	Alt ('old')	Altrütiholz
e. Material or texture	Fels ('rocky ground')	Felsbachriet
f. That which exists at or near		
i. Creature	Katz ('cat')	Katzenmoos
ii. Plant-growth	Erle ('alder')	Erlenholz
iii. Inanimate objects	Brugg ('bridge')	Bruggwald
g. Perceived qualities	Wild ('wild')	Wildriet
III. Usage	ziegelhütte (brick-factory/brick manufacturer)	Ziegelhüttenriet
Don't Know	Platz ('place')	Platzwald

Table 3.1 Gammeltoft taxonomy illustrated with microtoponyms examples

In Figures 3.5 and 3.6 it can be observed that despite a correspondence to this law, this correlation is greater for microtoponyms ($r^2 = 0.99$) than for ME ($r^2 = 0.94$). There are two potential reasons for this observation: 1) Microtoponyms are elements of language, so it is not absurd that they follow the rules that govern language in general by following power law (which is the case when they are not illustrated at a logarithmic scale). This has been demonstrated several times through various examples (see Zipf 1935; Piantadosi 2014). 2) It has been shown that through using ME, a large proportion of microtoponyms are also significant and therefore are significant language elements in their own right. Consequently, there is no reason justifying a power-law distribution of ME isolated from their use in microtoponyms.

Indeed, there is no external factor such as the topography or the geography which follows this distribution law (there is no general law indicating that there would be twice as many mountains as forests in this canton). However, since the frequency illustrated represents their use in the microtoponyms which follows Zipf's law, the lexicon is thus constrained by the same rules in its context of use, here the reference to a place. This is what Piantadosi illustrated in Figure 3.7 with dots close to the red line (visualizing equation 2) and with a high correlation value (R^2). He formulated as follows:

> 'The lexicon did not have much freedom in how it labeled the terms in these categories since the referents of these terms are salient, fixed natural binds.(…) For instance, our division of the world into 12 months comes from phases of the moon and the seasons, not from a totally free choice that language may easily adapt or optimize' (Piantadosi, 2014:9)

It should, however, be noted that Piantadosi used the normalized frequency to visualize his data rather than the raw frequency such as in Figures 3.5 and 3.6, but without any major differences. This constraint can also be observed in Figure 3.8 which illustrates the 200 most frequently used ME inside the entire microtoponym dataset of St. Gallen. This word cloud illustrates these meaningful elements in relation to their frequency through the size of the terms. The larger the term is, the greater its frequency.

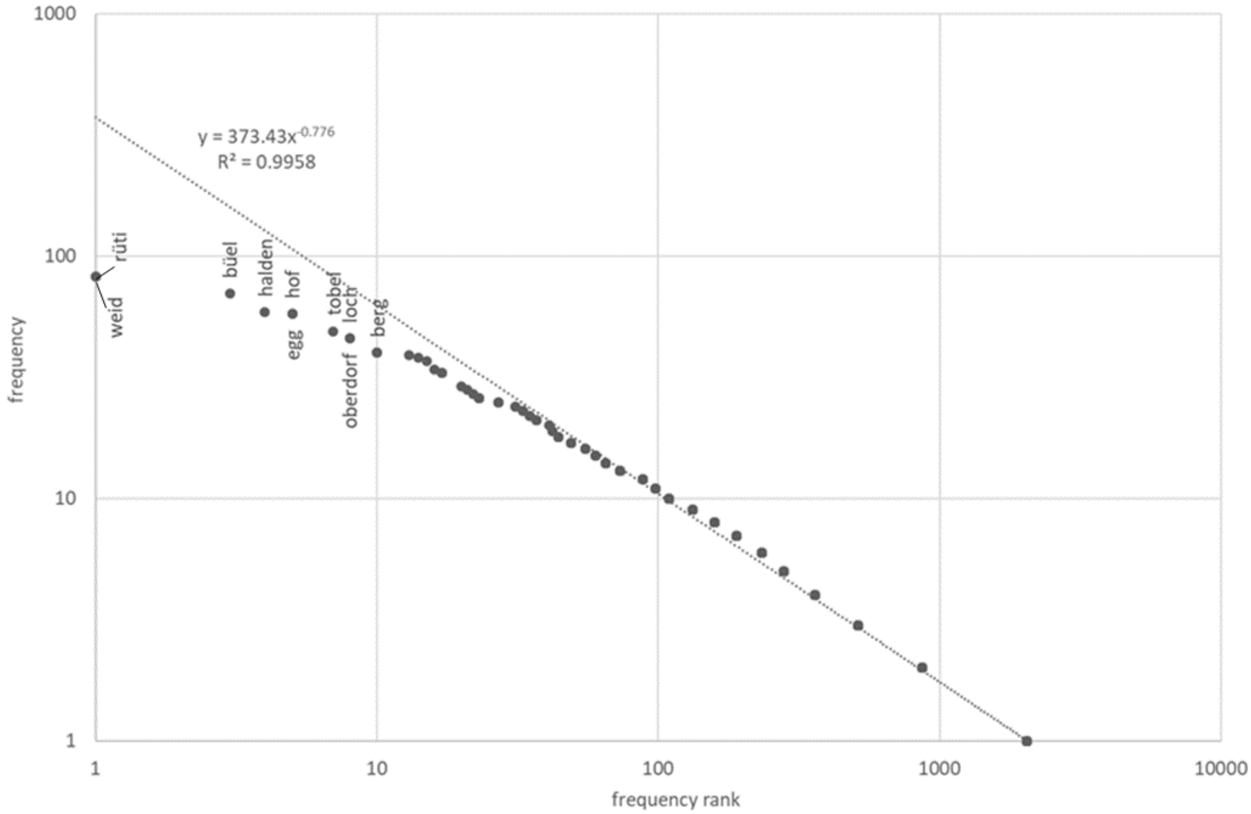


Figure 3.5 Frequency against rank of microtoponyms plotted on a log scale for both axis

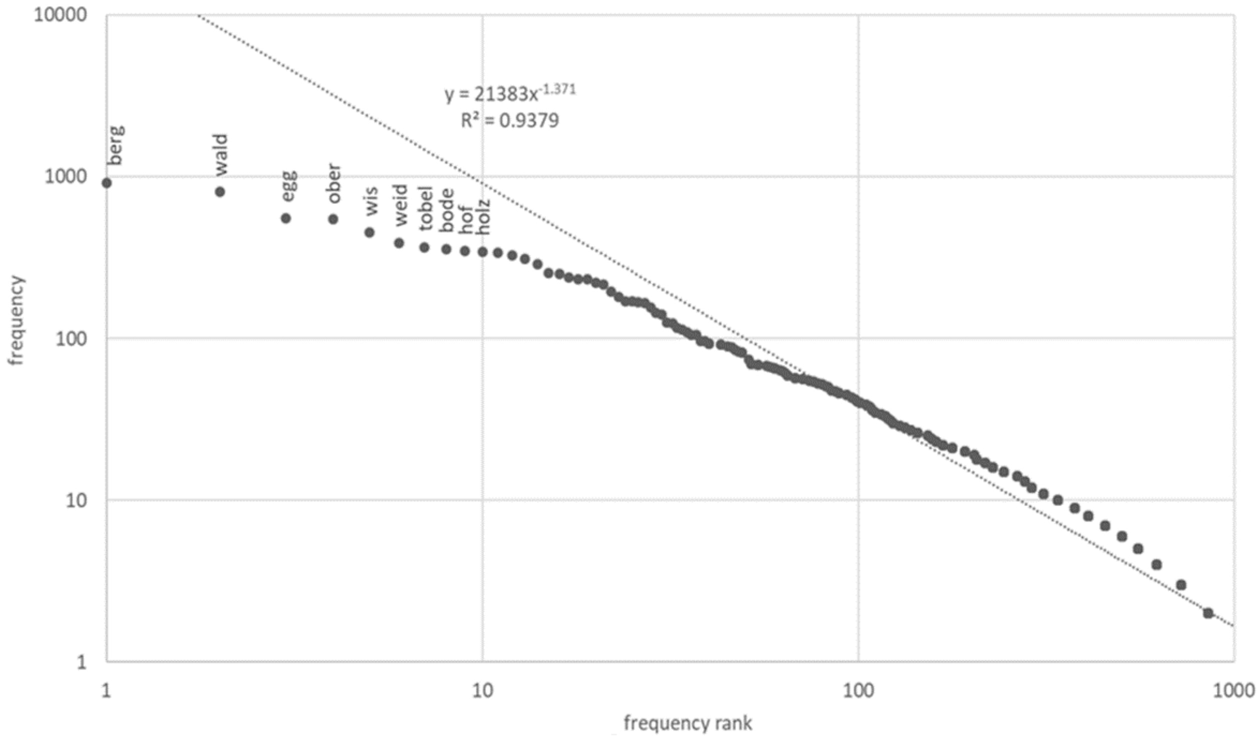


Figure 3.6 Frequency against rank of meaningful elements plotted on a log scale for both axis

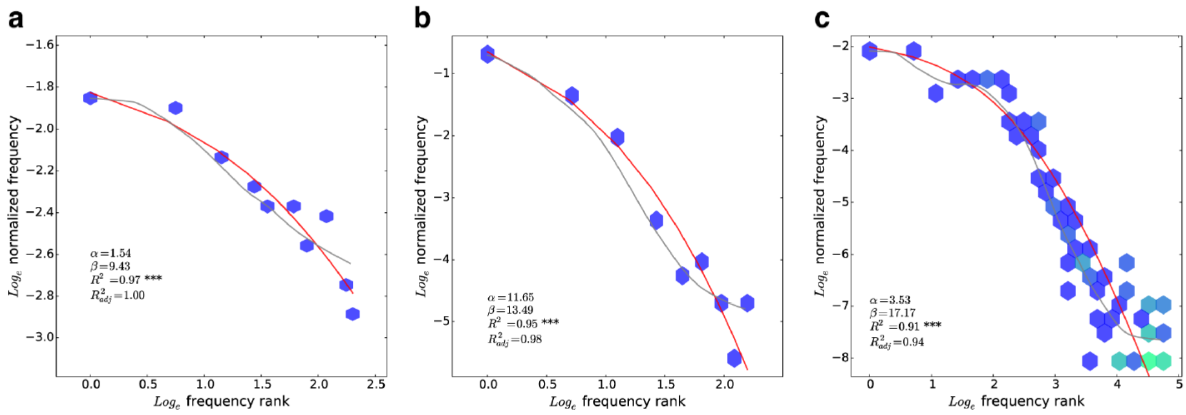


Figure 3.7 Frequency distribution in the American National Corpus for words whose scope of meaning has been highly constrained by the natural world: a months, b planets, and c elements (Piantadosi, 2014:31)

The ten most frequent terms are a mixture of natural (*Berg*, *Wald* (forest), *Egg* (edge, summit, hill), *Tobel* (ravine), *Bode* (level place on or between slopes)), land use (*Wis* (meadow), *Weid* (pasture), *Hof*, *Holz*) and one term used in inductive toponyms (*ober*), i.e. with reference to another place (Leino, 2005).

It should also be noted that these ME, for the most part refer to landscape elements and generally reflect the physical properties of the canton of St. Gallen. This result suggests an important relationship between the semantics of microtoponyms and the cultural landscape with the presence of terms related to both natural and cultural features as suggested by the field of toponomastics (Hough and Izdebska, 2016).

This exploration also provides the possibility to examine ME individually, and with the help of the linguists, to highlight inconsistencies. The linguists identified certain ME as referring to names of people (e.g. *nau* or *gar*), but after examining these particular cases it seems that they are the result of a matching error as can happen with short ME. Indeed, in the lexicon '*nau*' was associated to a Romansh etymology as a diminutive of names such as 'Donáu', 'Dunáu' or Dunó. However, most of the matching were related to the ending of a ME with a 'n' and its association with the ME '*Au*' indicating a relationship with water (such as in Brunau). That could be seen as a limitation of this approach; however, these results allow data to be explored at both a small or a large scale and to move between these scales during the exploration.

Figure 3.8 200 most frequent meaningful elements contained in St. Gallen microtoponyms

3.3.1.2 Associated ME in St. Gallen dataset

The second methodological step was to explore the associated ME of the most frequent ones. As indicated in the method section, I calculated from the number of occurrences of term combinations the probability that they appear more or less frequently than chance level with the χ-squared test. The most significant results of this exploration applied to the 26 most frequent terms are illustrated in Table 3.2. This figure represents the number of occurrences while the results of the χ-squared test are illustrated by the bold or gray values. Values in bold indicate a combination that appears more frequently than chance, and those in gray less frequently than random occurrence. It can be shown that the combinations that appear more than by chance are semantically significant. For example, *Buech* ('beech') relates to a particular type of tree which can be logically associated with *Wald* or *Holz*. Indeed, this combination indicates that the *Wald* and *Holz* categories are made up of trees and that the type of tree present in this area can be a specific element important enough to distinguish one forest from another. In another way, *Egg* is associated with length (*lang*) this time emphasizing physical properties to distinguish between different places. Finally, *Dorf* is also an interesting case. It is found in combination with ME which are less descriptive and more related to its related location. Indeed, they are associated with adjectives such as *neu* indicating the time aspect and a range of spatial expressions (*under* ('under'), *hinter* ('behind'), *vorder* ('in front of'), *ober*). This distinctive association of Dorf with the time aspect and spatial expressions indicates that this 'type of place' has to be distinguished from the ME referring to natural feature of the landscape. It provides the information of landscape elements which are salient enough to be a referent but also which evolve over time as its area spreads or with the creation of new villages.

	buech	feld	sonn	neu	lang	under	hinter	vorder	ober
wald	**20****	1**-	0*-	4	8	6	3	4	11**-
berg	7	1**-	**26****	5	1	15	**17****	10	31
egg	2	5	4	4	**15****	9	4	5	16
wis	1	1*-	0	7	**14****	4	4	3	14
holz	**15****	0*-	0	1	6	7	3	3	16
hof	2	8	**12****	**21****	1*-	1	1	1	10
dorf	0	0	0	**6****	0	**11****	**11****	**7****	**51****

Table 3.2 Co-occurrence counts for selected meaningful elements. Counts marked in bold and with ** occur significantly more ($p < 0.01$) than expected by chance. Counts in grey and with * - and ** - significantly less ($p < 0.05$ and $p < 0.01$ respectively)

Conversely, combinations that appear at a less than random frequency also indicate relevant semantic information. Thus, *Feld* (field) is specifically not chosen with *Berg*, *Wald* or *Holz* presumably because these features exclude one another. Furthermore, *Feld* is also not associated with *Wis* (meadow) probably in this case because these are related categories which cannot be associated. Such a combination for *Ober* and *Wald* is also highlighted, suggesting the unusual but not absent fact of having a landscape element located above *Wald* or referring to the upper part of *Wald*. The results relating to combinations of meaningful elements already bring much more detailed information than just exploring terms. They provide the first steps for defining and understanding the use of such landscape terms.

3.3.2 The semantic information of *Wald*, *Holz*, *Riet* and *Moos* microtoponyms

Having demonstrated above the interest of exploring the ME in microtoponyms and the combinations of ME, the results of the method applied to the *Wald*, *Holz*, *Riet* and *Moos* case study will be presented in the following section. I will first describe the structure of the databases and then present the characteristics of their associated ME.

3.3.2.1 The structure of the Wald, Holz, Riet and Moos microtoponym datasets

The four datasets including the microtoponyms with *Wald*, *Holz*, *Riet* and *Moos* are presented in Table 3.3. This table presents the alternative ways these ME can be spelled or pronounced (with respect to word formations), their rank of frequency as ME in the dataset of the cantonal microtoponyms and the number of microtoponyms in which they are present. It can be noticed that *Wald* appears as the second most frequent element of the lexicon (the ME *Berg* precedes it). This table also highlights that these four elements appear in more than 200 microtoponyms, a number large enough to be able to claim a 'data-driven approach'.

Meaningful Element (ME)	Alternative spellings	Overall rank in microtoponym dataset	Count of microtoponyms containing the ME
Wald	*Wäld*	2	856
Holz	*Hölz*	10	397
Riet	*Ried*	11	352
Moos	*Möös, Mos, Mös, Moor*	22	228

Table 3.3 Characteristics of microtoponyms with *Wald*, *Holz*, *Riet* and *Moos*

The structure of these microtoponyms was then explored, that is to say the position of these meaningful elements inside the microtoponyms. This is illustrated in Figure 3.9 with the number of combinations associated with each linguistic form.

Figure 3.9 illustrates that for all of our four meaningful elements, in more than 80% of the cases they are positioned last (e.g. Rot**holz** ('Red Wood')) or used alone (Moos). In these cases and according to Gammeltoft, (2005), they have the position of 'generic' and therefore they have a 'classifying function':

> 'If a word appears as a type stating generic in a place-name, it retains its normal classifying function. If, on the other hand, it appears as the specific element in a place-name, its function is to indicate a characteristic of the locality to which it refers.' (Gammeltoft, 2005:152)

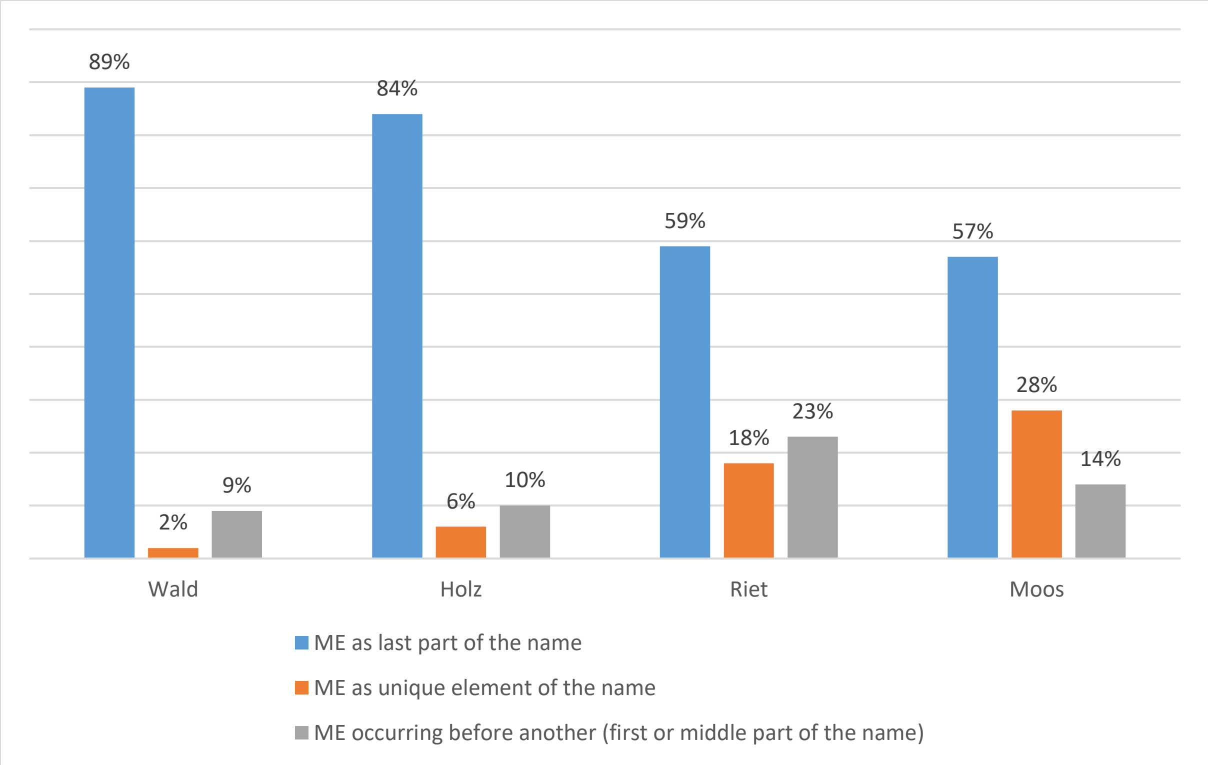


Figure 3.9 Landscape terms and their position in their microtoponym dataset

However, they can also be at the beginning or middle position such as inside the microtoponym **Wald**hügel. *Wald* is not used here to indicate the 'type of place' but to specify the *Hügel* ('hill') as being forested. Therefore, it can be hypothesized that in the case of place names the 'specific' element, which belongs to the first part of the name, has the function of distinguishing a named entity from another similar 'type of place' which is in the same territory such as the general characteristic of German word formation (the first element is determining – *Bestimmungswort*- and the second defines the class – *Grundwort*). For example, if two forests are in the same area (i.e., in the same valley or just visible from each other), it is necessary to add an element in their name to allow them to be distinguished from each other. Consequently, the position of these elements in the microtoponym plays a determining role concerning their relationship with the physical referent in question. However, such as illustrated in gray in Figure 3.9 this structure is much rarer in the dataset indicating that the selected elements are generally used as a classifier of the 'type of place' or as a 'generic' element. This figure also illustrates that *Riet* and *Moos* are used alone in a much larger proportion of names (18% and 28%, respectively) than *Wald* and *Holz* (2% and 6%, respectively). This means that these names, and therefore these landscape categories, are specific enough to appear only once in a territory and therefore do not need to be distinguished from another similar place. Indeed, if there is a single river or a single lake on an territory then it is not necessary to give it a more elaborate name than 'the river' or 'the lake' (Rostaing, 1965).

Related to the specific elements, Table 3.4 illustrates the number of combinations for each meaningful element. It is important to note here that these combinations are dependent on the matches found with the lexicon. This is why there is both labels '1' and 'unique' in this table. The label '1*' refers to the count of ME in the situation when the elements *Wald*, *Holz*, etc. are not used in isolation but are associated with an element absent in the lexicon such as with the microtoponym Tammoos in which only *Moos* was identified as the ME since *Tam* is not in the lexicon. In this situation, the count of ME remains 1 since this value illustrates the matches with the lexicon and not the real number of ME inside microtoponyms. This category represents 17.6% over all four datasets, which is relatively high but with few consequences in this study since they are mainly terms used in isolation at a low frequency. In addition, Table 3.4 also illustrates that the combination of two elements is the most frequent with 63.9%.

It has been established that the landscape terms *Wald*, *Holz*, *Riet* and *Moos* are generally used as 'generic' indicating a 'type of place'. Therefore, the next step will determine whether by exploring the meaning of the associated ME (the 'specific' element of the microtoponym) it could be possible to obtain semantic information in order to define the landscape terms or to investigate their use.

	Unique	***1****	***2***	***3***	***4***
Example	*Moos*	*Tam¦moos*	*Rötis¦riet*	*Bären¦boden¦wald*	*Vorder¦langen¦büel¦holz*
Wald	*18*	*186*	*533*	*117*	*2*
Holz	*23*	*52*	*293*	*25*	*4*
Riet	*62*	*52*	*224*	*13*	*1*
Moos	*64*	*32*	*121*	*11*	*0*
% in all 4 datasets	*9.1%*	*17.6%*	*63.9%*	*9%*	*0.4%*

Table 3.4 Count of matches by possible combination structure (* means that a term was not found in the lexicon)

3.3.2.2 Associated ME of Wald, Holz, Riet and Moos microtoponyms datasets

The exploration of the associated ME of the four datasets was conducted in two steps. Firstly, through the taxonomic classification of Gammeltoft (2005), and secondly, focusing on the level of the individual ME.

Table 3.4 shows the large number of combinations of terms from 164 combinations for *Moos* to 838 for *Wald*. Therefore, in order to consider each combination and to compare the datasets (*Wald* to *Holz* and *Riet* to *Moos*) the ME were associated to a taxonomic class as explained in Section 3.4.2 and the results of this are illustrated in the Treemap in Figure 3.10. This figure illustrate four blocs, one for each ME considered. Inside each bloc, there is four colors illustrating the first level of Gammeltoft taxonomy used to classified the associated ME (I. Quality, II. Relationship, III. Usage, and Don't know). The color are ordered by size from left to right. Inside the Quality sub-bloc (in orange) and the Relationship sub-bloc (in blue) are illustrated the sub-category, identified by the reference coding of the Table 3.1 when it was not possible to write the referring category.

Several observations can be made. First, at the first level of classification, illustrated by distinctive colors (orange, blue, gray and yellow), even if the 'Quality' is in three cases out of four the most important (on the left side) there is no class that significantly dominates all the others with 23.7% to 45.5% for 'Relationship', 39.6% to 54% for 'Quality' and 14.9 % to 23.7% for 'Usage'. The distribution is fairly homogeneous with only one value above 50% (Quality of *Moos*), contradicting here the fact raised by Gammeltoft in his paper (2005) indicating a small proportion of toponyms referring to the class 'Usage'. It is one of the least important at the first level of classification but if this class is consider as a second level it is largely similar to the other classes.

Second, at the second and third level of classification, several observations can be added. The class 'Topographical', 'Shape' and 'That which exists at or near' are the most important at the second level. This indicates that the landscape terms *Wald*, *Holz*, *Riet* and *Moos* are combined with ME which could be very useful to help to describe and determine them because they are related to the description of the place or to what is found there.

Indeed, the topographical relation is linked directly to the landscape such as the shape and 'What exists there or near' which is a more detail description of the location, a precise characterization of the referent. At the third level it is 'Plant-growth' and 'Characterization of the location by means of its relative position' that are the most common for *Holz* while

‘Characterization of the location in relation to a non-name-bearing location’, understood as landscape feature, is for all of them. These observations confirm that at every level of granularity of the taxonomy the associated elements are strongly related to the description of the place.

Nevertheless, as a third point, exceptions for two classes in respect to *Holz* can be noticed at the third level of classification. Firstly, for ‘Characterization of the location in terms of its relative position’ (i.e., associated with spatial expressions such as *ober*, etc.) *Holz* has 12.1 % of associated ME related to that class where the other three show percentages from 3.6% to 6.3%. Thus for this landscape term the class ‘Relationship’ is the most important compared to the three other landscape terms. Secondly, for the taxonomy ‘Plant-growth’ Holz has 13.2% and the others from 4.7% to 7.7%. That specific distinction highlighted by the general exploration of the associated ME suggest something distinctive for *Holz* compared to the others. The explanation of it will be investigated in more detail in the following section.

This distinction with *Holz*, raises the question of the similarity of the associated ME between the synonym terms. Indeed, the assumption in comparing the four landscape terms was that the microtoponyms of the synonyms will be more similar to each other (*Wald* with *Holz*, *Riet* with *Moos*) than to the others (*Wald* with *Riet* and *Moos* and so on…). This assumption was made in relation to some of their microtoponym aspects: to their linguistic aspect (their semantics) and to their physical aspects (the properties of their location). Nevertheless, the previous results seem to demonstrate something different relating to the semantics of their associated ME. To confirm that observation, the correlation (r^2) between the percentage (normalized for overall counts) of associated ME assigned to the second level of the taxonomy (Table 3.1) was calculated. The results are illustrated in Table 3.5 with *Holz* highlighted in green.

	WALD	HOLZ	RIET	MOOS
WALD	x	**0.7496**	**0.9219**	**0.9151**
HOLZ		x	**0.6969**	**0.5478**
RIET			x	**0.8637**
MOOS				x

Table 3.5 Correlation (r2) between normalized counts of the landscape terms classified according to Figure 3.10

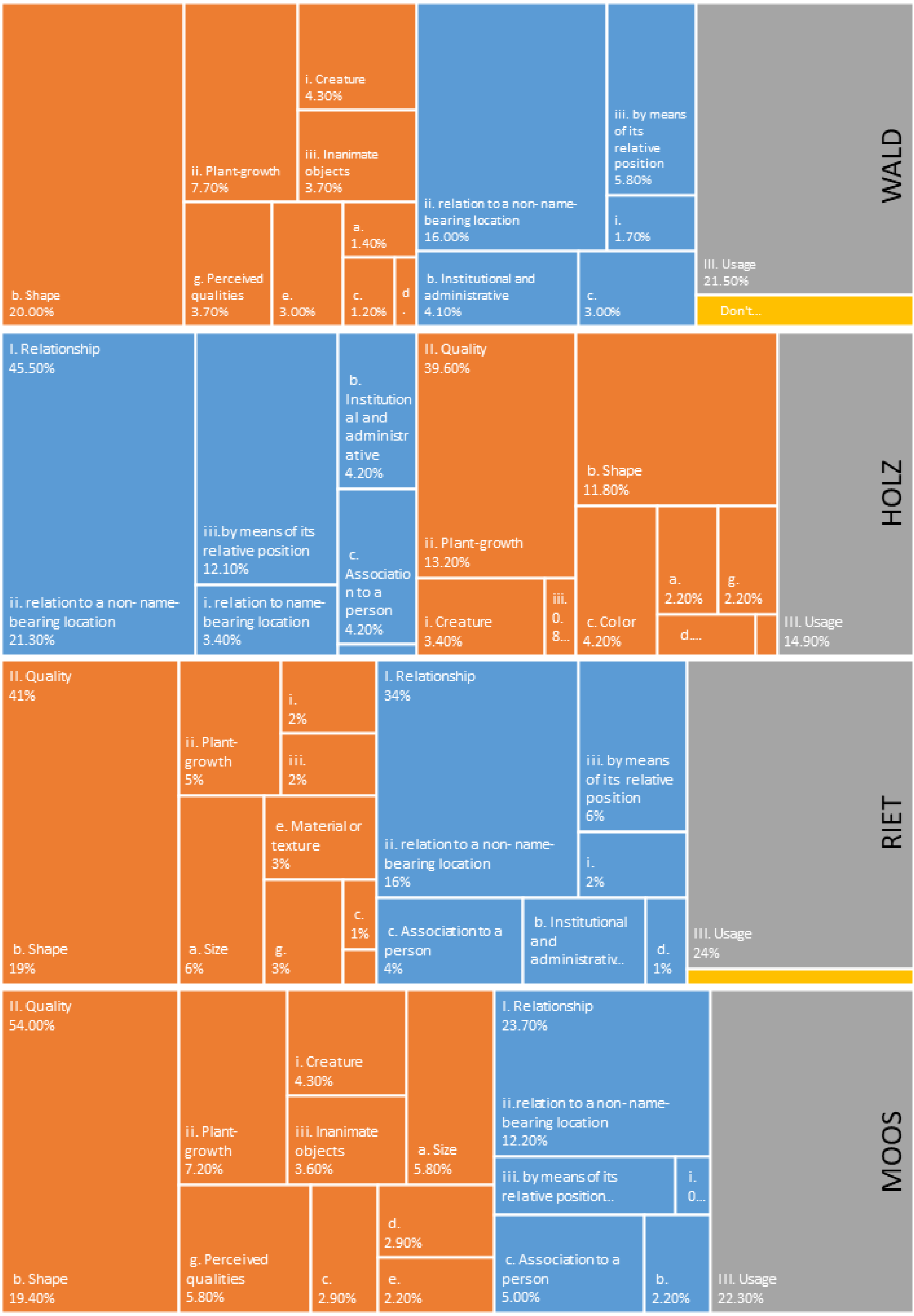


Figure 3.10 Gammeltoft classification applied to *Wald*, *Holz*, *Riet* and *Moos* associated ME (labels of the % equal to or less than 3 has been removed)

The correlation-matrix (Table 3.5) explores the amount of co-variance between two sets of data according to a linear distribution of the data. The assumption here is that the percentage of the number of values related to the same class will be similar between terms that are nearly synonyms. Nevertheless, this table confirms the previous observation with the lowest values associated to *Holz* (smaller than 0.75) even with *Wald*. Furthermore, this table also illustrates that the correlation of the classification of the associated ME between *Wald* and *Riet* or *Moos* (0.92 and 0.91) is higher than between *Riet* and *Moos* (0.86). This observation is nevertheless only visible with *Wald* since the correlation values between *Wald* and *Holz* (0.75) and between *Riet* and *Moos* (0.86) are higher than between *Holz* with *Riet* (0.70) or with *Moos* (0.55).

This suggests that ME of similar classes are used in combination with *Wald*, *Riet* and *Moos*. It also shows some distinction in these classes between 'synonyms', which is coherent with the utility of the associated ME to make a place distinguishable from another one. Moreover, the assumption can be made that this distinction between synonyms would be more efficient using terms of different classes since the number of ME used is limited. Therefore, the question which could be asked is if these results are the consequence of using the taxonomy, how similar are these associated ME at the level of the ME. Thus, I will explore here the similarity and the dissimilarity between the four datasets at the level of the ME.

To do so, the twenty most frequent ME and the ME sharing the same frequency as that the twentieth (sometimes more than 20 elements) associated with *Wald*, *Holz*, *Riet* and *Moos*, were selected and plotted as word clouds in Figure 3.11. Given the long tail distribution of ME in microtoponyms, these twenty most frequent ME represent more than 35% of *Wald* microtoponyms and 50% of *Holz*, *Moos* and *Riet* microtoponyms. Figure 3.11 represents the frequency of the associated ME according to the size of the ME and the color refers to the taxonomy to which they refer to by reusing the class defined in Table 3.1. It should be noticed here that all associated ME are considered whatever their position in the microtoponym.

The Figure 3.11 illustrates that for *Wald* and *Holz*, ten meaningful elements were shared, relating to landscape elements (*Berg*, *Wis*, *Büel* ('hill')), land use (*Rüti* ('clearing'), *Bann* ('restricted area'), *Chol* ('charcoal')), plant type (*Buech*), spatial expressions (*ober*, *hinder*), and shape (*lang*). Similarly, for *Moos* and *Riet* six shared elements were found. They are related to landscape elements (*Wis*, *Wald*), land use (*Feld*, *Holz*), and shape (*lang*, *Egg*). *Holz* appears to be more commonly associated with tree types (as we found in our classification in Table 3.1) with additional prominent tree types (*Eich* ('oak') and *Tane* ('Pine')). Interestingly, *Moos* is the only landscape term associated in its top twenty with animals (*Gir* ('bird of prey') and *Ross* ('horse')) and to a temporal dimension (*alt* ('old') and *neu* ('new')). *Moos* is also the only term not to use the spatial expressions *ober* and *hinder* and which is associated with only one referent of this class with *beim* ('at'). Globally, two ME (*lang* and *Wis*) are shared between all the four landscape terms.

