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Computational methods for forming a nation-wide toponymic overview

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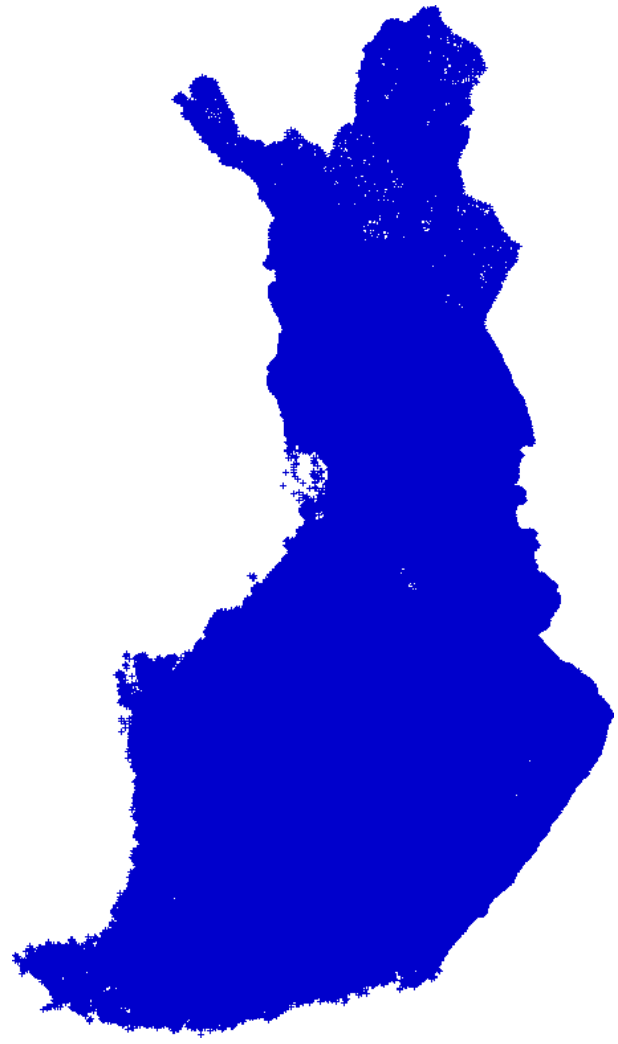
Introduction

So many names, so little time

- Lots of place names in a country
  - Finnish 1:20 000 Basic Map has
    - c. 800 000 named places
    - c. 360 000 different names
- Not feasible to study 360 000 distribution maps
- How to present the overall variation?



Introduction

What can we do?

- Data mining
  - Sub-field of computer science
  - Goal: find interesting new information in large collections of data
- Here: some examples of what can be done
  - Visualisation
  - Computational analysis
- Choice of tools depends on the data

Introduction

Languages in Finland

- Two official languages
  - Finnish (91.64 %)
  - Swedish (5.50 %)
- Five semi-official languages
  - Sámi languages (0.03 %)
    - Northern Sámi
    - Enare Sámi
    - Skolt Sámi
  - Romany
  - Finnish sign language

- Finnish, Swedish and the Sámi languages are used on maps

Introduction

Getting to know the data

- Place Name Register
  - Kept by the National Land Survey
  - Part of the map-making process

Language	Names	Places
Finnish	303 626	717 747
Swedish	48 319	74 726
Northern Sámi	4 115	4 529
Enare Sámi	3 306	3 774
Skolt Sámi	141	148
Total	359 507	800 924

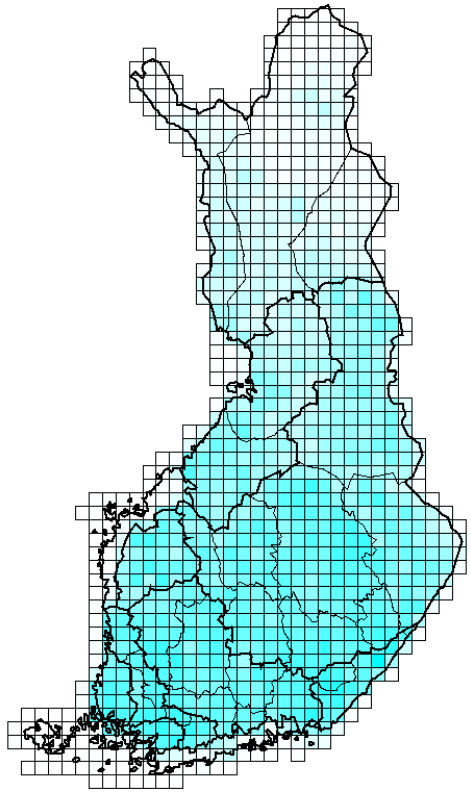
Languages in Toponyms

Visualisation

- Simple way to visualise the different languages:
  - Divide the contry into 20×20 km squares
  - Count the place names in each language in each square
  - Display these on a map
- Variation: how many % of the square's toponyms are in each of the languages?
- Computationally easy, good first step

