Cartography M.Sc.

GIS-Based Analysis and Visualisation of Indigenous-Derived Toponyms

Applied to Toponyms in Mexico

Nele Peschel

September 27, 2022

Research Identification

Toponymy research has been:

- Interdisciplinary
  (e.g., Fuchs, 2015; Lefebvre & Paredes Martínez, 2017; Tent, 2017)
- Mostly qualitative
  (Tent, 2015)

Research gap:

- GIS-based extensive research of *"Indigenous-derived"* toponyms (Blair & Tent, 2021)

Research Identification

Overall research objective:

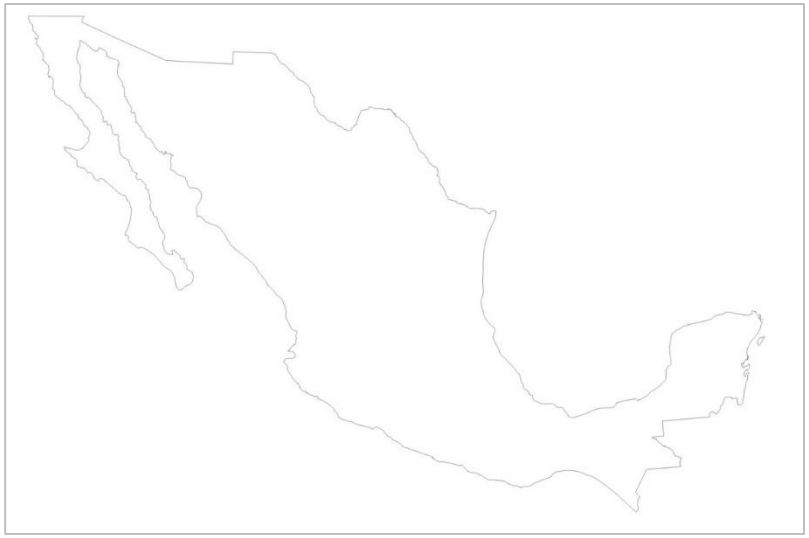
- Classification of toponymic dataset
- Application of GIS-based analysis and visualisation

ROs and RQs 1-4:

- Methodology and application
- Results and discussion

Research Preparation

language	morpheme group name	morphemes/ allomorphs + position	generic meaning	reference	associated feature type	environmental variable
nahuatl	tepetl	-tepetl	**-tepetl = mountain, mountain range, hill** (translated from monte, sierra, cerro in Spanish)	Lefebvre & Paredes Martínez (2017, p. 409)	orographic features	elevation
		-tepec	-c = locative suffix			
		-tepeque	-que = locative suffix			
...						



Lieber (2009)

Research Preparation

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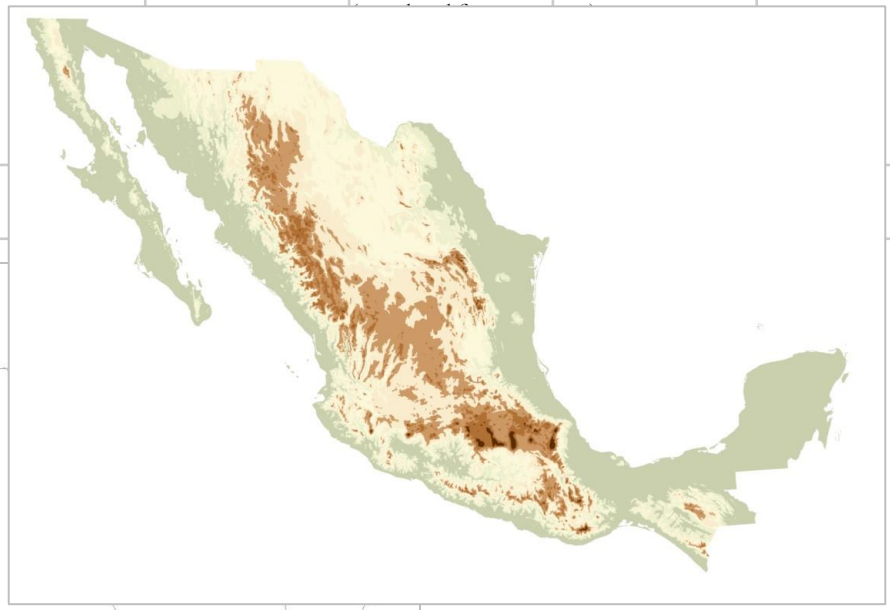

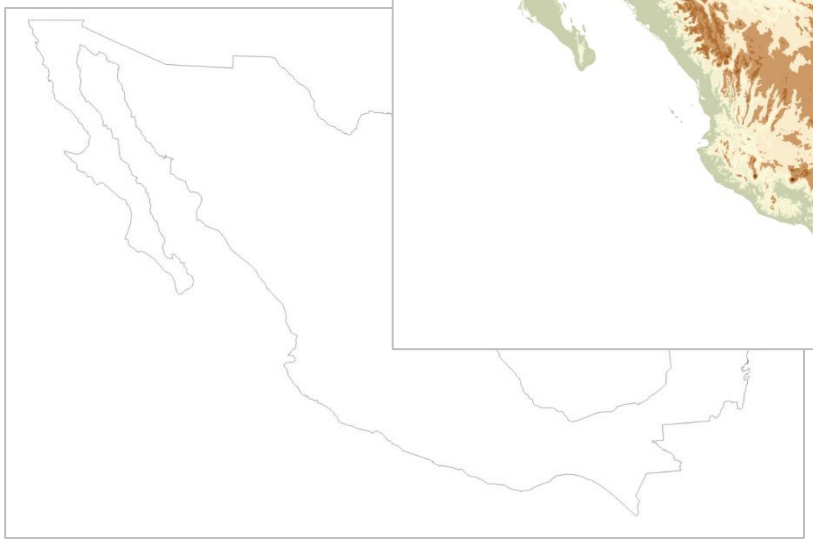

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Research Preparation

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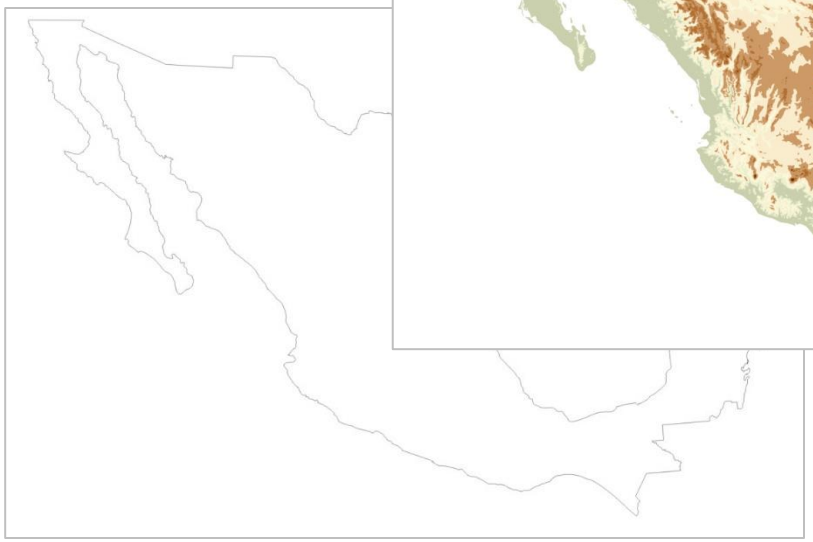

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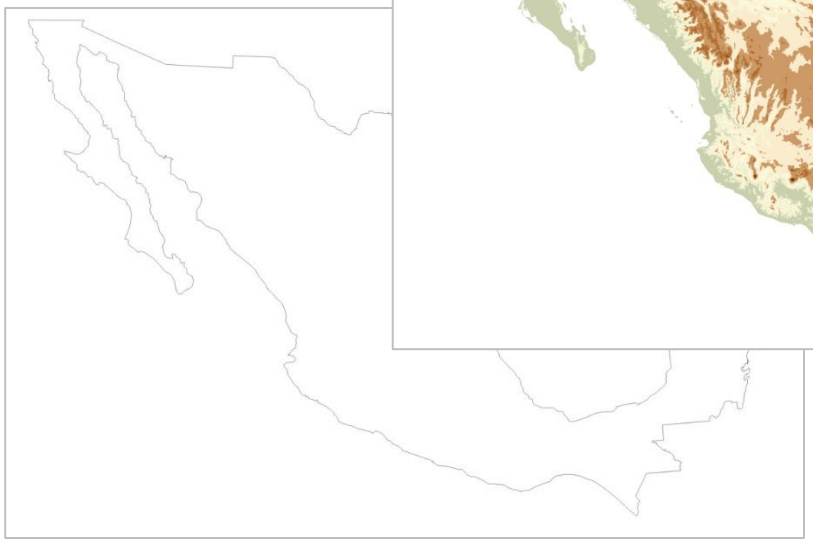


Lieber (2009)

RO1 – Development of a Toponymic Classification System

RQ1. *How can toponymic data be classified for GIS-based analysis and visualisation by linguistic origin, generic meaning, and geographical feature type?*

RO1 – Methodology and Application

- Morphemes to identify linguistic origin
- Generic meaning of morphemes to aggregate feature types

→ Querying database and value assignment

RO1 – Results and Discussion

lat	long	versionI	versionII	versionIII
19.557055	-97.426495	CERROCHICHILTEPEC	Cerro Chichiltepec	CHICHILTEPECCERRO

morphemeI	morphemeII	langI	langII	ft
chichil	tepetl	nahuatl	nahuatl	orographic

→ useful for large datasets and extensive toponymy research

→ morphemes might also appear in other languages

Overview Maps

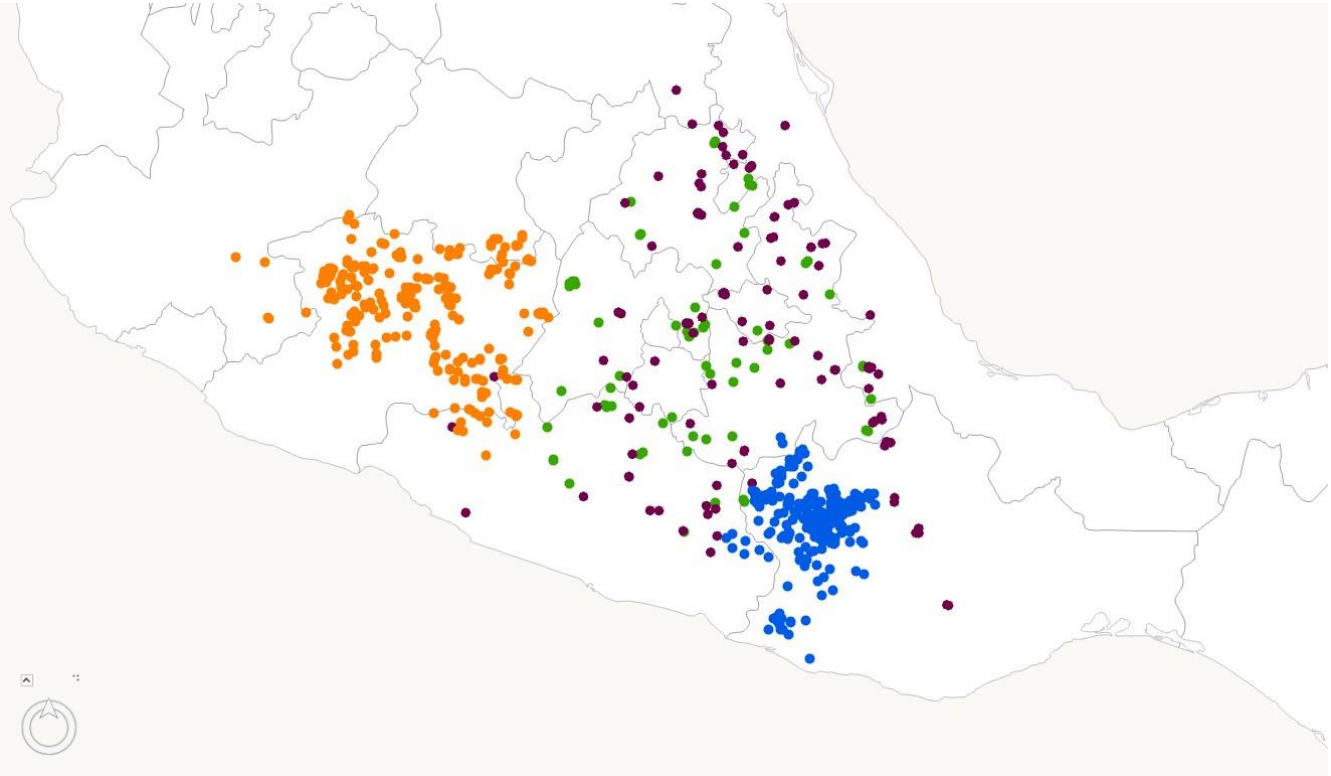
Cluster Analysis – AoI Identification

Morpheme group	a: Search distance [km]	b: Toponym count within major cluster	Ratio (a/b)	Dot color in Figure 54
yucu	50	332	0.15	blue
cuaro	100	269	0.37	orange
chichil	120	88	1.36	green
zoqui	150	151	0.99	purple

