GIS-Based Analysis and Visualisation of Indigenous-Derived Toponyms – Applied to Toponyms in Mexico

by **NELE PESCHEL**

Toponymy is the study of geographical names. While most toponymic research has been of qualitative nature focusing on a small set of toponyms, the development of GIS has enabled toponymy research to become more extensive [1, 2]. This research suggests a system to classify a large toponymic dataset based on Indigenous-derived morphemes, their generic meanings, and feature type information. Also, it offers a GIS-based approach to analyse and visualise toponymic patterns and their relationships with language and the geographic environment. The results are presented in overview maps (Fig. 1) and map sheets (Fig. 2) sharing a joint layout.

RESEARCH QUESTIONS

This master thesis research aims to answer the following questions.

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

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

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

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

TOPONYMIC CLASSIFICATION

This research classified a toponymic dataset by linguistic origin, generic meaning, and geographical feature type (RQ1). Indigenous-derived morphemes – with a meaning referring to the environment – were used to identify the linguistic origin. The database was queried by these morphemes and toponyms were assigned to morpheme and language groups. Feature types of the original dataset were aggregated based on generic meaning and stored in a new feature type group. The classification scheme has proven useful for large toponymic datasets and for extensive toponymy research.

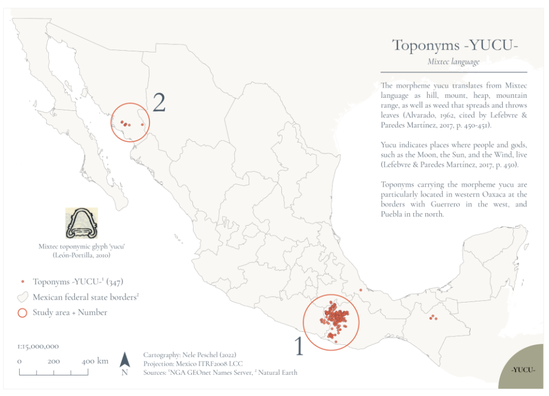

Fig.1 Overview map of all yucu toponyms

SPATIAL RELATIONSHIPS

Spatial relationships of toponyms and language distributions (RQ2), and of the toponyms' generic meanings and their environment (RQ3) were analysed. A historical ethnographic map was georeferenced and its historical language areas were digitized. Also, data on current language distributions and environmental variables, such as elevation and hydrography, was used. Relationships were visualised and quantitatively evaluated based on intersections and distances of the toponyms with or to the variables. Relationships were confirmed for toponyms of the Mixtec-derived morpheme groups *yucu* and *yuta* (Fig. 2 & Fig. 5) and the Nahuatl-derived morpheme group *chichil* (Fig. 4): toponyms of these groups were mainly located inside or within a short distance to areas of Mixtec language, and Nahuatl language, respectively. Also, toponyms carrying the morpheme *yucu,* which means mountain or hill, were mostly located within high elevation zones (Fig. 2); *yuta* toponyms (*yuta* means river) were located close to river streams (Fig. 5).