Languages in Toponyms

Finnish



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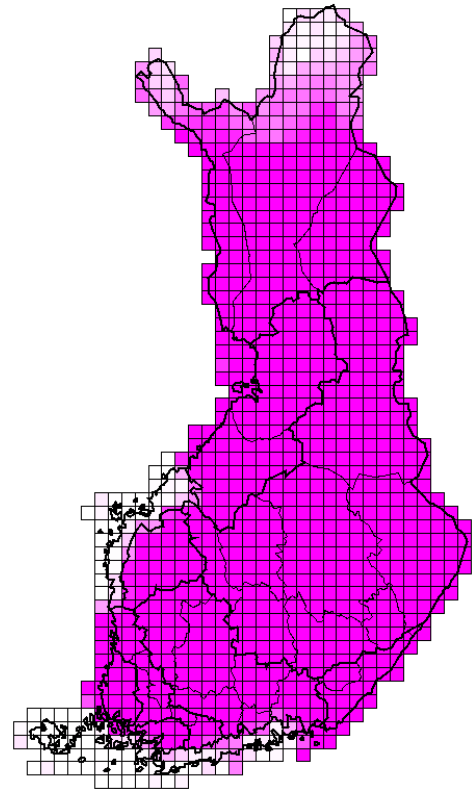

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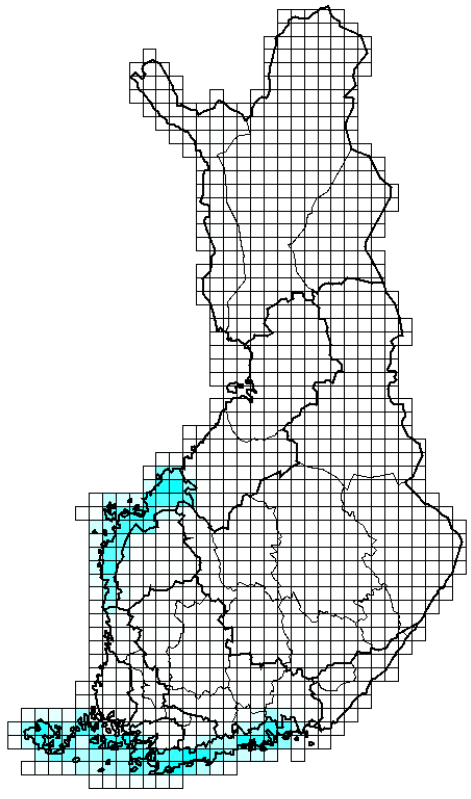
Languages in Toponyms

Swedish



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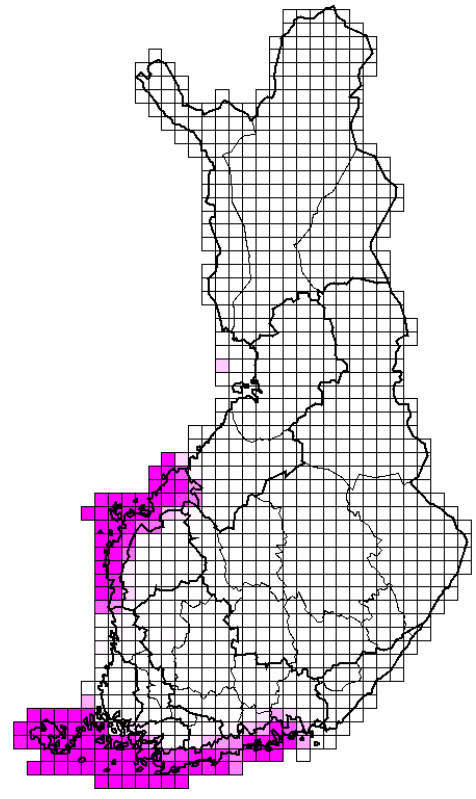