Toponym distributions:

a/b < 0.6: dense

a/b > 0.6: dispersed



RO2 – Spatial Relationship of Toponyms and Language

RQ2. *How can the spatial relationship of the Indigenous language spoken in a region with the toponyms deriving from this language be analysed?*

a) *Can the suggested methodology be used to indicate a change of language use in a region?*

RO2 – Methodology and Application

- Georeferencing a Historical Map

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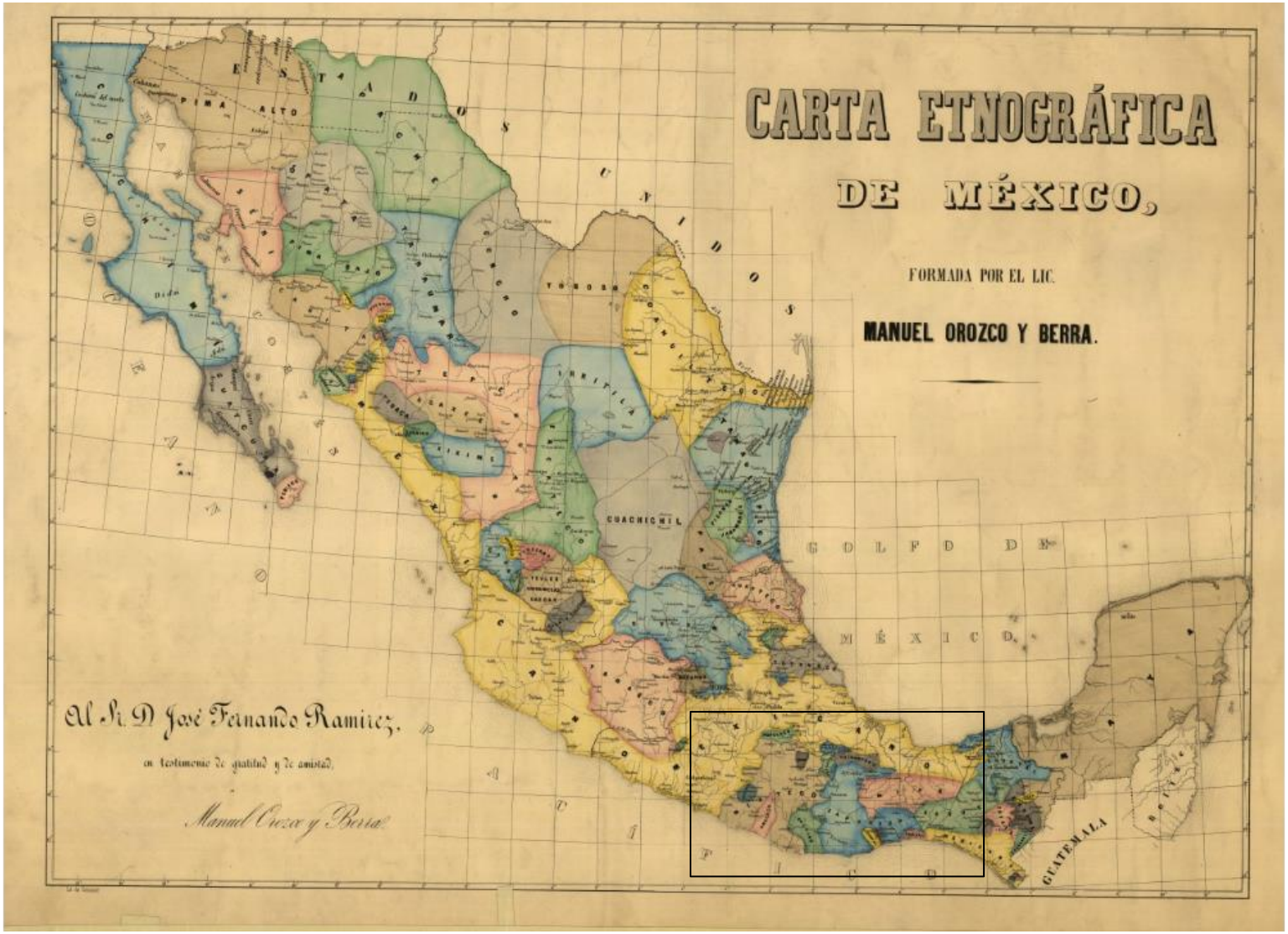

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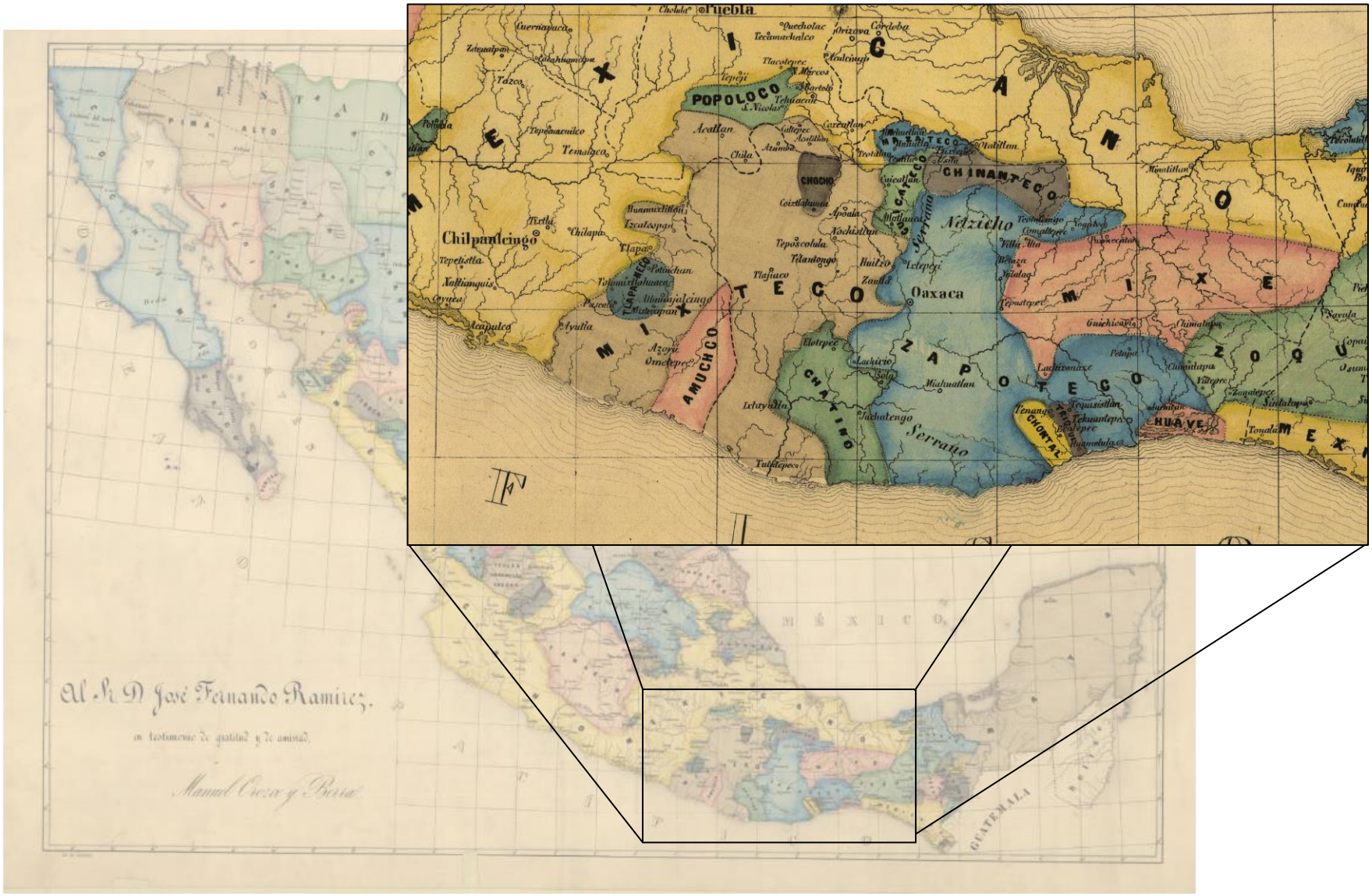

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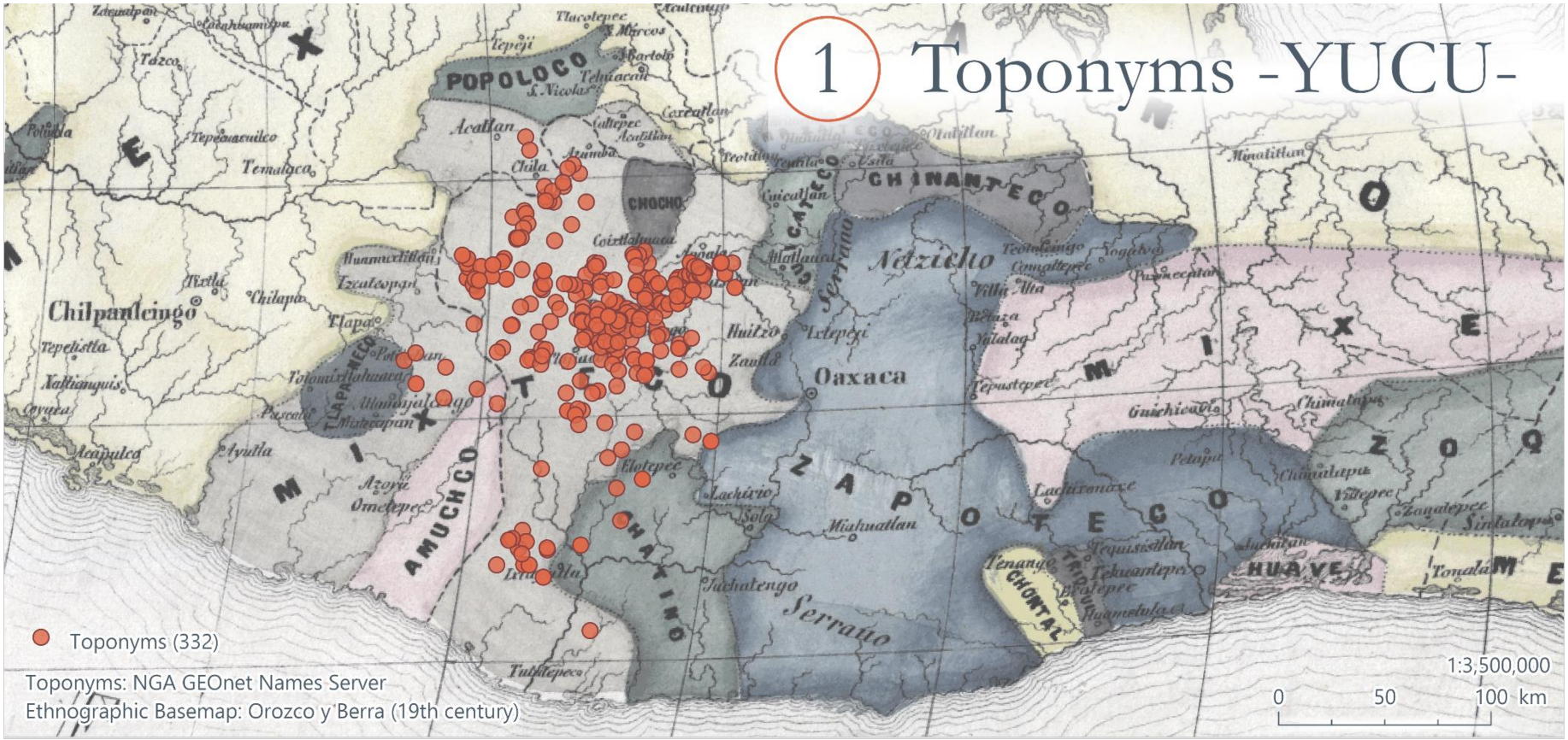