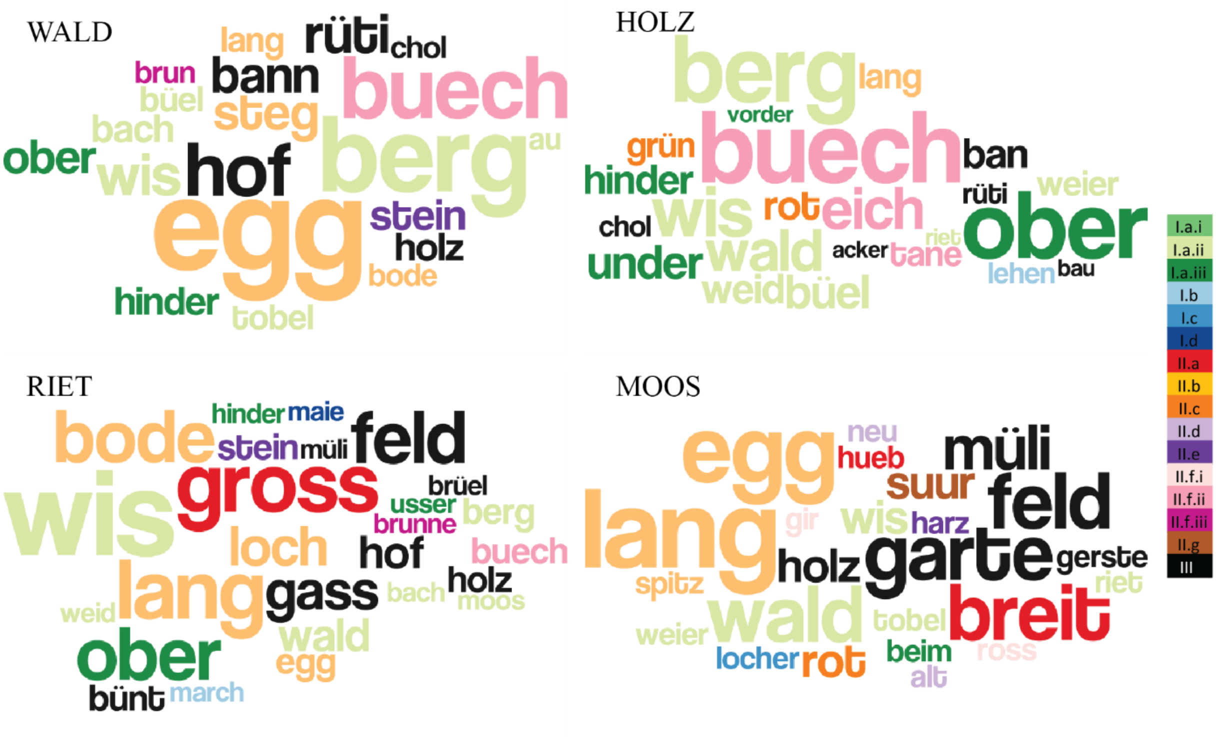


Figure 3.11 Word cloud showing frequency (size) and classification of the meaningful elements combined with *Wald*, *Holz*, *Riet* and *Moos*

Investigating at the level of the ME does not enable statistics or correlation with the taxonomy, for example, to be generated. Nevertheless, the number of similar (=) and dissimilar (≠) ME between all possible pairs of landscape terms were calculated and illustrated in Table 3.6.

Table 3.6 shows interesting results related to *Wald*. Indeed, most of the time the associated ME of all four datasets show more dissimilarities than similarities except between the *Holz*, *Riet* and *Moos* datasets compared to *Wald*. Indeed, within the dataset of Wald microtoponyms (1st column), 85 ME (25%) are shared (similarities) with the Holz dataset and 255 ME (75%) are not shared (dissimilarities). However, within the smaller Holz dataset where there are less associated ME, the 85 similar ME represent almost 50% of the ME combined with Holz. This is also the case for the associated ME of Riet and Moos where the number of similar and dissimilar associated ME represent around 50% of the ME.

	WALD		HOLZ		RIET		MOOS	
	≠	=	≠	=	≠	=	≠	=
WALD			86	85	65	73	49	47
%			50.3	49.7	47.1	52.9	51	49
HOLZ	255	85			92	46	61	35
%	75	25			66.7	33.3	63.5	36.5
RIET	267	73	125	46			68	28
%	78.5	21.5	73.1	26.9			70.8	29.2
MOOS	293	47	136	35	110	28		
%	86.2	13.8	79.5	20.5	79.7	20.3		

Table 3.6 Count of similar and dissimilar associated ME between the four datasets of *Wald*, *Holz*, *Riet* and *Moos*

It could be a consequence of the smaller number of associated ME combined with Riet (138 ME), Moos (96 ME) and Holz (171 ME) compared to the number combined to *Wald* (340 ME). Indeed, since only a few terms are very frequent, it can be assumed that, at this individual level, they are the terms shared between the four datasets. Moreover, at the level of the ME and unlike that at the taxonomic level, the exploration of the associated ME of *Holz* is not different from the others. This is an illustration of the interest to explore the dataset at different levels of granularity with the taxonomic exploration and the ME exploration providing different information.

Finally, it is also important to see that even when the associated terms could relate to the same class, they are mostly dissimilar confirming the necessity to be semantically distinctive even if both general and specific properties of the landscape are used to characterize microtoponyms.

3.4 Conclusion of the chapter

In this chapter, the potential of semantics of microtoponyms with the support of an etymological lexicon has been explored. I first explored it within the dataset of the microtoponyms of the canton of St. Gallen, starting by extracting the ME they contain using a string-matching process. Based on this, I was able to explore the frequency and distribution of ME to analyze both the most frequent terms used and the terms used only once. This approach demonstrated that the microtoponyms largely contained semantic information still etymologically interpretable today since they are part of the lexicon. It also revealed that the elements were for the most part very strongly linked to the physical and cultural landscape as descriptive elements such as suggested by the literature (Hough & Izdebska, 2016). The second step was to explore combinations of ME in microtoponyms and their potential to define some landscape terms through their use in microtoponyms. It also presented coherent results from a semantic perspective with association of terms related to features of the landscape.

This methodology was applied in a second step to selected datasets of microtoponyms with the landscape terms *Wald*, *Holz*, *Riet* and *Moos*. In the same way, ME which were combined with these terms were extracted and, for this case, they were classified using Gammeltoft's (2005) taxonomy. These four landscape terms were selected because they are two pairs of close synonyms (Section 3.2.3) which enabled investigation of how precise the semantics of place names can be. This exploration was supported by the large amount of data that were available for these four terms even if this quantity of microtoponyms made it difficult to explore each individual name in more depth. I have therefore explored the similarities and the distinctions of the ME combined to these terms at the classification level and at the level of the ME. I have shown that when the ME are classified into the Gammeltoft taxonomy (2005) the semantics of the associated ME of the four landscape terms refers more or less to the same classes. Some differences have been highlighted with Holz referring more to type of plants and to another location. Nevertheless, when the ME of each dataset were compared one by one the four datasets shown their own particularities with a large proportion (from 50 to 75%) of associated ME not share with the three other datasets. Nevertheless, since a limited number of ME were used within the cantonal microtoponyms, at least 25% of the ME are shared.

Finally, the semantic analysis here reaches its limits and does not enable us to go further in the understanding of these four landscape terms. I will therefore explore in a second chapter the potential of the microtoponym as a place (a location) to help understand these terms.

4 Physical aspects of microtoponyms and landscape investigation [12]

The previous chapter highlighted the rich linguistic information contained in place names. I have also, however, pointed out the limitations inherent in exploring place names in isolation for landscape investigation. Indeed, identifying the terms used for the landscape gives us little information about their use by a society, and the ways in which these terms were assigned to the landscape. To explore this question, it is necessary to collect information on both the *spatial expressions* referred to by these names and the *geographical context* of their use. This chapter therefore seeks to address the second objective of this thesis and demonstrate the value of exploring the relationships between the linguistic information of place names (structure and semantics) and their physical properties (biotic and abiotic).

Referring back to the semiotic triangle of the introduction (Figure 1.1) which introduced the relationship between a term, its physical referent and the concept it mobilizes, it seems obvious that the understanding of the concept must be supported by the exploration of the landscape term (the semantics of the linguistic sign) and the referent (the landscape feature). Through place name gazetteers, this relationship can be studied since they contain both landscape terms and their locations. The referent of a place name is usually the location associated with the name such as a city, a forest or a field. As illustrated in the background section, defining and describing a landscape feature is not an easy task because its boundaries are not always well defined – e.g. where does a mountain start or end (Mark and Smith, 2004), and because the perception of this feature, the relationship between people and space, varies in time and space (Seidl, 2008). Nevertheless, by working with gazetteers containing many place names, I have had access to many instances of the same landscape term, and could explore multiple referents and their properties. I therefore assume that the spatial extent of many referents of place names associated to a landscape term is sufficient to define the physical properties of this term.

[12] This chapter is based on Villette and Purves, 2020

To test this hypothesis and define the physical properties of a landscape term using the referents of place names, I first selected a number of properties to explore. Second, I reused the case study of the previous chapter with St. Gallen microtoponyms containing *Wald*, *Holz*, *Riet* and *Moos* to compute the physical properties associated with these four landscape terms. Finally, I conclude with the interpretation of the relationship of the linguistic aspect of these terms described in Chapter 3 with the results of the physical properties extracted in the present chapter. Figure 4.1 illustrates the methodological process and the structuring of chapter 3 and 4.

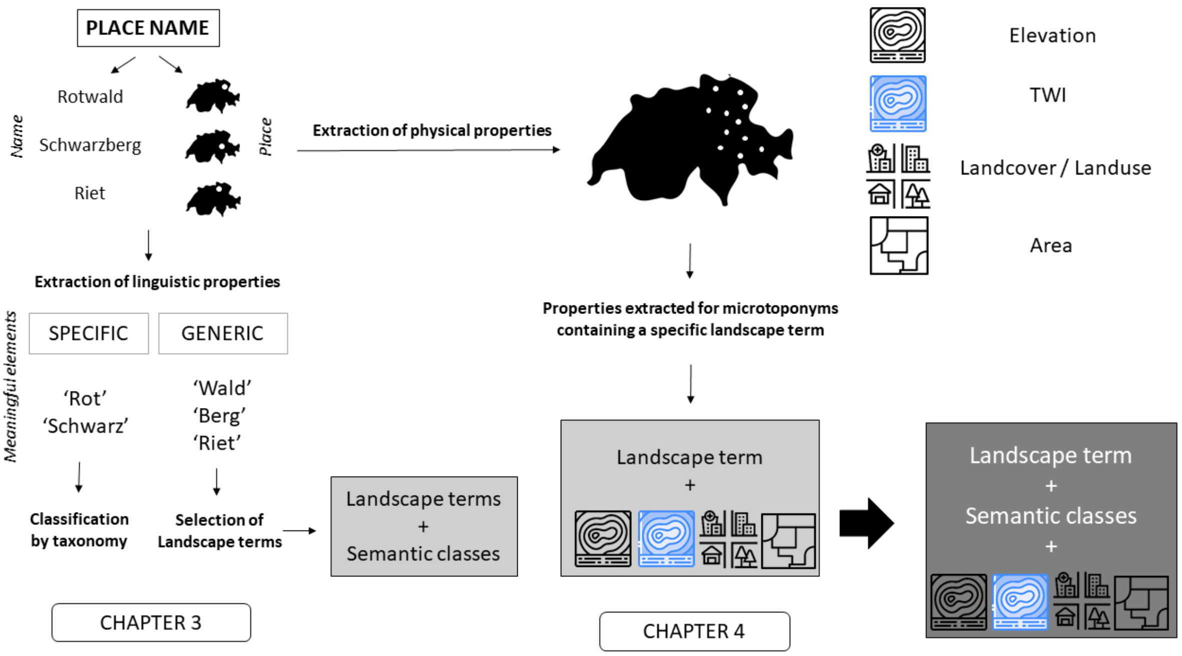


Figure 4.1 Methodological process of Chapter 3 and 4

4.1 Selection and computation of physical properties

Choosing which physical property (biotic or abiotic) is relevant to describe a place name referent in a distinctive and discriminatory manner is not an easy task. The difficulty arises in selecting a limited number of physical properties among the broad range of possibilities that may relate to topography, geology, land use, land cover, hydrology, for example. The choice of properties obviously depends on the landscape terms under investigation, and since I was interested in forested areas (*Wald/ Holz*) and cleared/ marshy areas (*Riet/ Moos*) I chose physical properties potentially related to these elements of the landscape.

I therefore selected elevation and area as general physical properties potentially relevant to all microtoponyms. Landcover/ landuse and topographical wetness index (TWI) were identified as being potentially relevant to the semantics of the four terms under investigation. In the following section, I describe the significance of these physical properties, and the way in which they were calculated in more detail.

4.1.1 Area

A place name referent is a feature in a landscape. Therefore, this feature is associated with a spatial extent which represents a certain area. The spatial extent of a place name is not necessarily illustrated on a map, often a point – usually the centroid of the feature – is used to link a name to a location. Nevertheless, some cartographic sources allow toponyms to be represented as broader areas, such as on cadastral maps. Indeed, by illustrating parcels for administrative or military reasons (Withers, 2000), this latter type of cartographic representation allows the association of names with a clearly delimited area assumed to be the related reference. Such data were collected and made available by the Canton of St. Gallen for microtoponyms, and introduced in the previous chapter (*Section 3.2*). Since these areas are associated with different classes of referents (*Wald*, *Holz*, *Riet*, *Moos*) I hypothesized that the surface of the polygons assigned to microtoponyms with each of these four landscape terms would have different spatial extents.

Therefore, the first property calculated was the area of the polygon associated with each microtoponym of the St. Gallen dataset provided by the canton. This spatial extent associated with each name was also used in a second step to calculate the four other physical properties.

4.1.2 Elevation

Elevation data (mean elevation and standard deviation) were examined since they are considered as potential ways of distinguishing between different landscape elements. Switzerland is characterized by its location between the Jura and Alpine mountain ranges, with significant variations in altitude ranging from 193m (shores of Lake Maggiore - Canton Ticino) to 4634m (Pointe Dufour - Canton Valais) (BFS, 2019). Elevation, unlike landcover for example, can be regarded as constant over time. In contrast to geology or soil composition, it is also easily perceptible in relative terms without any special measuring instruments or knowledge. Furthermore, elevation impacts on both environmental and social aspects of landscape. Thus, land use and land cover are influenced by the altitude of the place under consideration. Elevation determines whether or not certain plant and animal species can exist, since it partly determines the distribution of specific ecosystems (Billings, 1973; Seastedt et al., 2004). Numerous studies attest to the special character of alpine or marine ecosystems, where the altitude and the slope largely contribute to the specificity of these ecosystems through their influence on temperature and also their capacity to generate specific habitats. Thus, elevation has played a role in the selection of settlement areas throughout history by influencing the possibility of certain human activities (urban, agricultural or industrial) (Kvamme and Jochim, 1989; Pierik and van Lanen, 2019).

The elevation data used here were extracted from a Digital Elevation Model (DEM), a three-dimensional form of the earth's surface without buildings or vegetation. They were generated in Switzerland from the 1: 25000 Swiss National Map and consist of a height matrix with a 25m grid delivered as DHM25 by swisstopo (Swisstopo, 2004). Summary statistics related to elevation can be calculated for each polygon including: minimum altitude, maximum altitude, median, mean altitude and standard deviation. Only mean altitude and its standard deviation (a metric correlated to the slope and indicating the relief within a polygon) will be considered in this chapter. It is important to stress here that the average elevation calculated over the area of the entire polygon assigned to a toponym is a much more realistic datum than the elevation at its centroid. Indeed, a toponym represented as a point provides a relatively arbitrary elevation value since it depends on the location of this single point. Zürich provides a rather simple example of this principle with elevation variation within the city between 392m at the level of the Limmat to 871m at the summit of Uetliberg Kulm (Zurich statistics, 2013:17).

4.1.3 Landcover

The exploration of the terms *Wald* and *Holz* motivated the consideration of land cover since their semantics relate to wooded areas which are widespread throughout Switzerland. Nevertheless, this physical property has the peculiarity of undergoing regular modifications, mainly through changes in human use and activity but also as a result of environmental changes (natural disasters or climate change) (Lambin et al., 2001). Thus, it is necessary to emphasize that because of the historical nature of Swiss place names (e.g. the oldest reference to Lausanne dates from around the year 101-200, attesting Celtic origins (Kristol et al., 2005:512)) and the relatively modern nature of available data on land use, it is difficult to estimate to what extent their relationship is still valid. Indeed, previous studies trying to link land cover and place names (Fagúndez and Izco, 2016b) have observed that modern landcover has little if any relationship with historical patterns of place names referring to heathland. Nevertheless, place names can be used to reconstruct historical landscapes related to land use (agricultural land) or land cover (distribution of heathland) (Calvo-Iglesias et al., 2012; Seidl, 2008, Conedera et al., 2007).

With these limitations in mind, land cover and land use have been explored in this chapter. I used the CORINE[13] dataset and ArcGIS to compute land-cover classification for each polygon. When several landcover classes appeared in the same polygon, I computed the percentage of each according to their relative area. Landcover is not randomly distributed in space, for example, in the canton of St. Gallen, the class 'mixed forest' covers 39% of the canton while only 4 % of the canton area is classed as 'continuous urban fabric'. Thus, as for the previous chapter and the taxonomy associated with microtoponyms (conf. equation *3.1*), I calculated Chi-Values associated with each land cover category and for each linguistic element (*Wald*, *Holz*, etc...) to evaluate whether the observed data (the area of a specific landcover class for a specific landscape term) was:

- randomly distributed: implying that for a specific landscape term 39% of the area of microtoponyms with this term referring to 'mixed forest' and 4% associated with the class 'continuous urban fabric', showed no difference from the overall distribution of these classes.
- over-represented: meaning that these landcover classes for a specific landscape term appear more than expected within this spatial extent. Thus, for example 60% of the area associated with microtoponyms with *Holz* would be assigned to the class 'mixed forest'.
- under-represented: meaning that the area of a landcover class appears less than expected – for example only 10% of 'mixed forest' would be associated with microtoponyms with Moos.

[13] I chose a European rather than a national database in order to be able to compare the results of this thesis in future research involving German, French and Italian place names.

Chi-values were computed as below:

(4.1)

$$\alpha = \frac{Observed - Expected}{\sqrt{Expected}}$$

$$Observed = \frac{total\ area\ of\ a\ CLC\ code\ for\ 'terms'microtoponyms}{total\ area\ of\ 'terms'\ microtoponyms}$$

$$Expected = \frac{Total\ area\ of\ a\ CLC\ code}{Total\ area\ of\ the\ canton}$$

4.1.4 Topographic Wetness Index

The terms *Riet* and *Moos*, interpreted respectively as 'reed' and 'bog' (Section 3.2.3) explain why the Topographic Wetness Index (TWI) was considered. Since these terms refer largely to wetlands, the potential *wetness* associated with these microtoponyms was analyzed in order to determine two facts. First, whether the wetness of these locations is a discriminatory factor between microtoponyms containing *Riet* and *Moos* when compared to *Wald*, *Holz* and the rest of the canton's microtoponyms. Second, to determine whether the TWI value can be used to distinguish between the use of the term *Riet* rather than *Moos*, by hypothesizing that these landscape terms differentiated between locations with different degrees of wetness.

To this end, different hydrological measures could be used, but the most widely used tool to describe such conditions is the TWI. TWI is based on topography and was developed by Beven and Kirkby, (1979) and relates upslope area as a measure of water flowing towards a certain point, to the local slope. It has been criticized because it is based on the assumption that surface gradient and groundwater gradient are equal, which is not always the case, particularly in flat terrain (Grabs et al., 2009). Nevertheless, even if Grabs and al. (2009) demonstrated that a dynamic model such as a model-based wetness index (MWI) show better results than the static TWI in relatively low relief areas such as in Sweden, they also recognized that MWI requires more computer resources and high resolution data and therefore is less accessible. Consequently, since Switzerland is a mountainous country and that the use of this indicator is not to generate important hydrological conclusions but rather to compare locations, the use of TWI was considered suitable for this study.

The formula (4.2) developed by Beven and Kirkby, (1979) was used to calculate this value for each polygon.

(4.2)

$$w = \ln\left(\frac{A_S}{\tan\beta}\right)$$

where w is the Topographic Wetness Index (TWI);

A_S *is the specific catchment area flowing down into a considered polygon;*

and β *is the slope gradient.*

4.2 Results of exploring the physical properties of Wald, Holz, Riet and Moos microtoponyms

The results of the selected physical properties (area, mean elevation, standard deviation elevation, land use and TWI), are illustrated in box plots for each microtoponym datasets including the terms *Wald*, *Holz*, *Riet* and *Moos* in the canton of St. Gallen. Box plots have the advantage of providing a statistical representation of the values and enabling them to be compared despite the difference in size of the corpus (here the number of microtoponyms associated with each item). The lower and upper limits of each box represent the interquartile range in its extremities, i.e. the value of 25% and 75% of the data. The line inside the box represents the median (value of 50% of the data) and the whiskers the distribution of all the points. Outside the whiskers are the outliers.

4.2.1 Area

Figure 4.2 illustrates the results of the areas associated with each dataset of microtoponyms. Relatively similar results are observed for *Riet*, *Moos* datasets and all the microtoponyms of the canton, with 50% of the areas of their related polygons between 40,000 m^2 and 120,000 m^2 (blue box of *Riet*, *Moos* and the cantonal dataset). *Holz* and *Wald* have different distributions. Wald is represented by larger polygons than all the other elements with 50% of their area between 55,000 m^2 and 210,000 m^2. *Holz*, on the other hand, is made up of smaller polygons than the general trend, with 50% of these areas between 30,000m^2 and 100,000m^2.

These variations between landscape terms can be interpreted differently. As introduced in the previous chapter (Section 3.2), over the whole canton the polygons associated with the microtoponyms show considerable variation in size with areas ranging from 625 m^2 to 11455625 m^2.

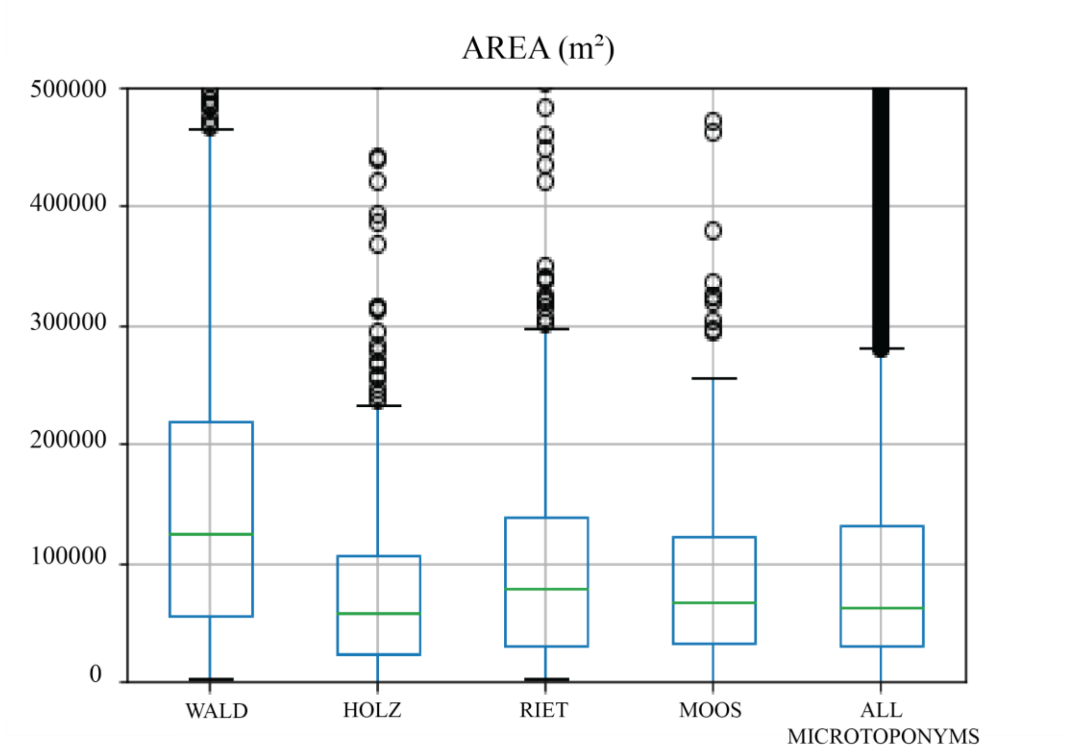


Figure 4.2 Areas of *Wald*, *Holz*, *Riet* and *Moos* polygons.

This variation may be the result of the place name collection process with a different strategy applied from one commune to another. Indeed, in order to digitalize and map a place name, first data have to be collected in the field. Such inventories are conducted at the communal level and they therefore involved different collectors. Some collectors may have paid more attention to microtoponyms which are vernacular names (local knowledge), while others may have limited themselves to 'officially' recognized names. Indeed, it is a fact that the names collected officially often underestimate the set of names that exist in the local and individual memory of these places (Kuhn, 2016; Taylor, 2016).

Moreover, the variation of name density and therefore of polygon size can be attributed to the physical properties of places. A lake is represented by a larger polygon than an urban dwelling parcel as explained in the previous chapter and illustrated in Figure 3.3. Nevertheless, since all microtoponyms were explored together at the scale of the canton and not at the communal scale, the results reflect the general distribution of the data within the canton of St. Gallen.

Finally, the findings from exploring the area of the microtoponym datasets suggests that only microtoponyms with *Wald* show a distinctive pattern with relatively large polygons.

4.2.2 Elevation

The results concerning elevation show much greater disparities between the microtoponym datasets than those related to area. Figure 4.3 illustrates a marked disparity between *Riet* and *Moos*. On the one hand, it shows a distribution of the polygons at much more varied altitudes for *Riet* with 50% of the data between 400m and 900m and with outliers up to more than 1500m. On the other hand, *Moos* presents much more concentrated data with 50% of its polygons between 550m and 750m and its outliers at 1150m. Moreover, *Riet* microtoponyms have a low median elevation, with a very high concentration of these polygons having an average elevation below 500m. Concerning *Wald* and *Holz*, a clear distinction is also visible. As for *Riet* and *Moos*, *Wald* polygons have a much greater range of elevations, with values between 400m and more than 1800m, while *Holz* is associated with lower altitudes with 75% of these polygons below 750m and outliers located between 1000 and 1200m. Concerning standard deviation, which indicates the range and slope of individual polygons, a distinction can be observed for *Wald* compare to *Holz*, *Riet* and *Moos* which are relatively similar. *Wald* is associated with high values of standard deviation indicating high relief and associated steep slopes, while the three other elements (and also all the microtoponyms of the canton) have lower values reflecting flatter terrain. It can also be noted that *Riet* has the lowest values among the four ME.

These results suggest that microtoponyms containing the term *Wald* are found at high altitudes with steep slopes. Conversely, microtoponyms with the term *Holz* are at lower altitudes with gentle slopes. This may be justified by their semantics suggesting an association of the microtoponyms with *Wald* with natural forests, less exploited for their wood resources, located in mountainous areas and serving as protective forests, whereas *Holz* microtoponyms may be associated with the forestry practice of logging and thus requiring proximity to human settlement, which is more often found on the valley floor. In addition, the gentle slopes associated with Holz microtoponyms make it easier to exploit them by facilitating the accessibility of these places.

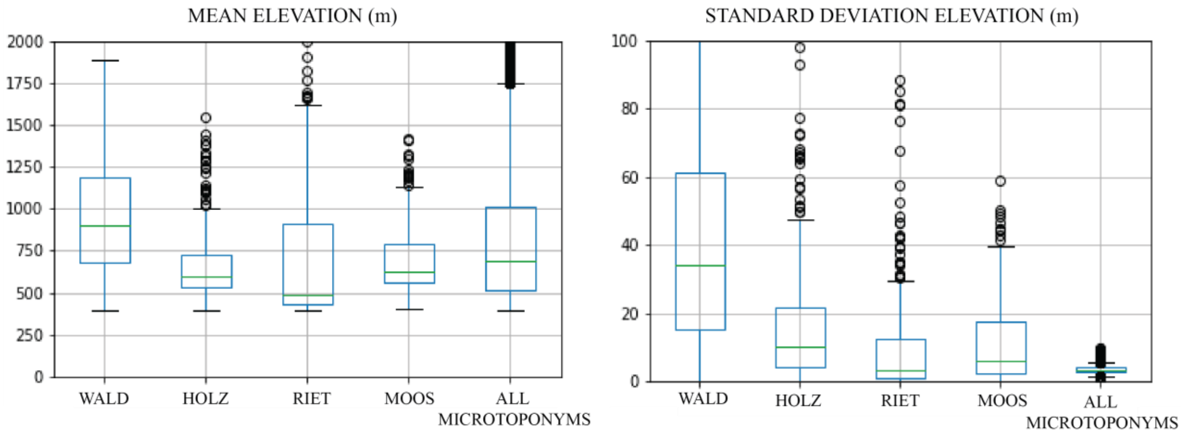


Figure 4.3 Mean and standard deviation elevation of *Wald*, *Holz*, *Riet* and *Moos* polygons

Concerning *Riet* and *Moos*, it would seem that despite relatively flat polygons, the microtoponyms with *Riet* are found at more varied altitudes even if a large part of them are located below 500m.

4.2.3 Topographical Wetness Index

TWI was explored because of its potential to distinguish the use between microtoponyms with *Riet* and *Moos*. The results demonstrate very similar values for *Wald* and *Holz* microtoponyms. Figure 4.4 shows *Wald* and *Holz* both have lower TWI values than the canton as a whole, confirming the location of these microtoponyms in relatively well-drained locations. However, microtoponyms with *Riet* and *Moos* have a higher TWI than the median of the canton with slightly higher values for *Riet*. This result confirms that *Riet* and *Moos* microtoponyms are located in less well drained areas and therefore, relatively wet places. It can also be noticed that *Riet* shows higher TWI values than *Moos* with 50% of them above 75% of *Moos* values.

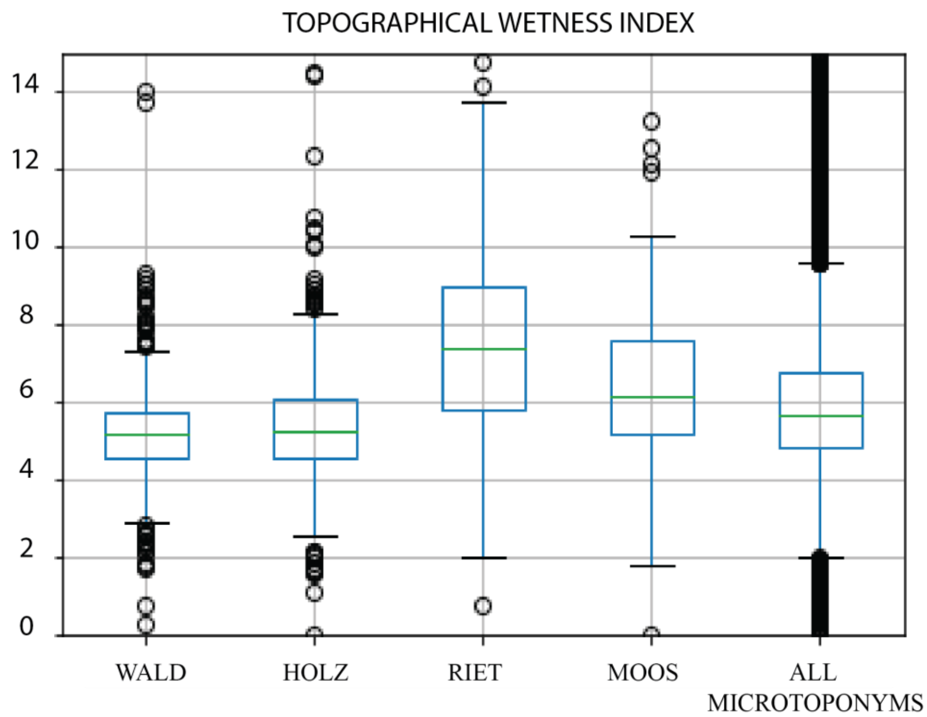


Figure 4.4 Topographic wetness index for *Wald*, *Holz*, *Riet* and *Moos* polygons

4.2.4 Land-cover

The results of the CORINE land cover classes associated with the microtoponym datasets are illustrated in Table 4.1. Only classifications which have a positive Chi-value for at least one of the four landscape terms are represented in this table.

Corine landcover classification (CLC code)	WALD	HOLZ	RIET	MOOS
Non-irrigated arable land (211)	-0.34	0.04	1.01	0.25
Coniferous forest (312)	0.74	-0.06	-	-
Mixed forest (313)	0.52	0.59	-	-
Discontinuous urban fabric (112)	-	-	0.01	0.07
Broad-leaved forest (311)	0.09	0.24	-	-
Pastures (231)	-	-	-0.20	0.21

Table 4.1 Chi-value of Landcover classification of the four landscape terms

The results demonstrate a certain tendency towards the expected classifications, despite the possibility of changes in land cover and land use over time. Indeed, microtoponyms containing *Wald* and *Holz* are mostly represented by coniferous forest, mixed forest and broad-leaved forest, all relating to forest cover. However, a significant distinction can be observed between these two terms, with *Wald* microtoponyms associated mainly with coniferous forests, followed by mixed forests and a small proportion of broad-leaved forests, unlike *Holz*, which shows a majority of microtoponyms associated with mixed and broad-leaved forests and which has a negative value for coniferous forests. These results demonstrate once again the diversity of physical properties related to these microtoponyms as for elevation and area data confirming distinct environments and therefore differentiable forest ecosystems. These results can also be related to the exploitation of the forested area for the *Holz* microtoponyms with the use of trees linked to the broad-leaved or mixed forest types.

With regard to *Riet* and *Moos*, it is interesting to note that none of them is directly associated with a wetland classification listed by CORINE (e.g. CLC 411: Inland marshes or, CLC 412: peat bogs). This means that *Riet* and *Moos* microtoponyms are no longer associated with wetland and that the meaning of these microtoponyms do not match the actual place description. However, they are both represented by the classes 'non-irrigated arable land' and 'discontinuous urban fabric'. It is difficult to state that 'non-irrigated arable land' is a new use of the places associated with *Riet* and *Moos*. Nevertheless, it seems very likely that 'discontinuous urban fabric' is the result of a draining of wetlands, to make then constructible. Moreover, the results link microtoponyms with *Moos* to the classification 'pastures' which is not shared with the microtoponyms with *Riet*, thus indicating a distinction between these two terms.

4.3 Chapter conclusion

All these results show a real potential in exploring the physical properties of microtoponyms to define some aspects of their semantics such as landscape terms and to provide elements concerning their use in the denominational act. They also support the idea of combining the study of many physical properties in order to define better the specificity of the places associated with each term.

In this chapter, I justified the choice of selecting area, elevation, land cover and TWI to explore the referent of microtoponyms containing the terms *Wald*, *Holz*, *Riet* and *Moos*. This exploration highlighted distinct patterns related to each term and validated the first observations made with the exploration of the linguistic aspects of these datasets as described below. Related to Wald and Holz, several conclusions can be made:

- The landuse analysis confirmed the association of the microtoponyms containing the terms *Wald* and *Holz* with the semantics of wooded area. Moreover, the linguistic exploration showed a very specific pattern for *Holz* with close link to plants, which were types of tree, and which correlated with the association of this specific landscape term with mixed and broad-leaved forest offering a larger possibility of type trees.
- The exploration of the elevation indicates new information. It demonstrates that microtoponyms with *Wald* and Holz are located at relatively high and relatively low locations, respectively. This correlates first with the tree types associated with these names with coniferous forest related to high ecosystems and linked to *Wald*, and mixed and broad-leave forest located at low elevation linked to Holz. However, it also correlates with the semantics of these terms with Holz associated with timber exploitation, justifying greater accessibility (low slopes) and situated at the bottom of the valley. That also correlates with the linguistic association of Holz with other place names referring to close settlements.
- The results relating to the area of the polygons associated with these microtoponyms also show interesting distinctions between Wald and Holz microtoponyms. Wald is associated with large polygons while Holz with small ones.

Finally, the combination of the linguistic and the physical aspects of these terms, which could be considered as synonyms since they both refer to wooded features, demonstrate a real distinction in their use in the microtoponyms of the canton of St. Gallen. This encourages the use of microtoponyms to investigate landscape concepts since such a degree of distinction can be captured through their holistic analysis. It could therefore be interesting to explore the specific concepts of *Wald* and *Holz* (translatable into French and Italian) to investigate their use in microtoponyms throughout Switzerland and also across France and Italy in order to determine how language or administrative boundaries impact how such landscape terms are used within microtoponyms.