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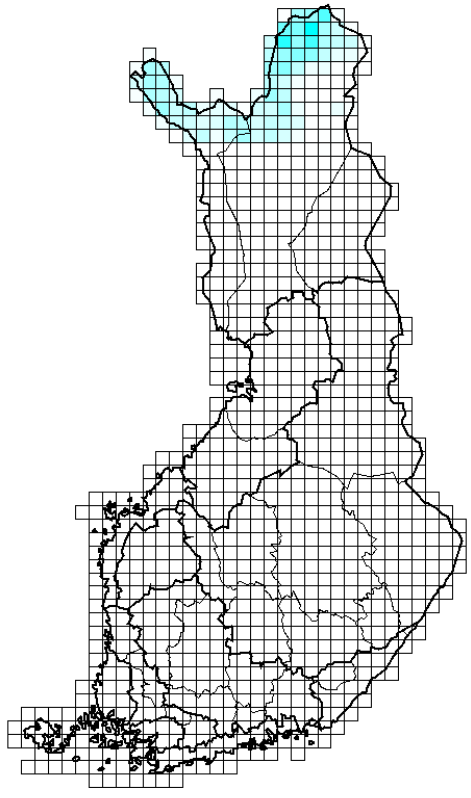
Languages in Toponyms

Northern Sámi



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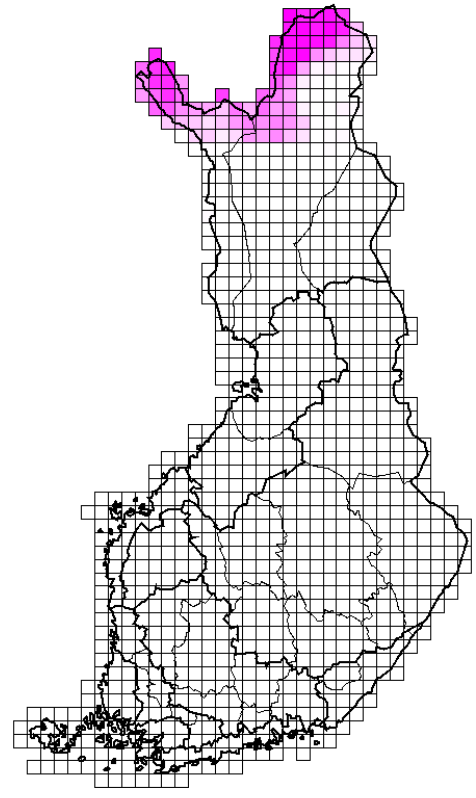
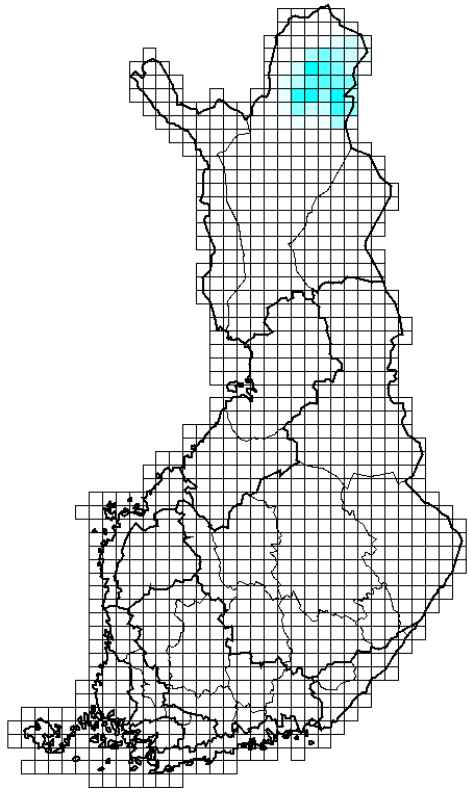