RO2 – Methodology and Application

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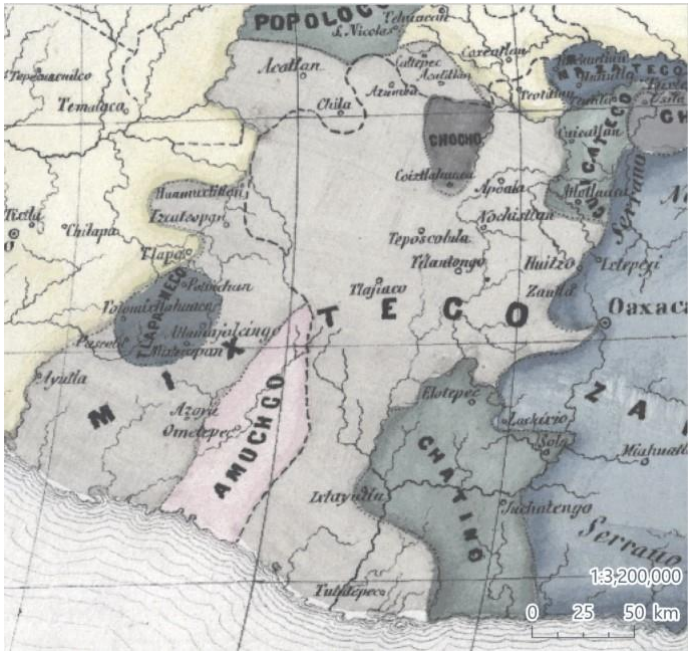
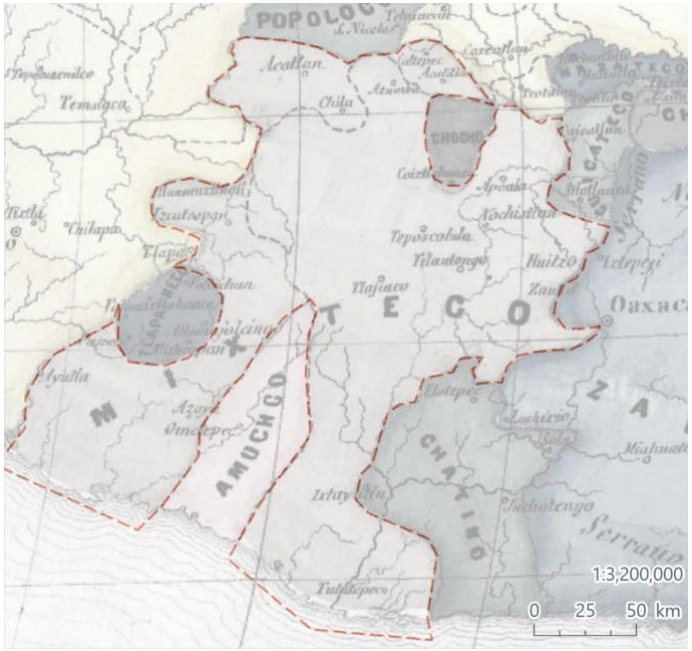


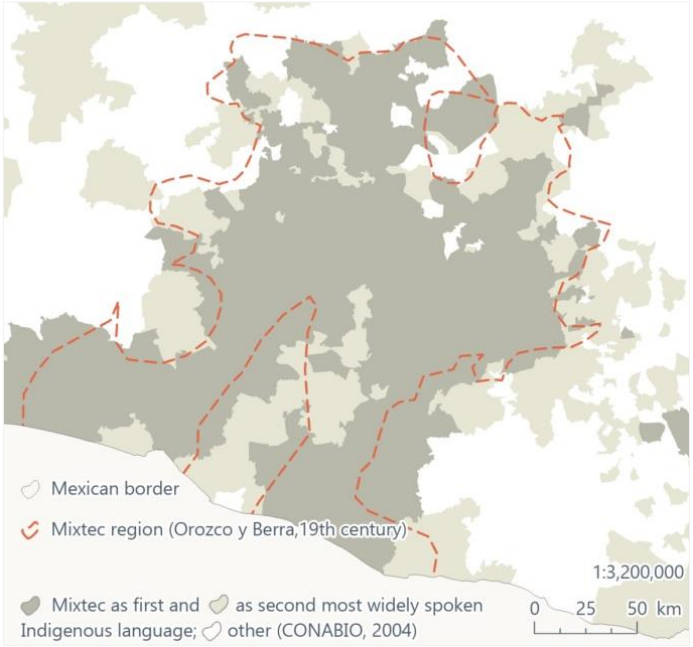
RO2 – Methodology and Application

- Georeferencing a Historical Map
- Digitizing historical language distribution



RO2 – Methodology and Application

- Georeferencing a Historical Map
- Digitizing historical language distribution
- Visualising language distribution – historical and current



RO2 – Methodology and Application

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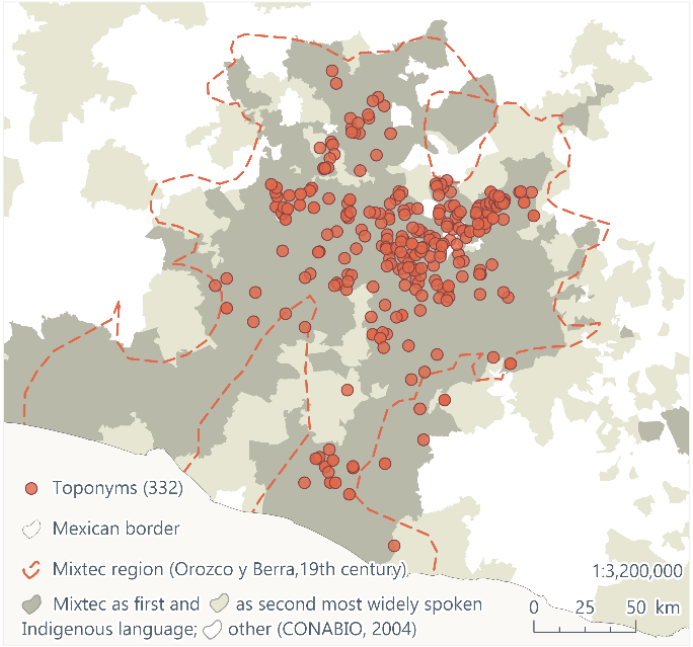
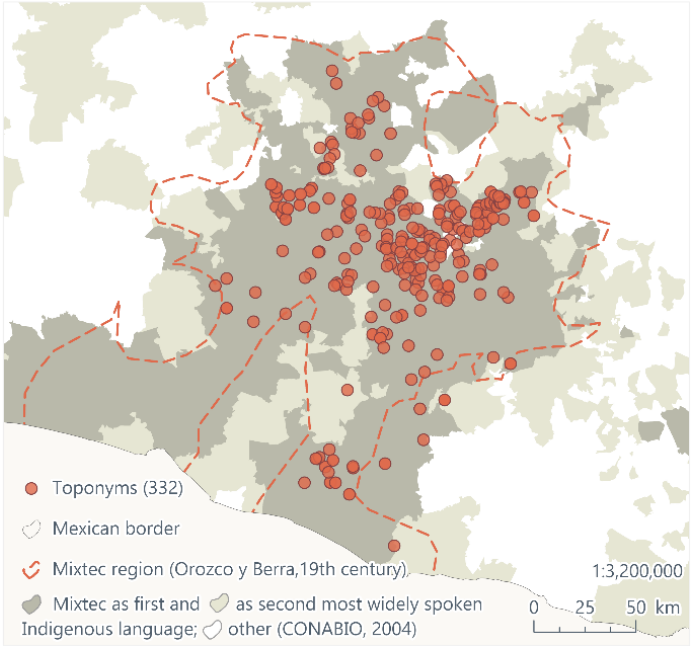
- Visualising language distribution – historical and current
- Visualising toponymic distribution



RO2 – Methodology and Application

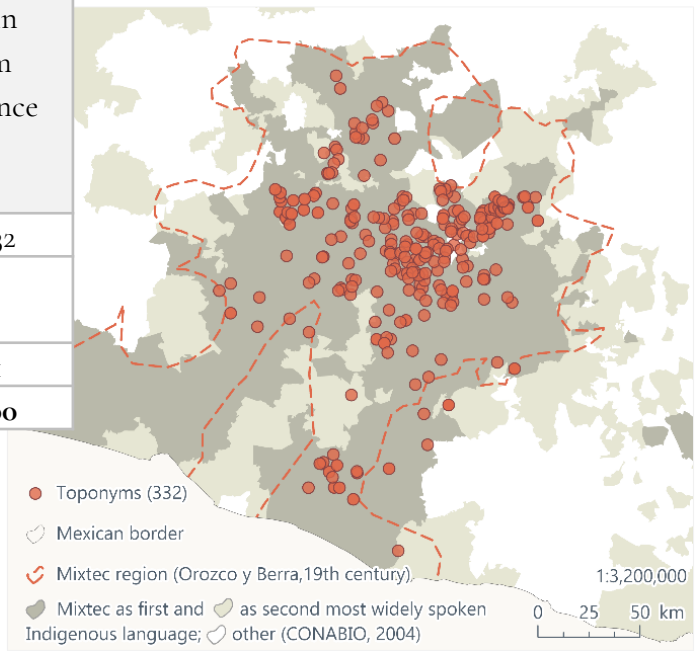
- Georeferencing a Historical Map
- Digitizing historical language distribution
- Visualising language distribution – historical and current
- Visualising toponymic distribution
- Calculating intersections with / distances to



RO2 – Methodology and Application

- Calculating intersections with / distances to

	Language layer				
Toponym subset: yucu – AoI 1	**Historical**		**Present-day**		
	Inside	Within 10-km distance	Inside 1st most widely spoken Indigenous language border	Inside 2nd most widely spoken Indigenous language border	1st + 2nd + within 10-km distance
a: Toponym count	317	327	313	10	332
b: Total toponym count	332				
Ratio (a/b)	0.95	0.98	0.94	0.03	1
Percentage [%]	**95**	**98**	**94**	**3**	**100**



RO2 – Results and Discussion

"It's an interesting visualisation since we see clearly this overlap between the toponyms and the Mixtec region – let's say – as the most widely spoken language [...]. Here it's clear that there is some relationship with the language" (E.L.T.P. Cunha)

"[the map by Orozco y Berra] is fundamental because it is one of the oldest [sources] that gives an overview of languages in Mexico in the 19th century [...] it is a very good source to have a perspective at a given moment in time. It is an important base for consideration."
(C.S. Paredes Martínez)

RO2 – Results and Discussion

a) *Can the suggested methodology be used to indicate a change of language use in a region?*

→ *interdisciplinary approach necessary*

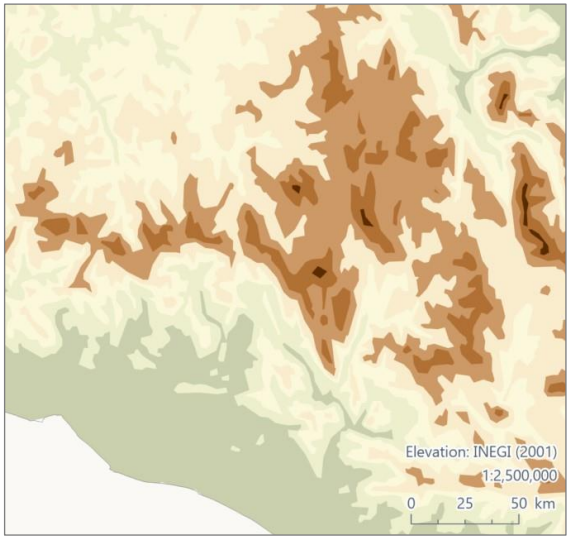
→ *future work*

RO3 – Spatial Relationship of Toponyms and Environment

RQ3. *How can the spatial relationship of the generic meaning of a toponym with its geographic environment be analysed?*