Regarding *Riet* and *Moos*, similar observations can be made:

- The results related to landcover indicate that they are no longer related to specific wetland, however, they are mostly related to not irrigated land confirming that they are relatively wet. Moreover, this exploration indicates these areas have been transformed with some being associated with urban areas far from their original meaning.

- Investigating elevation shows smaller slopes for *Riet* than for *Moos* and also relatively lower elevation even if microtoponyms with *Riet* cover a greater range of elevation. This indicates that the use of this term is less specific than *Moos* and can be applied to a more diverse type of landscape.
- Finally, the TWI indicates that microtoponyms with *Riet* are wetter than microtoponyms with *Moos* and that both of these terms are wetter than the rest of the canton. This confirms their semantics of wetland and poorly drained terrain.

To conclude, even if these two landscape terms were more similar in terms of physical properties, their distinctive use inside microtoponyms can be explained by much more than just the physical properties of their referent, but also by their location. Indeed, the previous chapter highlighted that the meaning of Riet can be associated with an area cleared of trees and not a wetland in the canton of Bern (Idiotikon, vol 6, p. 1729). This indicates that the location of these microtoponyms may also contained pertinent information related to their definition and their usage. For this reason the next chapter will investigate *Riet* and *Moos* across the German-speaking part of Switzerland in order to include more data and to consider the spatial distribution as a potential factor implying different uses of landscape terms.

5 Spatial distribution of microtoponyms and landscape investigation

The previous chapters demonstrated potential approaches to link the physical properties of a referent, through its name, to the landscape terms contained. However, the analysis reported so far has not considered the spatial distribution of names. The use of landscape terms and place names varies in time and space after a language contact situation (Sandnes, 2016). Thus, it is not uncommon for the same class of features to be referred to using different terms depending on the location, as illustrated by Zelinsky in his study of the distribution of generic terms in the Northeastern United States place-names (Zelinsky, 1955). Figure 5.1 illustrates his results showing the spatial distributions of the generic terms ‘branch’ and ‘run’, both referring to streams, as used in toponyms. The visualization of these data illustrates that where ‘branch’ is found, ‘run’ is generally missing and conversely, the use of ‘run’ typically excludes ‘branch’. Zelinsky (1955) explained this spatial pattern as resulting from sociolinguistic aspects such as the spread of one term within language or the new settlement with people developing their own dialect or making different choices about competing terms referring to the same thing (Auer et al., 2004).

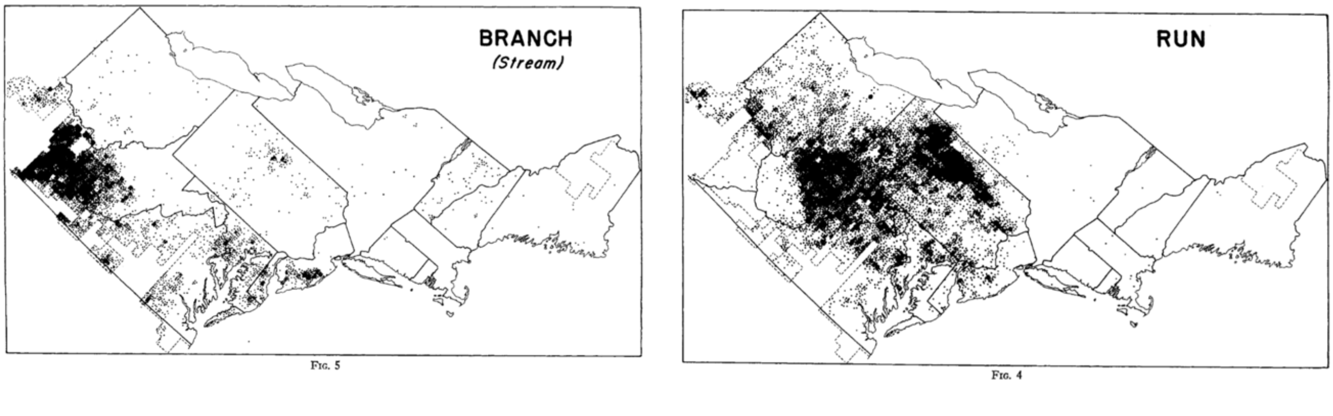


Figure 5.1 Distribution of toponyms with the generic terms ‘branch’ and ‘run’ in the Northeastern Unites States (from Zelinsky, 1955:327)

Using microtoponyms, it is also possible to study how the same term may have different meanings or connotations. Conedera et al. (2007) explored the location of the place name *'brüsàda'*, with the literal meaning 'burn'. They investigated the possible connotations and metaphorical meanings associated using properties of the locations of these place names. From the spatial exploration of the latter, they were able to identify three ways in which *'brüsàda'* was used. Firstly, in settled valley floor locations as a reference to a building on fire (as an event). Secondly, at high elevations, the name could be associated to the pastoral practice of pasture-fire related to the use of fire to improve the fertility of the land or to remove trees. Finally, its use was also linked to heat generated by the sun on south-facing slopes. Where none of these reasons could clarify the use of 'burn', the authors investigated the history of toponyms individually. This revealed historical practices of pasture-fires on low-altitude agricultural plots, a practice that was not known or previously recorded at such locations.

Moreover, Feng and Mark (2017) illustrated the influence of the topography, such as the elevation, in the choice of terms referring to 'mountain' or 'hill' inside place names. In their study' in Indonesian and Malaysian islands, a specific elevation (300m) used to distinguish a mountain from a hill, as seen in European dictionaries, cannot be applied to the local context of each island (Feng and Mark, 2017).

These examples illustrate that exploring the *spatial distribution* of place names can provide context to help understand patterns of the use of generic landscape terms inside toponyms. As a case study I explored the microtoponyms *Riet* and *Moos*, with a particular focus on understanding the semantics of *Riet*. As explained in Chapter 3, *Riet* or *Ried*, may refer either to landcover in the form of reeds, where it can be treated as a synonym of *Moos*, or to clearing an area of trees for cultivation (mainly reported in the canton of Bern).

This chapter will investigate whether combining the physical and linguistic properties of place names containing the landscape terms *Riet* and *Moos* by exploring spatial distribution can shed light on the meanings associated with *Riet*. To this end, a new case study of microtoponyms containing *Riet* and *Moos* over the whole of German-speaking Switzerland is used. The dataset of microtoponyms is first presented, together with the methodology used to investigate the spatial distribution of their linguistic and physical properties. After that the results of this investigation are presented, establishing the influences of the spatial distribution on the use of *Riet* and *Moos* inside microtoponyms.

5.1 Method used to investigate spatial distribution of microtoponyms and their linguistic and physical properties

5.1.1 Riet and Moos microtoponym dataset of the German speaking part of Switzerland

To investigate the influence of the spatial distribution, microtoponyms over the German-speaking part of Switzerland have been used. Working at this scale, as opposed to a single canton, leads firstly to a larger dataset containing more microtoponyms, and secondly encompasses a broader geographical context including distinct topographical settings such as the Alps, the Jura and the Swiss plateau. Broadening scales also allows different dialect areas to be considered, which are often associated broadly with cantons, and also for cantons at language borders to French- and Italian-speaking parts of Switzerland to be incorporated. Finally, this new study area allows us to consider the socio-cultural influences through the national border to Germany, and again can be linked to the diversity of each Swiss canton.

To analyse microtoponym use across German-speaking Switzerland, the first step was to identify an appropriate gazetteer. Very detailed datasets, such as that used for St. Gallen are not available for every German-speaking canton of Switzerland and therefore I had to choose between distinct national datasets. Figure 5.2 represents the number of toponyms identified as microtoponyms or *Flurnamen* in three different gazetteers covering Switzerland. It shows the very large disparity in the number of microtoponyms depending on the choice of gazetteer. There are very few microtoponyms in the Geonames gazetteer, which has international coverage, and a much larger number for both the Swiss gazetteers. Swisstopo, is the national database last updated in 2008 and SwissNAMES3D is based on an update made in 2016. Figure 5.2 also illustrates that updating the databases does not only increase the number of place names, but it also indicates that a new strategy of selection of names to include in the map or classification of these names as microtoponyms was used. Indeed, while the German-speaking part and the Italian-speaking part of Switzerland see their numbers of microtoponyms increase, the French-speaking part and the Romansh-speaking part show a decrease in microtoponym. This Figure illustrates some administrative choices rather than real changes in the use of place and confirms the need to be aware of the database used and to compare the toponyms within the same gazetteer. Therefore, since SwissNAMES3D appears as the most up-to-date and homogenous database, it was the one I used to extract all toponyms containing variants of *Riet* and *Moos*. Moreover, as it was the properties of the landscape elements related to *Riet* and *Moos* that were under investigation, I again chose to explore only microtoponyms, removing toponyms of other types such as streets or bus stops.

The resulting dataset consists of only the microtoponyms containing variants of *Riet* and *Moos* identified as *'Flurnamen'* and *'localnamen'* in the official Swiss database SwissNAMES^{3D} (SwissNAMES^{3D}, 2019) (Table 5.1). Furthermore, only the microtoponyms associated with the German-speaking part of Switzerland were selected, because due to the multilingual aspect of Switzerland false matches such as 'Les Me**riet**tes' or 'Cha**moss**ale' were found in the French-speaking part when the whole territory was considered. As in previous chapters, all possible spellings were considered, i.e. *Riet* and *Ried* and *Moos*, *Mos*, *Mös* and *Möös*.

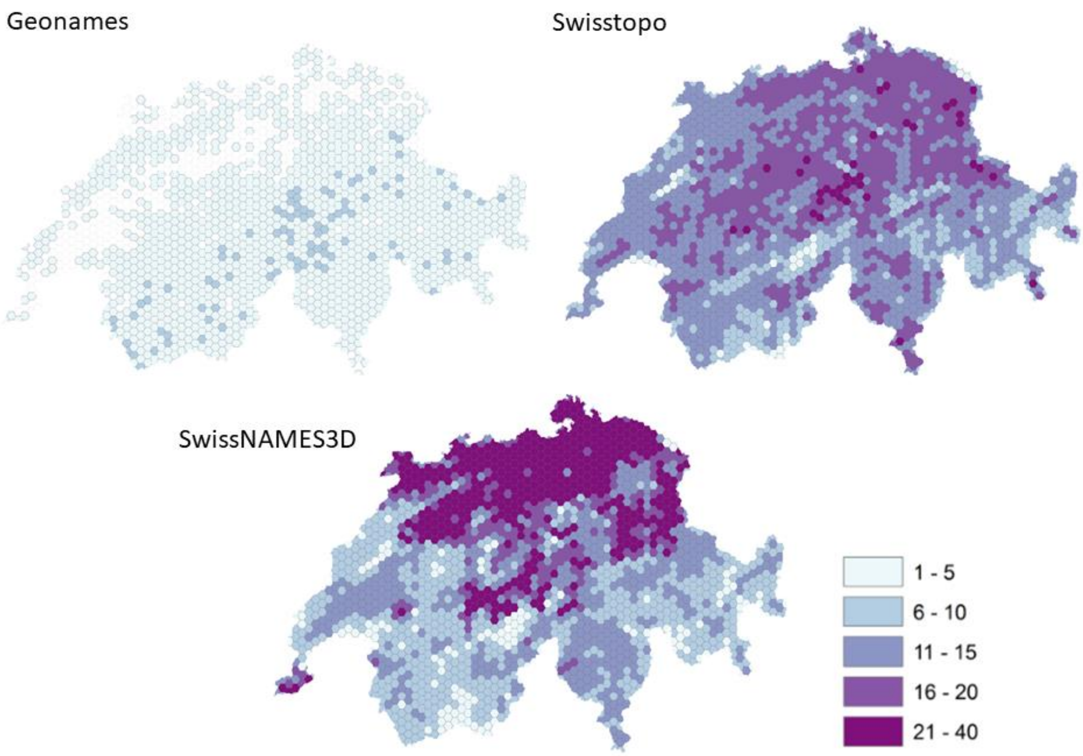


Figure 5.2 Distribution of microtoponyms in Switzerland according to gazetteers

Finally, only microtoponyms with *Riet* and *Moos* used either as a unique meaningful element, such as *Riet* or *Rietli*, or as the last part of the name, such as Oberriet or Langmoos, were extracted. Indeed, when I explored the linguistic structure of those toponyms, according to the position of the elements *Riet* or *Moos* I classified them into each toponym: unique element, first or middle position, last position. I then highlighted the top ten most frequent terms used in each position. I found that, with a greater number of toponyms, the general distribution of associated terms in place names are influenced by the most frequent meaningful elements (ME) (*Berg*, *Wald*, etc.) which mostly appear at the last position. Therefore, since I had more microtoponyms than in the previous case study, I decided to take into account only the toponyms in which *Riet* or *Moos* were used as unique elements or at the last position in the name. After that firstly I explored the spatial distribution and the physical properties of microtoponyms with *Riet* and *Moos* as unique element. Secondly, the investigation of the semantic information of the associated ME, as in the Chapter 3, was added when *Riet* and *Moos* are combined with other ME and when they appear at the last position in the name. Together they represent 66 % of the *Riet* microtoponyms with 1,428 names and 75% of *Moos* microtoponyms with 2,226 names (Table 5.1).

In the next stage, as developed in Section 3.2.2, I extracted meaningful elements co-occurring with *Riet* and *Moos* in microtoponyms using the etymological lexicon of more than 3,000 terms described in Chapter 3. The same matching process described in Figure 3.4 was used with the microtoponym dataset of *Riet* and *Moos* of the German-speaking part of Switzerland. However, the lexicon used was created from the establishment of the etymology of St Gallen microtoponyms, but as it contains German, Swiss German and Romansh meaningful elements, I assumed that I could use it for the rest of the German speaking part of Switzerland.

	Points	***'Flurnamen'***	**Unique**	**Last element**	**Unique and Last elements**
Riet	2659	2156	492	936	1428 (66%)
Moos	3211	2972	720	1506	2226 (75%)
SwissNAMES^{3D}	223218	178421	-	-	-

Table 5.1 Structure of the *Riet* and *Moos* microtoponym database considering the German-speaking part of Switzerland

In order to test this hypothesis, the elements that did not find a match between the microtoponyms of the German-speaking part of Switzerland and the lexicon at the end of the matching process were isolated and compared with the 'no-match' of the Canton of St. Gallen (Table 5.2**)**. It should be noted that the number of elements found in the toponyms not present in the lexicon is greater than the number of elements present in both datasets. However, it is important to remember that this lexicon was created to help linguists to establish the etymology of redundant terms in microtoponyms. It is by no means an exhaustive list of all the elements present in place names. Chapter 3 also showed that the distribution of these terms follows an exponentially decreasing curve with few terms appearing in very large numbers and many terms appearing uniquely. This distribution, which follows the distribution of language terms (Zipf's law), implies such a limitation in the use of a lexicon with many terms used only once. Indeed, Table 5.2, shows a very large proportion of these terms that appear uniquely and therefore implies that few redundant elements have been omitted. This phenomenon being observed in similar proportions between the application of the lexicon to cantonal and national data, suggests that this lexicon can be used in the same way on the German-speaking national territory as it was used for the canton of St. Gallen considering that only a few frequent terms will be omitted.

	Number of associated ME	**Number of unmatched ME**	**Number of ME appearing only once**
Flurnamen of the Canton of St Gallen (17 598 toponyms)	1,409	1,631	1,391 (85%)
Riet and Moos Flurnamen in Switzerland with elements as unique or final (3656 toponyms)	522	553	484 (88%)

Table 5.2 Proportion of ME absent from the etymological lexicon of St. Gallen after matching with St.Gallen and microtoponyms of the German-speaking part of Switzerland

5.1.2 Spatial exploration of the semantic aspects of microtoponyms

The semantics of microtoponyms containing the term *Riet* were compared to microtoponyms containing the term *Moos*. The assumption made here is that microtoponyms associated with *Riet* referring to a wetland will have a greater semantic similarity with microtoponyms associated with *Moos* than when *Riet* microtoponyms refer to a cleared area. Thus, in order to measure their semantic similarity, the associated ME of these two terms (*Riet* and *Moos*) were compared using the cosine similarity measure.

The cosine similarity measure allows two vectors of terms to be compared, here the respective lists of meaningful elements associated with *Riet* and *Moos* within a region. To be more concrete, within each delimitated region, a vector 'u' was created with the terms associated to Riet within the Riet microtoponyms of the region. Similarly, a vector 'v' was created with the terms associated to Moos within the Moos microtoponyms of that region. Then, for each region, the cosine similarity between these two vectors was calculated. As indicated by its name, the cosine similarity measure computes an angle formed by the vectors of the studied documents.

The following equation was used to compute it:

$$1 - \frac{u \cdot v}{\| u \|_2 \| v \|_2}$$

Where $u \cdot v$ is the dot product of u and v.

The smaller the angle, the greater the similarity is between[2] documents and the value of the cosine similarity measure is close to 1. Conversely, increasing difference between the documents results in values closer to 0. Note that the interest of the cosine similarity measure is the potential to compare documents of different sizes which could be the case in this study with the number of microtoponyms with Riet not necessarily being the same as that with *Moos*. Nevertheless, although this information is relevant for this analysis, it is also important to be able to observe the relative difference in the frequency of the associated meaningful elements shared. Indeed, low frequencies can illustrate the distinctive semantics of *Riet* when the microtoponym associated with this term refers to a cleared area. Considering the frequency takes into account that *Riet* can have both meanings in the same region and is a way to explore which one dominates. Moreover, by considering that associated terms could be specified by different meaningful elements, while still more or less referring to the same thing, I classified those associated ME according to Gammeltoft taxonomy (2005) as in chapter 3 and illustrated in Figure 3.5. The next step was therefore to compute the cosine similarity between the *Riet* and *Moos* lists using the taxonomy of their associated elements and their associated frequency between different geographic areas as described in the next section.

In this stage, I also compared the spatial distribution of place names composed of the *Riet* element and those with the *Ried* element. Indeed, according to the Swiss dictionary Idiotikon (described in section 3.2.3), the semantic association of clearing is rather etymologically related to the spelling *Ried* referring to the *Rodung* (clearing process) and mainly in the canton of Bern. Since both these spellings of *Riet* are not only used as unique element, their associated ME were also explored. These associated ME were compared at the scale of the study area, this time using a correlation measure applied to their classification following the Gammeltoft taxonomy (2005).

5.1.3 Extraction of physical properties of microtoponyms

The interest in exploring the physical properties of the microtoponyms associated with *Riet* and *Moos*, is to compare them with the first results observed when comparing the semantics of these terms (conf. Chapter 3). As demonstrated in the previous chapter, it also makes sense to explore the physical properties of the microtoponyms in combination with their linguistic features, as it helps to define the geographical context of use of the landscape terms contained in these microtoponyms. Therefore, the hypothesis formulated here is that microtoponyms associated with *Riet* referring to a clearing will show a weaker physical similarity with microtoponyms associated with *Moos* while they refer to a distinctive environment. In order to explore this hypothesis, the elevation (mean and standard deviation) and the TWI of these microtoponyms was explored as in the previous chapter. However, as described above, the new dataset of microtoponyms related to the German-speaking area of Switzerland relates each name to a point instead of to a polygon. Therefore, the first step was to associate these points with an area in order to compute the physical properties in the same way as in chapter 4, in the spatial extent of the microtoponym referents.

Diverse methods using GIS can be used to change a point layer into a polygon layer, each based on different assumptions. The assumption made here is that the SwissNAMES3D dataset of microtoponyms (*Flurnamen* and *Localnamen*) constitutes the most complete digital dataset available and reflects the name density of microtoponyms of the study area. I considered that each part of the territory can be associated to a microtoponym of this dataset, even if it is probabilistic that more names could be collected at a finer scale for some areas. Therefore, assuming that they represent all the microtoponyms of the study area, the 'Thiessen polygon' tool can be used to generate polygons from these points. Indeed, it is possible to consider that if all the toponyms are known for a certain region, it is then possible to associate a polygon to each point based on its relationship with its neighboring points. Using this tool, all the microtoponyms of the SwissNAMES^{3D} dataset were used to generate a continuous layer of polygons based on the spatial distribution of these names instead of the real area assigned to them as was the case for the cantonal dataset used previously. Thus, in order to assess if the polygons created with this tool are close to the real referent of these microtoponyms, the area of polygons of the canton of St. Gallen used in the previous chapter and the Thiessen polygon created for this same territory were compared.

Once these polygons were created, the same methods described in the previous chapter were used to compute elevation data (mean and standard deviation) and TWI for the *Riet* and *Moos* microtoponym datasets of the German-speaking part of Switzerland.

5.1.4 Representing the data spatially

This chapter will explore the spatiality of the linguistic and physical properties of place names. Thus, a first step visualizes the spatial distribution of these microtoponyms. To do so, a grid was generated over the whole of Switzerland to delimit the study area in equal and random spatial units. It would have been possible to use the existing administrative boundaries of communes or cantons to explore the variation of their linguistic and physical properties within these socially significant groupings. Nevertheless, these administrative units have greatly changed since the creation of the Swiss confederation in 1291 with the 26 current cantons created and defined progressively over time (Rappard, 1948). Therefore, I assumed that the definition of the cantonal boundaries was not deeply correlated to the act of naming the space and that exploring the spatial distribution of microtoponyms outside the current predefined administrative boundaries would allow me to investigate any possible spatial influences. Thus, a hexagonal grid was generated, preferred to a more basic square grid, as it allows each hexagon to share the same number of sides as its neighbours. Due to the large scale of analysis, I chose a relatively large diameter for the hexagon, namely 20 kilometers with each edge being 10 km long. Using that grid, it was then possible to illustrate spatially the linguistic and physical properties of these microtoponyms.

The grid enables the spatial distribution of *Riet* and *Moos* to be visualized. The spatial distribution of toponyms is largely dependent on geography, with a much higher density of names in the plains and a much lower density in mountainous areas such as illustrated in the Figure 5.3. It is therefore important to visualize the distribution of the microtoponyms considered (*Riet* and *Moos* dataset) in relation to the general distribution of microtoponyms in order to avoid any misinterpretation.

These hexagons were used to illustrate the distribution of *Riet* and *Moos* microtoponyms according to the overall distribution using once again the Chi-value (conf. equation 4.1) but with different expected and observed values.

They are in this case computed with:

$$Expected = \frac{Total\ nbr\ of\ Riet\ or\ Moos\ MicroT.}{Total\ nbr\ of\ MicroT.} \times Nbr\ of\ MicroT.per\ Hexagons$$

and

$$Observed = Nbr\ of\ Riet\ or\ Moos\ MicroT.at\ x\ Hexagon$$

This same grid will be used to compare the cosine similarity values of the elements associated with the microtoponym *Riet* and *Moos* and their physical properties across the German-speaking part of Switzerland.

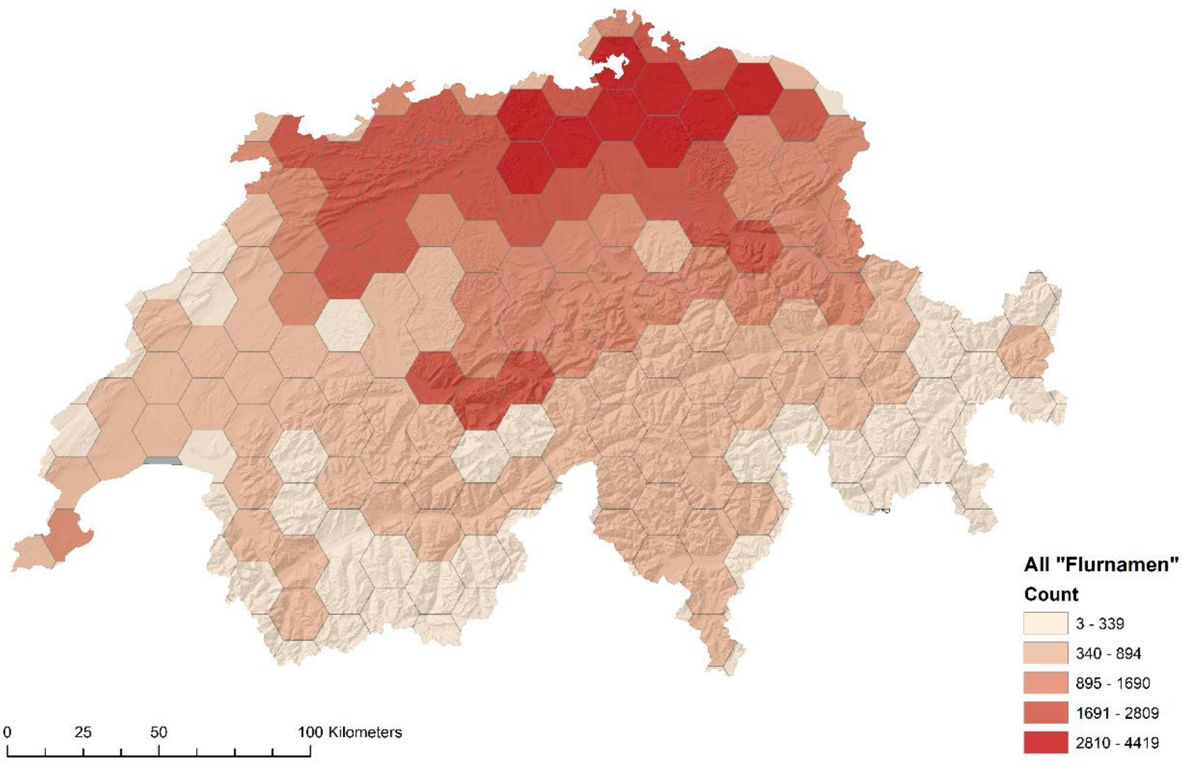


Figure 5.3 Spatial distribution of microtoponyms in Switzerland

5.2 Results: spatial distribution of the linguistic and physical aspects of Riet and Moos microtoponyms

The results of exploring the spatial distribution of the linguistic and physical properties of the microtoponyms with *Riet* and *Moos* in the German-speaking part of Switzerland is presented in three parts: first, the exploration of their spatial distribution, second, the comparison of the semantic aspect of their associated terms and finally, the comparison of their physical properties throughout Switzerland.

5.2.1 The spatial distribution of Riet and Moos microtoponyms

Figure 5.4 illustrates the spatial distribution of microtoponyms with *Riet* and *Moos* throughout German-speaking Switzerland. It shows a spatial distribution covering almost the same hexagons as the whole of the area considered (104 hexagons), microtoponyms with *Moos* are present in 87 of them (i.e. 84%) and microtoponyms with *Riet* in 93, i.e. (89%).

However, Figure 5.5 shows only 15% of these hexagons (16) sharing the same chi-value illustrating some irregularities in this relatively homogeneous distribution. This disparity is relatively visible in Figure 5.5 which illustrates an over-representation of *Moos* microtoponyms mainly in the hexagons located in the west of the zone considered, while on the contrary *Riet* is over-represented in the eastern part. I also notice a relatively condensed zone of under-representation for the term *Riet* grouping eight hexagons (in blue in the figure) which deserve particular attention. Nevertheless, the east-west spatial distribution of Moos and Riet microtoponyms is relatively similar to that illustrated by Zelinsky's work(1955) in Figure 5.1. That could reflect either a linguistic choice of one term instead of the other or different physical properties implying the use of different terms to designate the place referent. This hypothesis will be explored in the results related to the linguistic and physical properties of the corresponding microtoponyms. The absence of microtoponyms with these terms (*Riet* and *Moos*) in the highest part of the Alps (southern Switzerland- the Romansh-speaking part of Switzerland) and a moderate representation of them in the pre-Alpine areas (south-central Switzerland) are also noticeable. This confirms the results of the previous section (Section 4.2.2) indicating their spatial distribution at relatively low altitudes with the majority of their over-representation in the northern part of Switzerland corresponding to the Swiss Plateau.

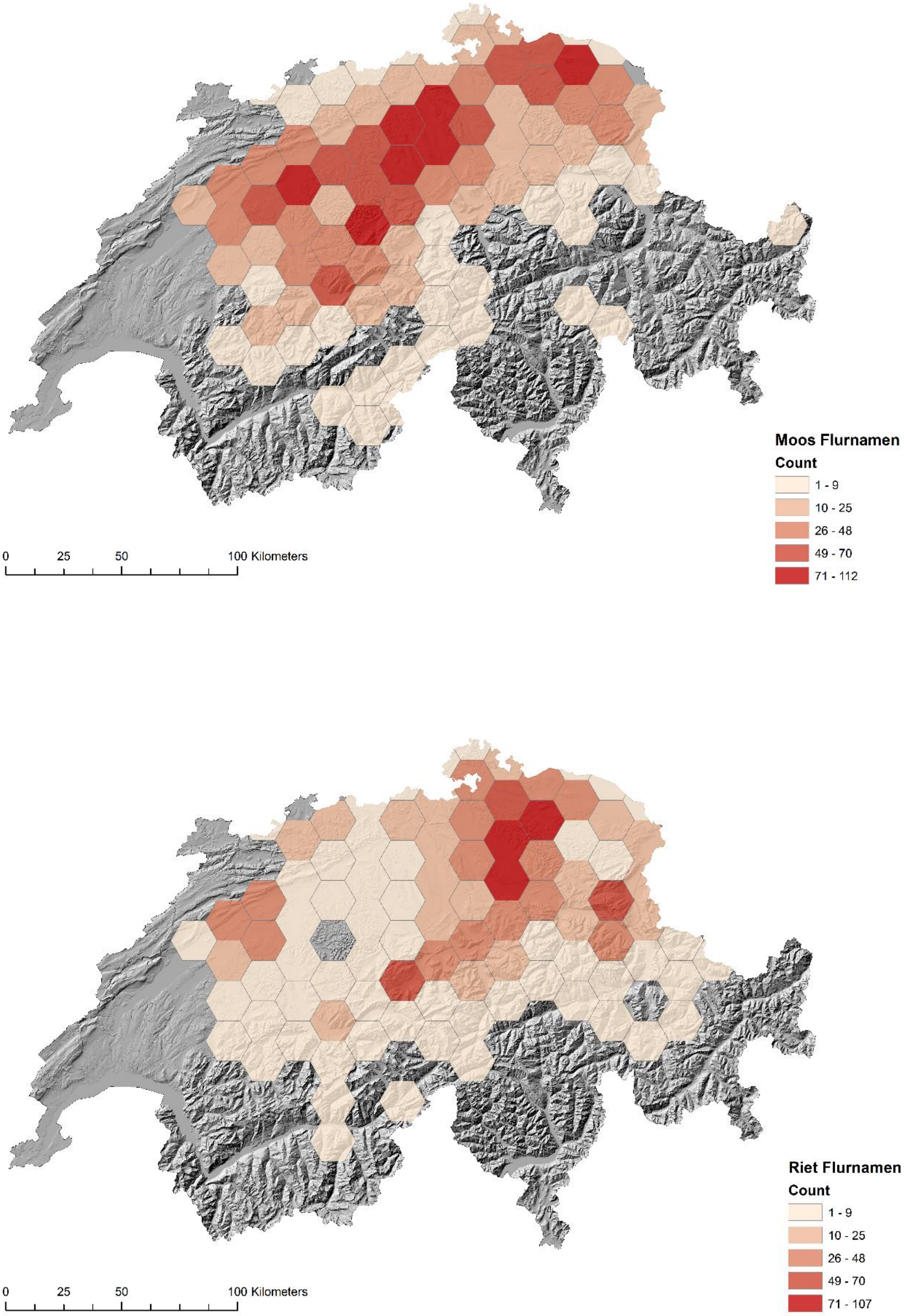


Figure 5.4 Distribution of Moos and Riet microtoponyms in the German-speaking part of Switzerland

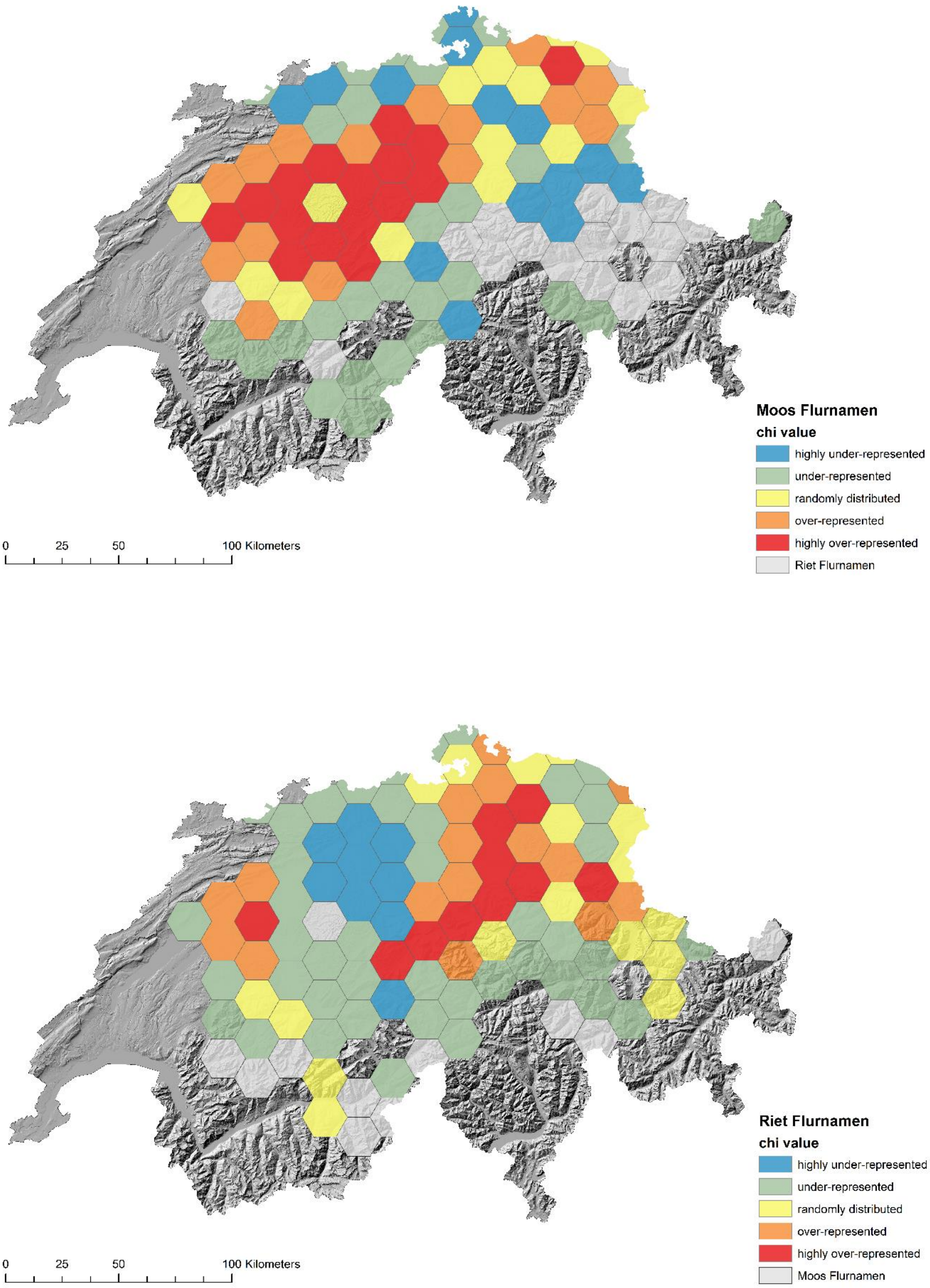


Figure 5.5 Distribution of Chi-value of the number of microtoponyms with Moos and Riet

In addition, the distribution of both linguistic forms of *Riet* (*Riet* and *Ried)* is illustrated in Figure 5.6. Again, there is a significant disparity between the microtoponyms containing *Riet* located in the north-east of the country and the microtoponyms containing *Ried* located in the west and south of Switzerland. There are in fact few hexagons containing microtoponyms with both forms. These two forms will also be compared in the linguistic and physical results that follow.