Relative
max=100 %

Languages in Toponyms

Enare Sámi



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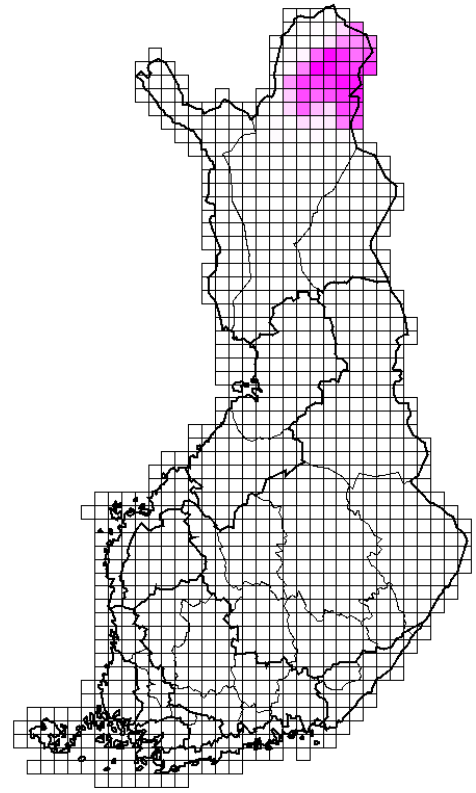
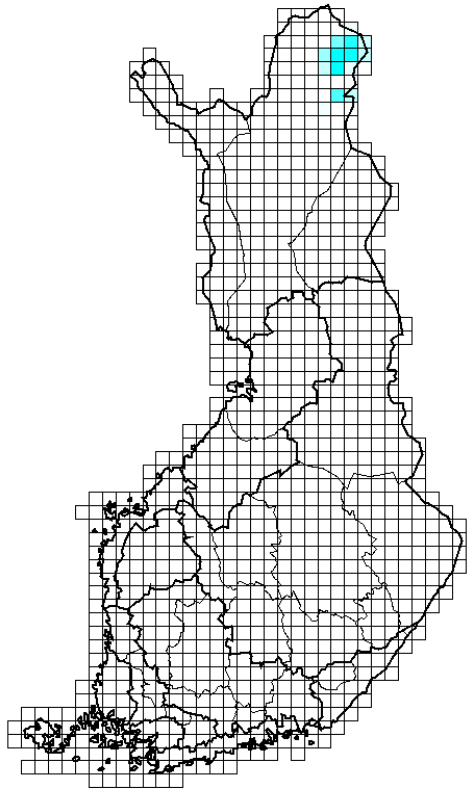


Relative
max=65 %

Languages in Toponyms

Skolt Sámi



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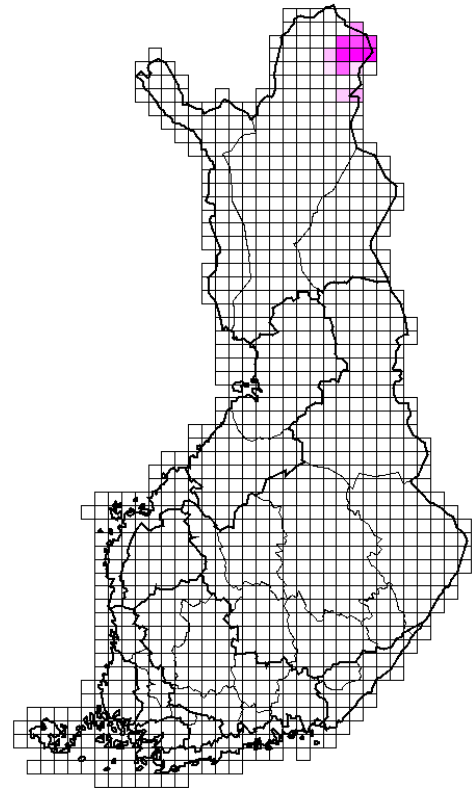

Relative
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Languages in Toponyms

So what?

- Finnish is a clear majority language
- This is reflected in place names

- So few Sámi toponyms that a more thorough onomastic overview is not meaningful
- With Swedish such an overview could be useful

- Finnish names used here to illustrate further methods

Variation in Names

- Goal: summarise most notable aspects of variation
- Most common names in different regions
  - Computationally and conceptually easy
  - Not always very informative
- Underlying components that explain the variation
  - Sophisticated statistical / computational methods
  - Not always intuitive
  - Can be more informative