RO3 – Methodology and Application

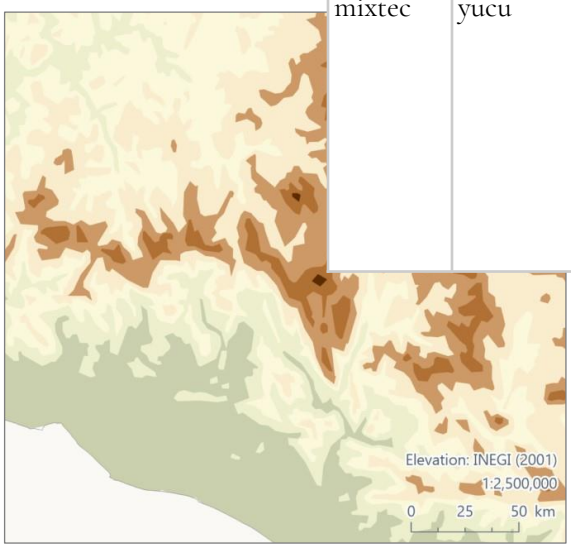
- Visualising environmental variable



RO3 – Methodology and Application

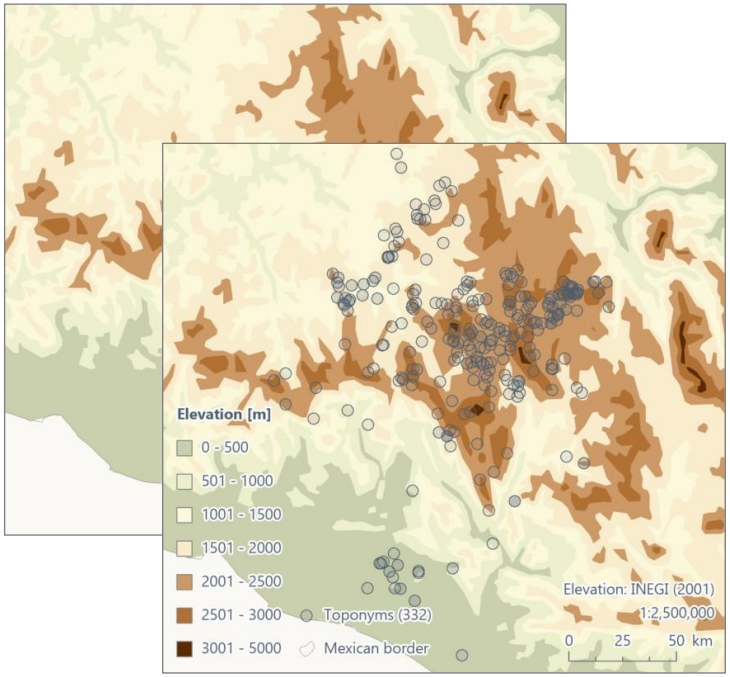
- Visualising environmental variable

language	morpheme group name	morphemes/ allomorphs + position	generic meaning	reference	associated feature type	environmental variable
mixtec	yucu	-yucu-	**yucu = hill, mount, heap, mountain range**, weed that spreads and throws leaves (translated from cerro, monte, montón, sierra, "yerba que se extiende y echa hojas" in Spanish)	Alvarado (1962), as cited in Lefebvre & Paredes Martínez (2017, p.450-451)	mountain, hill, ridge	elevation



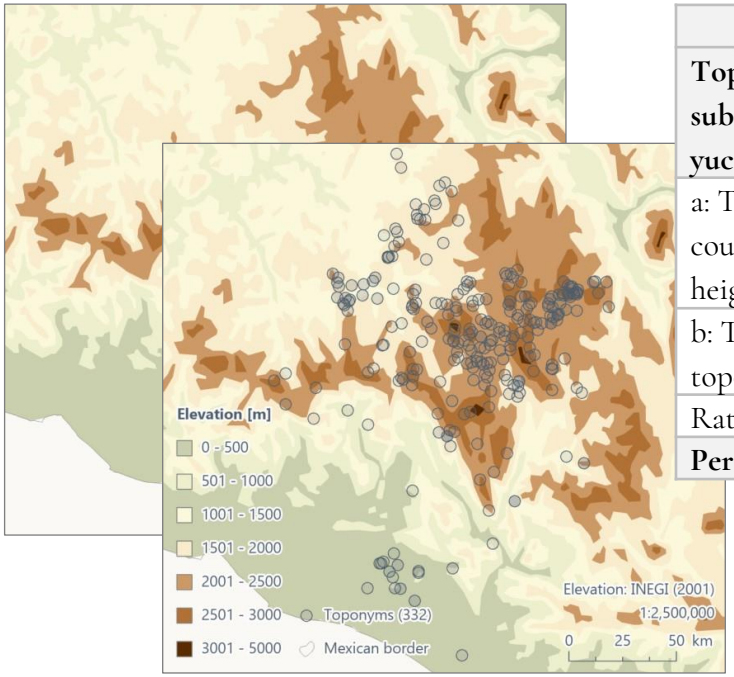
RO3 – Methodology and Application

- Visualising environmental variable
- Visualising toponymic distribution



RO3 – Methodology and Application

- Visualising environmental variable
- Visualising toponymic distribution
- Calculating intersections with height zones



	Environmental layer						
Toponym subset: yucu – AoI 1	**Elevation/height zone [m]**						
	≤ 500	501 – 1,000	1,001 – 1,500	1,501 – 2,000	2,001 – 2,500	2,501 – 3,000	≥ 3,001
a: Toponym count within height zone	17	9	19	86	141	59	1
b: Total toponym count	332						
Ratio (a/b)	0.051	0.027	0.057	0.259	0.425	0.178	0.003
Percentage [%]	**5.1**	**2.7**	**5.7**	**25.9**	**42.5**	**17.8**	**0.3**

RO3– Results and Discussion

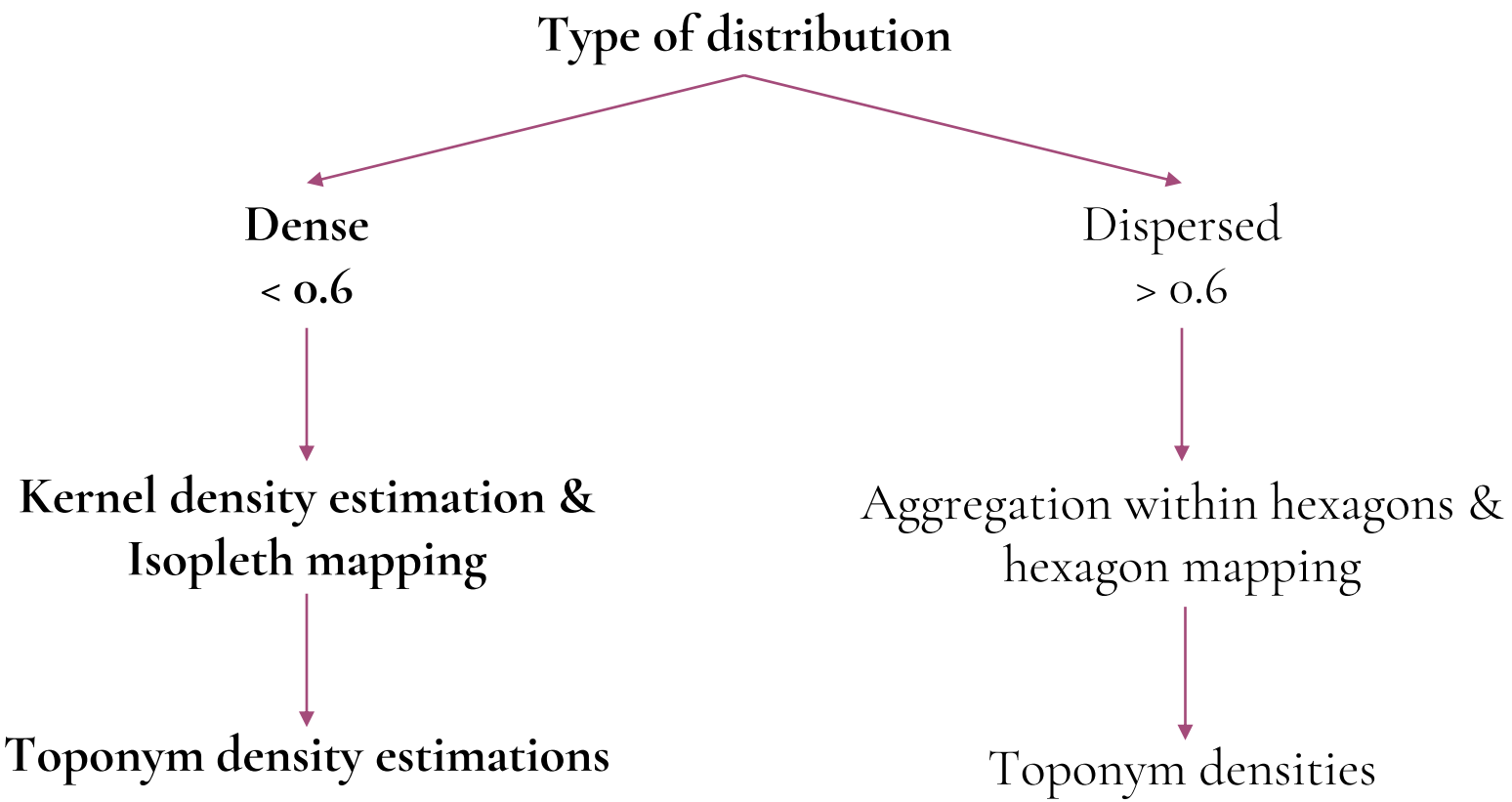
"when we make this cross comparation between the toponyms and other features in the environment, we gain a lot of information that otherwise [is] hidden when we only see the toponyms without this environmental context" (E.L.T.P. Cunha)

"these comparisons [of toponyms, generic meaning, and geographic environment] are relevant and carrying the toponymic analysis to cartography, I believe that what you are doing is an important step" (C.S. Paredes Martínez)

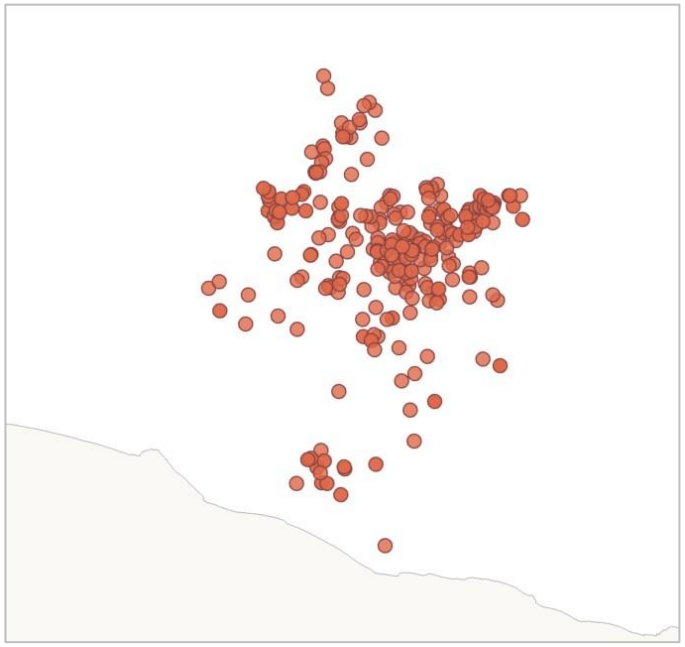
RO4 – Toponymic Distributions Differentiated by Feature Type