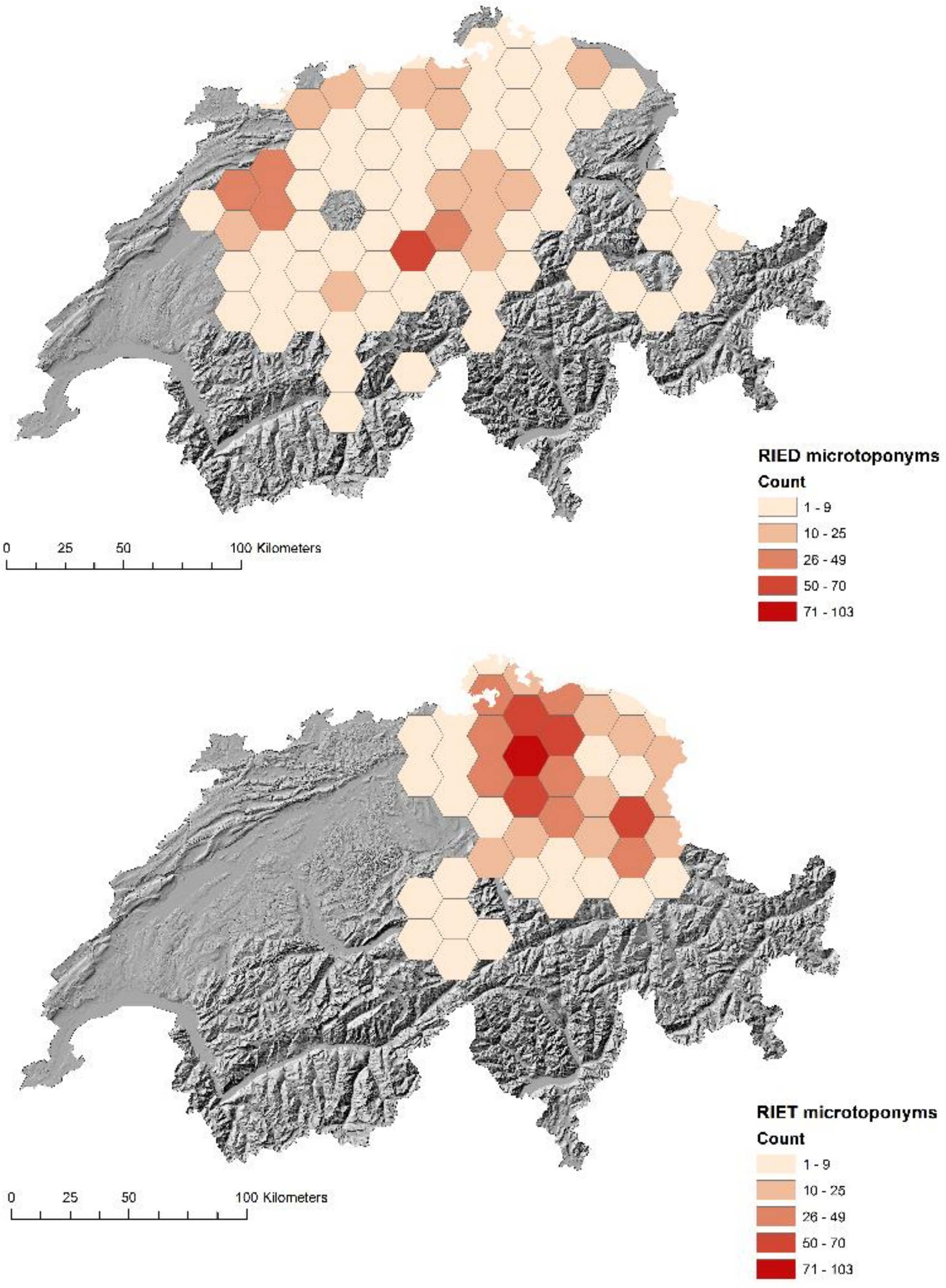


Figure 5.6 Spatial distribution of Riet and Ried microtoponyms

5.2.2 The semantic exploration of Riet and Moos microtoponyms

The spatial disparity between the microtoponyms including *Riet* and *Ried* is also visible in the semantic comparison of their associated meaningful elements. Table 5.3 presents the results of the correlation (r^2) of the percentage of the Gammeltoft taxonomy (2005) applied to their associated meaningful elements. This table indicates a greater difference between the taxonomy of the associated meaningful elements of *Ried* and *Moos* (0.53 r^2) than between those of *Riet* and *Moos* (0.81 r^2). This suggests a variation in semantics between the microtoponyms including *Riet* and those including *Ried*.

Moreover, the semantic similarity between *Riet* (with *Riet* and *Ried* forms) and *Moos* was explored using the cosine similarity measure. To visualize it, it was necessary to have a reference value (one hexagon) to compare with all the others. Therefore, the hexagon with an overrepresentation for *Riet* and *Moos* containing more than 25 names in each microtoponym dataset was chosen as a reference. The results are shown in Figure 5.7 where the hexagon of reference is highlighted by a thick black outline. The results are illustrated by a gradation of red of varying intensity, the higher the intensity is the greater the similarities are, and vice versa.

R^2	Ried	Riet
Riet	0.52	/
Moos	0.53	0.81

Table 5.3 Correlation (r^2) between semantic taxonomy

The Figure 5.7 illustrates three comparisons:

- *Riet* vs. *Riet*, where the taxonomy of the associated meaningful elements of *Riet* microtopoymes of this hexagon are compared with the taxonomy of the associated meaningful elements associated with *Riet* microtopoyms which are present in each of the other hexagons.

- *Moos* vs. *Moos* where the taxonomy of the associated meaningful elements of the microtoponyms with *Moos* of this hexagon are compared with the taxonomy of the associated meaningful elements of the microtopoyms with *Moos* present in each of the other hexagons, and

- *Moos* vs. *Riet* where the taxonomy of the associated meaningful elements of *Moos* microtopoymes of this hexagon are compared with the taxonomy of the associated meaningful elements of *Riet* microtopoyms present in each of the other hexagons represented.

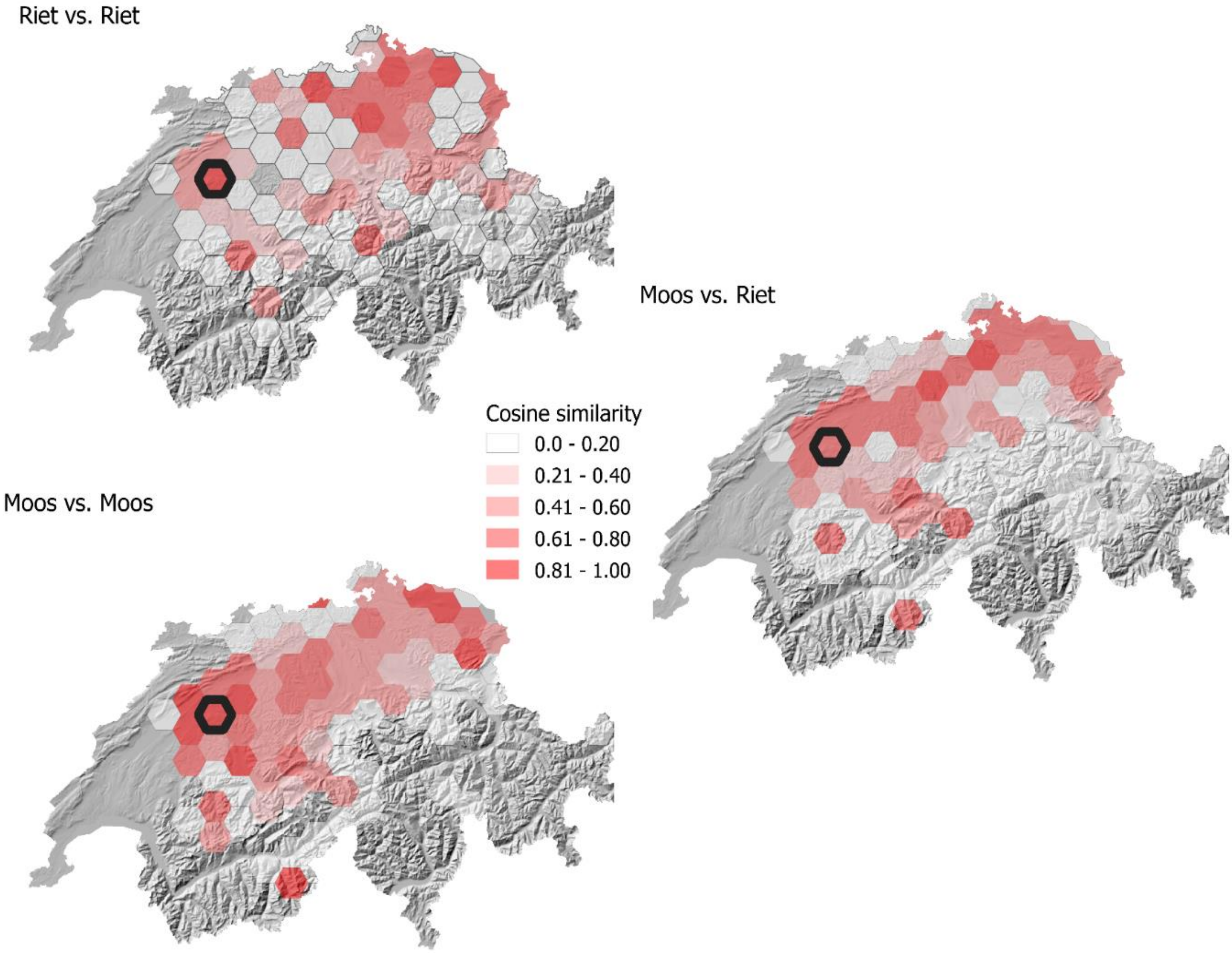


Figure 5.7 Cosine similarity of microtoponym semantics

These comparisons highlight several facts. First, the distribution of *Moos* microtoponyms is homogeneous across space and their associated semantics are also relatively homogeneous in their spatial distribution indicated by a relatively constant shade of red (*Moos* vs. *Moos* map). It should be noted, however, that on the same map there is a very light red color indicating a small similarity at the north and the south of the Swiss Plateau, where a low toponym density is observed (Figure 5.5).

The correlation between low toponym density and small similarity is also visible with the *Riet* dataset comparison on *Riet* vs. *Riet* map. This suggests that a minimum of data is necessary in order to evaluate any similarity.

Second, regarding the *Riet* vs. *Riet* map, it is important to note that the microtoponyms containing *Riet* inside the referent hexagon are associated mainly to the *Ried* spelling. Nevertheless, a high degree of similarity is visible with the names located at the north-eastern part of the study area, where they are mainly related to the form *Riet*. This high similarity in this part of the study area is also visible in the *Moos* vs. *Riet* map suggesting that they are (*Riet*, *Ried* and *Moos*) associated with similar meaningful elements there.

Nevertheless, this similarity is less marked within the hexagons associated with the canton of Bern and in the south-eastern part of the German-speaking part of Switzerland. This confirms what was indicated in the *Idiotikon* dictionary linking the 'clearing' meaning mainly with the canton of Bern (Idiotikon, vol 6, p. 1729). Moreover, the lower degree of similarity observed in the south-eastern part may be a combination of low toponym density and a modification in the local landscape implying other associated terms related to this different landscape such as suggested in Table 5.3 with a lower correlation between *Riet* & *Ried* and *Moos* & *Ried* than between *Moos* & *Riet*. Moreover, the history of this specific area associated to the canton of Grisons (the only trilingual canton) could also be investigated as having influenced the act of naming space.

5.2.3 Exploration of the spatial distribution of the physical properties of Riet and Moos microtoponyms

In order to explore the physical properties of the *Riet* and *Moos* dataset of German-speaking Switzerland, I first modified the data referent of these names from points to polygons. To do so, I used the Thiessen polygon tools as described in the first part of this chapter. I then compared the area of the polygons created with this tool in the canton of St. Gallen with the polygon dataset provided by the canton and used in the previous chapters. The results of this comparison are illustrated in Figure 5.8. They demonstrate that the area of polygons created using the Thiessen polygons tools is larger than the polygons of the cantonal dataset. It is not surprising since these polygons were created from the SwissNAMES3D dataset of microtoponyms (*Flurnamen* and *Localnamen*) which contains fewer names (10976) than the cantonal dataset (17598). Nevertheless, since they represent areas regarding their relation with the other points (such as the cantonal dataset) and they are still proportional to the number of names, this tool can be considered as a reasonable way to generate these polygons.

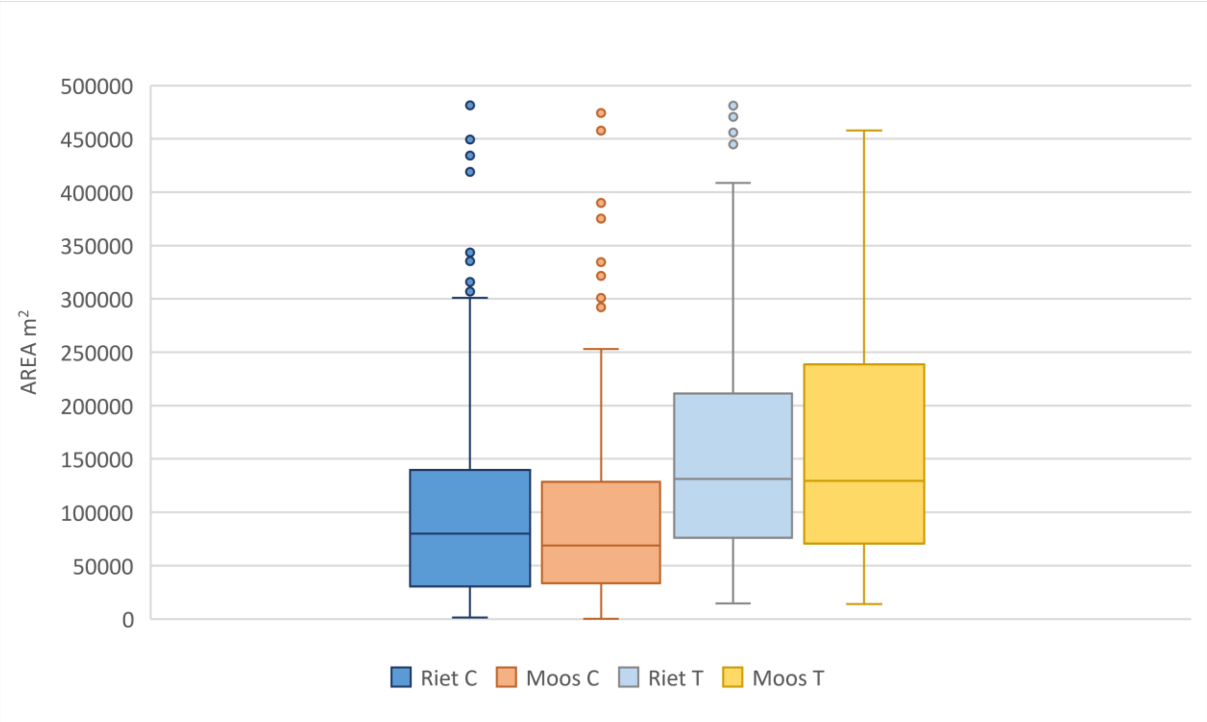


Figure 5.8 Area of polygons for Riet and Moos microtoponyms in the canton of St. Gallen according to the cantonal dataset ('C') or the Thiessen polygons ('T')

This new layer of polygons was used to compute the elevation values and the TWI for *Riet* and *Moos* microtoponyms located in the German-speaking part of Switzerland. Figure 5.9 shows in red variations of the mean altitude of the *Riet* and *Moos* microtoponyms and in blue variations of their TWI values. With regard to elevation, microtoponyms with *Moos* follow the general distribution of Swiss altitude with low values on the plateau and higher values in mountainous areas. This is nevertheless, not the same pattern for microtoponyms with *Riet* which show some variations in this trend, particularly in the northwestern part of the study area.

This is in the same area as where very low TWI values are observed for *Riet*. Similarly, one hexagon in the northeastern part shows higher values for microtoponyms with *Riet* than those with *Moos* and it is also where a very low TWI is observed. This result could suggest that in this specific area the microtoponyms with *Riet* are related to the 'clearing of trees' semantic.

Moreover, related to TWI, some observations can be made. First, there is an east-west distribution of TWI according to the microtoponym dataset. Indeed, microtoponyms with *Moos* have higher values in the western part of the study area indicated by darker hexagons, while microtoponyms with *Riet* have higher values in the eastern part of Switzerland. This east-west distribution correlated to the *Riet* and *Moos* dataset is already visible in Figure 5.5, illustration of the spatial distribution of microtoponym density. Thus, where microtoponyms with *Moos* are the most frequent, they also have higher TWI values than *Riet* and vice versa. This may suggest a correlation between a linguistic usage with one term more frequent than the other, and a specific physical property, which in this case is the TWI. Once again, relatively homogeneous TWI values are related to *Moos* microtoponyms and a heterogeneous distribution of TWI values are associated with *Riet* microtoponyms

This observation made for each physical property might suggest that *Riet* is associated with environments less specific than *Moos* and can be linked to places at higher elevations. However, this result confirms that the canton of Bern combines high elevation values and low TWI for *Riet* microtoponyms suggesting that these specific polygons may contain microtoponyms with *Riet* referring to a clearing rather than to a reed and marshy area.

.

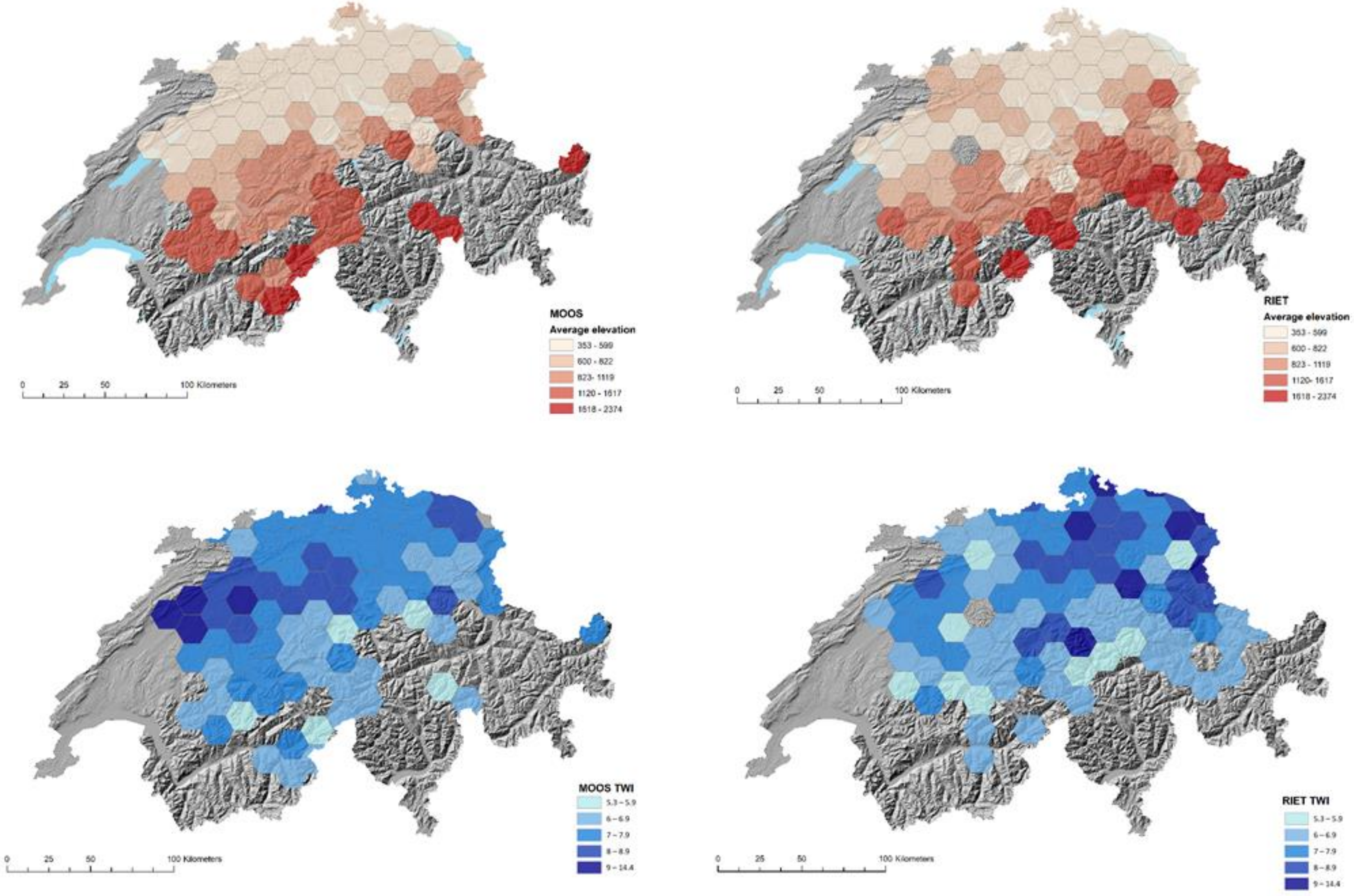


Figure 5.9 Altitude and TWI of microtoponyms with Riet and Moos in the German-speaking part of Switzerland

5.3 Chapter conclusion

This chapter explored the spatial distribution of the linguistic and physical properties of *Riet* and *Moos* microtoponyms throughout the German-speaking part of Switzerland. Since language varies in space (Seguy, 1971 ; Sandnes, 2016 ; and Derungs and al. 2020), the purpose of this chapter was to explore to what extent the spatial distribution influences the semantics used in place names. First, it demonstrates that even though both *Riet* and *Moos* are used inside microtoponyms in the whole study area, the density of their related spatial distribution is not the same. *Moos* are represented to a greater extent in the western part, while there is a greater representation of *Riet* in the east. Moreover, a stricter distinction can be visualized between the spatial distribution of the linguistic form *Ried* in the western part and *Riet* in the east. Many reasons could explain such a distribution and they are mainly cultural and linguistic. As suggested by Zelinsky (1955), it can be influenced by the choice of a certain social group to use one term instead of another, or by interactions as formulated by Auer et al. (2004):

> 'Language habits ('Sprachusus') are determined by human interaction ('Verkehr') which has either a levelling or a differentiation effect (Paul 1920:section23).' (Auer et al., 2004)

Indeed, the semantic exploration of associated terms demonstrated that when they are used together in the same area, as for *Moos* and *Ried*, they are associated with more distinctive terms. This relates to the need for a place name to be distinguishable from another (Oral and Beaucage, 1996), and even more the case when they relate to similar places as their semantics suggest.

Second, the spatial distribution of the associated meaningful elements does not reveal much information alone. Indeed, this property should help to identify when *Riet* could have a different meaning than *Moos*, but since the data are visualized by hexagons and not individually, no specific patterns were identified. This means that the use of *Riet* associated with the meaning of 'clearing' is not spatially defined, with in one part of Switzerland the meaning of 'clearing' and in the other the meaning of 'marshy area'. Nevertheless, as stated at the beginning, the etymology of those terms are sometimes very hard to elucidate (lack of historical sources), and therefore it seems that exploring the associated meaningful elements at the scale of the hexagon cannot help in this task.

Third, the exploration of the physical properties may help to distinguish one semantic of *Riet* from another in the hexagons overlapping the canton of Bern, since it reveals some distinctive patterns for *Riet* microtoponyms compared to those for *Moos*. Indeed, some hexagons illustrate a low TWI at a higher elevation suggesting that maybe the microtoponyms with *Riet* located in these hexagons refer to a 'clearing activity'. Moreover, in the southeastern part of the study area, in the southern most part, *Riet* is the only element used in microtoponyms, with *Moos* microtoponyms no longer being represented. This could suggest that in this southern part where *Riet* and *Moos* are used together, since the use of *Riet* in microtoponyms is associated to a greater extent with a higher location, the geographical context combined with the naming fashion of this area removed the use of *Moos* in microtoponyms at higher locations.

Finally, combining an exploration of the linguistic and physical properties, and the spatial distribution of these microtoponyms has revealed some patterns to help determine the use of landscape terms in space. Nevertheless, this type of exploration requires a relatively complete dataset of place names and it would be difficult to carry out such an investigation with a poor quality gazetteer containing fewer names. It is also necessary to have the support of precise and detailed linguistic knowledge of the etymology of the landscape terms explored, as microtoponyms imply a broad time scale.

The next chapter will therefore investigate place names and their various aspects in landscape explorations, when data are not complete and the etymology of the terms do not refer to landscape terms.

6 Act of naming and landscape investigation[14]

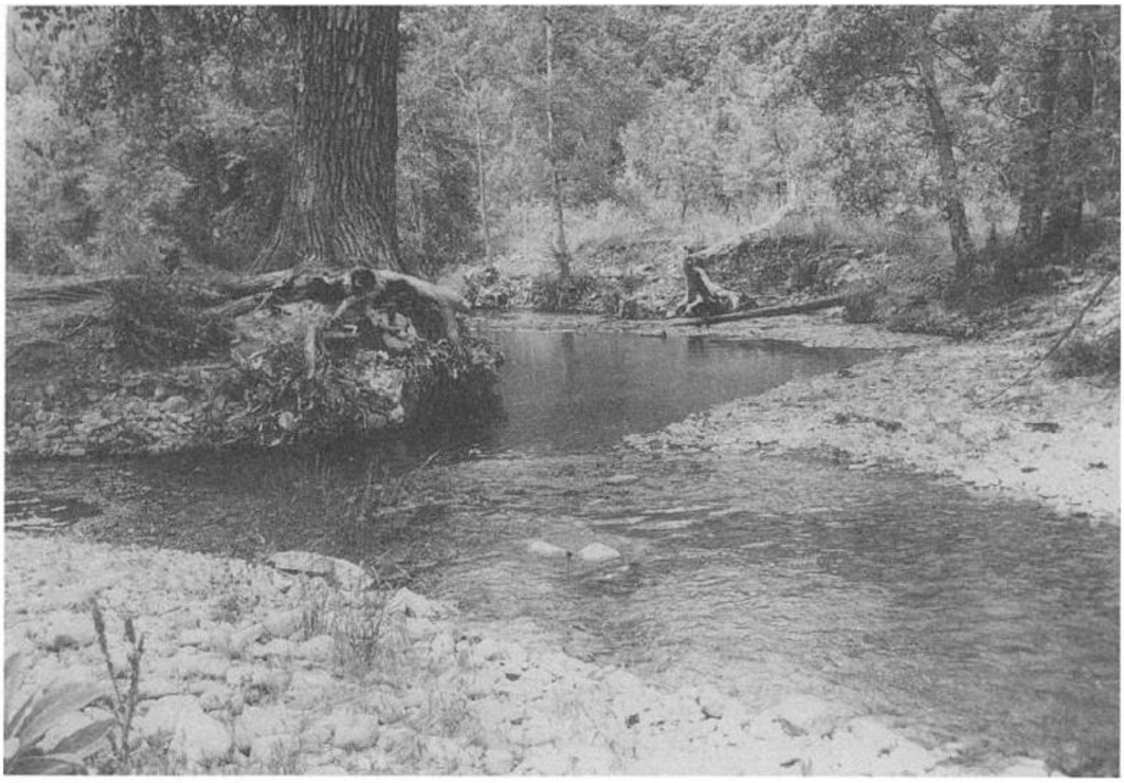
I have previously demonstrated the interest of place names for the exploration of landscape terms. This was performed with a relatively complete dataset of microtoponyms, mostly transparent, and containing landscape terms. Nevertheless, as Chapter 2 illustrates, in many societies, place names do not have such structure and therefore, investigating using methods described in Chapters 3, 4 and 5 is not possible. However, this chapter seeks to demonstrate that landscape can be explored using the cultural and geographical aspects of indigenous place names. Since, place names can have very distinctive linguistic structures, for example, they can be descriptive sentences used as discourse elements in indigenous American societies described by Basso, (1988) and illustrated in Figure 6.1.

Place names can also be built on a complex cultural system involving relationships with many entities, such as in the Australian Western Arnhem Land where place names may or may not be transparent but are used to 'do things'. They are used to communicate in diverse ways between places, people and things (Garde, 2014). Similarly, in the Bolivian Andes, Quechua place names are descriptive features referring to the earth as a living entity (Boillat et al., 2013). Moreover, place names can also be a way of sharing cultural knowledge, such as in northern Fennoscandia where Sami place names are the map instead of any inscribing support. They describe events or resources and help to navigate and to transmit cultural and historical information about landscape (Cogos et al., 2017).

Consequently, indigenous place names, can be used to explore landscape in a broader sense of the relationship that people have with their environment. Nevertheless, from a western perspective it sometimes remains challenging to understand the principle that drives the place naming system in indigenous societies because it is very different from how place names are used in European societies (Descola, 2019). Moreover, many researchers working with indigenous societies (Descola and Ingold, 2014; Janz, 2011) claim that it is hard and almost impossible to explore the relationship that humans have with their environment using a single

[14] This chapter is based on a paper currently in review : Maps meet Myths: understanding Jahai place naming through Geographical Information Systems

discipline and exploring only one aspect of that relationship (society or environment) as Boas already suggested a long time ago (Boas, 1934:14 as cited in Thornton, 1997a). Such investigations have to be conducted using interdisciplinary approaches and using a diversity of tools and methods. It has also been suggested that place names should not be looked at as individual entities but through a system providing information about wider processes relating humans to the environment inside the society (Oral and Beaucage, 1996; Tent, 2015).



***t’iis bitł’áh tú ’olį́į’* (“Water flows inward underneath a cottonwood tree”).**

Figure 6.1 Example of Western Apache place name (From Basso, 1988:111)

This leads me to the third objective of this thesis which aims to consider the act of naming and the social function of place names. To this end, I aim to answer the following questions:

- How can the cultural settings of place names be analyzed with their linguistic and physical properties?
- What are the benefits of considering the name, the referent and the cultural settings of place names in landscape research?

These questions underline challenges related to the specificity of indigenous place names and to their exploration as a whole. Although place names have the advantage of being a linguistic fact that nowadays seems to be universal (Burenhult and Levinson 2008:138-139), this potential universality reveals a great diversity, especially with indigenous societies as illustrated above. Grasping this diversity and the specificities of a system is a role of the field of anthropology, but for certain specific investigations, an interdisciplinary approach is needed. This is why fields related to ethnosciences were created (Berlin et al., 1973). Therefore, in this exploration of landscape, interdisciplinarity is also a necessity and exploring the geographical aspect of place names implies the possibility to use a cartographic tool such as GIS software. However, mapping indigenous data using GIS or digital database technology has been criticized by the field of humanities as introduced in *Section 1.5.1* (Agarwal, 2005; Agrawal, 2002; Rundstrom, 1995; Sieber, 2000). It is what Turnbull (2007) calls 'the problem of incommensurability of multiple, incompatible ontologies and perspectives' (Turnbull, 2007:140). In its most extreme form, Rundstrom expresses a strong criticism related to the cartographic process of fixing information in time and space. He blamed that process for destroying indigenous culture by standardizing and making uniform the data with the risk of changing this knowledge into an object, 'tangible and accessible' (Rundstrom, 1995:52).

Less radically, Lake (1993) stated:

> 'ultimately at issue is whether the integrative capacity of GIS technology proves robust enough to encompass not simply more data but fundamentally different categories of data that extend considerably beyond the ethical, political, and epistemological limitations of positivism' (Lake, 1993:411).

Nevertheless, progressively, this technology is slowly becoming accepted with Harvey mentioning it as a 'technological artifact … which reinforces social agreements about human geography' (Harvey and Chrisman, 1998:1693) and Sieber who recognized the plasticity of this technology even if some progress was needed regarding the analyses of social information (Sieber, 2000). Moreover, in 2011, Sieber and Wellen highlighted that:

> 'For us, GIS offers three approaches to integrate landscape and language. It is a mapping tool, and it is a spatial analytic modeling method. Lastly, it is a language unto itself producing a digital and abstracted landscape of the imagination that we can interrogate (R. Sieber and Wellen, 2011:384).

Indeed, they argued that the use of this technology could have numerous advantages, and specifically, GIS as a database has the potential to combine much information in very diverse formats (Sieber and Wellen, 2011:383).

Aware of these challenges, I would like to demonstrate in this chapter how an interdisciplinary approach considering both physical and cultural aspects of place names could be undertaken. To this end, I will use and analyze Jahai place names, indigenous data collected in Malaysia and described first by Burenhult (2008; Kruspe et al., 2014). I will first present the ethnolinguistic description of the Jahai society and their place naming system related to the hydrological network of the study area as described by Burenhult (2008). Using this physical relationship, I will then analyze the geography of this network to explore its relationship with Jahai place names. Finally, I will conclude with the potential of an interdisciplinary approach to understand the place naming system and landscape conceptualization and open new research outlooks for both disciplines.

6.1 The Jahai

6.1.1 Study area and cultural information

The Jahai live in Malaysia, in the center of this peninsula on the southern border of Thailand (Figure 6.2). Their territory extends over an area of about 3,500 km2 comprising the northeastern part of Perak State (Hulu Perak district) and the western part of Kelantan State (Jeli district). They inhabit the upper part of the watersheds of two major rivers: The Perak and the Pergan. It is a territory dominated by rainforest but still relatively mountainous with a topography ranging from 100m to 1,800m. It is bordered by two peaks of great mythological importance for the Jahai, with to the west the peaks of Kenderong and Kerunai (Rlay & Rnayoh in Jahai language) and to the east, a precipitous limestone formation (Burenhult, 2008).

The Jahai are an indigenous community descended from the first peoples of Malaysia known as the 'Orang Asli'. They form a sub-branch of the Semangs, an associated population in northern Malaysia. They are hunter-gatherers who occasionally practice swidden agriculture. The Jahai now number about 1,000 individuals, and have been mainly sedentary since 1970s, although originally they were a nomadic people (Van der Sluys, 2000). They speak the Jahai, an Aslian language and a branch of the Mon-Khmer language family described by Burenhult (Burenhult, 2005, 2008, 2009). Jahai language is influenced by Malay, the main language of the peninsula.

Van der Sluys (2000) described the Jahai as a culture in which generalized sharing is practiced, which trusts in the environment, which is egalitarian and which asks for individual autonomy. She described a society with a 'world-view' based on mythical beliefs where 'world-view' is understood as:

> '… the hierarchical configuration of value-laden premises and values proper, through which the participants of that culture, in a continuous dialogue with their environment and themselves, give meaning to the cosmos in which their lives are embedded.' (Van der Sluys, 2000:430-431)

Jahai understand their society as a whole organized in a two-layer hierarchy with the 'primordial immortal ancestors' and the present-day living Jahai. They believe that mythical beings created the earth with its landscape and flora in a short period (Van der Sluys, 2000:435).

Figure 6.2 Study area, Jahai territory

6.1.2 The myth of creation and Jahai place names

In the Jahai myth of the creation of the earth, giants (*cnεl*) formed the earth's substrate by lying face down on it. They then had children and laid them out along their bodies. These mythical beings perceive human activity on their backs even though for the Jahai their bodies are not really discernible in the landscape.