Variation in Names

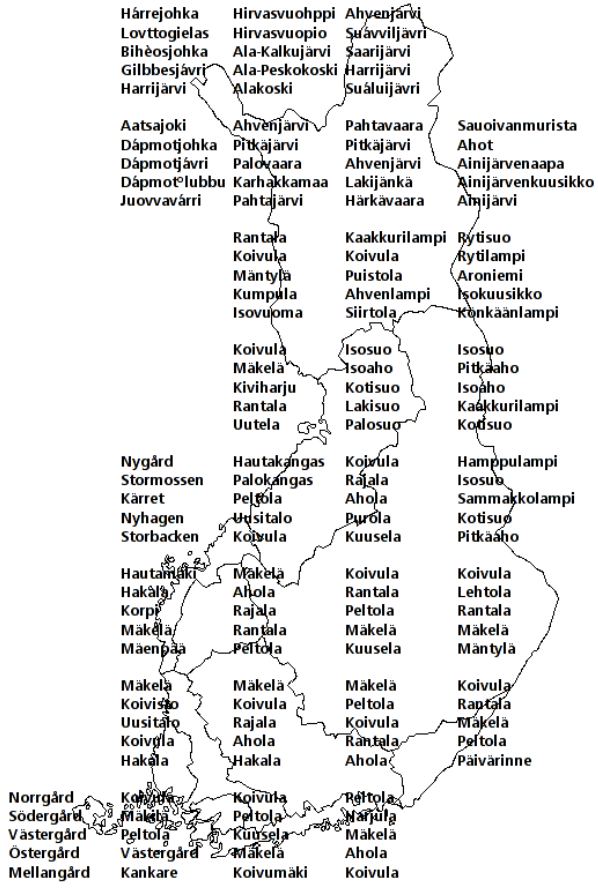
Most Common Names

- Divide country to e.g. 150×150 km squares
- Write on map the most common names

- Variant: name elements instead of complete names
  - Finnish names often consist of two parts, e.g. *Mustalampi*: *musta* 'black' + *lampi* 'pond'
  - Last elements shows the type of place
  - First part describes / identifies the place

Variation in Names

Most Common Names



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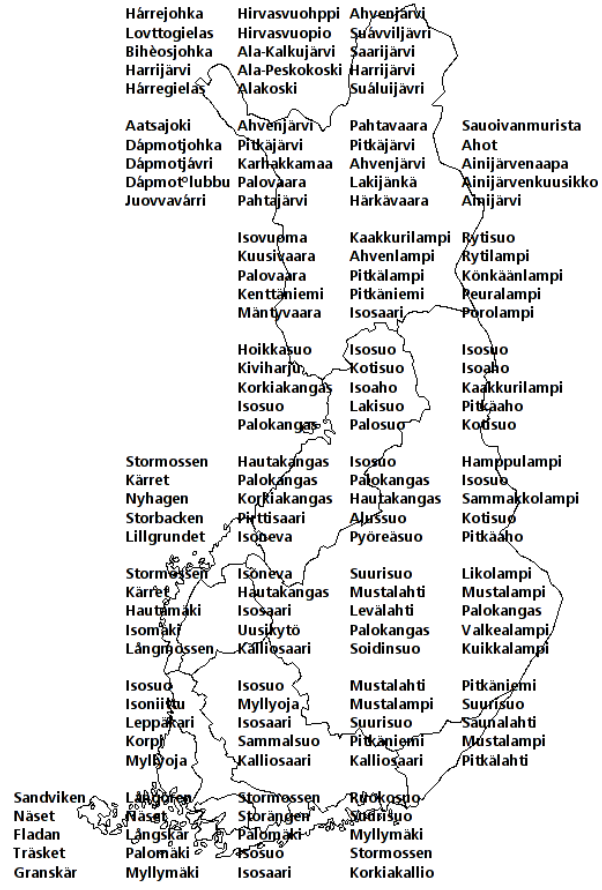
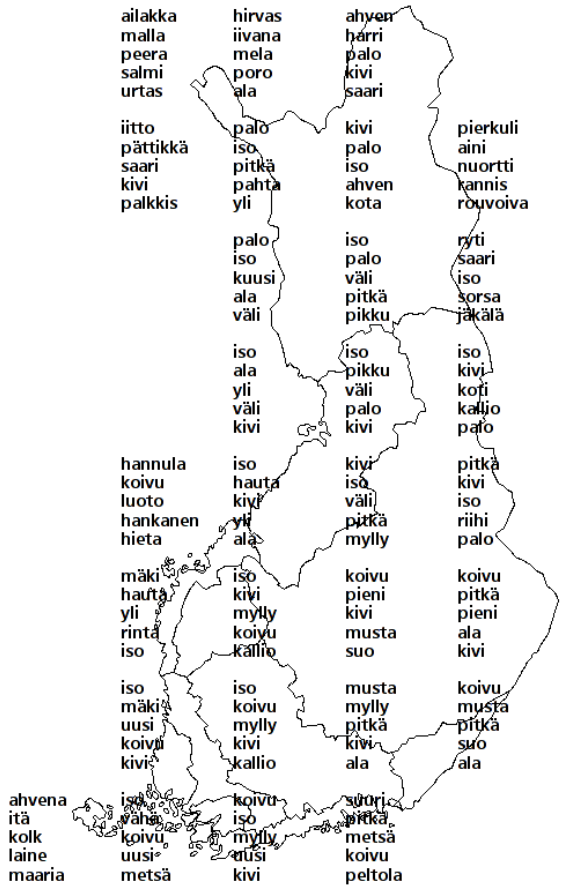