RQ4 *How can distributions of toponyms of different feature type groups be analysed and compared in relation to the overall toponym subset?*

RO4 – Methodology and Application

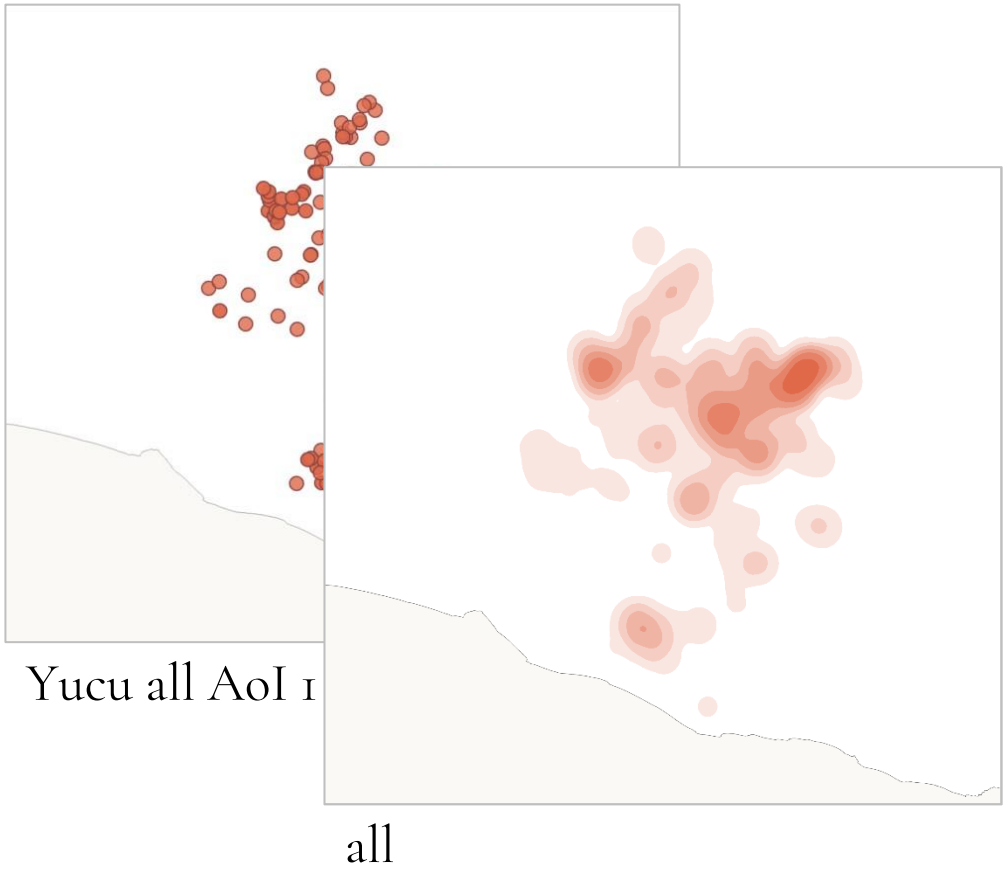


RO4 – Methodology and Application



Yucu all AoI 1

RO4 – Methodology and Application



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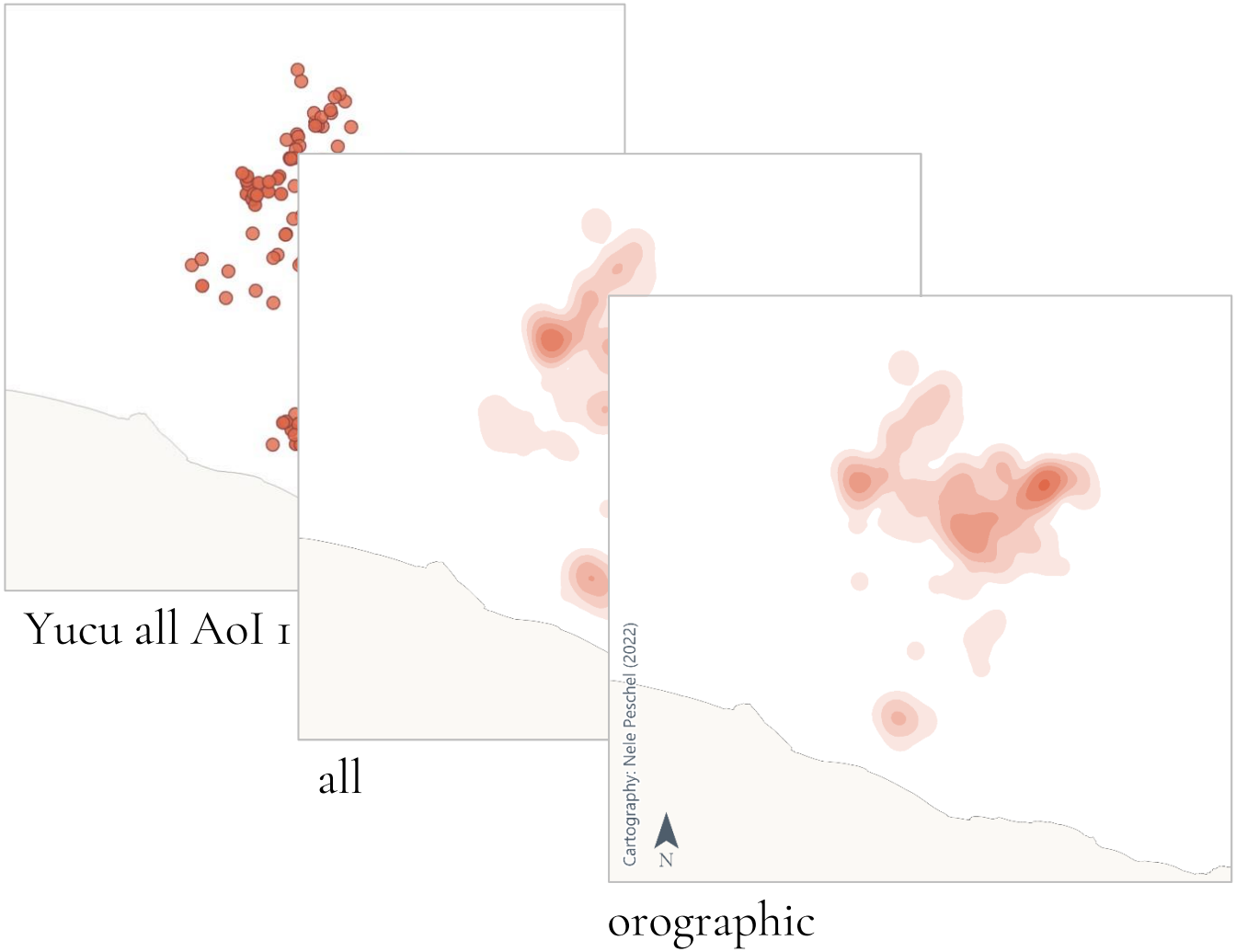

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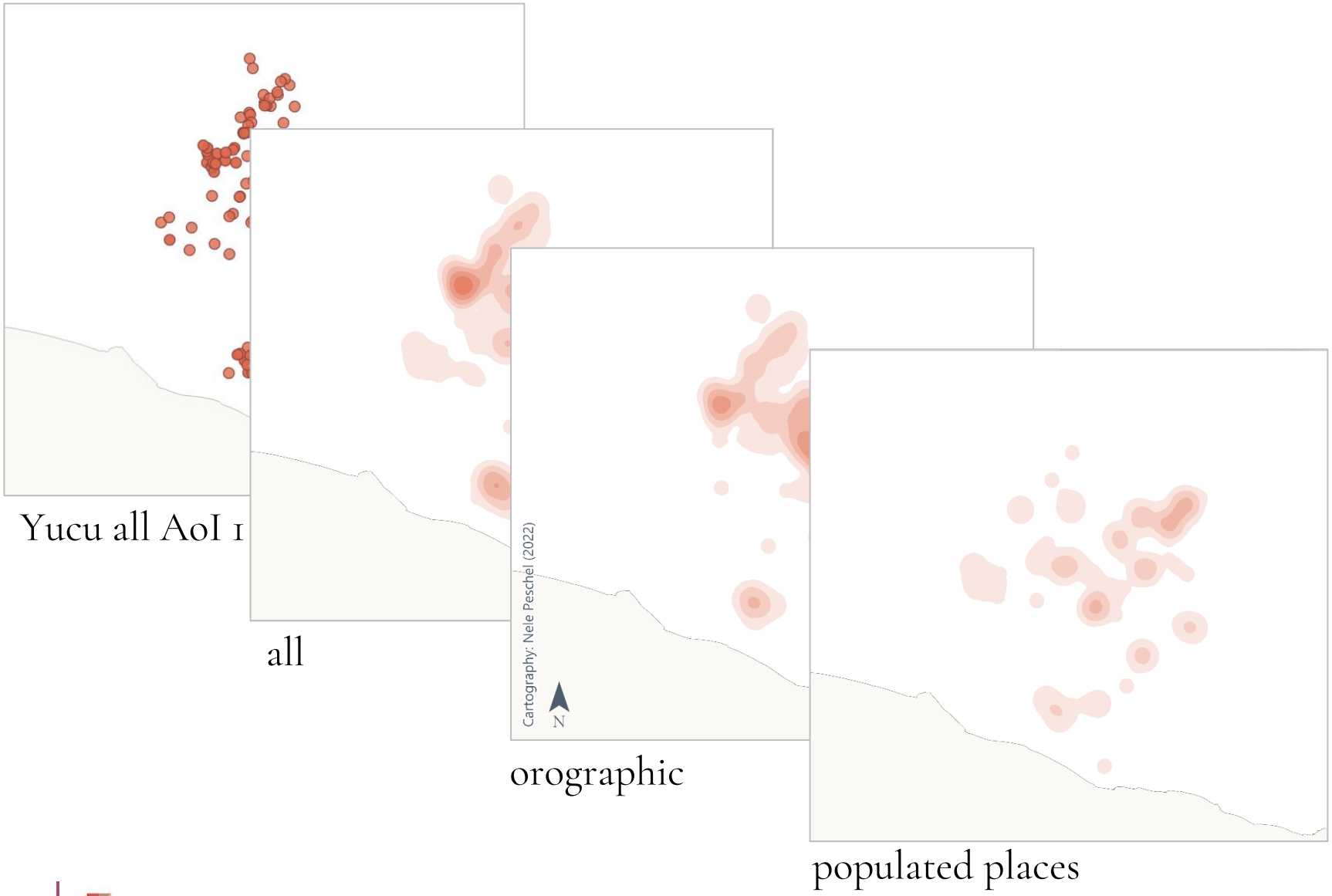