Jahai place names are the names of those mythical beings which are in 75% of cases opaque and simply correspond to the name chosen by their parents. In 25% of the cases they are transparent, and they then refer to the fauna, flora or material culture in relation to an event that took place during the creation of the earth. In most cases they are thus formed from a single word (monolexemic) (Burenhult, 2004).

It is through the presence of two elements that the Jahai attest to their presence: the rocks and their essence of life materialized through the water that comes out of the earth (from their eyes). It is necessary for the water to flow permanently from the earth in order to be associated with a creation being. If it forms a large stream it is associated with a parent, and following the same logic, a smaller stream is associated with a child. Therefore, the kinship relationship is used as an implicitly hierarchical system of reference in which the entity defines the context which has to be considered and which gives the opportunity to zoom in and out in space.

The personification of these beings implies genders and kinship relationships between the creation beings but also the possibility to use body metaphors to locate specific areas or streams inside a single watershed (Burenhult, 2004, 2008) :

> ' … it is the metaphorical templates themselves, or rather their source domains of body and kinship, which form the most fundamental dimensions along which the Jahai categorise the physical world.' (Burenhult, 2008: 198)

Thus, in 2008, Burenhult described a linguistic system mobilizing the metaphor of the body in relation to the drainage system illustrated in Figure 6.3:

> 'In Jahai, the body serves as a productive, systematic and coherent metaphorical template with which the rest of the physical world is mapped, referred to and described' (Burenhult, 2008:186)

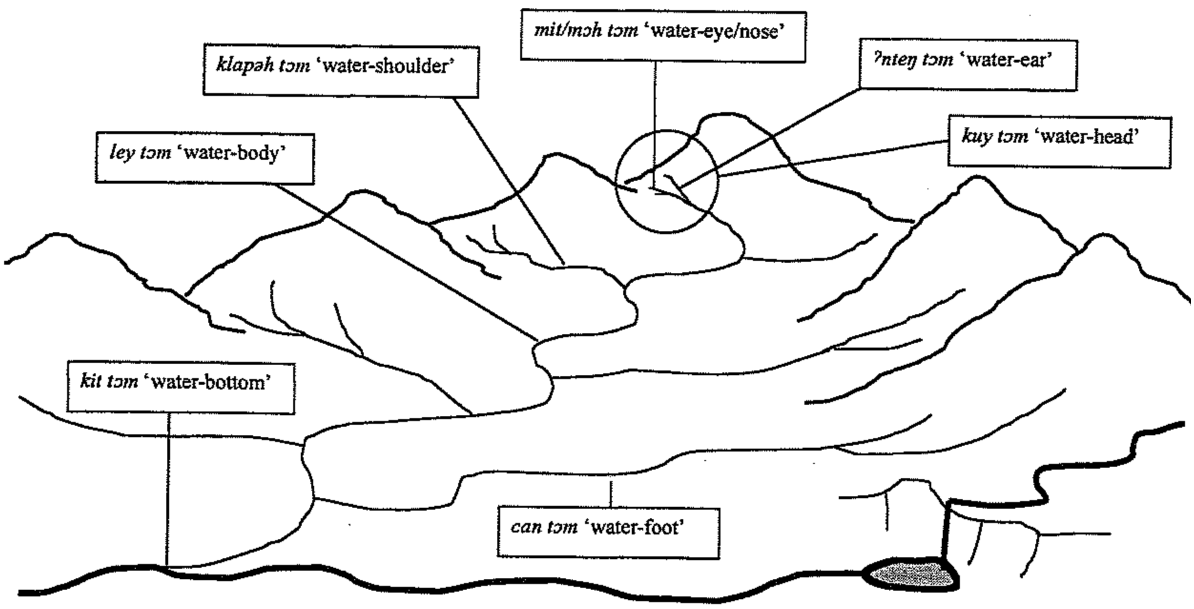


Figure 6.3 Examples of body part terms used metaphorically in Jahai to denote features of a drainage basin system (From Burenhult 2005:20)

He adds: 'Note also that the template is entirely flexible in relation to the size of the drainage system and may be applied at any level of scale.' (2008:187). Thus, this reference system using the body of the entities and their names makes it possible to indicate each part of a watershed with a very high degree of precision as in kuy Cɔs 'Cɔs's head' (meaning the upper part of the cnɛl named Cɔs), tɔm Cɔs 'Cɔs's stream' (the main water channel above the cnɛl), jlmɔl Cɔs 'Cɔs's mountain(s)' (a mountainous feature above the cnɛl), or hayɛʔ Cɔs 'Cɔs's camp' (a temporary camp somewhere along the cnɛl).

6.2 Data and method:

The ethnolinguistic background provides a basis from which we can start to understand Jahai place names. Nevertheless, even though the principle of creation beings was understood and the relation to drainage was obvious after some years of fieldwork, there remained uncertainties about how the entire system worked. However, due to this very strong relationship with the hydrological network, the assumption was made that a geographical analyses combined with the ethnolinguistic data may bring additional information to help understand the Jahai place naming system and the Jahai's word-view. In what follows, I present the data and method of a novel approach used to explore the relationship between these place names and their physical referent.

6.2.1 Jahai place names

The data used here were collected during field trips conducted by Niclas Burenhult among the Jahai. Since 1998, Niclas Burenhult has been working with the Jahai on the documentation of their language by making regular visits among them. By sharing their daily life, he recorded and collected much information that he analyzed on his return in order to understand the subtleties of their language. During these initial stays and interviews, he collected place names in an opportunistic way. The specificity of these names, as described above, aroused a certain interest which led Burenhult to explore these linguistic elements in greater detail. Thus, from 2003 onwards, he accompanied informants on hunting trips with the explicit aim of collecting place names with their GPS coordinates and descriptive notes. Over the years and thanks to the growing amount of data, Burenhult gradually established a connection between place names, the creation beings of the myth of the earth's creation and permanent streams. He established a theory on the link between large watersheds and the bodies of these creator beings that form the earth's substrate and he published these first results in 2008 (Burenhult, 2008). Having made this connection, he has since collect additional information about these names in relation to the mythical entities, such as their gender or kinship.

Between 2003 and 2010, Burenhult collected 130 place names all associated with their GPS coordinates and altitude as well as metadata such as photos of the place or descriptions relating to the location ('at mountain ridge') or the mythical being (gender or family status). From 2013 onwards, he undertook much more detailed walks with his informants with the aim of collecting all the names of the paths travelled, resulting in much more extensive data with 54 names collected in 2013, 93 in 2014 and 48 in 2016. In total, nearly 350 geo-localized place names were collected in the Jahai territory between 2003 and 2016. They are illustrated in Figure 6.4.

This figure illustrates the different data collection strategies adopted by Niclas Burenhult with numerous points collected between 2003 and 2010 along the road that crosses the Jahai territory. Although this is not the case for all the points in this period, in what follows I have focused on the most complete data, i.e. those collected from 2013 onwards. I have also used their metadata to select only data related to the entities, i.e. along the rivers. In the end, the database used consists of 180 names (illustrated in Figure 6.6).

6.2.2 Creation of an hydrological network

In order to explore the physical referent of these names and considering their close relationship with the hydraulic network, I first generated a set of hydrological attributes (Figure 6.5). Using a digital elevation model (DEM) with a resolution of 30 meters. From the DEM, many physical properties can be generated such as the gradient - the slope using the difference in elevation - or the aspect - the direction of the slope by considering neighbouring cells (usually 3x3 cells). Before being able to continue the creation of hydraulic attributes it is necessary to identify and fill the local minimums (sinks) in order to generate a DEM without depressions. Once this has been done, it is then possible to calculate the potential direction of each cell, giving us information on the direction taken by any precipitation - flow direction. For this, I used the D8 algorithm described by Wilson and Gallant (2000) which deduces the direction of the cell from the slope of neighbouring cells. From the flow direction it is then possible to associate a value corresponding to the flow accumulation with each cell by adding the value of all the flows arriving in each cell. By using these values and by associating a certain correspondence (for example from the value 2 a watercourse can be considered), it is then possible to create a stream network of potential watercourses.

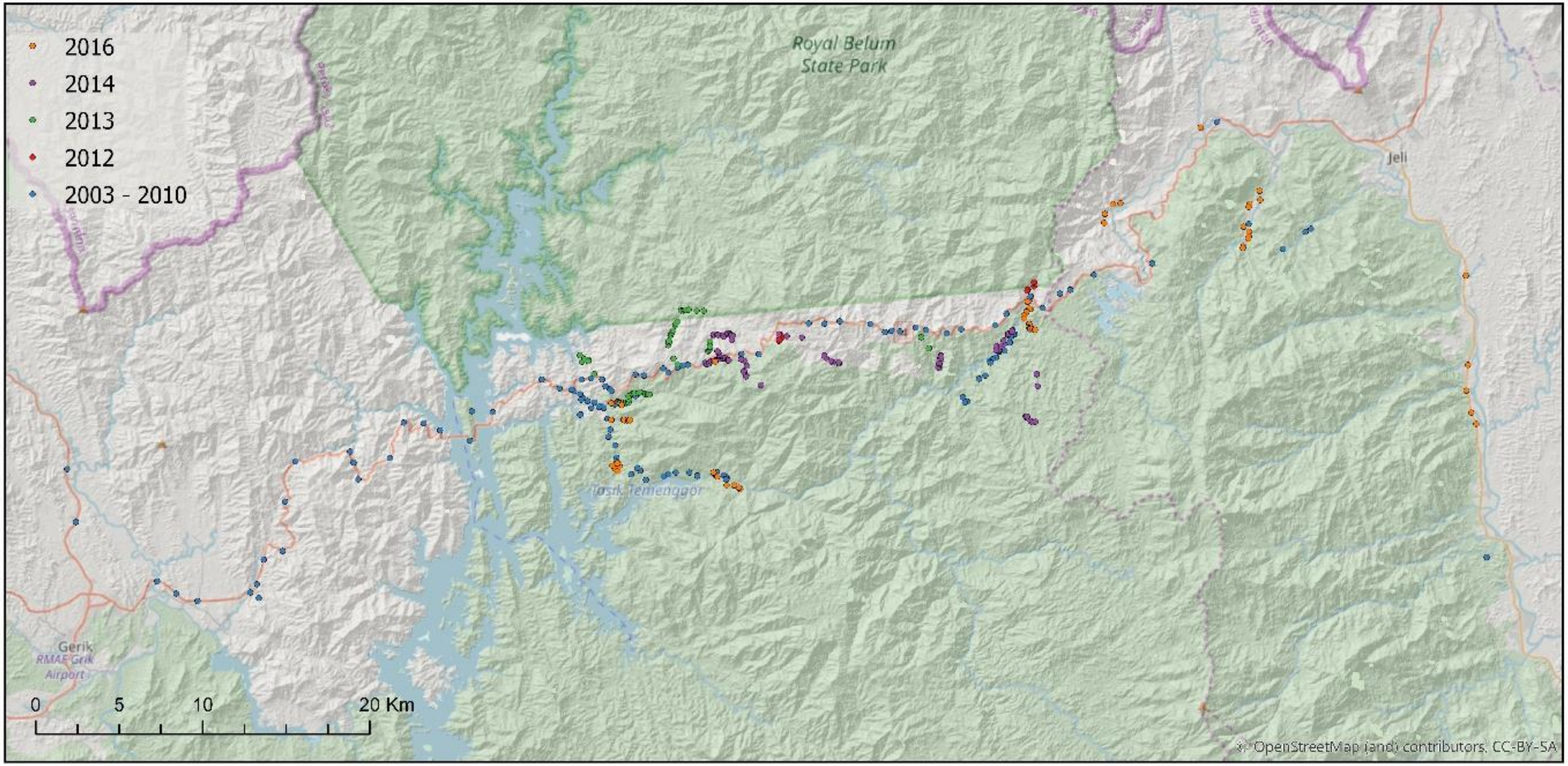


Figure 6.4 Overview of the main points of the dataset represented according to the year of collection

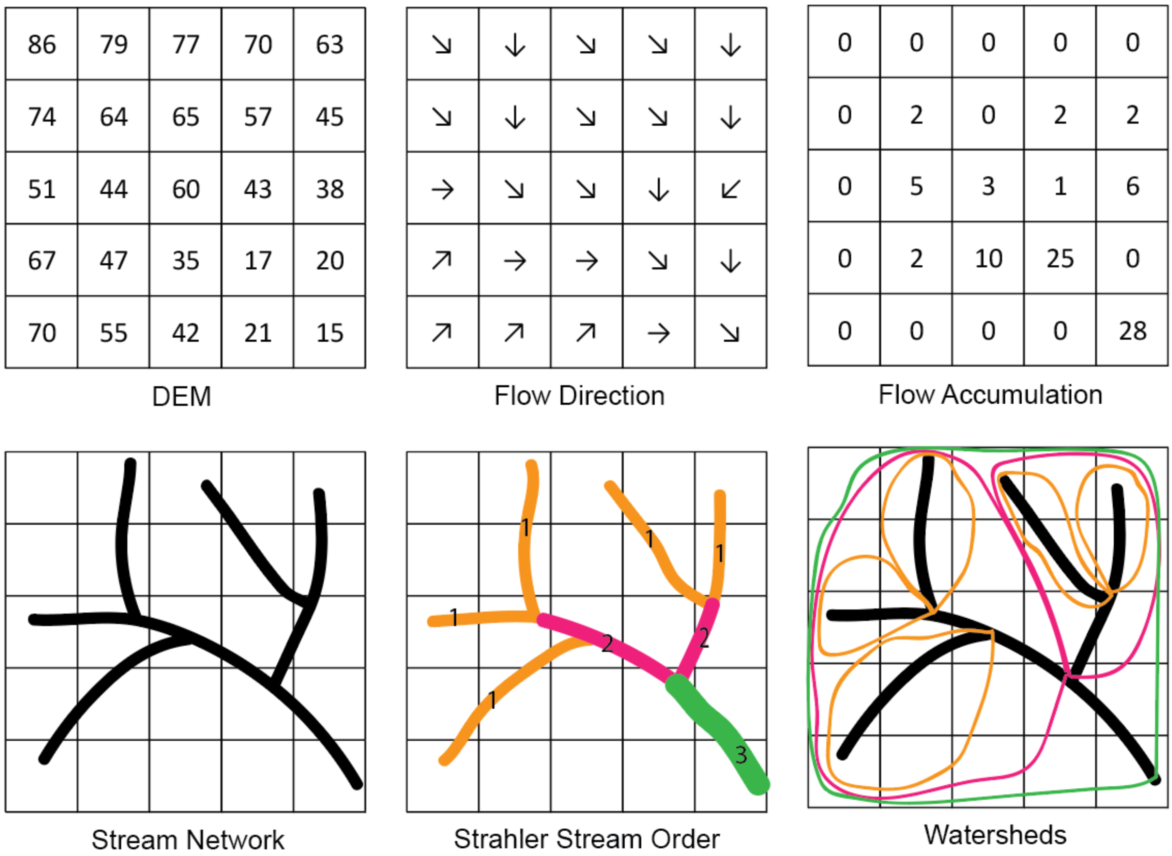


Figure 6.5 GIS and hydrology

For analytical purposes, it is possible to assign a stream order to the network according to the size of each tributary. This can be done in different ways but the Strahler order (Strahler, 1957) was chosen relating to its non-exponential numbering process, thus providing orders only from 1 to 10 in the relatively large Jahai territory. Indeed, Strahler order assigns a rank of 1 to each stream located between its source and its first confluence. The rank increases by 1 only when two streams of the same order meet. Finally, the flow direction associated with the accumulation of flow enables the corresponding watershed to be calculated for each confluence (a pour point) and to associate a rank in relation to the order of the tributary.

The results of combining the place name dataset of 180 Jahai place names and the stream network are presented in the following sections.

6.3 Results and interpretation: linking Jahai place names to the stream network

6.3.1 Highlighting a naming system consistent with a reading of the hydrology of the Jahai territory

The first step in exploring Jahai place names was to visualize the data collected after 2013 in parallel with the ordered hydraulic network (Figure 6.6). As expected the place names collected are all located along a river identified by the hydraulic model applied to Jahai territory. It should be noted that first and second order streams are not shown in this figure since no points were identified along these streams. There are three potential explanations for this fact. First, it may indicate that the granularity of the hydraulic model is too large and that level 1 and 2 do not accumulate enough flow to form a stream, at least permanently as required by the Jahai to be named. Secondly, these streams are not large enough (even with permanent water flow) to be associated with a creation being. Thirdly, not all place names have been collected and only place names of large areas have been collected. Indeed, this figure illustrates that the place names collected are found mainly along streams of order 5 and 6 and occasionally along a stream of order 4. These three hypotheses should be verified in the field, but the current state of research suggests that streams of at least order 4 are associated with mythical entities.

Indeed, exploring the Jahai naming system in a systematic manner, in the sense of looking for the pattern which drives the act of naming, could enable stream levels that can be associated with an entity to be determined. Figure 6.6 shows a strong possibility for streams at levels 5 and 6 to be associated with an entity, this is less frequent for level 4, and it never happens for levels 3 to 1. More extensive and complete data would be required to validate this hypothesis but it suggested that all streams associated with at least a fifth order stream have a strong potential to be associated with a *cnɛl* (a mythical entity) and thus to have a place name. Understanding the Jahai act of naming from a systematic viewpoint provides the opportunity to identify missing names (names not collected yet) and therefore provides very important information for the next fieldtrips.

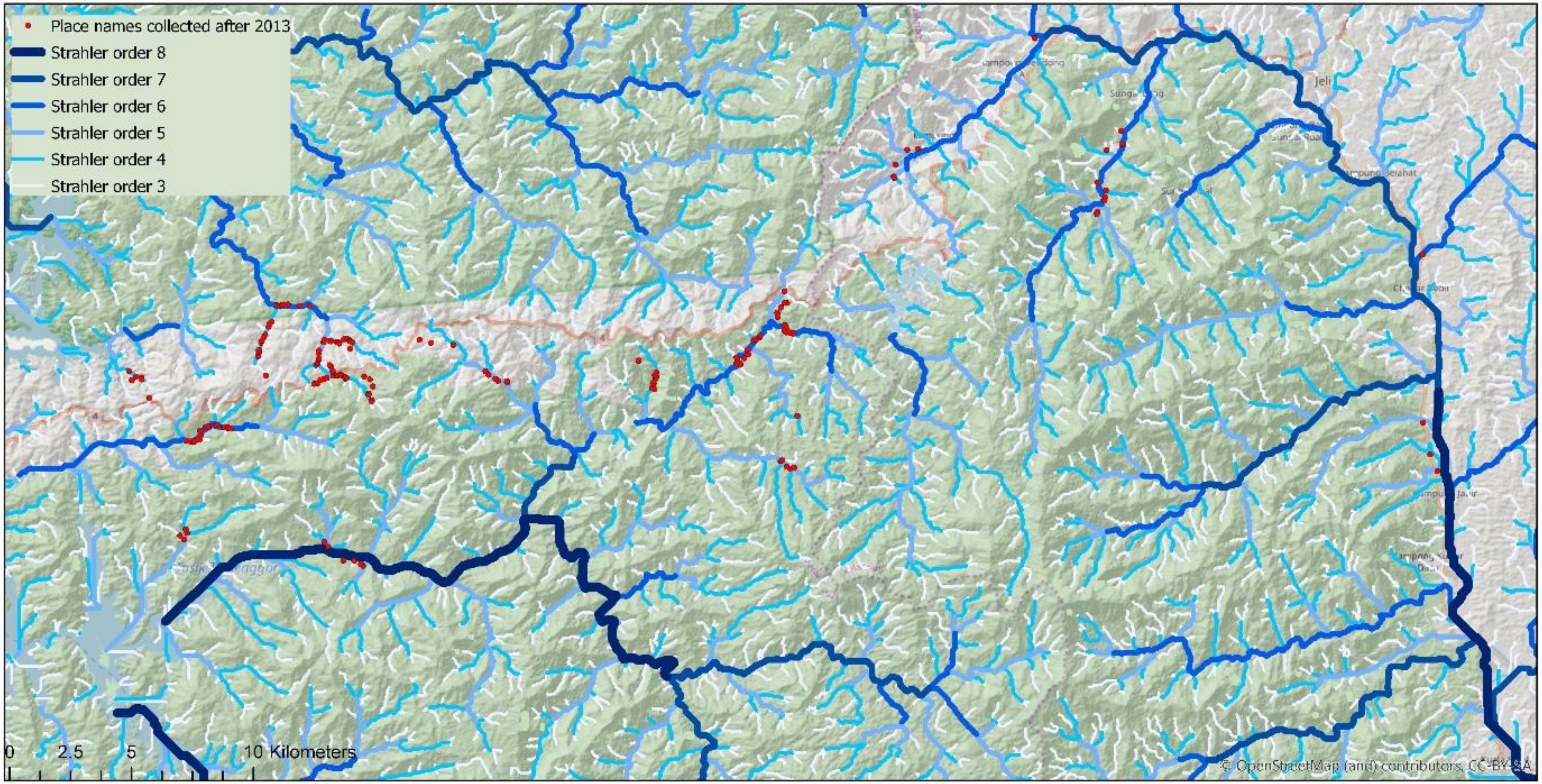


Figure 6.6 The 180 place names collected after 2013 visualized along with the Strahler order of the stream network

The data available also enables family relationships (parent-child) of the different mythical entities to be explored. Indeed, Burenhult (2008) suggested a hierarchical system associated with the family kinship related to the stream hierarchy. Therefore, in order to explore the kinship relationships between the different mythological entities and their spatial footprint, a specific data sample was selected: the walk of January 30, 2013. The choice of this specific sample was made because during this trip, place names were collected along two streams of different sizes and therefore potentially referring to several kinship status:

- 14 points were collected along a stream of order 4, from its source to its first confluence (suggesting that all names were collected along this stream).

- And 6 other points were collected along its tributary, a larger stream of order 6.

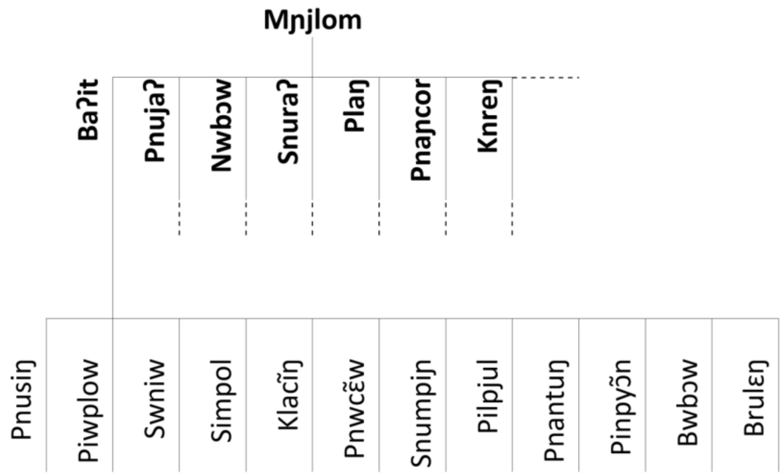
These points in Figure 6.7 are illustrated first in relation to the stream order, then in relation to the watersheds of the area concerned. This visualization illustrates as closely as possible the reference made by the Jahai when referring to their place names:

> '…the place names do not refer to the watercourse as such, but to a wider surrounding area which typically corresponds to the catchment area of the particular child-water.' (Burenhult, 2008:195)

This figure also illustrates the relationship between all these names as collected in the field in the metadata via a family tree. Combining these three visualizations allows a connection to be made between a specific order and a family rank. Here the points associated to the stream order 6 refer to *Mɲjlom's* children and the stream order 4 to his grandchildren. Furthermore, the illustration of the catchment areas according to stream order opens up a much greater potential for analysis. Indeed, it illustrates that while this naming of space is systematic, only a tiny part of *Mɲjlom* has actually been explored. It also reveals that even if the focus was only on the upper part of this catchment area (shown in yellow as 'upstream part of the walk'), many children and potentially grandchildren remain to be identified.

Based on this finding, it appears that other names (68) were collected during five different walks in the Mɲjlom watershed and were identified as his descendants. They are illustrated in Figures 6.8 and in Figure 6.9 by their family status.

The cartographic illustration in Figure 6.8 highlights several important points. First and again, it appears that place names are still missing and invites a new expedition along stream levels 5 and 4 to confirm this hypothesis.



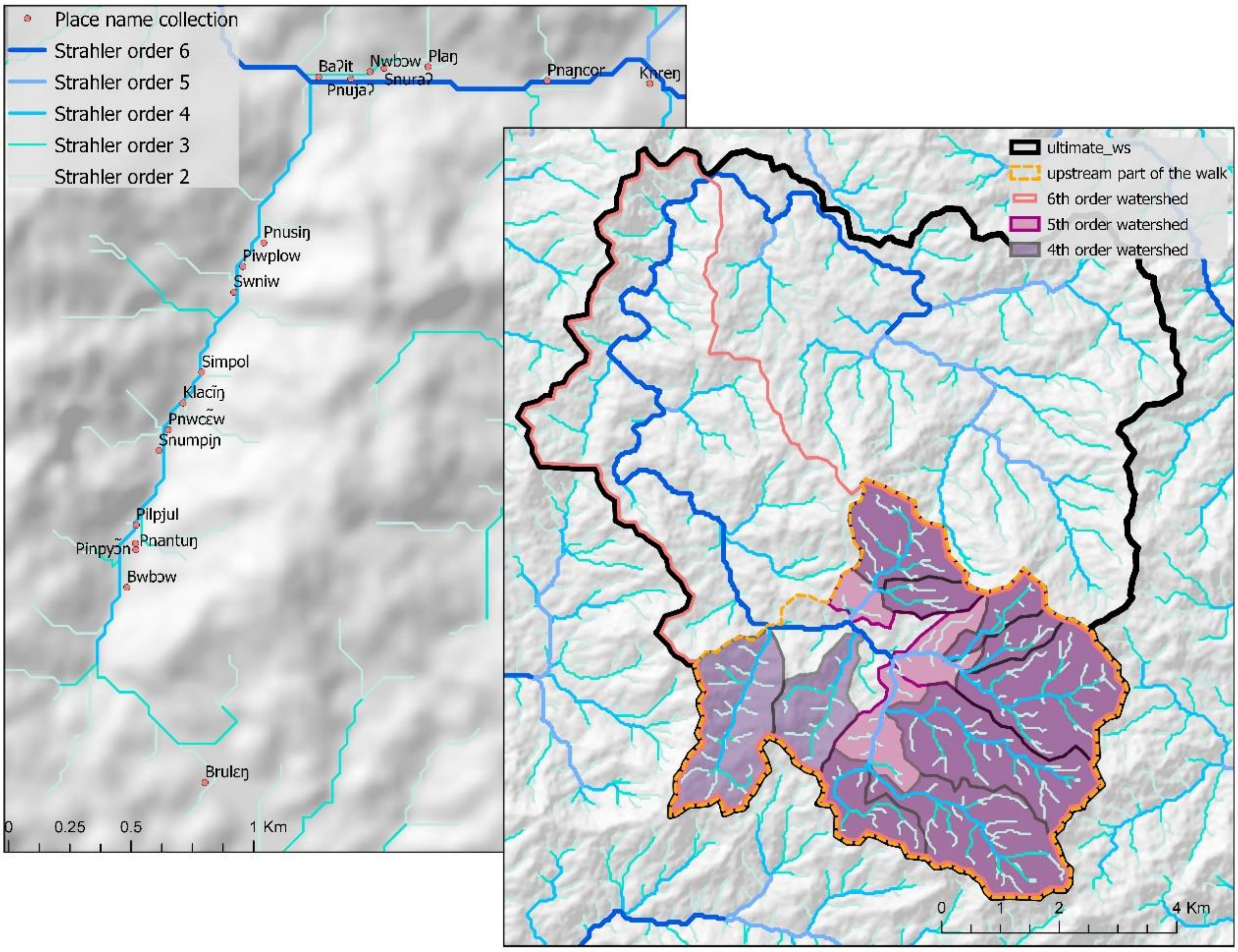


Figure 6.7 Complete watershed of the walk of 30 January 2013 with related stream orders and watersheds from fourth to sixth order

Second, this figure only shows the watersheds of Mɲjlom and his children in which grandchildren have been identified. These grandchildren are then only represented by dots, revealing a granularity limitation of the hydrological model that does not allow the watershed of reference for each of these names to be determined with certainty. However, it appears from field observations that they all refer to streams, admittedly not very large ones, but with permanent flow. Thirdly, it is noted that the observation made in Figure 6.7 associating a family status with a stream order is no longer valid. This can be explained by the location of these points on the upper part of the catchment area and a mismatch of the DEM proportion with the terrain. This implies the importance of identifying the source recognized as the head of the entity by the Jahai before establishing a valid family tree. This identification is decisive in order to be able to relate the rank of the stream to the associated family status, and the hydrological model alone does not allow this to be done. This demonstrates how important it is for researchers to constantly combine their work with field research, without which false conclusions can be drawn. Finally, however, this figure illustrates that even if a strict association cannot be established between the rank of a stream and a family status, the hierarchical order is still respected, i.e., a child always has a smaller order than his or her parents.

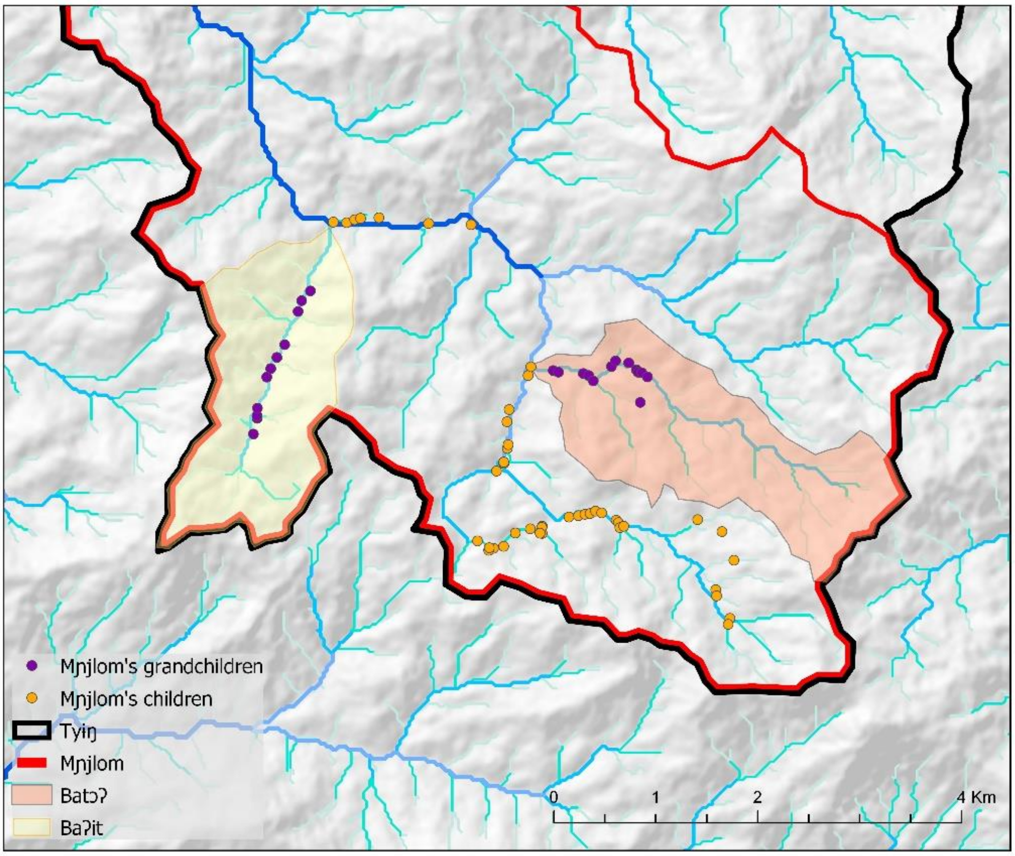


Figure 6.8 *Mɲjlom* catchment with collected place names and their related kinship

Figure 6.9 illustrates on a large family tree all the names collected in the *Mŋjlom* watershed as well as his ancestors *Blum* and *Tyɨŋ*. This visualization provides information of another type such as the gender collected as metadata, but for which no physical explanation has been found. Nevertheless, this representation may enable to explore this watershed on a broader reference system. This figure also appears as a potential research support through its ability to schematize a large amount of information while maintaining its hierarchical relationship.

This system in relation to spatial representation offers great potential for future field work encouraging research on the empty branches of the tree and the corresponding catchment areas of importance. It provides a better understanding of the Jahai's world view by enabling their system of superimposed thinking to be reproduced, as already highlighted by Burenhult in 2008:

> 'By superimposing the systems onto each other, Jahai speakers are in control of a powerful and flexible apparatus of reference for discourse about all the phenomena that exist and take place in the Jahai world.' (p197)

6.3.2 Applying the system to the rest of the data

The relationship of the Jahai place names to the hydraulic system and the kinship of the creation myth enables a greater understanding of the rest of the names collected. Indeed, this makes it possible to visualize these names on the network of streams and to consider each watershed as a potential entity linked by the relationships between these basins. New questions can then emerge to push the reflection beyond the simple collection of data and allow knowledge to be collected in their reference system.

For this purpose, from the visualization of the 180 names on the hydraulic network and I have generated the widest possible watersheds in order to contain all our points. This operation highlights seven basins of varying sizes, three of a relatively large size and four of a smaller size, illustrated in Figure 6.10.