Natural Features

Variation in Names

Most Common Name Elements



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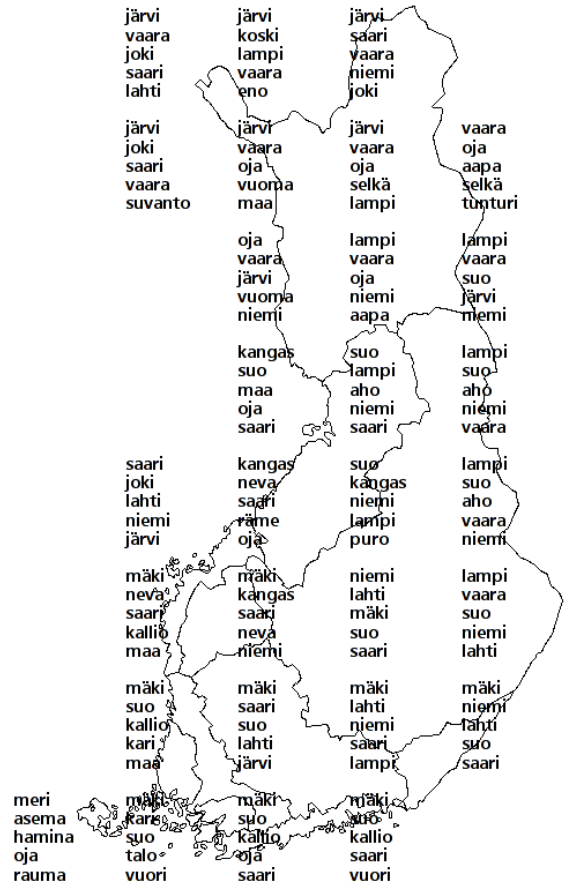


Last

Onomastic Regions

How to find?

- Goal: present regional toponymic variation concisely
- Concise: at most 10–20 maps
- Two main alternatives
  - Clustering
  - Component / Factor Analysis

Onomastic Regions

Clustering

- Overall goal: divide the data into groups (≈ regions) so that
  - Data items (≈ municipalities / grid cells) in the same cluster as similar as possible
  - Those in different clusters as different as possible
- Problematic for linguistic variation in general
  - Variation is gradual, no clear borders between regions
- Especially so for toponyms

Onomastic Regions

Component and Factor Analysis

- Goal: find factors that explain the overall variation
- Analogy: traditional dialectology
  - Determine dialect borders by combining individual isoglosses
  - The isoglosses are weighted: some features are considered more important than others
- Here, the same thing but automatically
  - Distributions of different toponyms are combined
  - The weight of each toponym is determined so that the overall division is maximally clear

Onomastic Regions

Non-negative Matrix Factorisation

- Designed for non-negative data
  - This applies here: the number of names in a region ≥ 0
- Pretty much the same results as with traditional Factor Analysis
- Computationally much faster
- By no means the only method available
  - Use one you (or your pet data analyst) are comfortable with

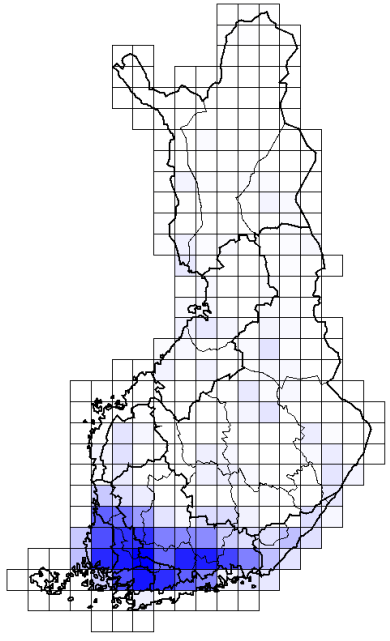
Onomastic Regions

Regions in Finland

- NMF applied to three different data sets
  - All names on the 1:20 000 Basic Map
    name ≡ (written form, type of place, language)
  - First parts of at most two-part names in Finnish: **Musta**lampi
  - Last parts of at least two-part names in Finnish: Musta**lampi**
- 40 × 40 km squares, occurrence of names in a square as 1/0
- Factors shown as maps
- Result: ‘regions’ as diffusion patterns