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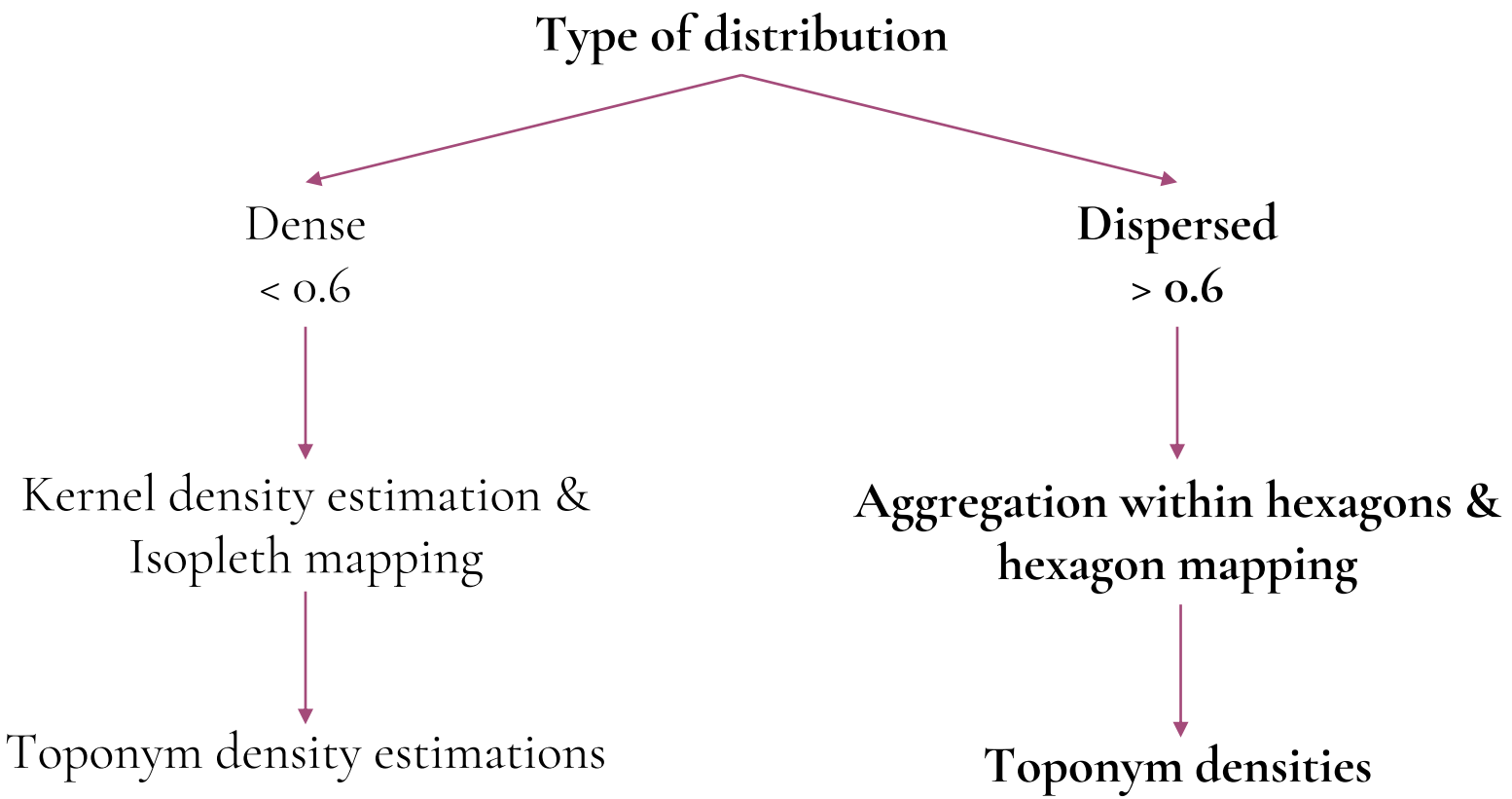

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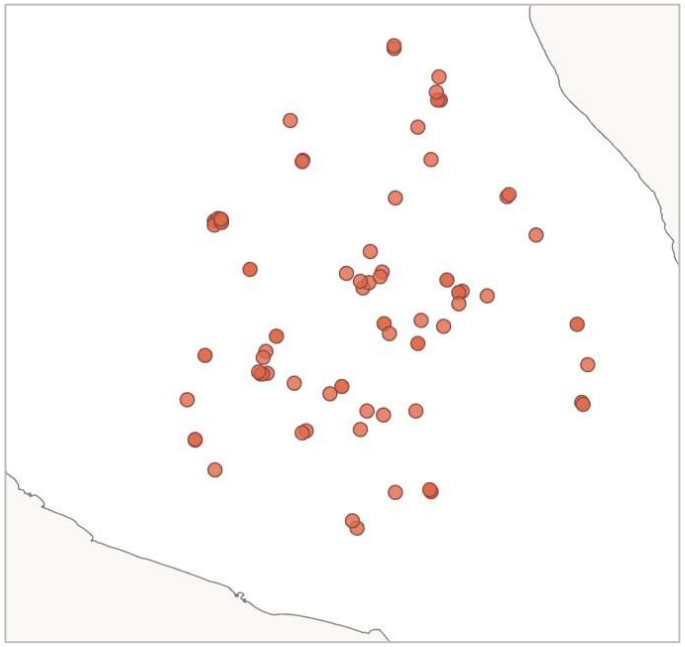
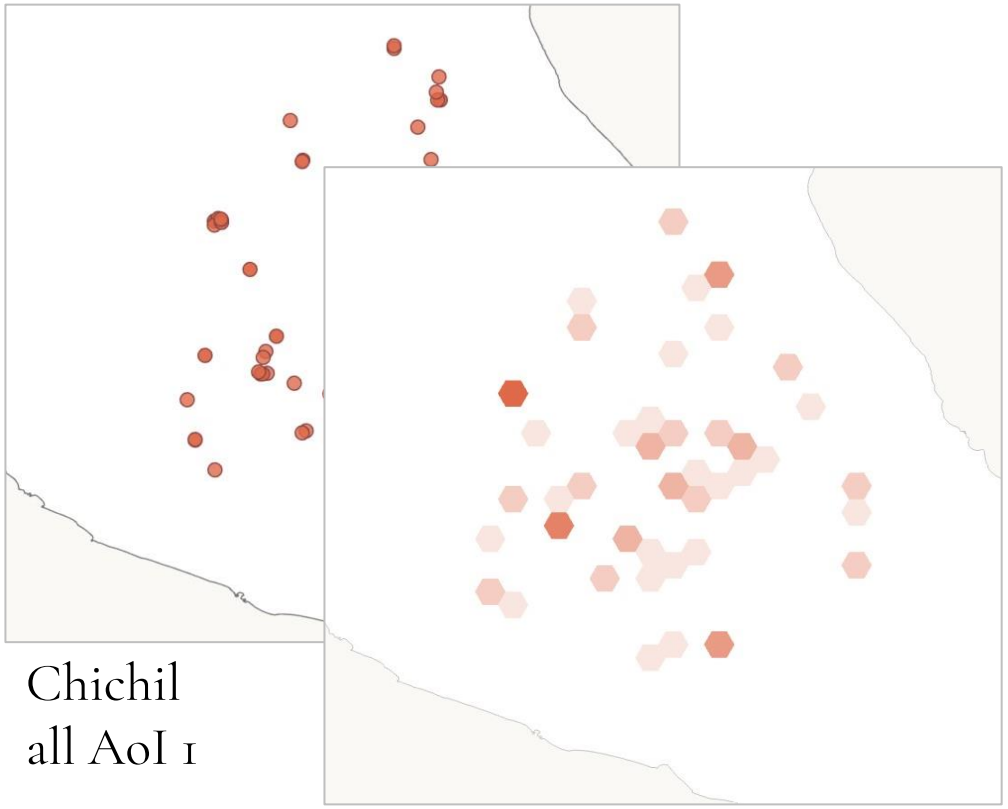