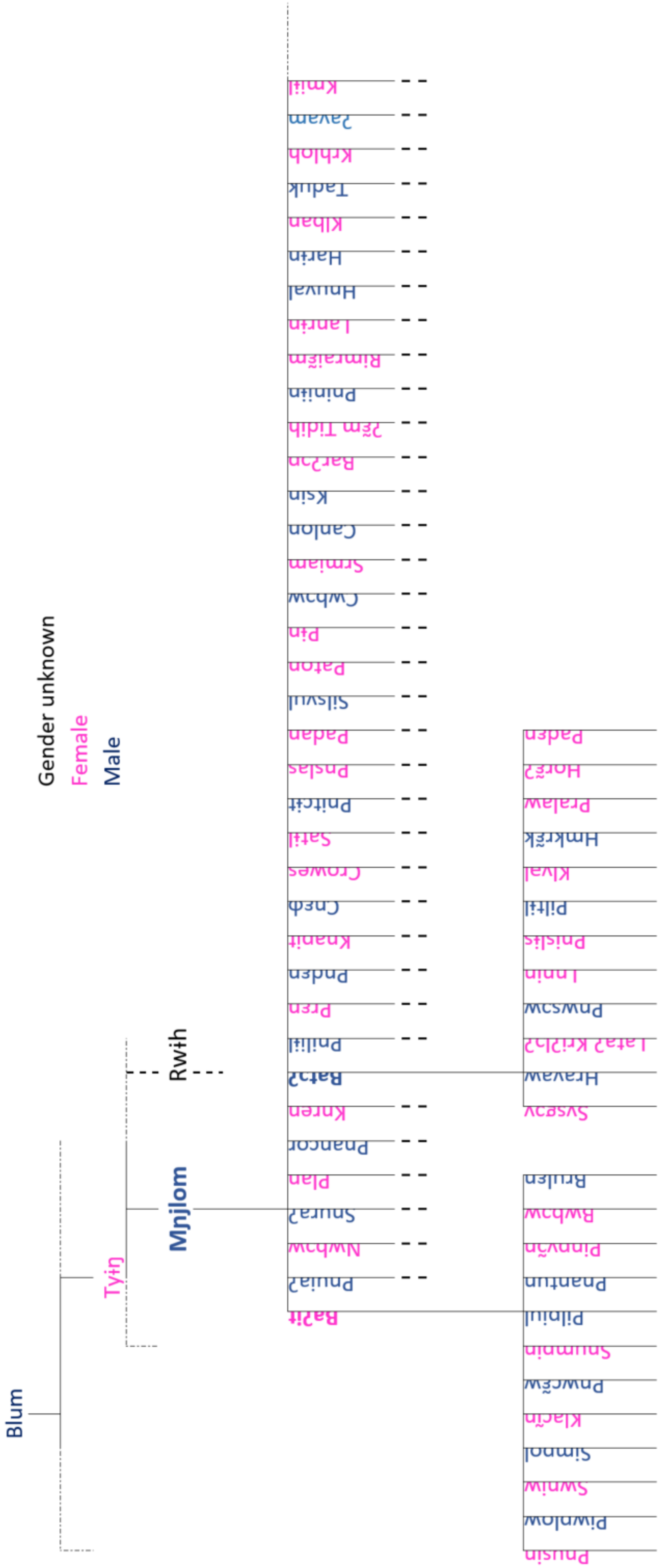


Figure 6.9 Larger family tree with all the names collected within the *Mŋjlom* watershed

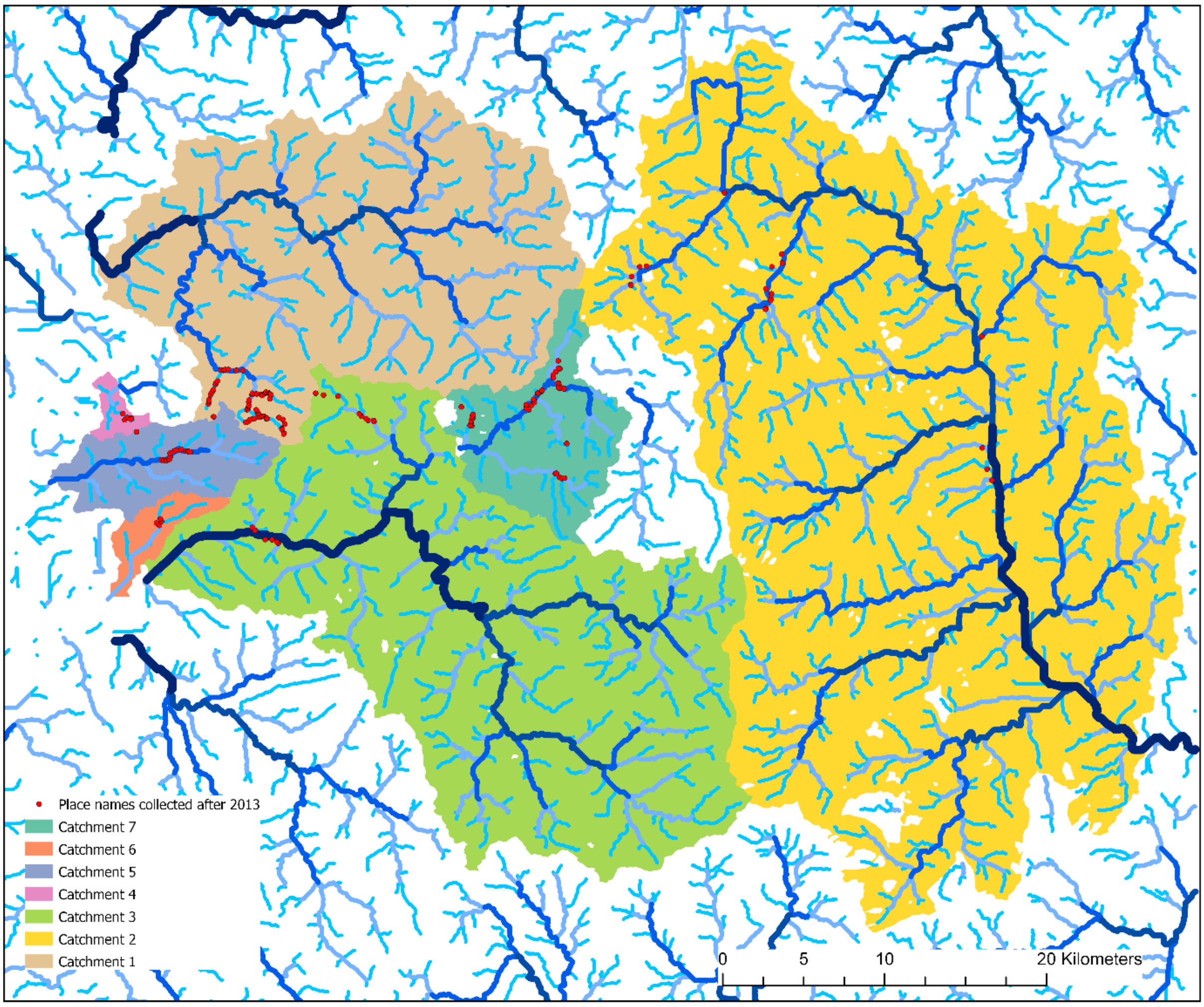


Figure 6.10 Drainage basins containing all 180 points

For the names of each catchment area a family tree has been created. Initially only their location was used, then Niclas Burenhult's field notes were consulted in order to confirm the hypotheses of kinship and to bring additional elements of understanding or to clarify inconsistencies.

The process of reflection brought to each family tree will be detailed in the following section.

Watershed 1 containing names related to *Mɲjlom* has already been described in the previous section, I will therefore start with watershed number 2. This is the largest watershed (1179 km^2) and yet it contains only 20 points and 22 names collected in 2016 (Figure 6.11). It is interesting to note here that the reference to *Prgɔw* as the name of this large drainage basin is mentioned in the metadata for all points along the main river from the highest to the most downstream point. Moreover, this catchment area has a distinct origin, that of the basin of *Mɲjlom* (Catchment 1). It is not associated with the ancestor *Blum*. However, if *Blum* is *Mɲjlom's* earliest known ancestor in the creation myth, we could wonder what the equivalent entity of this second main catchment is and whether this fact matters to the Jahai.

Watershed number three is also large (587 km^2) and it is associated with the mythical being *Sŋɛʔ*. It consists of 17 points and 19 names (Figure 6.12) collected in three distinctive field trips. Moreover, the visualization in Figure 6.10 shows that the points were collected only on the northern part of this basin, leaving a large area of this catchment to explore. The metadata revealed a kinship connection with *Blum*, as suggested by its geographic orientation.

Moreover, field notes indicated a kinship relationship between the catchment area 6 (*Smlor*) and 7 (*Mangga*) with the catchment area of *Sŋɛʔ*, which was not obvious from the hydrological model. These catchments will be described later.

Watersheds 4 and 5 are relatively small and their kinship relationship can only be assumed based on the hydrological model. Nevertheless, the metadata indicates that watershed 4 (*Rwɨh*), despite being partly submerged under the artificial Temenggor lake, is a child of *Tyɨŋ* and consequently a sibling of *Mɲjlom*. Indeed, it may be important to note here that in the 1970s a dam was constructed upstream of the Jahai territory transforming the stream bed associated with the *Blum* entity into a lake (Lake Temenggor). This lake is not represented in our hydraulic model, which is based on the morphology of the terrain only, but in the same way that *Sŋɛʔ* is related to *Blum*, it seems legitimate to wonder about the kinship relationship with this new entity. Moreover, the metadata indicates that the catchment area 5 (*Cɔs*) is a child of *Blum*. The family trees of watersheds 4 and 5 are shown in Figures 6.13 and 6.14 respectively.

The catchment area number 6 is associated with the entity *Smlor* (Figure 6.15) and as watershed 7 (*Mangga*, Figure 6.16), in the metadata it is associated with the children of *Sŋɛʔ*. Information about watershed 7 remains unclear, but after *Mɲjlom* it has the most place names collected recording 50 points and 52 names. It is associated to the Malay name *Mangga* and the Jahai name *Maŋəh*. One of the issues with this catchment is that its points were collected from many field studies on different dates and sometimes with different informants. Thus, the family tree shown in Figure 6.16 was particularly difficult to construct considering that the place names registered under the codes ‘pn-136-cp’ to ‘pn-139cp’ were in the same location as the points ‘PN-213-16-SU’ to ‘PN-216-16-SU’ but were associated with different names and have distinct parent entities. Indeed, points ‘pn-136-cp’ to ‘pn-139cp’ are associated with *Maŋəh* and points ‘PN-213-16-SU’ to ‘PN-216-16-SU’ with *Blan*. However, it is important to note here, that the metadata associated with points ‘pn-136-cp’ to ‘pn-139cp’ indicate that their collection took place along a road and ‘far uphill' from the area designated by these names. They may therefore refer to entities other than points ‘PN-213-16-SU’ to ‘PN-216-16-SU’. These facts will have to be verified during future field trips in Jahai territory.

The exploration of these additional watersheds has brought more questions than answers. Nevertheless, despite incomplete data, the validity of the Jahai naming system highlighted by our first example has been demonstrated. Indeed, these additional explorations demonstrate a very strong relationship between the place names collected and stream orders equal to or higher than 4. This exploration has also made it possible, to identify all the watersheds or place names that remain to be collected, even though this represents a considerable number.

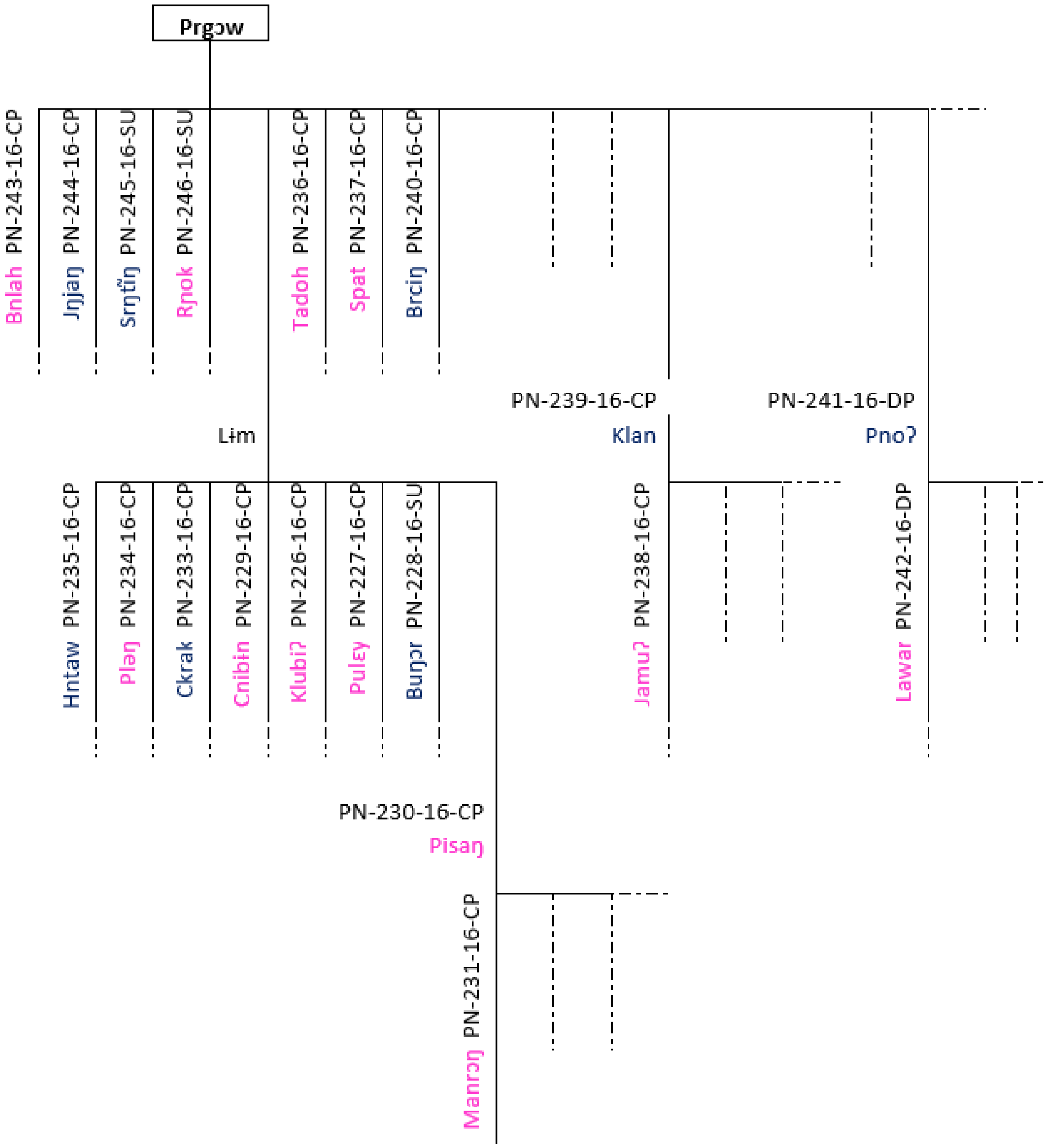


Figure 6.11 Family tree of *Prgɔw* (catchment area number 2)

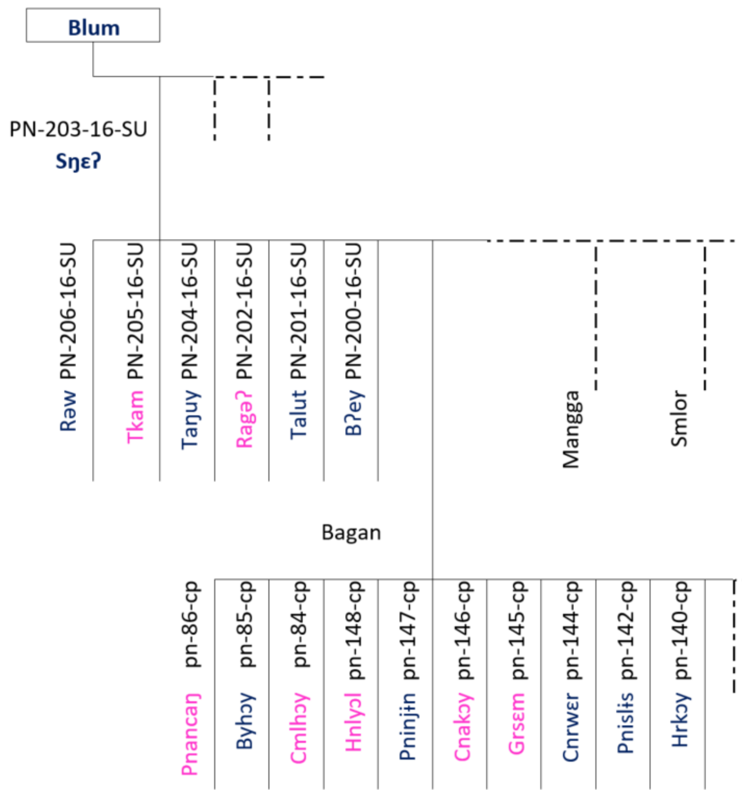


Figure 6.12 Family tree of *Sŋɛʔ* (catchment area number 3)

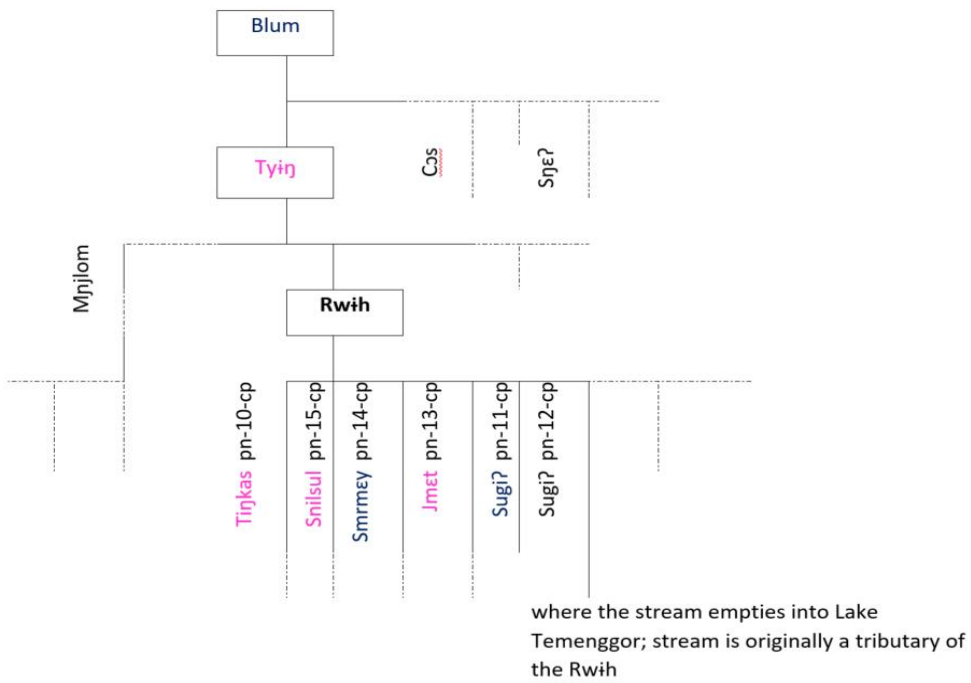


Figure 6.13 Family tree of *Rwɨh* (catchment area number 4) with metadata related to the name of the main entity

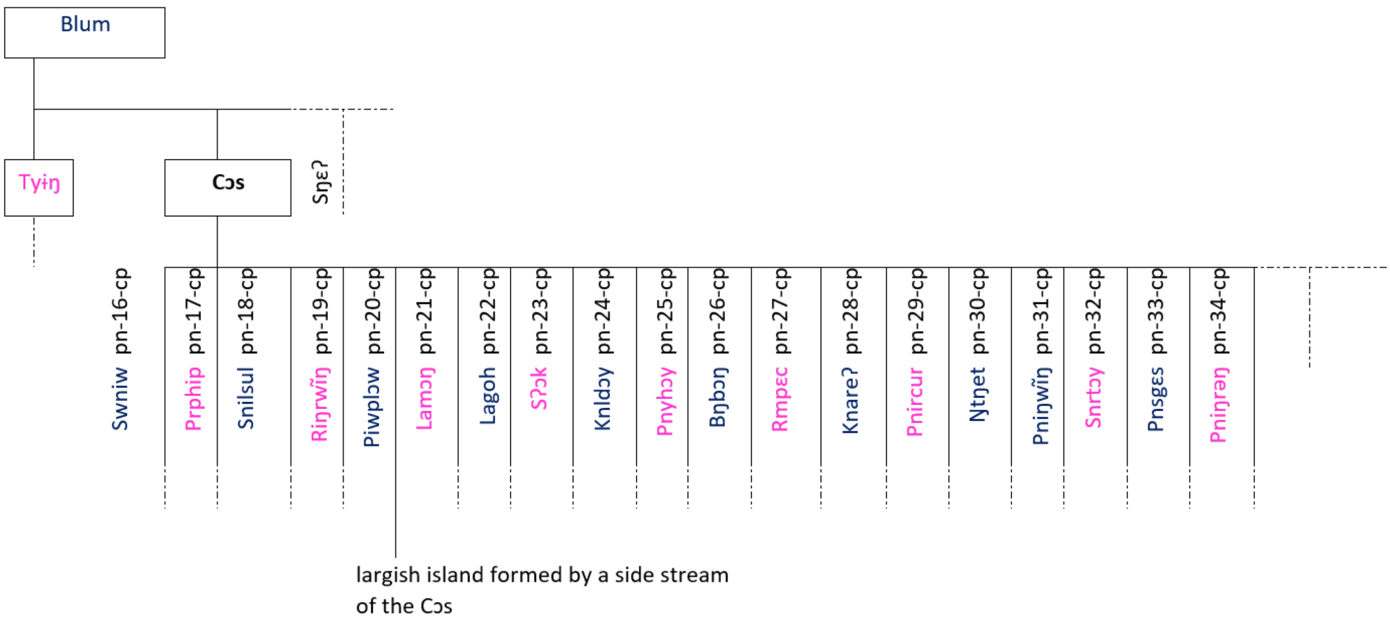


Figure 6.14 Family tree of *Cɔs* (catchment area number 5) with the metadata used to hypothesis the name of the main catchment

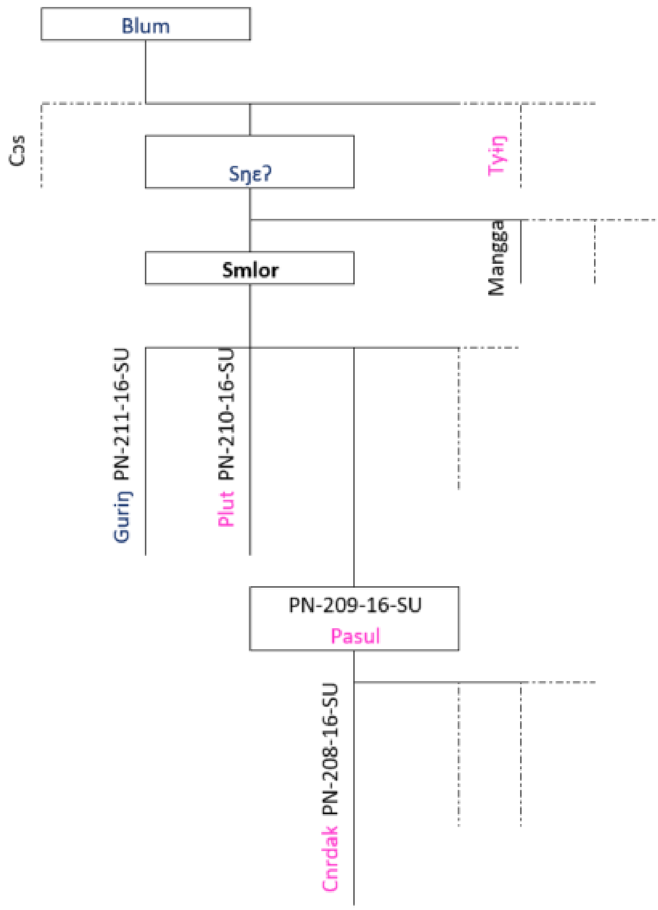


Figure 6.15 Family tree of *Smlor* (catchment area number 6)

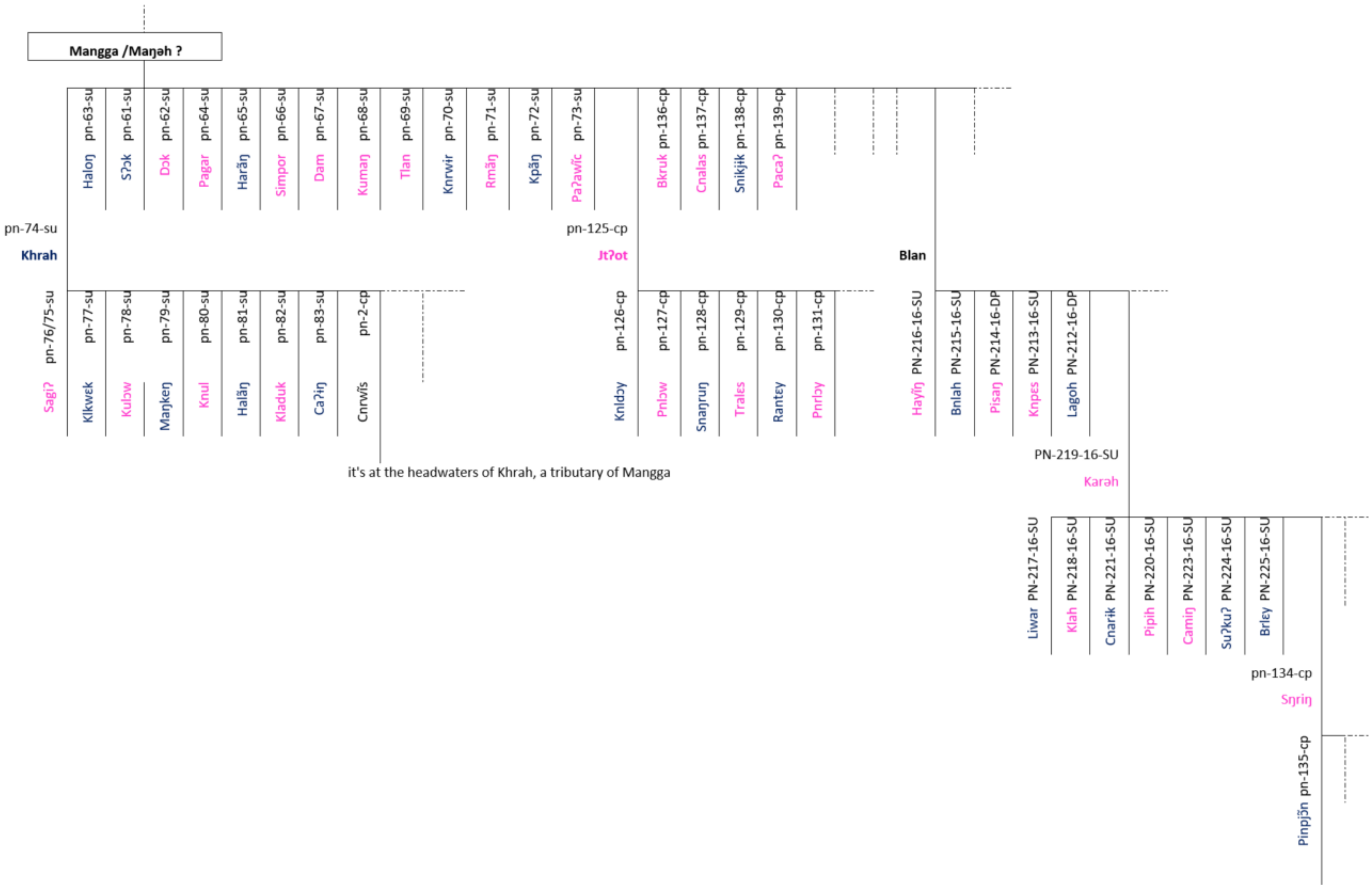


Figure 6.16 Family tree of *Mangga* (catchment area number 7)

6.3.3 Jahai system of naming

Considering the cultural landscape as 'A composition of meaningful places within a socio-ecological system' (Thornton, 2011) it is now possible to affirm that for the Jahai this socio-ecological system is composed of their myth of creation associated with the natural drainage system of their territory. Thus, by combining these two elements, the Jahai possess a system of spatial naming where each significant place has a unique and unambiguous name. Indeed, the drainage system allows them to identify and delimit their territory in a very precise manner where the land use is dominated by dense rainforest, which makes it difficult to strictly segment the space. The forest-dominated environment also gives very little visibility on a large scale, while the hydraulic network provides a grid covering each part of their land. At the same time, the myth of creation associating creative beings to watersheds offers the singularity of each name and thus removes any ambiguity.

Indeed, even if duplicates were identified (13), for 11 of them, they were associated with different parent entities offering then an indisputable distinctive element. Only two were located on the same entity and at the same location, but it would seem that their attribution to an identical name comes from the complexity of discerning the name and the use of this name as a reference, for example Paul and Paul's eyes, since one refers to the head and the other to the eyes.

Moreover, as an originally nomadic society and moving frequently (about every fortnight), the territory to be named was relatively large explaining the large number of place names. It is therefore essential that each place have an unambiguous name because, as Oral and Beaucage (1996) mentioned, the naming system is a classification system that is not motivated by its utilitarian aspect, but for its ability to refer to a place without ambiguity (Oral and Beaucage, 1996).

I have presented here the analysis of 180 names, although incomplete. This implies a considerable number of names to be known, especially for an oral society that does not use writing as a means to conserve knowledge. Indeed, it is recognized that the acquisition and memorization of knowledge takes place according to very distinct processes between an oral and a written society (Connerton (1989) as cited in Rundstrom, 1991). Connerton (1989, as cited in Rundstrom 1991) refers to a process of 'inscribing' as opposed to the process of 'incorporating', since each mobilizes very distinct cognitive functions. This 'incorporating' process can be materialized by descriptive place names as illustrated by Jett (1997) and the Navajo people. However, a completely different illustration of this process is offered by the

Jahai, who use the myth of creation, in which the protagonists of this myth are linked to each other, as a way of memorizing place names. It is also interesting to note here that Hollis and Valentin (2001) have shown that the cognitive process required to memorize a place name or a personal name is identical because they both refer to a single element and thus constitute a simple referencing expression (Hollis and Valentine, 2001). Moreover, as a myth of the creation of the earth, it is a historical reference to the common history of the Jahai, and thus it is a narrative that is known by all the society (the creation of the world). This ensures the possibility of being able to communicate within the territory between each member of the society, reducing possible ambiguities to a minimum. Finally, this association between the myth and the drainage system makes it possible to bring together three important characteristics necessary for place names: to be unique, memorable and shared.

Another important aspect is made possible by combining the mythical entity and stream network and its understanding as a system: the possibility of using different reference scales. From a geographical point of view, it is possible to modify the reference scale by considering different levels of catchment areas. In fact, the hydraulic network offers a hierarchical but inclusive system that allows space to be segmented into different units without ever excluding any part of the territory. We can illustrate this with the Strahler order associated to each stream from which it is possible to consider the watersheds of the streams at their order individually or inclusively, i.e. by considering the watersheds of order 3, we automatically include the lower orders 2 and 1. This hierarchization is also made possible with the myth via the kinship system in which children are considered as a continuity of their parents. This is what Burenhult formulated in 2008: 'the kinship metaphor ... expresses taxonomic relationships based on size' (p.188). This idea is very well illustrated by the family tree where each branch starts from a previous branch and is thus connected. There is then a hierarchical order based on kinship that can be correlated with the importance and inclusion of catchments.

6.4 Conclusion:

The exploration of Jahai place names, demonstrates that the Jahai have a very detailed sense of the stream network system and of its hierarchy at a small scale but also at a large scale implying a strong sensitivity to its spatial organization. It is clear after this investigation that for Jahai the 'landscape' is the sum of many entities relating to a person and not a thing. According to the perspective of the western world, there is no distinction between what belongs to the natural aspect or to the cultural aspect. It is a humanization of the environment from our ontological point of view as found in many other societies, as for example the Inupiat from Alaska (Fair, 1997). Finally, the Jahai place names tell us that what they distinguish and identify inside the landscape is an area and not landmarks. We could link that with their nomadic lifestyle and the necessity to move from one area to another. We need more field work to investigate what motivates moving from one area to another, but it may be assumed that the way they chose their next destination could also be related to the myth.

To come back to Thornton's statement that place names help understand how a society perceives, conceptualizes and utilizes their environment (Thornton, 1997b) I suggest that this place name exploration permit a better understanding of the relationship that the Jahai have with their environment.

To conclude this chapter, associating fields of competence such as geography and ethnolinguistic, raises new research questions in both fields. It helps orientate data collection during field work by bringing a better understanding of the system and providing knowledge in order to ask pertinent question to the informant. It helps geography to look at place names as part of a coherent system providing information about the relationship with the environment even if there is no obvious information about it. It encourages an interdisciplinary approach to understand indigenous societies, and also provides new research perspectives in understanding landscape conceptualization.

7 Discussion

This thesis sought to demonstrate the potential of place names in the study of landscape. For this, the linguistic and the geographical aspects of place names were investigated using methods and data from both fields with three objectives. First, relevant information was identified and extracted from place names for landscape investigation. Second, the potential of exploring the relationship between linguistic and geographical information was demonstrated using an interdisciplinary approach. Third, new insights into the use of GIS and cultural data was provided for landscape research. The extent to which the results of this thesis fulfills these objectives is discussed in what follows.

7.1 Identifying and extracting relevant information from place names for landscape investigation

Firstly, the information contained within place names needed to be extracted and analyzed. It is diverse in nature, containing linguistic information (in the semantics and structure of the name), geographical data (in the physical referent of the name) and cultural information (in the patterns of the act of naming). This section discusses the methods used to extract the linguistic and geographical information and its implication in landscape investigation.

7.1.1 Extracting linguistic information: limitations of the approach

Place names contain linguistic information. As linguistic information I considered not only the semantics of the names, but also their structure. Chapter 3 explored this linguistic information contained in microtoponyms of the canton of St. Gallen in Switzerland. To do so, I used a matching process between an etymological lexicon of meaningful elements frequently found inside microtoponyms and the microtoponyms of that canton. That involves first working with a lexicon and second applying an automatized process on linguistic data. These two aspects of the method are discussed below.

The Lexicon:

The process of extracting meaningful elements contained in place names from a lexicon enable each extracted element to be associated with etymological information. Other methods could have been applied, such as a matching with a dictionary which also preserves the semantic consistency of the term extracted (e.g Atik and Swaffield, 2017; Feng and Sorokine, 2014; Zinkin, 1969). Nevertheless, using a dictionary seems relevant for semantic studies of texts, written in recent language or as used by Atik and Swaffied (2017) in their exploration of recent place names as is the case in New Zealand with English place names established from the colonization process. However, it seems less relevant for the study of European toponyms which may have antique forms, i.e. they may imply a language that is also ancient and sometimes even forgotten, which is thus no longer present in current dictionaries (Kristol et al., 2005). Moreover, even if they follow the rules of language as demonstrated in Chapter 3 with Zipf's law, they have an independent linguistic structure and they contained elements (suffixes, prefixes, etc.) and not necessarily words, which may not have been captured using a matching process with a dictionary. Another way of extracting elements from place names would be to use algorithms to extract the most frequent associations of letters (Dahinden, 2014). In such cases, however, the semantic interpretation remains to be done at the end of the process in order to select from the extracted elements those elements which are known. It also requires that the researcher have a very good linguistic knowledge to interpret the semantics of the elements extracted. Therefore, such a method is more appropriate when the research objective is to explore one specific term such as '*Berg*' in Dahinden's study (2014).

In this thesis, the aim was first to avoid making any assumption about the meaningful terms contained in place names. Instead of looking at selected landscape terms because of their conceptual interest as was done with the concept of 'mountain' for example (Feng and Mark, 2017), I first looked at which terms were present and how frequently they were used. Using a lexicon also enables all written forms to be considered as well as terms which are no longer transparent but nonetheless are related to landscape. It opens up new research questions in the linguistic field and also in landscape investigation in order to understand for example why the use of a common term '*Au*' in place names referring to water is no longer used in everyday language. What is the distinction in its way of describing a geographical feature which is no longer valid implying the loss of this term from everyday language? Using this approach also allowed me to explore which landscape terms are pertinent in St.Gallen. Not surprisingly no terms referring to sea were found, but instead landscape terms referring to the landscape of the canton. This suggests that the terms found in microtoponyms of this canton make sense and were in use in this specific location. This observation seems obvious; however, it would be interesting to explore the semantics of place names of different locations on earth with similar ecosystems and to explore how similar they are. Therefore, instead of comparing only terms which are supposed to be similar, it is the exploration of the cultural act of naming which highlights which terms are used in a specific landscape and which feature is named, indicating terms which are culturally important enough to be used to designate a place and places which are important enough to be named.

Moreover, since the linguistic aspect of place names had to be investigated and the interdisciplinary approach promoted, it made sense to work with linguists and to benefit from their expertise. Using the lexicon was therefore the best way to extract elements with their etymology and it enabled meanings to be associated with elements which are no longer transparent. Consequently, more elements could be treated as meaningful.