Onomastic Regions

Finland Proper



All
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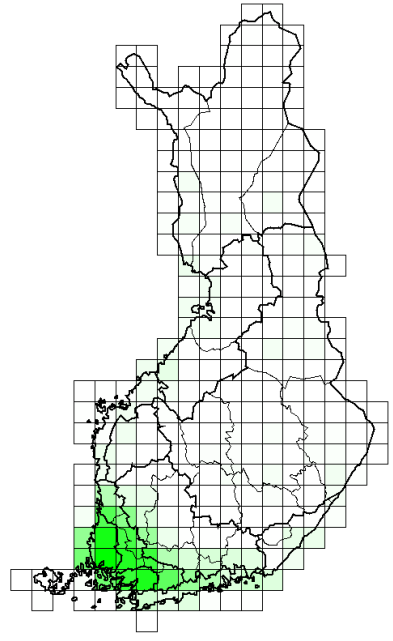
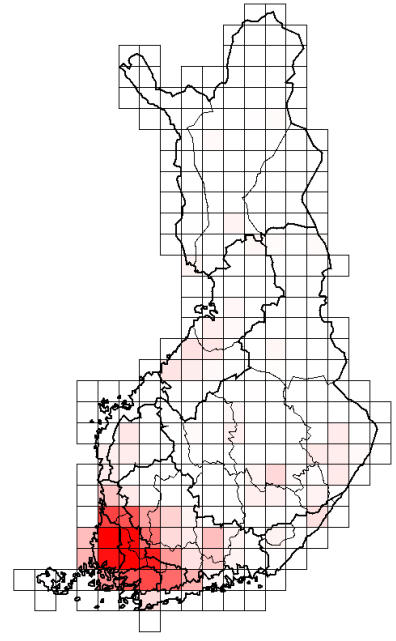


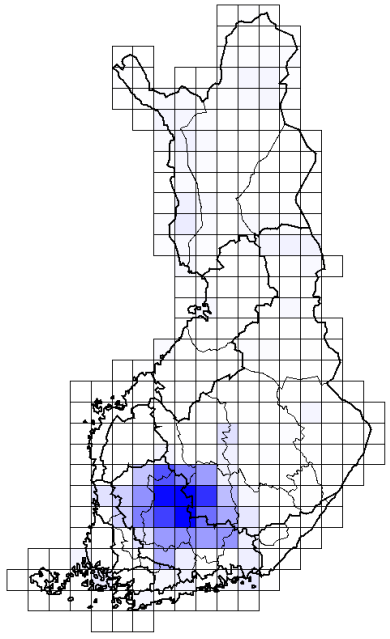
Finnish
first parts



Finnish
last parts

Onomastic Regions

Tavastia



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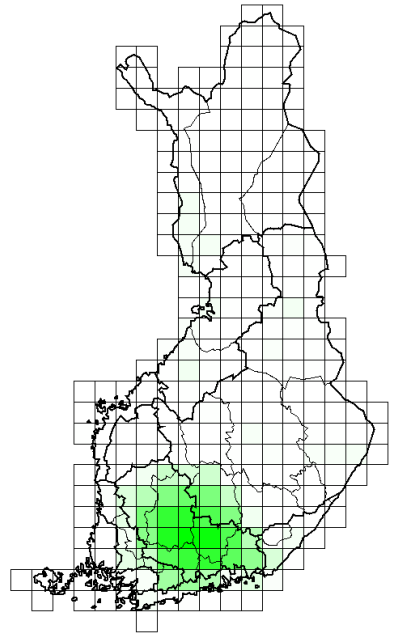

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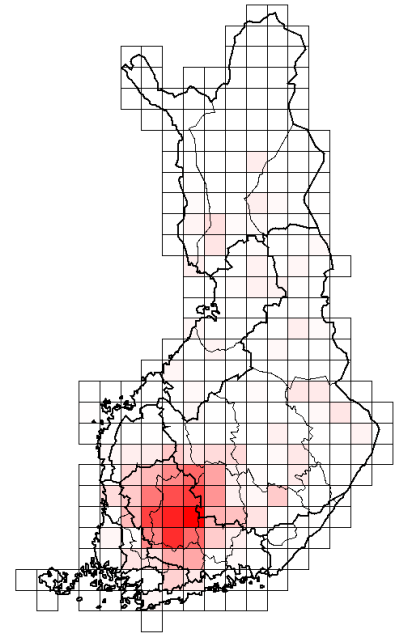

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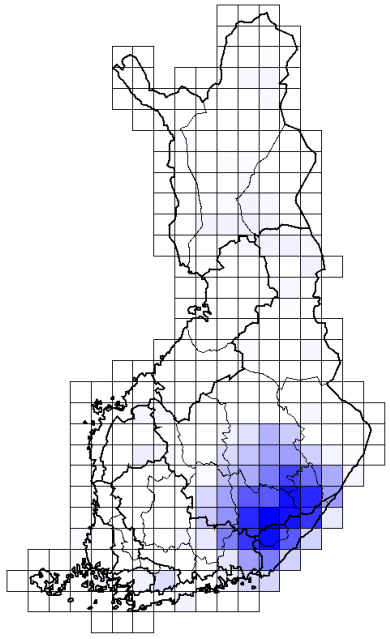
Onomastic Regions