Chichil
all AoI 1

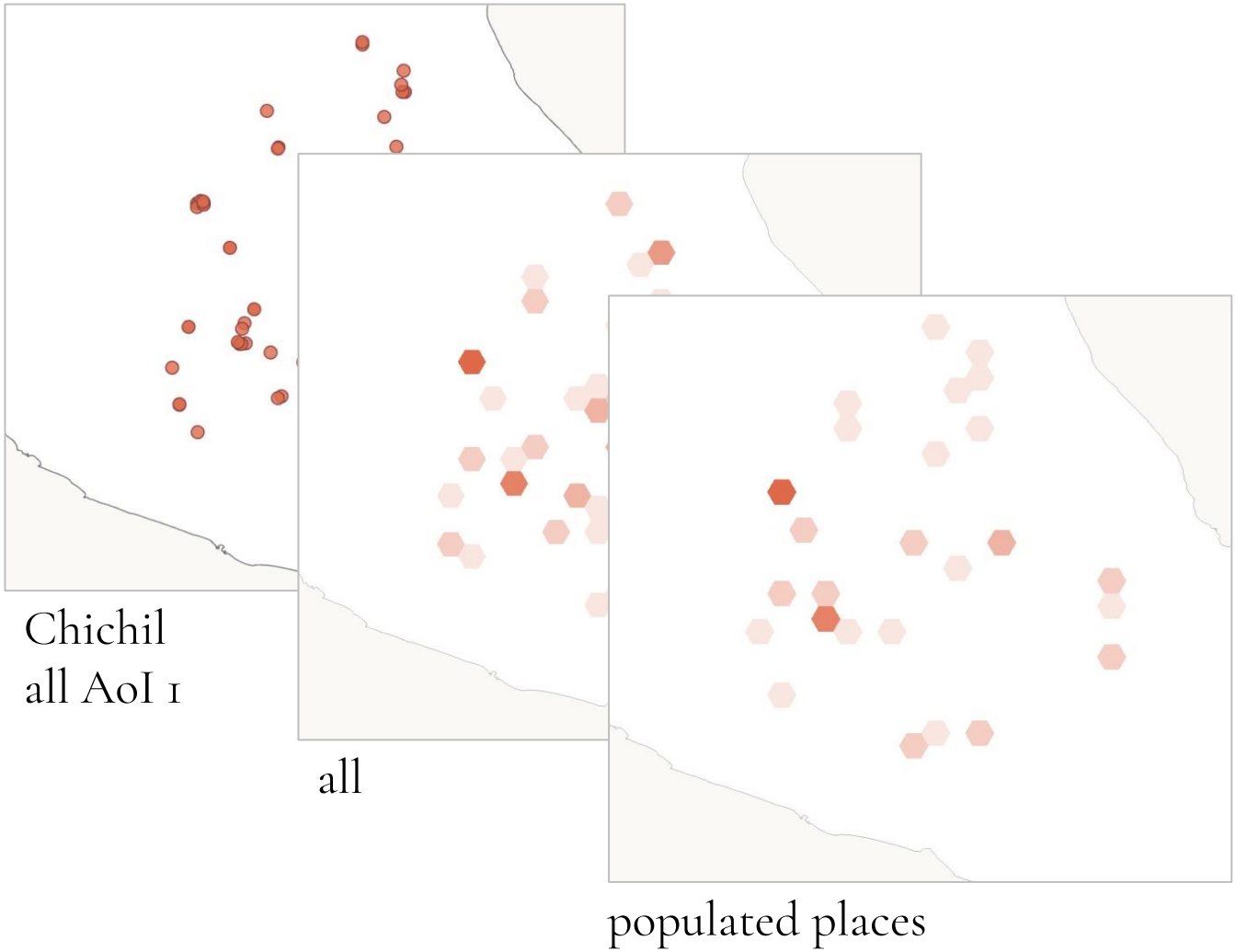
RO4 – Methodology and Application



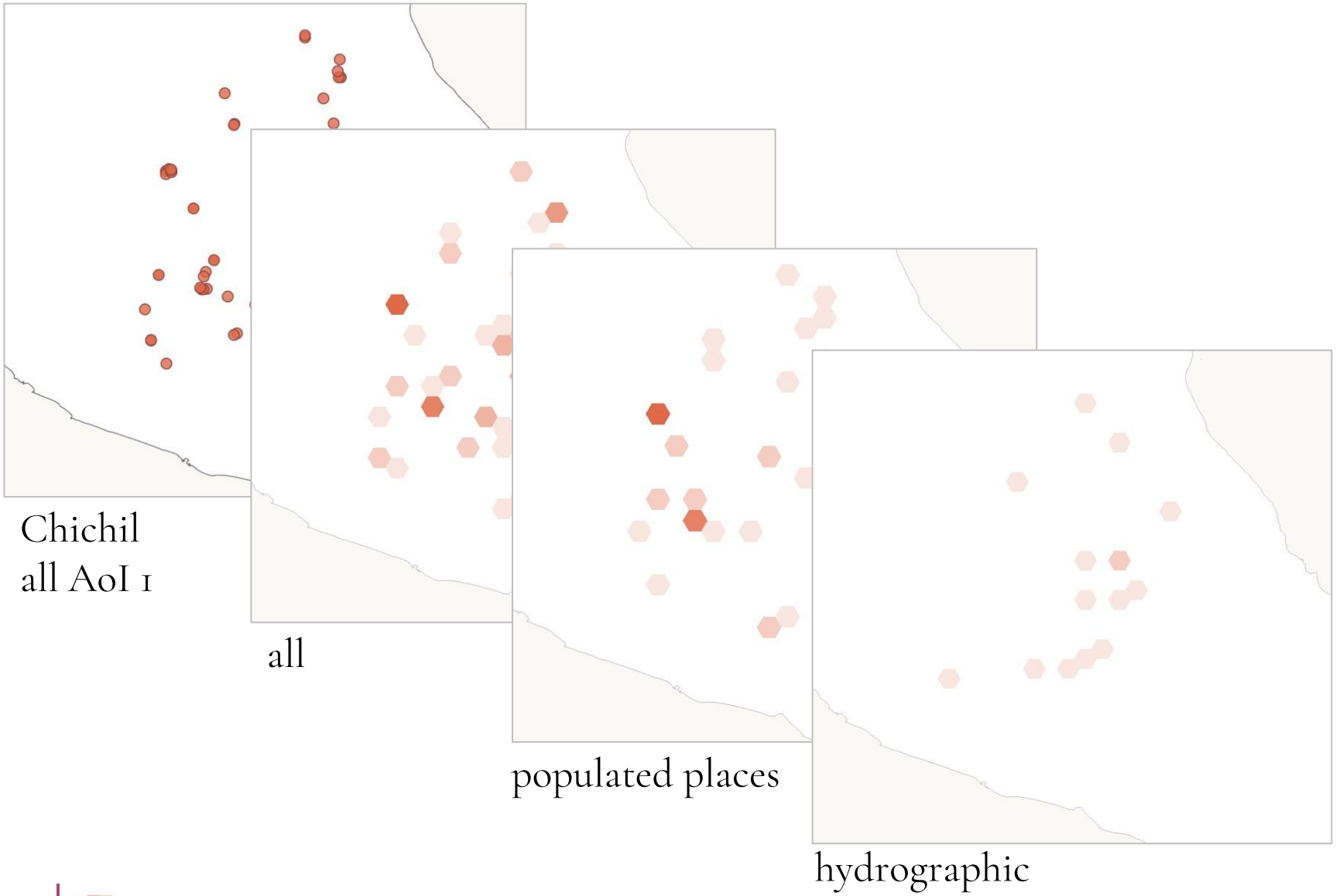
Chichil
all AoI 1

all

RO4 – Methodology and Application



RO4 – Methodology and Application

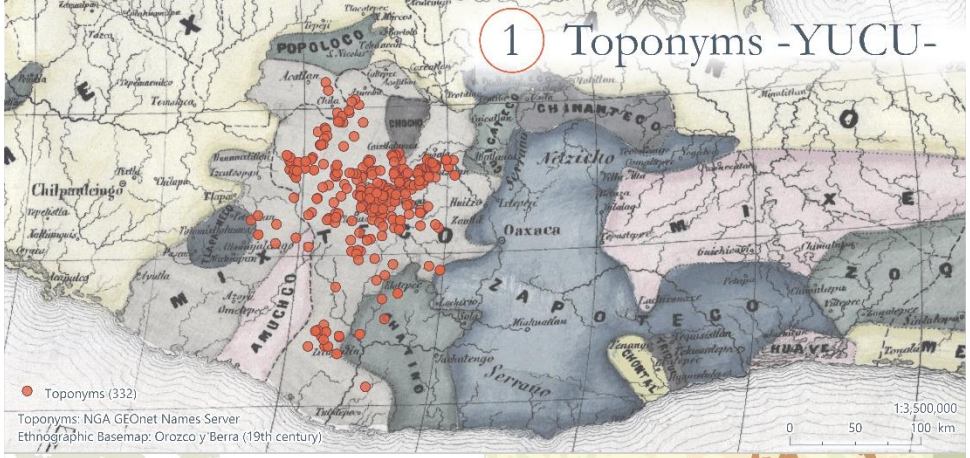


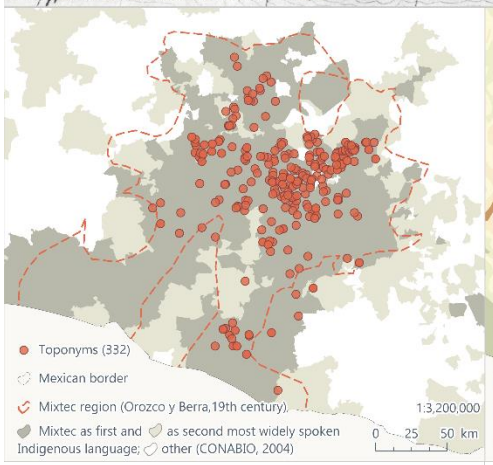
RO4 – Results and Discussion

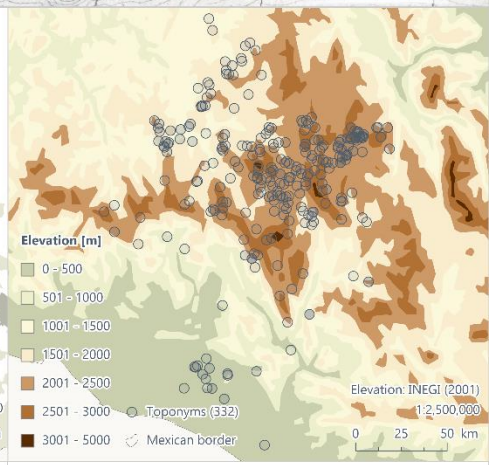
"it is interesting to compare the density of toponyms with different characteristics [...]" (E.L.T.P. Cunha)

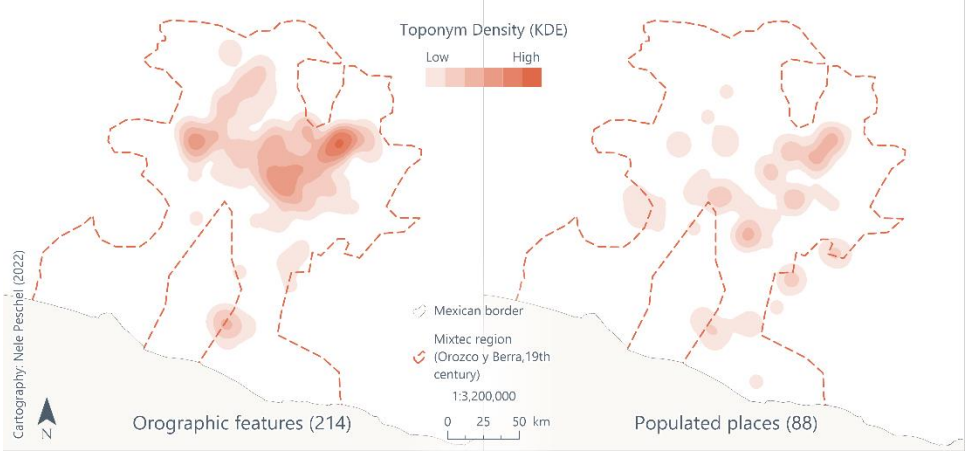
"we don't see these [high densities] in the orographic features [...] this region is more relevant for the populated places than for the orographic feature toponyms" (E.L.T.P. Cunha)

Map Sheets

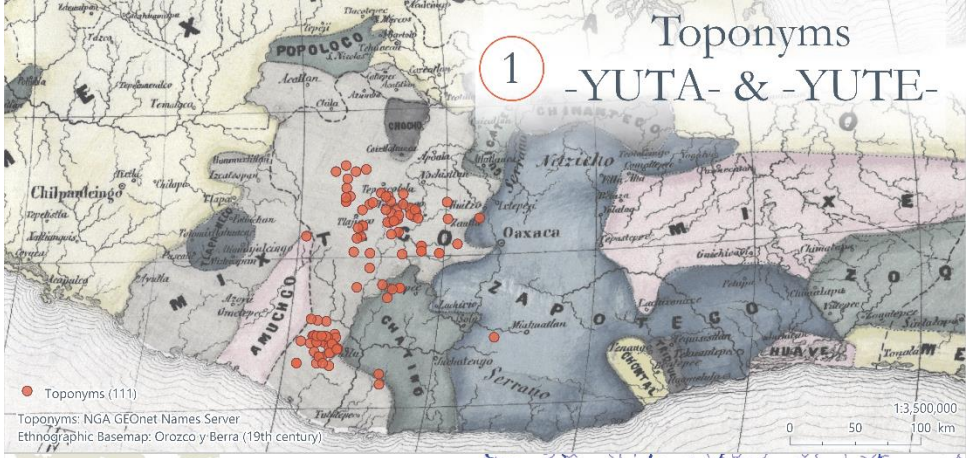

1 Toponyms -YUCU-
Toponyms (332)
Toponyms: NGA GEOnet Names Server
Ethnographic Basemap: Orozco y Berra (19th century)
1:3,500,000
0 50 100 km

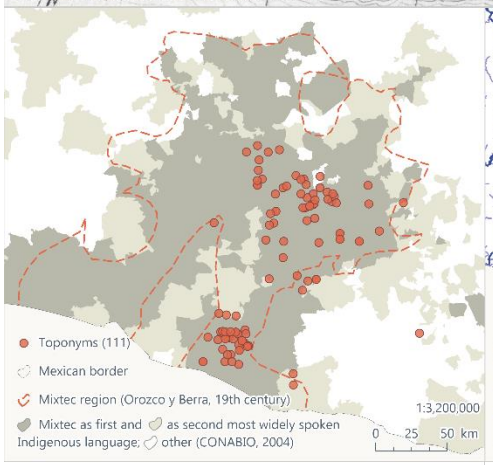

Toponyms (332)
Mexican border
Mixtec region (Orozco y Berra,19th century)
Mixtec as first and as second most widely spoken Indigenous language; other (CONABIO, 2004)
1:3,200,000
0 25 50 km


Elevation [m]
0 - 500
501 - 1000
1001 - 1500
1501 - 2000
2001 - 2500
2501 - 3000
3001 - 5000
Toponyms (332)
Mexican border
Elevation: INEGI (2001)
1:2,500,000
0 25 50 km


Toponym Density (KDE)
Low
High
Mexican border
Mixtec region (Orozco y Berra,19th century)
1:3,200,000
0 25 50 km
Cartography: Nele Peschel (2022)
N
Orographic features (214)
Populated places (88)

Map Sheets


1
Toponyms
-YUTA- & -YUTE-
Toponyms (111)
Toponyms: NGA GEOnet Names Server
Ethnographic Basemap: Orozco y Berra (19th century)
1:3,500,000
0 50 100 km


Toponyms (111)
Mexican border
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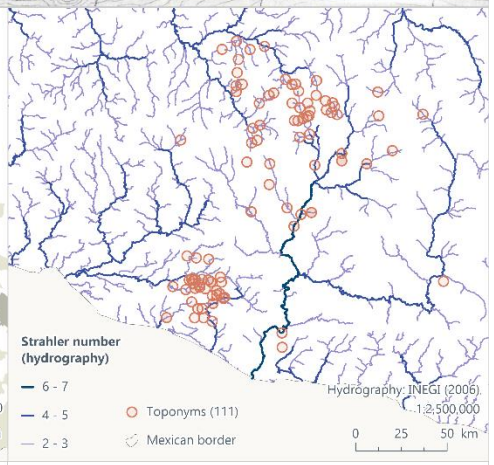
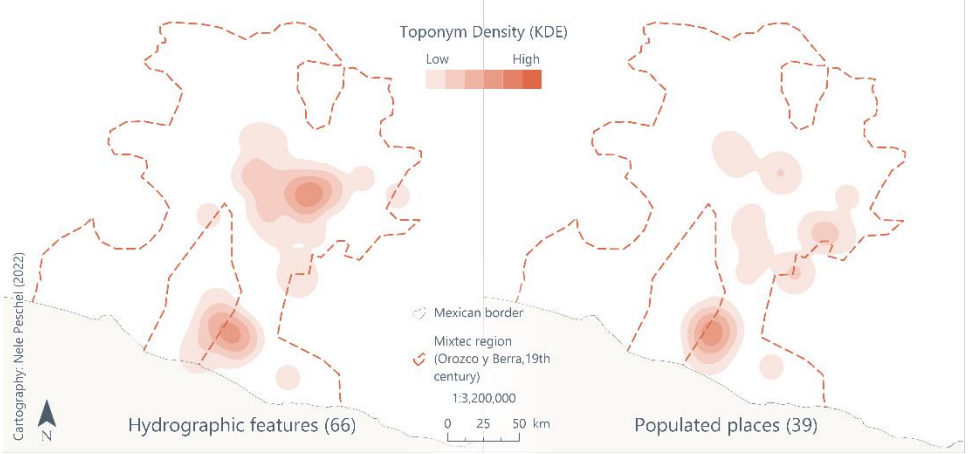
1:3,200,000
0 25 50 km