Nonetheless, using a specific lexicon limits the possibility of reproducing this study outside the German-speaking part of Switzerland and implies that, if this is done, the relevance should be checked beforehand. The use of the lexicon by non-linguists may also be questioned for possible misinterpretation of the results possibly due to the automatic correspondence. Indeed, generalizing such information to help the investigation of terms in isolation can sometimes lead to misanalyses. Indeed, after discussing the results with linguists, it was noticed that some elements extracted as meaningful were actually proper nouns (place names or surnames). Therefore, for the analysis of place names in general and not only microtoponyms, it might also be relevant to add a list of proper names to this lexicon. Considering that many European cities or street names are named after famous people (Hough, 2016), it could be useful to include these terms to improve the quality of matching.

Automatized bottom-up process

The second aspect of this method is the use of an automated process to extract the meaningful elements from the microtoponyms. This enables a very large amount of data to be processed in a very short time. Indeed, a few seconds were enough to carry out the matching between the lexicon of more than 3,000 terms and the database of more than 17,500 microtoponyms. This automatic process can be repeated infinitely, to explore each step and to investigate the consequences of each modification. It was used to adapt the lexicon to match with the length order and to delete short terms. This flexibility can be used to apply this method to other kinds of place names or another lexicon.

Nevertheless, even if many positive points can be attributed to the automation of the method, it remains criticized when qualitative data are explored outside of their context (Agrawal, 2002). Thus, though there has never been any question of producing an etymological interpretation of individual microtoponyms at the end of the process, the generalized semantic analysis of these names can be questioned for its relevance in linguistic investigations.

Furthermore, even if linguistic investigation is mainly applied to individual place names, it could be beneficial to explore place names and their linguistic aspect at a broader scale, thus enabling many names to be considered. This process can be used to highlight patterns, and it could also be used to explore data that do not follow this trend and thus may be relevant to explore in more detail.

7.1.2 RQ1: What linguistic information related to the landscape is contained by place names? RQ2: How is the semantics of place names relevant to exploring landscape concepts?

Two types of linguistic information were investigated in the St. Gallen microtoponyms: their semantics (the meaningful elements they contained) and their structure (the position of the meaningful elements in the microtoponym). Both have to be considered in the use of place names in landscape studies. Indeed, Chapter 3 first explored the semantics of the microtoponyms by extracting and describing the meaningful elements they contained. It has been demonstrated that even if there is a debate inside the study of names (onomastics) about the potential meaning of proper nouns, microtoponyms of the canton of St. Gallen are composed of meaningful elements. Indeed, many onomasticians such as S. Kripke and K. Donnellan consider that place names have no meaning of their own ('the meaninglessness thesis') as described by Nystrom (2016). Nevertheless, that does not mean that they are not composed of meaningful elements such as in the microtoponyms explored, but, that their semantics no longer have to be true or understandable. However, the meaningful elements extracted from the cantonal dataset show, as suggested by Kuhn (2016), that the semantic information contained in microtoponyms are mostly transparent and are linked to the description of the landscape. This transparency is dependent of the level of knowledge that linguists have about the form of the place names which may have evolved because of the temporal dimension (Walsh, 2009). This is particularly the case for Romansh place names that are not transparent anymore for the inhabitants but which could be investigated semantically using the etymological researches done by the linguists.

The second step of the linguistic exploration was to select four landscape terms frequently present in the microtoponyms of the canton. The semantics of the associated elements present in microtoponyms with *Wald*, *Holz*, *Riet* and *Moos* were therefore analyzed using Gammeltoft taxonomy (2005). This part of the investigation involved some linguistic issues. First, looking at the associated elements and classifying them, I assumed that they could provide additional semantic information to the landscape term investigated. For this, I used the structure of the microtoponyms, that is to say the position of the meaningful elements inside the microtoponym. Using the structure of microtoponyms it was possible to identify the linguistic function of these MEs as theorized through the expressions of 'specific' or 'generic' elements corresponding to 'specification' or indication of 'type of place' functions (Leino, 2007; Zinkin, 1969). Therefore, I considered the landscape terms explored as a 'type of place' and the associated meaningful elements as their specification. Nevertheless, it should be noted that this approach, considers the MEs independently and not systematically in the coherence of association in the toponym. This is what Gammeltoft indicates by the difference between an approach to studying words rather than names that gives rise to different results (Gammeltoft, 2005). This criticism could make sense in the exploration of place names themselves. Nevertheless, the method used in this thesis, aimed to use the associated meaningful elements in order to specify generic meaningful elements which are landscape terms. Therefore, the method used here enabled semantically coherent associations of terms and concepts to be identified and did not classify place names.

Since many microtoponyms were considered, exploring each associated meaningful element in isolation was not very efficient to compare landscape terms. Several taxonomies exist to classify place names. They are described and compared in Tent and Blair's (2011) paper. Most of the time linguists develop their own classification to achieve the best fit with the place name explored and the research objectives set. Since I am not a linguist and I did not have time to establish my own taxonomy to apply to the canton of St. Gallen, I used Gammeltoft taxonomy (2005) developed for European place names. Since this taxonomy was not designed to fit the microtoponyms of the canton of St. Gallen, and I used it to classify the meaningful elements inside the name instead of the name itself, some mismatches were highlighted. Indeed, since I considered elements in isolation, it was sometimes hard to define to which classes the element belonged, such as a reference to a 'place' that would have been classified if it had been considered with its associated term. However, these mismatches were rare.

Finally, the association of the methods used to extract linguistic information from microtoponyms can be used to investigate landscape and specifically landscape terms. Starting from an analysis of the most frequent meaningful elements occurring inside microtoponyms, I first identified terms used in naming in St. Gallen. This bottom-up approach was useful in subsequently selecting specific landscape terms to investigate, since I knew they were frequent and therefore pertinent for the area investigated.

The second exploration of specific landscape terms demonstrated some potential to provide information on the use of these terms across space. In fact, the approach generally adopted for the study of landscape terms is usually conducted through linguistic fieldwork, and it is then the use of this term in the linguistic context that provides information on its meaning and use (Enfield, 2008). Thus, the exploration of these terms via microtoponyms certainly provides a limited view of the use of these terms. However, despite this, it is an approach that could be considered a preliminary or complementary approach to certain studies that require time and money (participant observations, depth interviews, community meetings, focus groups, questionnaires, etc.) such as suggested by Atik and Shaffield (2017).

This first objective aimed to demonstrate that place names contain relevant information to investigate landscape. In this thesis, place names were analyzed using digital methods considering all names holistically and not in isolation. Using this approach to extract place name information allows a larger territory to be investigated and the general trend of the data to be extracted. For example, using that method on St Gallen and then Swiss German microtoponyms enabled me to underline that most of the time microtoponyms were transparent and described their surroundings. It provides information about the pattern of the act of naming, of how place names are constructed in general: which form they have (here it underlines a specific + generic structure) and what kind of semantics they capture (descriptive terms, proper nouns, etc.).

7.2 Exploring the relationship between the physical and the linguistic aspects of microtoponyms for the investigation of landscape terms

The exploration of the linguistic aspect was only the first step of this thesis. The second step investigated physical aspects of the microtoponyms in Chapters 4 and 5 in order to explore the relationship between linguistic and physical properties. First, physical properties were extracted and analyzed. The physical aspects were classified into some selected physical properties (area, elevation, landcover and topographic wetness index (TWI)) and the spatial distribution of the microtoponyms. The following subsection will discuss the choice of the physical properties explored.

7.2.1 The physical properties explored

In order to explore the spatial referent of microtoponyms, area, elevation, landcover and TWI were selected. Numerous limitations can be raised concerning the selection and calculation of these properties. First of all, the selection of these specific properties may be questioned. Indeed, today many properties can be explored thanks to increasingly innovative tools and methods, facilitated in particular by the development of GIS. Indeed, simply to explore and classify topography, Iwahashi and Pike (2007) compared 20 classifications developed since 1990. These classifications, based on different algorithms, have been developed to identify topographic types such as landforms or terrain types. They are generally based on three measures that are then declined in various ways: slope gradient, local convexity and surface terrain (Iwahashi and Pike 2007). These authors developed a model generating between 8 and 16 landscape types but at the end they were still not able to distinguish what a hill was and what differentiated it from a mountain. Indeed, this question of interpreting topography goes beyond any measure used to characterize it. Moreover, such a model generally applies to very large areas such as countries, and even the world in this study. However, for this thesis, I chose fairly simple attributes to describe the polygons oriented towards measurements and methods widely known to allow a broad scientific audience, implied by an interdisciplinary approach. Using more complex attributes could be the subject of future investigations.

In addition, this thesis explored the referent of a place name through a selection of physical properties where other researchers have explored different kinds of properties such as the distance to water resources or to cities etc. (Qian, Kang and Wang, 2016). Nevertheless, in the study of Qian et al (2016) these indicators were also chosen in relation to the specific data of the research, namely the semantic information contained in the data: land use was only explored for two specific uses - paddy and irrigated land- and distance from markets only when the semantics of the place names referred to it. The same approach can be seen in the study of Feng and Mark (2017), which explored the mountain and hill landscape category in Indonesia and Malaysia and paid attention to altitude only, even if they consider it at different scales. With this single indicator, they demonstrated a distinct use of these terms and even managed to highlight local terms for the designation of eminences. Consequently, as in these examples, my choice was partly guided by the presupposed semantics of the landscape terms explored and by my research questions. Indeed, the choice of land use exploration was motivated by exploration of the microtoponyms *Wald* and *Holz* and the TWI motivated by *Riet* and *Moos* microtoponyms. Therefore, to make the study applicable to other landscape terms it requires the methodology to be adapted through the selection of other physical aspects.

Finally, the range of choices is limited to what we know, just as we are dependent on the data available for their calculation. Indeed, this study does not, at any time, imply the collection of geo-morphometric information in the field but uses the data already available. Thus, the results are also dependent on the methods and biases used by the scientists who collected these data upstream, allowing the widest possible use of them, but in no way for the precise purpose of this study. This is an ex-situ use of the data. Many data are therefore considered as an indicator of a certain reality at a certain time T rather than a reality that is not questioned.

7.2.2 RQ3: How can the relationship between the semantics of place names and the physical properties of designated places be investigated?

Chapters 3 and 4 explored the linguistic and the physical aspects of the microtoponyms of the canton of St. Gallen with the landscape terms *Wald*, *Holz*, *Riet* and *Moos*. These terms were selected because they were within the most frequently used terms in the microtoponym of the canton, and because they were two pairs of synonyms. Indeed, *Wald* and *Holz* both refer to a wooded area and *Riet* and *Moos* to a wetland. Nevertheless, in the case of *Riet* and *Moos*, *Riet* can also refer to an area cleared of trees, therefore, the second case study presented in Chapter 5 and applied to the German-speaking part of Switzerland, focused only on this pair. Synonyms were investigated in order to establish to what degree the exploration of microtoponyms enables a term to be understood and to distinguish between two almost synonyms. Chapter 3 demonstrated that, even if the linguistic aspects of these microtoponyms provide useful information, it is hard to use it to accurately determine the landscape feature referred to by these terms. Indeed, the exploration of the linguistic aspects indicated that these terms were mainly used generically, such as type of place. For example, in the microtoponym Bannwald, *Wald* is located at the end of the place name and indicates that the banished place (*Bann*) is a forest (*Wald*). Through the classification of their associated elements, it was possible to determine that they were specified using similar terms referring to their shape or aspects and that *Holz* showed a distinct pattern with more terms related to plants and another spatial reference such as another place or feature. Nevertheless, even if they were associated individually with different meaningful elements, it was hard to distinguish them from their pair. This was, however, possible when combining them with some physical properties (area, elevation, land-cover and TWI). Indeed, exploring the properties of all the microtoponyms associated with the terms explored, enabled another level of distinction to be reached establishing specific physical properties for each term. It was thus determined that the distinction between *Wald* and *Holz* is expressed in microtoponyms by their size, their elevation and also by the type of trees found in these wooded places. Related to *Riet* and *Moos*, it seems that they both refer to the same type of landscape as expected through their definition of wetland. Nevertheless, *Riet* seems to be present on a broader range of elevations than *Moos* in the canton of St. Gallen.

These results indicate that microtoponyms, through their linguistic and physical aspects, can provide useful information to determine certain landscape terms. It demonstrates that the exploration of a certain quantity of microtoponyms allows some patterns of naming and some shared physical properties to be extracted, which can help link some landscape features, referents, to a term. It is therefore possible to establish a connection to the concept related to this term by understanding how it is used in space.

Using physical properties subsequently allows the influence of spatial distribution on the use of these terms within place names to be explored.

7.2.3 RQ4: To what extent does spatial distribution influence the semantics used in place names?

How a term is used may vary across space because of socio-demographic variables and the influence of geographic distance on linguistic variation (Séguy, 1971 ; Derungs et al., 2020). Chapters 3 and 4 demonstrated that microtoponyms were data robust enough to determine the use of landscape terms and it was very clear within the exploration of *Wald* and *Holz*. Nevertheless, the distinction between *Riet* and *Moos* was less clear, and no information was extracted relating to the possible meaning of Riet referring to an area cleared of trees mentioned in the canton of Bern (Idiotikon, vol. 6, p.1729). Thus, since microtoponyms enable the use of these terms to be explored in space and these uses can vary in space, I explored for the specific case of *Riet* and *Moos*, if the use of these terms within microtoponyms varies in space.

The aim was to investigate how the linguistic and physical properties of *Riet* varied when this term was linked to the meaning of clearing. This research highlighted some areas as potential locations for this specific semantics when both linguistic and geographical properties are considered. The results of Chapter 5 also illustrate variations of the linguistic form of *Riet* with *Ried* much more frequent in the western part of the German speaking part of Switzerland than *Moos*. This is an input that could be explored in more detail during linguistic fieldwork at this specific location.

Moreover, the question of the scale of analysis should be taken with caution since certain elements in the results may depend on this aspect of the data. Indeed, although *Riet* and *Moos* were two of the most common terms used as part of microtoponyms, when they were displayed across the territory, their distribution was not dense. Using the hexagons was a way of visualizing uniformly their occupation of the territory but then exploring their properties quantitatively needs to be moderated by their quantity in some hexagons. Moreover, the size of the hexagons may influenced the results.

Finally, the results demonstrated a diversity of usages of these landscape terms within place names. According to where they are, they have different linguistic forms, they are more or less numerous and they refer to places with physical properties related to the local geographical setting. Indeed, as in the research of Feng and Mark (2017) and of Qian et al. (2016), the choice of landscape terms are influenced by the location, with *Moos* most frequently used in some parts of Switzerland, and also by the geographical context with the specific use of *Riet* in mountainous areas. Nevertheless, some limitations can be underlined related to the number of data necessary for such investigations and the interpretation of the results when there are only a few names.

To sum up, it has been demonstrated that microtoponyms contain landscape terms and therefore these terms could be investigated using their location and their reference within the landscape. Consequently, both the semantic and the location of those place names may be used to investigate landscape using the semiotic triangle presented in the introduction of this thesis. Linguistic and geographical aspects of place names are complementary. I demonstrated that each element in isolation provides only one piece of the puzzle and all are useful to investigate landscape. The semantics provide information of which landscape terms are used and how common they were in a specific territory. The physical properties provide information about the properties and the specificity of these terms. The results also indicated that according to their location the linguistic form and the physical properties of place names might vary slightly. These names are all dependent on the geographical and socio-cultural context of where and how they are used. It could be useful to keep these conclusions in mind when investigating place names. Even for individual investigations of place name, it is important to take into account to what extent the location and physical properties of the place are considered.

In the case study of Switzerland, such landscape exploration could be seen as straightforward since I specifically chose microtoponyms that are the place names related the most to natural landscape features. Therefore, I knew that they would contain landscape terms despite not knowing which terms would be the most common. However, although the relationship with the landscape was clearly expressed in the semantics of the names in this example, this thesis also supports the idea that such an investigation can be conducted whatever the linguistic form of the place name. This is what was carried out in Chapter 6 that investigated indigenous place names without any referencing to landscape using landscape terms inside the semantics of the names.

7.3 Consider the act of naming to investigate landscape

Finally, the third objective of this thesis considered the act of naming in order to explore landscape when place names do not necessarily have a descriptive form.

7.3.1 RQ5: How can the cultural settings of place names be analyzed with their linguistic and physical properties?

In Chapter 6, an interdisciplinary method, combining GIS, ethnology and linguistics was used to explore Jahai place names and their relationship with their physical referents. Combining these three fields, enabled analysis of the features named (watershed), their names (personal names of mythical entities) and their relationships (myth of creation of the earth and a hierarchical system based on the mythical entity kinship). I demonstrated that these three elements would be considered together by the Jahai and used as a systematic way of naming space. Indeed, names within all the Jahai territory follow the principle of a watershed named after a mythical being. The landscape features (such as a camp) within a catchment area are identified in relation to their location within it, for example, 'at the head of *Smlor*' when *Smlor* is a specific watershed.

Chapter 6 used GIS software and its tools, to create a hydrological model and to build a stream order network. From that specific and technical hydrological template, describing one aspect of the physical environment of the Jahai, it was possible to find patterns of naming related to the stream network of the Jahai territory. Indeed, the Jahai place names collected by Niclas Burenhult during fieldtrips are linked to streams related to Strahler order 4 and above. It was also demonstrated that using stream-order hierarchy, it was possible to build the family tree of the place names (since they constitute the names of mythical beings). The combination of the stream order with the kinship relationship opens up new research perspectives in the field, such as collecting place names more systematically for each stream with an order higher than 4 and investigating further the entities of the creation myth. Such a study would not have been possible using only one field of research and without constantly communicating with Niclas Burenhult about the method and results. Nevertheless, such interdisciplinary study working with ethnographical data implies certain challenges (Turnbull, 2007).

Firstly, it implies working with an incomplete dataset since it relies on data collection. This was the case here with Jahai place names collected opportunistically during an ethnolinguistic investigation of the Jahai language. Therefore, the dataset of Jahai place names was very different compared to the St. Gallen, and even the Swiss dataset of microtoponyms. That meant that I did not know the extent of the real dataset and that I had to work with a relatively small amount of data.

Secondly, since these place names were, for most part, collected opportunistically during exchanges with informants, the metadata associated with them were weak and non-systematic. For example, for some locations, only the place name was collected and for others it was associated with further information such as gender, kinship or even the myth linked to the specific location. At the end, only a few place names were collected specifically as place names and therefore with rich metadata. This is why I chose the data collected after 2013, because they were collected with metadata providing more information about the GPS point linked to each place name. It was useful to disambiguate duplicates and to explain points located far from the stream network.

Finally, the place names collected are not an official or validated dataset of names but they represent specific knowledge possessed by a few members of the Jahai society. This can be seen as an important bias related to the legitimacy of that information, especially when they are used to generate a model. In order to be as objective as possible, the data were split into two parts and the model was generated with only a small sample. To test this sample for its legitimacy, I first explored the name with the stream network without any knowledge of their kinship, and then compared them with the metadata of Niclas Burenhult. Since the interpretation made using the hierarchy of the stream network was the same as the metadata collected by Niclas Burenhult, I considered the data reliable and I applied the model to the rest of the place names. The same checking process was applied with a theoretical kinship model that was completed and validated by the data collected during the fieldwork.

Moreover, there were also limitations in the hydrological model itself, since the study area provided a limited amount of geographical information. Indeed, Malaysia does not have a great amount of geographical information compared to Switzerland, because it implies money and people working to collect the data. Consequently, the stream network had to be built from a DEM based on SRTM data and not from the field. This implies that the hydrological model built is imprecise and cannot be considered to correspond totally to reality. Some errors are possible and they were underlined in the hydrological model used. Indeed, the 30m granularity of the model showed its limitations in visualizing the watersheds with reference to the grandchildren of *Mɲjlom* in Figure 6.7. Thus, even though the field notes taken by Niclas Burenhult indicated which side of the main stream the entity referred to, it was not possible to establish an exact correspondence between these names and the streams of second order. Moreover, again in this figure, in the south-western part of the *Batɔʔ* catchment area, points were identified as children of *Mɲjlom* and located on a third-order stream. From the field notes, it would appear that these points are actually on the same stream as the other points located in the south of *Batɔʔ* and not on a separate tributary as the hydrological model indicates. This demonstrates once again the importance of using GIS in close collaboration with field information and more generally the need for good communication between each field during interdisciplinary research.

7.4 RQ6: What are the benefits of considering the name, the referent and the cultural settings of place names in landscape research?

This thesis demonstrates in many ways the benefit of using place names in combination with GIS to investigate landscape. Such technology enabled the linguistic theory of the semiotic triangle to be deployed and explored in space. Moreover, it also allowed this information to be considered in a cultural setting through the pattern represented by such a quantity of data. Therefore, despite the criticisms of using GIS with cultural data, which include place names, I believe in this thesis I have demonstrated that the benefit can be appreciable. This aspect is developed in the following section. Moreover, benefits from a linguistic perspective can also be highlighted, with one example being the possibility of exploring semantics through space. This second point is developed in the light of landscape investigations.

7.4.1 GIS and mapping cultural data

Applying GIS and considering place names in their entirety rather than in their individuality, is not the usual way of exploring cultural data but it was made possible by the mapping process. This quantitative method applied to cultural data is at the core of the main debates related to the use of GIS and more generally the use of maps to investigate indigenous and local knowledge. Several arguments were put forward and are exposed here in the light of this thesis.

The first action of the geographer during the collection of place names is the cartographic process: geo-locating and recording these names on a support. So what are the implications of this cartographic process? This process could raise ethical considerations when related to Jahai place names. This is what Rundstrom questioned in a postmodernist context and applied to indigenous peoples (Rundstrom, 1991). He pursued a debate initiated by Harley and explained the impossibility of mapping cultures that have no written traditions because the cartographic process is a creation of text in which has to be questioned. Indeed, the creation of text or maps implies fixing information in time, and it is often the goal of such an action. However, there are societies which manage knowledge in a completely different way (through action or process). He used the concept developed by Connerton in 1989 which distinguishes ‘incorporation’ from ‘inscribing’ when he considered cultural practices and the knowledge associated with them. He then highlighted that changing this method of preserving knowledge necessarily has consequences to which we must pay attention. He blamed that process for destroying indigenous culture by standardizing and making uniform data with the risk of changing this knowledge into an object, ‘tangible and accessible’. He called for social or cultural mapping that would take into account these commemorative actions and that would minimize the aspect of fixing information over time.

Considering these remarks, it is important to indicate that Jahai place names were collected using GPS in the field and not using the support of a map. Moreover, the purpose of this research was less to map these names, than to understand how their system of naming worked. However, it should be noted that nowadays, fixing this information into such a support may be the only way to keep the memory of these names which are currently known by only a few members of the community. Moreover, the use of maps, as in the western way of looking at space was useful to be able to understand the way the Jahai perceived space. In addition, the understanding of their system of naming was only possible through combining information (the name and the kinship), linked with the strength of GIS to the initial geo-coordinates. A strength recognised by Lake (1993):

> 'ultimately at issue is whether the integrative capacity of GIS technology proves robust enough to encompass not simply more data but fundamentally different categories of data that extend considerably beyond the ethical, political, and epistemological limitations of positivism' (Lake, 1993:411).

Progressively, this technology is slowly becoming accepted with Harvey mentioning it as a 'technological artifact … which reinforces social agreements about human geography' (Harvey and Chrisman, 1998:1693). Moreover, Sieber (2000) recognized the plasticity of this technology even if some progress was needed regarding the analyses of social information (Sieber, 2000). The potential of GIS is becoming stronger with time:

> 'Where GIS has served historically as a tool for the elimination of epistemologies and the codification of particular environmental knowledge systems, it might yet open doors onto the very nature of knowledge production itself' (Robbins, 2003:250)

Indeed, applying GIS tools to the Jahai territory and system of naming raised new research questions related to the mythical entities and their relationship with the land and with each other. Without that visualization, some hypothesis would have been difficult to formulate. This fact was effectively stated by Sieber and Wellen (2011):

> 'For us, a GIS offers three approaches to integrate landscape and language. It is a mapping tool, and it is a spatial analytic modeling method. Lastly, it is a language unto itself producing a digital and abstracted landscape of the imagination that we can interrogate (Sieber and Wellen, 2011:384).

However, even if GIS is a powerful tool, this conclusion then raises questions about what is mapped and what information the computer and cartographic tools can contain and disseminate and to whom. Indeed, these questions are central to the mapping of Western concepts, but also and with more significant political implications in the case of indigenous populations. This is the warning that was expressed by Agrawal (2002) on the consequences of creating a database with indigenous knowledge. He highlighted three negative consequences of these processes which he described as 'scientization' as a particularization with the consequence of separating knowledge from the whole in which it makes sense; the 'validation' of this knowledge by scientific methods in order to be considered as knowledge and the 'generalization' implied by the cataloguing of this knowledge. He criticized the use of such tools as being at the service of science and not at the service of indigenous knowledge with the consequence of smoothing the diversity of knowledge (Agrawal, 2002). This is the second argument against the use of GIS for cultural data. It claims that this interdisciplinary approach and mapping indigenous knowledge can be seen as a way of imposing a western model over an indigenous world view and therefore it does not transcribe their original perception. Indeed, applying the hydrological network to the Jahai mythical understanding of the environment can be seen as imposing a thought on Jahai data - a colonialist approach seeking to transpose an indigenous system of knowledge into a Western system (Agrawal, 2002). Nevertheless, it seems important to indicate that here the use of GIS is put to the service of the understanding of their system and this in order to be able to transcribe their vision of the world as accurately as possible. Under no circumstances does the use of GIS and the hydrological network make it possible to validate their system of thought. It is a tool that allows better communication between different conceptions of reality as already formulated by Robbins in 2003:

> 'By simultaneously exploring the partialities of experts and producers, GIS can help to break apart the boundaries inherited from more traditional approaches to local knowledge, and so open onto broader explorations of ecological knowledge' (Robbins, 2003:234)

Finally, Chapter 6 highlighted the possibility of a broader exploration of the Jahai knowledge and more specifically, the exploration of the relationship they have with the land using the myth of creation. It has been demonstrated that combining GIS and cultural data can be conducted within an ethical approach and it can be a door to understanding and sharing this unique landscape conceptualization Moreover, the Jahai themselves have asked for a map of their territory with their names. It therefore became an act of reciprocity between the community and the research, implying a co-learning process and serving the interest of the Jahai (Tobias et al. 2013). The western world had already entered their land, roads had been built and a dam had modified the stream network a long time before anyone asked them how it would disturb their way of considering their surroundings. Nowadays, a map of their territory with their names and where they are mapped with their respective referent may be a tool for them to open up discussions about their territory and their conceptualization. It could serve indigenous knowledge since we all live on the same earth and the laws are created by a minority of its inhabitants. In that context it is urgent to be able to share the diversity of landscape perception in an understandable way.

7.4.2 A Spatial approach to linguistics to investigate landscape

Using GIS to investigate the semantics of place names also demonstrates an important potential to investigate landscape. Despite the debate of the meaning of place names already exposed, this thesis demonstrates that the semantics of place names are deeply linked to the experience of people with their land and even when those names do not contain any landscape terms. It has been demonstrated that using a lexicon, despite certain limitations, it enables relevant semantic information to be extracted from a large quantity of names. It is also important to mention that in this thesis, benefiting from the interdisciplinary approach, no assumption was made about the meaning of the place names. Using the etymologically based lexicon enabled meanings to be explored even when the elements were no longer transparent. However, it is also important to note that no assumption was formulated relating to the meaning of the place names, only the meaning of the morphemes (meaningful elements) was explored and interpreted.

Moreover, in this thesis I only explored microtoponyms since they are place names which are the most connected to landscape features. However, the method used could be apply to any kind of place name such as street names or even names of points of interests as carried out by Hu and Janowicz (2018). They demonstrated spatial correlation about the semantics of names with similar terms used close to each other. Our method, however, made it possible to explore which semantics are associated with which kind of place. Knowing what terms are used to name a street, a restaurant or a city, and how different they are could be used to investigate the landscape as was done with the Jahai place names. What element is salient enough in the landscape to designate each distinctive place and what terms are used for that purpose? If landscape terms are used to name landscape features, which terms are used to name street or new road? The diachronic aspect of place names could also be investigated and could provide information on the evolution of the act of naming. Are the same features named and is the pattern of naming identical through years or centuries? Can we distinguish, using place names' information which places are historical (meaning that they are important for a nation) and which are not? We are touching here on more political questions with the possibility of investigating how a place is described through names and how time and the society in action can modify the way landscape is perceived (Rose-Redwood et al. 2010).

Indeed, the Jahai case study highlighted that the semantics of their place names related to entities cannot be neglected in landscape investigation. This is how the Jahai understand and apprehend landscape, namely through entities which constitute the land. It therefore emphasizes the importance of paying attention to all forms of semantics within place names and to explore each form because each of them could provide potential information to understand landscape. However, such a conclusion can be reached because of the amount of data. One name alone does not allow such a conclusion to be drawn and this leads to the question of how many names are needed. It can be a problem if we want to investigate variation in space at a smaller scale, as was the case with *Riet* and *Moos* in Chapter 5. Moreover, we need to identify which information should not be considered when semantics of names are investigated in such a way, that is to say quantitatively. Metaphor and multiple meanings cannot be considered using such a method, there is also no way of determining if this meaning is still relevant nowadays and even more generally, to which time period these semantics can be applied.

Moreover, since the same terms can be used within place names across space, we can also investigate whether their use is modified according to the location. In the present work we only examined *Riet* and *Moos* within the Swiss German- speaking part of Switzerland, however it could be possible to extend this investigation to the German-speaking part of Europe to see, from a geographical perspective, how similar or dissimilar the use of these terms within place names is. Developing this further, we could consider translated terms such as for *Wald* and *Holz*, the translation into '*forest*' and 'w*ood*' in English or f*orêt* and *bois* in French. This relates to the Linguistic Relativity Hypothesis, investigating the relationship between the cognitive aspect of language (i.e., the concepts) and the linguistic structures (i.e., the semantics). Are there more differences in the use of these terms related to the geographical settings or to administrative borders or to linguistic borders? Switzerland would be an interesting place to investigate such questions since three languages are used in delimited geographical areas.

Finally, the strength of this approach is possible because of the multidisciplinary, transdisciplinary or interdisciplinary aspect of place names. Gausset (2003) proposed that the study of environmental anthropology should be part of an interdisciplinary approach so that each discipline is enriched rather than multidisciplinary in which one would serve to make others legitimate (Gausset, 2003). In the particular case of cartographic representation and the use of GIS, Dao (2004) offered guidelines on the potential of GIS in many fields of study subject to an upstream development of the map components and their uses and he underlined the need for a 'common research approach' (Dao, 2004:25). Under these conditions, the use of such tools opens up great potential with, for example, the accomplishment of a Corsican research group whose work combined anthropological, archaeological and astronomical data (Khoumeri et al., 2005). This is also what Maschner had demonstrated much earlier in his analysis of prehistoric settlements by combining knowledge via GIS (chapter 10 in Aldenderfer and Maschner, 1996) and what continues to be highlighted in the field of 'digital humanities' to explore historical and more broadly social data (Chloupek, 2017; Fuchs, 2015; Gregory, 2014). Indeed, the identification of patterns in the data highlights places of specific interest and allows a critical analysis of data (Fuchs, 2015). More specifically and in relation to language and landscape, the studies of Sieber and Wellen (2011) and Cogos et al. (2017) demonstrate uses of GIS for and by indigenous peoples to digitize the landscape. It then becomes an action tool for the territory. However, they pointed out that this tool should always be used with caution and that a more general cultural view will always be inseparable from it (Cogos et al., 2017; Sieber, 2000; Sieber and Wellen, 2011).

8 Conclusion

In this thesis, I explored the potential of place names to explore landscape. Since place names encode linguistic and geographical information, the relationship of these two components was used to investigate landscape terms in Switzerland. I hypothesized that the semantics of place names relate to their locations and therefore can provide information about this physical referent. From that assumption and using a bottom-up approach starting from the semantic content of microtoponyms of the canton of St. Gallen, enabled me to identify four frequent landscape terms contained in these name: *Wald*, *Holz*, *Riet* and *Moos*. Using their high frequency, many names and many physical references were explored, in order to provide linguistic and physical trends related to these terms.

The use of an etymological lexicon of semantically meaningful elements, enabled linguistic information to be extracted from microtoponyms. This revealed that limited numbers of terms are used within microtoponyms, but they combine a specific and a generic element. Therefore, when the generic element is a landscape term, the specific element associated with it, the associated meaningful element, provides descriptive information such as shape or aspect of this landscape term. Combining this information with a selection of physical properties, such as area, elevation, and then more specifically, landcover or TWI, it was also possible to determine attributes to distinguish terms from each other. Finally, place names also provide the possibility of exploring the influence of the spatial distribution on the use of terms. This was explored through the investigation of *Riet* and *Moos* across the German-speaking part of Switzerland. The results demonstrated that geographical context can influence the use of some landscape terms, for example, *Riet* is use instead of *Moos* in places of high elevation and there is a tendency for an East-West spatial distribution of these two terms across Switzerland.

In this work, indigenous place names were also explored, through their linguistic and physical aspects, in order to explore landscape. Combining ethnolinguistic data and GIS, it was possible to establish a relationship between Jahai place names as names of mythical entities and the stream network of their territory. This relationship provides understanding of elements related to the relationship that Jahai have with their environment, namely entities instead of features.

In sum, it has been demonstrated that place names, provide valuable information to investigate landscape when they are explored through an interdisciplinary approach investigating their linguistic and their physical aspects. Moreover, since they are considered as universal, they can be used to investigate landscape across languages and space. They could provide a basis to start communicating about landscape, using terms pertinent for society and understanding its relationship with this landscape, even when it is far from the European perception.

This research could be extended to other languages or countries across the world, generating promising linguistic investigations of landscape terms. It would also be interesting to explore the relationship to landscape types using different types of place names. For instance can the relationship of a society with a city be explored through city place names? Can the relationship of people with a certain neighborhood be explored through street names? These questions also generate new geographical avenues related to landscape perception.

9 References

Agarwal, P. (2005). Ontological considerations in GIScience. *International Journal of Geographical Information Science, 19(5)*, 501–536.

Agnew, J. (2011). Space and place. *Handbook of Geographical Knowledge*, 316–331.

Agrawal, A. (2002). Indigenous knowledge and the politics of classification. *International Social Science Journal, 54(173)*, 287–297.

Aldenderfer, M., & Maschner, H. D. G. (1996). *Anthropology, space, and geographic information systems.* Oxford University Press.

Alderman, D. H. (2008). Place, naming, and the interpretation of cultural landscapes. *In B. Graham & P. Howard (Eds.), Ashgate Publishing Company Burlington, VT*, 195-213.

Antrop, M., & Van Eetvelde, V. (2019). Territory and/or Scenery: Concepts and Prospects of Western Landscape Research. *In E. F. Mueller L. (Ed.), Current Trends in Landscape Research. Innovations in Landscape Research (Springer,), 3-39*

Atik, M., Işikli, R. C., Ortaçeşme, V., & Yildirim, E. (2015). Definition of landscape character areas and types in Side region, Antalya-Turkey with regard to land use planning. *Land Use Policy, 44*, 90–100.

Atik, M., & Swaffield, S. (2017). Place names and landscape character: a case study from Otago Region, New Zealand. *Landscape Research*, 1–16.

Auer, P., Hinskens, F., & Kerswill, P. (2004). *Dialect change: Convergence and divergence in European languages.* Cambridge University Press.