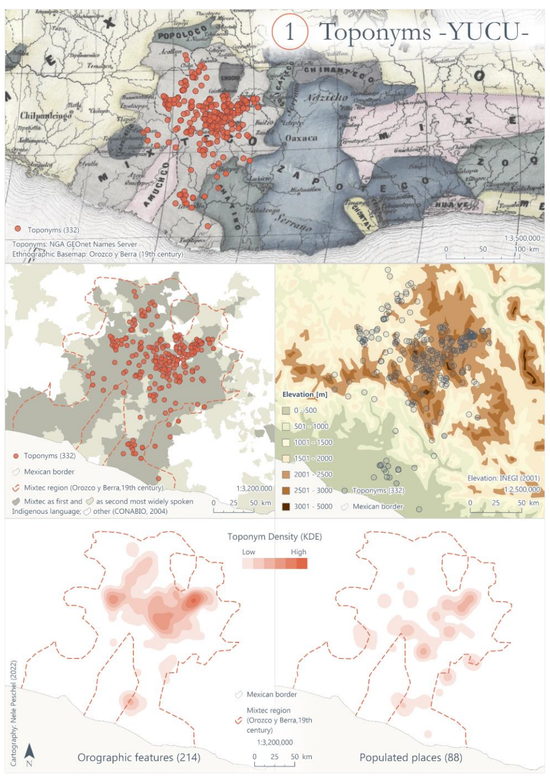

Fig.2 Map sheet of yucu toponyms within AoI 1

COMPARING TOPONYM DENSITIES

Areas of interest (AoIs) of toponym agglomerations were identified by cluster analysis. The ratio between the selected search distance and the number of toponyms within a cluster was used to differentiate between dense (<0.6) and dispersed toponym distributions (>0.6). Two approaches were developed to compare densities of the two most common feature type groups in relation to the overall density of a toponymic subset (RQ4): KDE and isopleth mapping were applied to dense distributions (Fig. 2), hexagonal mapping (toponym aggregation within hexagons) was applied to dispersed distributions (Fig. 3). In both approaches, class ranges as defined for the density of the overall subset were applied to the densities of the feature type groups.

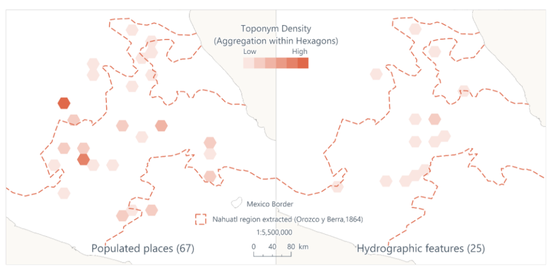

Fig.3 Hexagonal mapping of Nahuatl-derived chichil toponyms within AoI 1

CONCLUSION

This research has shown how to enrich toponymic data with information about linguistic origin, generic meaning, and feature type based on morphemes. GIS-based methods were used to analyse and visualise spatial relationships and toponymic distributions. This research opens possible directions for future research including intensive toponymy research that explains the identified patterns and relationships in the study area, the application of the methodology to other study areas, and the extension of the methodology by adding other aspects to the analysis. Interviews conducted with experts from the fields of linguistics and history as part of this research revealed: *"these comparisons [of toponyms, generic meaning, and geographic environment] are relevant and carrying the toponymic analysis to cartography […] is an important step"* (C. S. Paredes Martínez); *"I think this is something that toponym research should invest more – in visualisations and beautiful maps"* (E.L.T.P. Cunha).

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THESIS ASSESSMENT BOARD

Chair Professor: Prof. Dr. Liqiu Meng, TUM

Supervisor: Dr.-Ing. Christian Murphy, TUM

Reviewer: Priv.-Doz. Dr.rer.nat. Franz-Benjamin Mocnik (UT)

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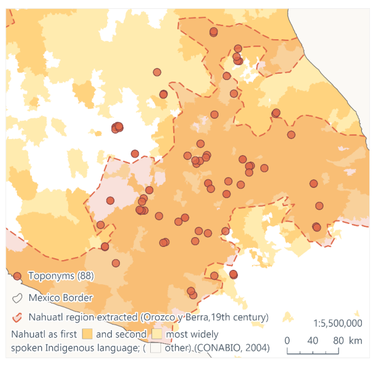

Fig.4 Nahuatl language distribution and chichil toponyms within AoI 1

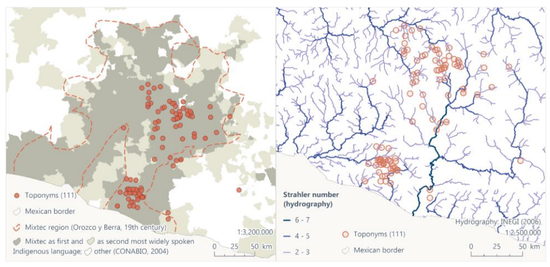

Fig.5 Mixtec language distribution (left) and hydrographic network (right) along with yuta toponyms within AoI 1

REFERENCES

[1] Fuchs, S. (2015). Toponymic GIS - Role and potential of place names in the context of geographic information systems and GIS.

[2] Tent, J. (2015). Approaches to research in toponymy. Names, 63(2), 65–74. https://doi.org/10.1179/0027773814Z.000000000103

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