Strahler number (hydrography)
6 - 7
4 - 5
2 - 3
Toponyms (111)
Mexican border
Hydrography: INEGI (2006)
1:2,500,000
0 25 50 km


Toponym Density (KDE)
Low
High
Mexican border
Mixtec region (Orozco y Berra,19th century)
1:3,200,000
0 25 50 km
Cartography: Nele Peschel (2022)
N
Hydrographic features (66)
Populated places (39)

Future Work and Conclusion

Future Work

- Apply methodology to more selected morphemes in the study area
- Apply methodology to another study area
- Intensive toponymy research
- Including all toponyms in analysis of spatial relationships (RO_2 and RO_3)

Conclusion

- Toponymic classification system based on morphemes
- Analysis of spatial relationships of toponyms with language and environment
- Analysis of toponymic distributions differentiated by feature type group
- Overview maps and map sheets
- Expert interviews to assess results

References

- Blair, D., & Tent, J. (2021). A Revised Typology of Place-Naming. *Names*, *69*(4), 31–47. https://doi.org/10.5195/names.2021.2260
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ITC
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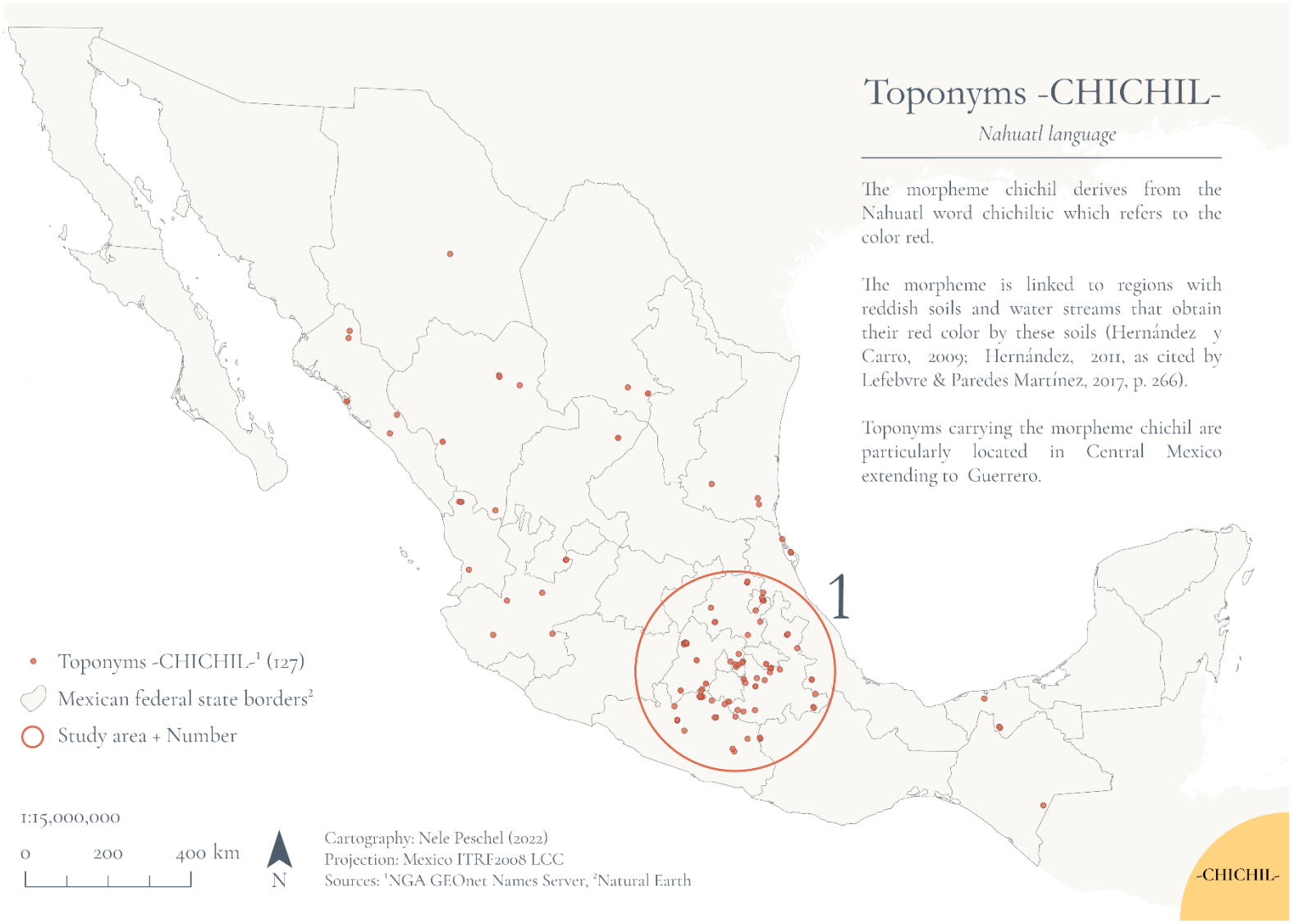
UNIVERSITÄT
DRESDEN
Technical
University
of Munich
TU
WIEN
TECHNISCHE
UNIVERSITÄT
WIEN
Vienna University of Technology

Thank you.

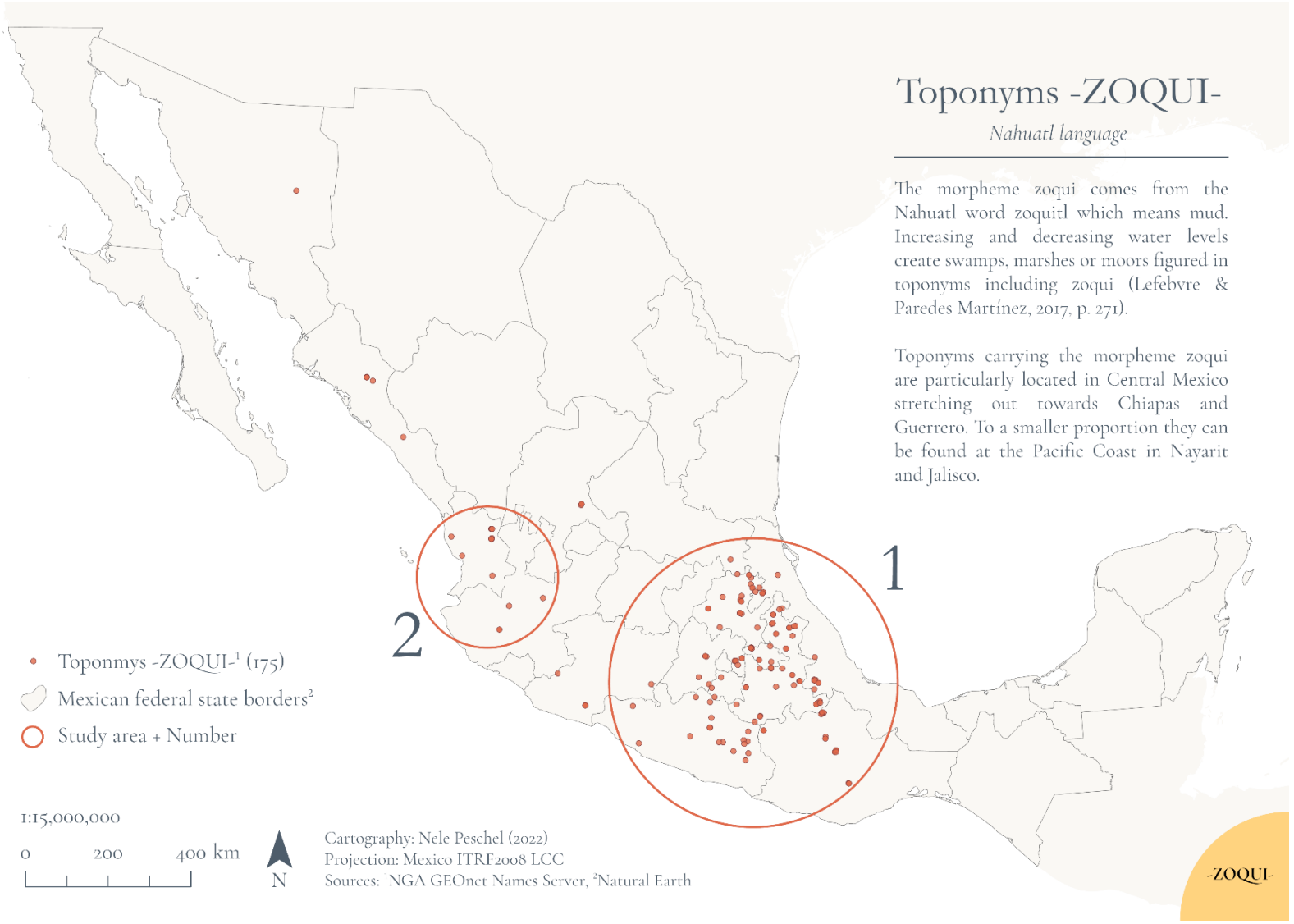
More Overview Maps

More Overview Maps

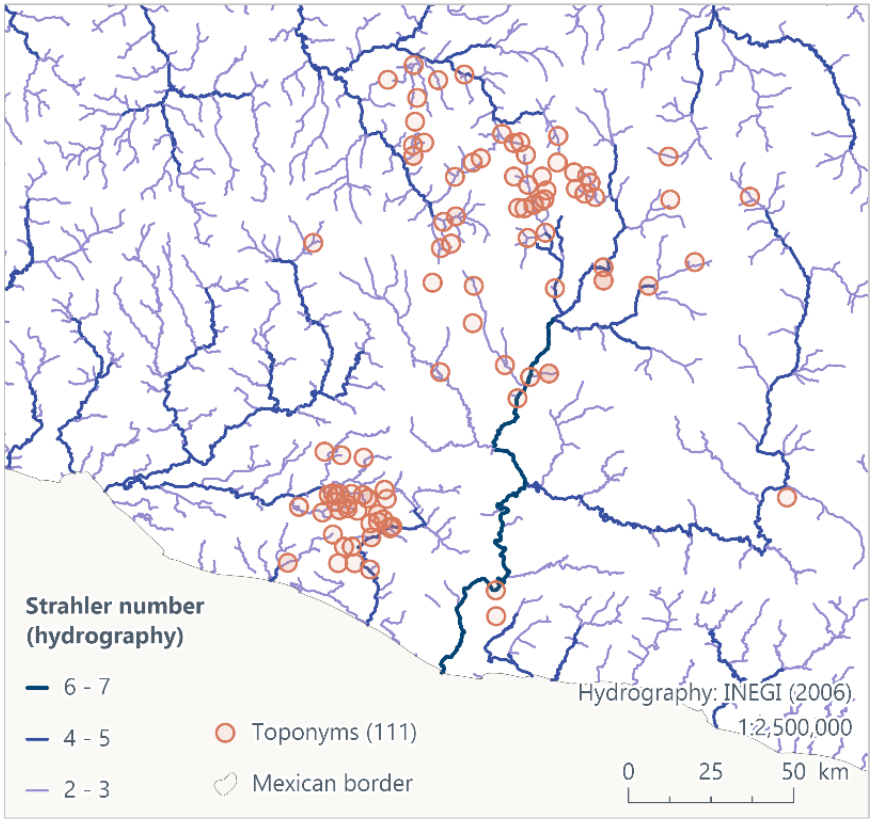
More Overview Maps



More Overview Maps



RO3 – Methodology and Application



	Environmental layer			
Toponym subset: yuta – AoI 1	**Hydrography [m]**			
	≤ 100	101 - 500	501 – 1,000	≥ 1,001
a: Toponym count, within distance	62	29	12	8
b: Total toponym count	111			
Ratio (a/b)	0.559	0.261	0.108	0.072
Percentage [%]	**55.9**	**26.1**	**10.8**	**7.2**