Azaryahu, M., & Golan, A. (2001). (Re) naming the landscape: The formation of the Hebrew map of Israel 1949–1960. *Journal of Historical Geography, 27(2)*, 178–195.

Backhaus, N., Reichler, C., & Stremlow, M. (2008). Conceptualizing landscape: An evidence-based model with political implications. *Mountain Research and Development, 28(2)*, 132–139.

Bailly, C., & Séchehaye, A. (1997). *Ferdinand de Saussure. Cours de linguistique générale* (Grande bib). Paris: Charles Bailly et Albert Séchehaye.

Ballatore, A., & Mooney, P. (2015). Conceptualising the geographic world: the dimensions of negotiation in crowdsourced cartography. *International Journal of Geographical Information Science, 29(12)*, 2310–2327.

Basso, K. H. (1988). "Speaking with names": language and landscape among the Western Apache. *Cultural Anthropology, 3(2)*, 99–130.

Bénézet, M. P. (2013). *« It's our home » Expressions de la relation au territoire des Dane-zaa de Doig River (Colombie-Britannique, Canada)*. Mémoire. Corpus Université Laval.

Berg, L. D., & Vuolteenaho, J. (2009). *Critical toponymies: The contested politics of place naming*. Ashgate Publishing, Ltd.

Berlin, B., Breedlove, D. E., & Raven, P. H. (1973). General principles of classification and nomenclature in folk biology. *American Anthropologist, 75(21)*, 214–242.

Bertrand, G. (1978). Le paysage entre la nature et la société. *Revue Géographique Des Pyrénées et Du Sud-Ouest. Sud-Ouest Européen, 49(2)*, 239–258.

Bertrand, C., & Bertrand, G. (2002). *Une géographie traversière: l'environnement à travers territoires et temporalités.* Editions Quae.

Beven, K. J., & Kirkby, M. J. (1979). A physically based, variable contributing area model of basin hydrology. *Hydrological Sciences Journal, 24(1)*, 43–69.

BFS, (2019): https://www.bfs.admin.ch/

Billings, W. D. (1973). Arctic and alpine vegetations: similarities, differences, and susceptibility to disturbance. *BioScience, 23(12)*, 697–704.

Blandin, P. (2009). *De la protection de la nature au pilotage de la biodiversité.* Quae.

Bohnemeyer, J. (2001). Toponym questionnaire. *In Manual for the field season 2001. Max Planck Institute for Psycholinguistics*, 55-61

Bohnemeyer, J., Burenhult, N., Enfield, N. J., & Levinson, S. C. (2004). Landscape terms and place names elicitation guide. *In Field Manual Volume 9. Max Planck Institute for Psycholinguistics*, 75-79

Boillat, S., Serrano, E., Rist, S., & Berkes, F. (2013). The importance of place names in the search for ecosystem-like concepts in indigenous societies: an example from the Bolivian Andes. *Environmental Management, 51(3)*, 663–678.

Bonnemaison, J. (1981). Voyage autour du territoire. *Espace Géographique, 10(4)*, 249–262.

Boyer, H. (2008). Fonctionnements sociolinguistiques de la dénomination toponymique. *Mots. Les Langages Du Politique, (86)*, 9–21.

Brabyn, L. (1996). Landscape classification using GIS and national digital databases. *Landscape Research, 21(3)*, 277–300.

Brabyn, L. (2009). Classifying landscape character. *Landscape Research, 34(3)*, 299–321.

Brabyn, L., & Mark, D. M. (2011). Classifying landscape character. *In S. D. Turk, Andrew G, Mark, David M (Ed.), Landscape in Language: Transdisciplinary Perspectives. Amsterdam/Philadelphia: John Benjamins Publishing Compagny*, 395–409

Brown, G., & Brabyn, L. (2012). An analysis of the relationships between multiple values and physical landscapes at a regional scale using public participation GIS and landscape character classification. *Landscape and Urban Planning, 107(3)*, 317–331.

Burenhult, N. (2004). Landscape terms and toponyms in Jahai: a field report. *Lund Working Papers, 51*, 17–29.

Burenhult, N. (2005). *A grammar of Jahai.* Pacific Linguistics, Research School of Pacific and Asian Studies, The Australian National University.

Burenhult, N. (2008). Streams of words: Hydrological lexicon in Jahai. *Language Sciences, 30(2)*, 182–199.

Burenhult, N., & Levinson, S. C. (2008). Language and landscape: a cross-linguistic perspective. *Language Sciences, 30(2–3)*, 135–150.

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

Burenhult, N., Hill, C., Huber, J., Putten, S. V., Rybka, K., & San Roque, L. (2017). Forests. The cross-linguistic perspective. *Geographica Helvetica*, 72, 455-464.

Burenhult, N., & Purves, R. S. (2020). The spatial properties of forager motion categories: Evidence from Jahai. *Hunter Gatherer Research, 4(3)*, 411–426.

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.

Calvo-Iglesias, M. S., Díaz-Varela, R. A., Méndez-Martínez, G., & Fra-Paleo, U. (2012). Using place names for mapping the distribution of vanishing historical landscape features: the Agras field system in northwest Spain. *Landscape Research, 37(4)*, 501–517.

Carson, R. (1962). *Silent spring*. Houghton Mifflin Harcourt.

Charvolin, F. (2003). *L'invention de l'environnement en France*. La découverte.

Chloupek, B. R. (2017). A GIS approach to cultural and historical toponymic research in Nebraska. *Journal of Cultural Geography*, 1–21.

Coates, R. (2006). Properhood. *Language*, 356–382.

Cogos, S., Roué, M., & Roturier, S. (2017). Sami place names and maps: transmitting knowledge of a cultural landscape in contemporary contexts. *Arctic, Antarctic, and Alpine Research, 49(1)*, 43–51.

Cohn, A. G., & Gotts, N. M. (1996). The 'egg-yolk'representation of regions with indeterminate boundaries. *Geographic Objects with Indeterminate Boundaries, 2*, 171–187.

Collignon, B. (2002). Les toponymes inuit, mémoire du territoire: Étude de l'Histoire des Inuinnait. *Anthropologie et Sociétés, 26(2–3)*, 45–69.

Collot, M. (1986). Points de vue sur la perception des paysages. *Espace Géographique, 15(3)*, 211–217.

Conedera, M., Vassere, S., Neff, C., Meurer, M., & Krebs, P. (2007). Using toponymy to reconstruct past land use: a case study of 'brüsáda'(burn) in southern Switzerland. *Journal of Historical Geography, 33(4)*, 729–748.

Cosgrove, D. (2006). Modernity, community and the landscape idea. *Journal of Material Culture, 11(1–2)*, 49–66.

Council of Europe, European Landscape Convention, *Report and Convention Florence, ETS No. 17(176)*, 8, 2000.

Cresswell, T. (2004). *Place: A Short Introduction.* In Malden, MA: Blackwell Ltd. Blackwell Publishing.

Dahinden, T. (2014). Towards a Spatial Analysis of Toponym Endings. *In Cartography from Pole to Pole. Springer*, 369-379

Daniels, S., & Cosgrove, D. (1988). *The iconography of landscape*. Cambridge University Press Cambridge.

Dao, Q.-H. (2004). Les principes de la représentation cartographique de données géographiques. Une approche ontologique et sémiologique. *Revue Internationale de Géomatique*, *14(2)*, 259–283.

Department of Economic and Social Affairs. Statistics division., & Kadmon, n. (2002). Glossary of terms for the standardization of geographical names. UN.

Derungs, C., & Purves, R. S. (2012). Measuring topographic similarity of toponyms. *Proceedings of the 15th AGILE International Conference on Geographic Information Science, Avignon, France, 2427*.

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. *International Conference on Spatial Information Theory, Springer*, 261–278.

Derungs, C., & Purves, R. S. (2014). From text to landscape: locating, identifying and mapping the use of landscape features in a Swiss Alpine corpus. *International Journal of Geographical Information Science*, *28(6)*, 1272–1293.

Derungs, C., & Samardžić, T. (2017). Are prominent mountains frequently mentioned in text? Exploring the spatial expressiveness of text frequency. *International Journal of Geographical Information Science*, 1–18.

Derungs, C., Sieber, C., Glaser, E., & Weibel, R. (2020). Dialect borders—political regions are better predictors than economy or religion. *Digital Scholarship in the Humanities*, *35(2)*, 276–295.

De Sabbata, S., & Acheson, E. (2016). Geographies of gazetteers in Great Britain. *In: 24th GIS Research UK (GISRUK 2016) conference, Greenwich, 30 March 2016 - 1 April 2016.*

Descola, P. (2005). Anthropologie de la nature. *Cours: la catégorisation des objets naturels. Enseignement*, 428–442.

Descola, P. (2013). Anthropologie de la nature. *L'annuaire Du Collège de France 2011-2012*, (112), 649-669.

Descola, P., & Ingold, T. (2014). *Être au monde. Quelle expérience commune?* Lyon (Presses universitaires de).

Descola, P. (2018). *Les Natures en question: Colloque de rentrée du Collège de France 2017.* Odile Jacob.

Descola, P. (2019). De la nature universelle aux natures singulières: les leçons pour l'analyse des cultures? *La Lettre Du Collège de France, (44)*, 20p.

Dorier, E., & Van Den Avenne, C. (2003). Usages toponymiques et pratiques de l'espace urbain à Mopti. Marges linguistiques, (3), 151-158.

Dugas, J.-Y. (1984). L'espace québécois et son expression toponymique. *Cahiers de Géographie Du Québec, 28(75)*, 435–455.

Durkheim, E. (1900). Review of Ratzel, Anthropogeographie, vol. 1. *L'Année Sociologique, 3*, 550–558.

Duvall, C. S., Butt, B., & Neely, A. (2018). The Trouble with Savanna and Other Environmental Categories, Especially in Africa. *In The Palgrave Handbook of Critical Physical Geography. Springer, 107–127.*

Ebdon, D. (1991). *Statistics in geography: A practical approach-revised with 17 programs.* Wiley-Blackwell.

Edwardes, A. J., & Purves, R. S. (2007). A theoretical grounding for semantic descriptions of place. *International Symposium on Web and Wireless Geographical Information Systems. Springer, 106–120.*

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

Enfield, N. J. (2008). Linguistic categories and their utilities: The case of Lao landscape terms. *Language Sciences, 30(2)*, 227–255.

Fagúndez, J., & Izco, J. (2016a). Diversity patterns of plant place names reveal connections with environmental and social factors. *Applied Geography, 74*, 23–29.

Fagúndez, J., & Izco, J. (2016b). Spatial analysis of heath toponymy in relation to present-day heathland distribution. *International Journal of Geographical Information Science, 30(1)*, 51–60.

Fair, S. W. (1997). Inupiat naming and community history: The Tapqaq and Saniniq coasts near Shishmaref, Alaska. *The Professional Geographer, 49(4)*, 466–480.

Feng, C., & Mark, D. M. (2012). Exploring NGA GEOnet names server data for cross-linguistic research on landscape categories: a case study of some toponyms in Malaysia and Indonesia. *GIScience 2012.*

Feng, C.-C., & Sorokine, A. (2014). Comparing English, Mandarin, and Russian hydrographic and terrain categories. *International Journal of Geographical Information Science, 28(6)*, 1294–1315.

Feng, C.-C., & Mark, D. M. (2017). Cross-Linguistic Research on Landscape Categories Using GEOnet Names Server Data: A Case Study for Indonesia and Malaysia. *The Professional Geographer*, 1–12.

Friedberg, C. (1997a). Diversité, ordre et unité du vivant dans les savoirs populaires. *Natures Sciences Sociétés, 5(1)*, 5–17.

Friedberg, C. (1997b). Ethnoscience et sciences cognitives. *Journal Des Anthropologues, 70(1)*, 41–49.

Fuchs, S. (2015). An integrated approach to Germanic place names in the American Midwest. *The Professional Geographer, 67(3)*, 330–341.

Gaio, M., Sallaberry, C., & Nguyen, V. T. (2012). Typage de noms toponymiques à des fins d'indexation géographique. *TAL, 53(2)*, 143–176.

Gammeltoft, P. (2005). In search of the motives behind naming. A discussion of a name-semantic model of categorisation. *Proceedings of the 21st International Congress of Onomastic Sciences, Uppsala 19-24 August 2002, 1. Swedish Institute for Language and Folklore*, 151–160.

Gammeltoft, P. (2016). Names and Geography. *In The Oxford Handbook of Names and Naming. Oxford University Press*, 502-513.

Garde, M. (2014). 6. Doing things with toponyms: The pragmatics of placenames in Western Arnhem Land. *Indigenous and Minority Placenames*, 97-121.

Gausset, Q. (2003). Séminaire de l'Association française des anthropologues «Actualités de l'anthropologie». Problèmes méthodologiques, conceptuels et éthiques de l'anthropologie environnementale. *Journal Des Anthropologues. Association Française Des Anthropologues, (94–95)*, 255–282.

Giraut, F., Houssay-Holzschuch, M., & Guyot, S. (2008). Au nom des territoires! *L'Espace Géographique, 37(2)*, 97–105.

Gomez Alvarez, L., & Bennett, B. (2017). Classification, Individuation and Demarcation of Forests: formalising the multi-faceted semantics of geographic terms. *13th International Conference on Spatial Information Theory (COSIT-2017). Leibniz International Proceedings in Informatics.*

Goodchild, M. F., & Hill, L. L. (2008). Introduction to digital gazetteer research. *International Journal of Geographical Information Science, 22(10)*, 1039–1044.

Grabs, T., Seibert, J., Bishop, K., & Laudon, H. (2009). Modeling spatial patterns of saturated areas: A comparison of the topographic wetness index and a dynamic distributed model. *Journal of Hydrology, 373(1–2)*, 15–23.

Gregory, I. (2014). Challenges and opportunities for digital history. *Frontiers in Digital Humanities*, 1, 1.

Harvey, F., & Chrisman, N. (1998). Boundary objects and the social construction of GIS technology. *Environment and Planning A, 30(9)*, 1683–1694.

Haspelmath, M. (2010). Comparative concepts and descriptive categories in crosslinguistic studies. *Language, 86(3)*, 663–687.

Hastings, J. T. (2008). Automated conflation of digital gazetteer data. *International Journal of Geographical Information Science, 22(10)*, 1109–1127.

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

Hedquist, R. (2005). The meaning of proper names. *E. Brylla and M. Wahlberg (Eds.), 1*, 172–184.

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.

Hough, C. (2016). Settlement Names. In *The Oxford handbook of names and naming. Oxford University Press, 87-103.*

Hough, C., & Izdebska, D. (2016). *The Oxford handbook of names and naming*. Oxford University Press.

Hu, Y., & Janowicz, K. (2018). An empirical study on the names of points of interest and their changes with geographic distance. *ArXiv Preprint ArXiv:1806.08040.*

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

Hunn, E. S., & Meilleur, B. A. (2010). Toward a theory of landscape ethnoecological classification. *In Landscape Ethnoecology, Concepts of Physical and Biotic Space*, 15–26.

Idiotikon: https://digital.idiotikon.ch/

Ingold, T. (1993). The temporality of the landscape. *World Archaeology, 25(2)*, 152–174.

International Union for Conservation of Nature, & World Wildlife Fund. (1980). World conservation strategy: living resource conservation for sustainable development. *Gland, Switzerland: IUCN.*

Iwahashi, J., & Kamiya, I. (1995). Landform classification using digital elevation model by the skills of Image Processing. *Geoinformatics, 6(2)*, 97–108.

Iwahashi, J., & Pike, R. J. (2007). Automated classifications of topography from DEMs by an unsupervised nested-means algorithm and a three-part geometric signature. *Geomorphology, 86(3-4)*, 409-440.

Janz, B. (2011). Philosophical Issues in Ethnophysiography: Landform Terms, Disciplinarity, and the Question of Method. *In S. D. Turk, Andrew G, Mark, David M (Ed.), Landscape in Language: Transdisciplinary Perspectives. Amsterdam/Philadelphia: John Benjamins Publishing Compagny*, 101–119.

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, L. M. (2000). "A place that's good," Gitksan landscape perception and ethnoecology. *Human Ecology, 28(2)*, 301–325.

Johnson, L. M., & Hunn, E. S. (2010). *Landscape ethnoecology: concepts of biotic and physical space.* Berghahn Books.

Jones, C. B., Purves, R. S., Clough, P. D., & Joho, H. (2008). Modelling vague places with knowledge from the Web. *International Journal of Geographical Information Science, 22(10)*, 1045–1065.

Jordan, P. (2012). Place names as ingredients of space-related identity. *Oslo Studies in Language, 4(2).*

Jordan, P. (2014a). Place Names as an Expression of Human Relations to Space. *Hough, Carole/Daria Izdebska (Hgg.): ICOS*, 209–223.

Jordan, P. (2014b). Thoughts on a concept of language geography. *Geographica Timisiensis, 23(1)*, 5–16.

Kari, J. (1989). Some principles of Alaskan Athabaskan toponymic knowledge. *In H. M. H. Marie Ritchie Key (Ed.), General and Amerindian ethnolinguistics: in remembrance of Stanley Newman (Mouton de). Berlin*, 129-149

Key, M. R., & Hoenigswald, H. M. (Eds.). (2019). *General and Amerindian ethnolinguistics: in remembrance of Stanley Newman (Vol. 55).* Walter de Gruyter GmbH & Co KG.

Khoumeri, E. H., Santucci, J.-F., & Federici, D. (2005). Multi level Representation of spatial data; application in Archeaology and Anthropology. *International Cartographic Conference 2005.*

Kristol, A., Cattin, F., & Aquino-Weber, D. (2005). *Dictionnaire toponymique des communes suisses.* Centre de Dialectologie, Université de Neuchatel.

Kruspe, N., Burenhult, N., & Wnuk, E. (2014). 1 Northern Aslian. *In The Handbook of Austroasiatic Languages (2 vols). Brill, 415-474.*

Kuhn, J. (2016). Rural Names. *In The Oxford Handbook of Names and Naming, Oxford University Press*, 136–143.

Kvamme, K. L., & Jochim, M. A. (1989). The environmental basis of Mesolithic settlement. *The Mesolithic in Europe: Papers Presented at the Third International Symposium, John Donald Publishers, Edinburgh*, 1–12.

Lake, R. W. (1993). Planning and applied geography: Positivism, ethics, and geographic information systems. *Progress in Human Geography, 17(3)*, 404–413.

Lambin, E. F., Turner, B. L., Geist, H. J., Agbola, S. B., Angelsen, A., Bruce, J. W., … Folke, C. (2001). The causes of land-use and land-cover change: moving beyond the myths. *Global Environmental Change, 11(4)*, 261–269.

Leino, A. (2005). In search of naming patterns: A survey of Finnish lake names. *Denominando Il Mondo. Dal Nome Comune Al Nome Proprio/Naming the World. From Common Nouns to Proper Names*, 355–367.

Leino, A. (2007). Construction Grammar in onomastics: the case of Finnish hydronyms. *In International Congress for Onomastic Sciences - Pisa, Italy: 28 Aug 2005-4 Sep 2005*, 297-309.

Leo (2020) : https://dict.leo.org/franz%C3%B6sisch-deutsch/Wald

Levinson, S. C. (2003). *Space in language and cognition: Explorations in cognitive diversity* (Vol. 5). Cambridge University Press.

Louis, R. P. (2011). *Hawaiian storied place names: re-placing cultural meaning.* John Benjamins Publishing Company.

Luo, W., Hartmann, J., Liu, J., & Huang, P. (2007). Geographic patterns of Zhuang (Tai) kinship terms in Guangxi and border areas: a GIS analysis of language and culture change. *Social & Cultural Geography, 8(4)*, 575–596.

Makoudjou, L. C. T., & Kamga, V. L. (2017). Noun Classes and Toponyms in Shüpamem. *In Advances in Cultural Linguistics. Springer*, 461-475.

Malt, B. C. (1995). Category coherence in cross-cultural perspective. *Cognitive Psychology, 29(2)*, 85–148.

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

Mark, D. M., & Turk, A. G. (2003a). Ethnophysiography. *In: Workshop on Spatial and Geographic Ontologies, 23 September. Kartause Ittingen, Switzerland.*

Mark, D. M., & Turk, A. G. (2003b). Landscape categories in Yindjibarndi: Ontology, environment, and language. *International Conference on Spatial Information Theory, Springer*. 28–45.

Mark, D. M., & Smith, B. (2004). A science of topography: bridging the qualitative-quantitative divide. *Geographic Information Science and Mountain Geomorphology, Springer-Praxis, Chichester, England*, 75–100.

Mark, D. M., Turk, A. G., & Stea, D. (2008). Defining the meanings of landscape terms and their associated categories. *In: 5th International Conference on Geographic Information Science (GIScience 2008), 23 - 26 September 2008, Park City, UT, USA*

Mark, D. M., Turk, A. G., Burenhult, N., & Stea, D. (2011a). Landscape in Language: An introduction. *In S. D. Turk, Andrew G, Mark, David M (Ed.), Landscape in Language: Transdisciplinary Perspectives.* Amsterdam/Philadelphia: John Benjamins Publishing Compagny, 1-24

Mark, D. M., Turk, A. G., Burenhult, N., & Stea, D. (2011b). *Landscape in language: Transdisciplinary perspectives* (David M Mark, A. G. Turk, N. Burenhult, & D. Stea, Eds.). Amsterdam/Philadelphia: John Benjamins Publishing Compagny.

Meilleur, B. A. (2019). Hawaiian Seascapes and Landscapes: Reconstructing Elements of a Polynesian Ecological Knowledge System. *Journal of the Polynesian Society, 128(3)*, 305–336.

Nash, D., & Simpson, J. (2012). Toponymy: recording and analyzing placenames in a language area. *In N. Thieberger (Ed.), The Oxford Handbook of Linguistic Fieldwork* . New York: Oxford University Press, 392-404

Nash, J. (2015). The How of Toponymy: A Comment on Tent's "Approaches to Research in Toponymy." *Names, 63(4)*, 233–236.

Nyström, S. (2016). Names and meaning. *In The Oxford handbook of names and naming. Oxford University Press, 39-51.*

Nash, J. (2017). Linguistics, geography, and the potential of Australian island toponymies. *Australian Geographer*, 1–19.

Olwig, K. R. (2005). Representation and alienation in the political land-scape. *Cultural Geographies, 12(1)*, 19–40.

Olwig, K. R., Dalglish, C., Fairclough, G., & Herring, P. (2016). Introduction to a special issue: the future of landscape characterisation, and the future character of landscape–between space, time, history, place and nature. *Landscape Research, 41(2)*, 169–174.

Oral, T. de T., & Beaucage, P. (1996). La bonne montagne et l'eau malfaisante. Toponymie et pratiques environnementales chez les Nahuas de basse montagne (Sierra Norte de Puebla, Mexique). *Anthropologie et Sociétés, 20(3)*, 33–54.

Ortsnamen, 2020 : https://ortsnamen.ch/index.php/de/

Ottino-Garanger, P., & Ottino-Garanger, M.-N. (2017). Toponymie littorale aux îles Marquises, Fenua 'Enata/Henua 'Enana, Polynésie orientale (Polynésie française). *Revue d'ethnoécologie, (11)*.

Palacio, D., Derungs, C., & Purves, R. (2009). Development and evaluation of a geographic information retrieval system using fine grained toponyms. *Journal of Spatial Information Science, 2015(11)*, 1–29.

Paskvan, S. (2011). Revitalizing place names through stories and songs. *Landscape in Language: Transdisci-plinary Perspectives. David M. Mark, Andrew G. Turk, Niclas Burenhult, and David Stea, eds*, 261-274.

Paveau, M.-A. (2008). Le toponyme, désignateur souple et organisateur mémoriel. L'exemple du nom de bataille. *Mots. Les Langages Du Politique, (1)*, 23–35.

Piantadosi, S. T. (2014). Zipf's word frequency law in natural language: A critical review and future directions. *Psychonomic Bulletin & Review, 21(5)*, 1112–1130.

Pierik, H. J., & van Lanen, R. J. (2019). Roman and early-medieval habitation patterns in a delta landscape: The link between settlement elevation and landscape dynamics. *Quaternary International, 501*, 379–392.

Piper, N. (2014). 9. Saltwater Placenames around Mer in the Torres Strait. *Indigenous and Minority Placenames*, 163.

Purves, R. S., Clough, P., & Joho, H. (2005). Identifying imprecise regions for geographic information retrieval using the web. *Proceedings of the 13th Annual GIS Research UK Conference*, 313–318.

Purves, R. S., & Jones, C. (2011). Geographic information retrieval. *SIGSPATIAL Special, 3(2)*, 2–4.

Purves, R. S., & Derungs, C. (2015). From Space to Place: Place-Based Explorations of Text. *International Journal of Humanities and Arts Computing, 9(1)*, 74–94.

Qian, S., Kang, M., & Wang, M. (2016). An analysis of spatial patterns of toponyms in Guangdong, China. *Journal of Cultural Geography, 33(2)*, 161–180.

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.

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

Raffestin, C. (1977). Paysage et territorialité. *Cahiers de Géographie Du Québec, 21(53–54)*, 123–134.

Rappard, W. E. (1948). *Collective security in Swiss experience, 1291-1948*. George Allen and Unwin Ltd, London.

Rennick, R. (2005). How to study placenames. *Names, 53(4)*, 291–308.

Rippon, S. (2013). Historic landscape character and sense of place. *Landscape Research, 38(2)*, 179–202.

Robbins, P. (2003). Beyond ground truth: GIS and the environmental knowledge of herders, professional foresters, and other traditional communities. *Human Ecology, 31(2)*, 233–253.

Rosch, E. H. (1973). Natural categories. *Cognitive Psychology, 4(3)*, 328–350.

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.

Rostaing, C. (1965). Les noms de lieux. Paris: PUF coll Que-Sais-Je.

Rundstrom, R. A. (1991). Mapping, postmodernism, indigenous people and the changing direction of North American cartography. *Cartographica: The International Journal for Geographic Information and Geovisualization, 28(2)*, 1–12.

Rundstrom, R. A. (1995). GIS, indigenous peoples, and epistemological diversity. *Cartography and Geographic Information Systems, 22(1)*, 45–57.

Sandnes, B. (2016). Names and Language Contact. *In The Oxford Handbook of Names and Naming, Oxford University Press*, 540–553.

Sapir, E. (1912). Language and environment. *American Anthropologist, 14(2)*, 226–242.

Seastedt, T. R., Bowman, W. D., Caine, T. N., McKnight, D., Townsend, A., & Williams, M. W. (2004). The landscape continuum: a model for high-elevation ecosystems. *BioScience, 54(2)*, 111–121.

Séguy, J. (1971). *La relation entre la distance spatiale et la distance lexicale*. G. Straka, Palais de l'université.

Seidl, N. P. (2008). Significance of Toponyms, with Emphasis on Field Names, for Studying Cultural Landscape. *Geografski Zbornik/Acta Geographica Slovenica, 48(1).*

Senft, G. (2008). Landscape terms and place names in the Trobriand Islands–the Kaile'una subset. *Language Sciences, 30(2)*, 340–361.

Sieber, R. E. (2000). Conforming (to) the opposition: the social construction of geographical information systems in social movements. *International Journal of Geographical Information Science, 14(8)*, 775–793.

Sieber, R., & Wellen, C. (2011). The role of geospatial technologies for integrating landscape in language. *In S. D. Turk, Andrew G, Mark, David M (Ed.), Landscape in Language: Transdisciplinary Perspectives.* Amsterdam/Philadelphia: John Benjamins Publishing, Vol. 4, 381–393.

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

Sklyarenko, A., & Sklyarenko, O. (2005). Interrelationship between common nouns and proper nouns. *Proceedings of the 21st International Congress of Onomastic Sciences, Uppsala 19–24 August 2002.*

Smart, P. D., Jones, C. B., & Twaroch, F. A. (2010). Multi-source toponym data integration and mediation for a meta-gazetteer service. *International Conference on Geographic Information Science. Springer*, 234–248.

Smith, B., & Mark, D. M. (2001). Geographical categories: an ontological investigation. *International Journal of Geographical Information Science, 15(7)*, 591–612.

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.

St. Gallen statistics, (2017): https://www.bfs.admin.ch/bfs/fr/home/statistiques/statistique-regions/portraits-regionaux-chiffres-cles/cantons/saint-gall.html

Strahler, A. N. (1957). Quantitative analysis of watershed geomorphology. *Eos, Transactions American Geophysical Union, 38(6)*, 913–920.

SwissNAMES^{3D}, (2019), Informations produit, 21p. [Accessed 12.05.2020] https://shop.swisstopo.admin.ch/en/products/landscape/names3D

Swisstopo, (2004), DHM25: The digital height model of Switzerland : https://shop.swisstopo.admin.ch/en/products/height_models/dhm25 [consulted the 29.04.2020]

Tamisari, F. (2002). Names and naming: speaking forms into place. The land is a map: Placenames of indigenous origin in Australia, 87-102.

Taylor, S. (2016). Methodologies in place-name research. *In The Oxford handbook of names and naming. Oxford University Press, 69-86.*

Tent, 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. (2017). Indigenous Toponyms in the Antipodes: A Gazetteer-Based Study. *Names, 65(4)*, 204–214.

Thornton, T. F. (1997a). Anthropological studies of Native American place naming. *American Indian Quarterly, 21(2)*, 209–228.

Thornton, T. F. (1997b). Know your place: the organization of Tlingit geographic knowledge. *Ethnology*, 295–307.

Thornton, T. F. (2011). Language and landscape among the Tlingit. *Landscape in Language: Transdisciplinary Perspectives. John Benjamins Publishing Co., Amsterdam, Netherlands, and Philadelphia, Pennsylvania, USA, 275–289.*

Tobias, J. K., Richmond, C. A., & Luginaah, I. (2013). Community-based participatory research (CBPR) with indigenous communities: producing respectful and reciprocal research. *Journal of Empirical Research on Human Research Ethics, 8(2), 129-140.*

Tuan, Y.-F. (1975). Place: an experiential perspective. *Geographical Review*, 151–165.

Tuan, Y.-F. (1979). Space and place: humanistic perspective. *In Philosophy in geography. Springer*, 387-427.

Tuan, Y.-F. (1991). Language and the making of place: A narrative-descriptive approach. *Annals of the Association of American Geographers, 81(4)*, 684–696.

Tulloch, S. (2006). Preserving dialects of an endangered language. *Current Issues in Language Planning*, 7(2-3), 269-286.

Turk, A., Mark, D. M., Stea. D. (2011). Ethnophysiography. *In S. D. Turk, Andrew G, Mark, David M (Ed.), Landscape in Language: Transdisciplinary Perspectives. Amsterdam/Philadelphia: John Benjamins Publishing Compagny*, 25-45

Turk, A., Mark, D., O'Meara, C., & Stea, D. (2012). Geography: documenting terms for landscape features. *In N. Thieberger (Ed.), The Oxford Handbook of Linguistic Fieldwork. New York: Oxford University Press*, 368-391

Turk, A., & Stea, D. (2014). David Mark's contribution to ethnophysiography research. *International Journal of Geographical Information Science*, *28(6)*, 1246–1263.

Turnbull, D. (2007). Maps narratives and trails: performativity, hodology and distributed knowledges in complex adaptive systems–an approach to emergent mapping. *Geographical Research*, *45(2)*, 140–149.

Tversky, B., & Hemenway, K. (1983). Categories of environmental scenes. *Cognitive Psychology*, *15(1)*, 121–149.

Van der Sluys, C. M. I. (2000). Gifts From the Immortal Ancestors. *In Hunters and Gatherers in the Modern World: Conflict, Resistance, and Self-Determination. Berghahn Books*, 427-454.

Van Langendonck, W., & Van de Velde, M. (2016). Names and grammar. *In The Oxford Handbook of Names and Naming. Oxford University Press*, 17-38.

Varzi, A. C. (2001). Vagueness in geography. *Philosophy & Geography*, *4(1)*, 49–65.

Veyret, Y. (2007). L'environnement, objet géographique. *Responsabilité & Environnement*, *48*, 19–29.

Villette, J., & Purves, R. S. (2018). Exploring microtoponyms through linguistic and geographic perspectives. *AGILE. Lund.*

Villette, J., & Purves, R. S. (2020). From Microtoponyms to Landscape Using Semantics, Location, and Topography: The Case of Wald, Holz, Riet, and Moos in St. Gallen, Switzerland. *The Professional Geographer*, *72(1)*, 109–120.

Vivien, F.-D. (2013). *Philippe Descola-L'écologie des autres. L'anthropologie et la question de la nature.* Paris, Ed. Quae, coll. Sciences en question, Économie Rurale. Agricultures, Alimentations, Territoires.

Walsh, M. (2009). Transparency versus opacity in aboriginal placenames. *In J. S. Luise Hercus, Flavia Hodges (Ed.), The land is a map: Placenames of indigenous origin in Australia*, 43–49.

Wang, F., Hartmann, J., Luo, W., & Huang, P. (2006). GIS-based spatial analysis of Tai place names in southern China: an exploratory study of methodology. *Geographic Information Sciences, 12(1)*, 1–9.

Wartmann, F. M., & Purves, R. S. (2017). What's (Not) on the Map: Landscape Features from Participatory Sketch Mapping Differ from Local Categories Used in Language. *Land, 6(4)*, 79-95.

Wilson, J. P., & Gallant, J. C. (2000). *Terrain analysis: principles and applications.* John Wiley & Sons.

Wismann, H. (2014). *Penser entre les langues.* Albin Michel.

Withers, C. W. J. (2000). Authorizing landscape:«authority», naming and the Ordnance Survey's mapping of the Scottish Highlands in the nineteenth century. *Journal of Historical Geography, 26(4)*, 532–554.

Zeini, N. T., Abdel-Hamid, A. M., Soliman, A. S., & Okasha, A. E. (2018). An exploratory study of place-names in Sinai Peninsula, Egypt: a spatial approach. *Annals of GIS, 24(3)*, 177–194.

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.

Zhu, Z., Zhang, H., Zhao, J., Guo, X., Zhang, Z., Ding, Y., & Xiong, T. (2018). Using Toponyms to Analyze the Endangered Manchu Language in Northeast China. *Sustainability, 10(2)*, 563.

Zinkin, V. (1969). The syntax of place-names. *Names, 17(3)*, 181–198.

Zipf, G. K. (1935). *The psycho-biology of language.* Oxford: Houghton, Mifflin.

Zurich statistics, (2013) : https://www.stadt-zuerich.ch/prd/de/index/statistik/publikationen-angebote/publikationen/Taschenstatistik/TAS_2013en.html [Accessed 17.03.2020]

PUBLICATIONS

Acheson, E., **Villette, J**., Volpi, M., & Purves, R. S. (2017). Gazetteer matching for natural features in Switzerland. Proceedings of the 11th Workshop on Geographic Information Retrieval, 11. ACM.

Villette, J., & Purves, R. S. (2018). Exploring microtoponyms through linguistic and geographic perspectives. AGILE. Lund.

Villette, J., & Purves, R. S. (2020). From Microtoponyms to Landscape Using Semantics, Location, and Topography: The Case of Wald, Holz, Riet, and Moos in St. Gallen, Switzerland. The Professional Geographer, 72(1), 109–120.

Van Putten S., O'Meara C., Wartmann F., Yager J., **Villette J**., Mazzuca C., Bieling C., Burenhult N., Purves R., Majid A. (2020) Conceptualisations of landscape differ across European languages. *Plos one, vol. 15, no 10,* https://doi.org/10.1371/journal.pone.0239858