Southern Carelia



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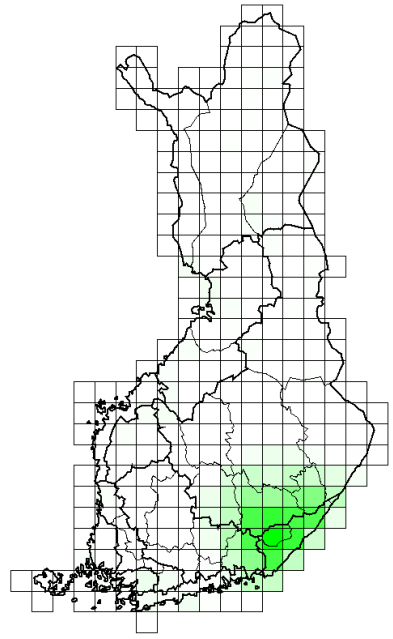

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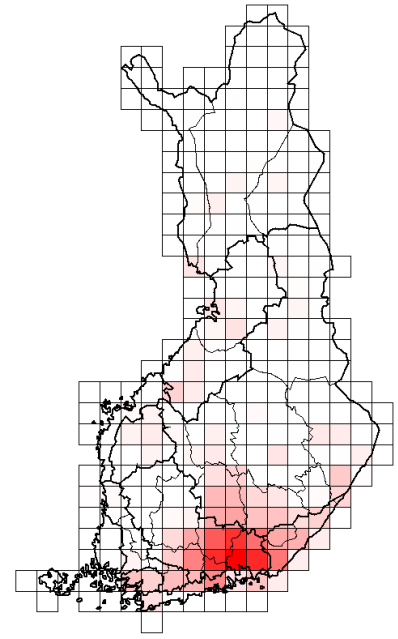

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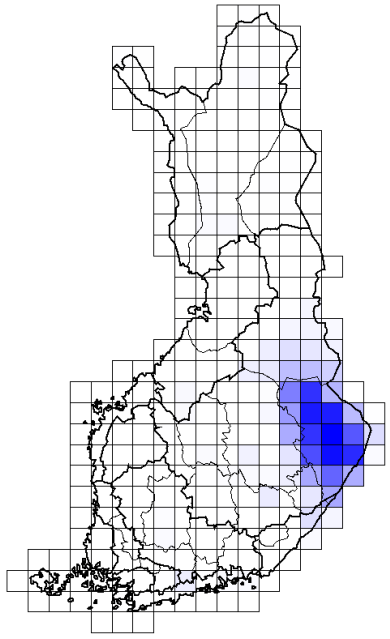
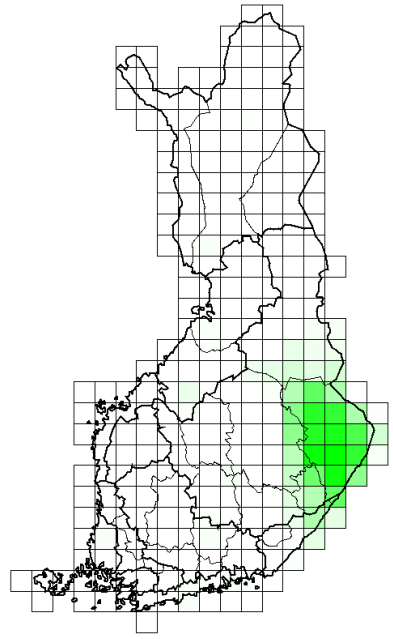
Onomastic Regions

Northern Carelia



All names



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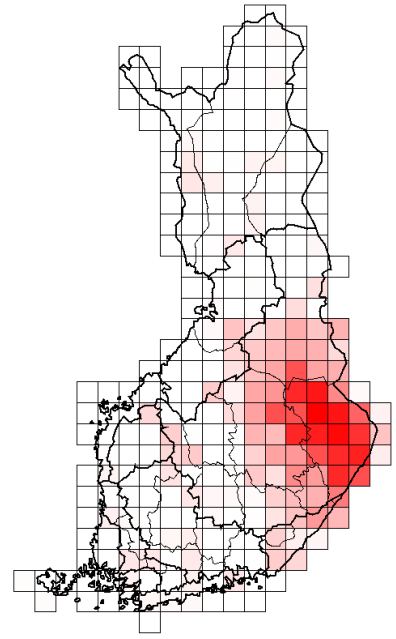

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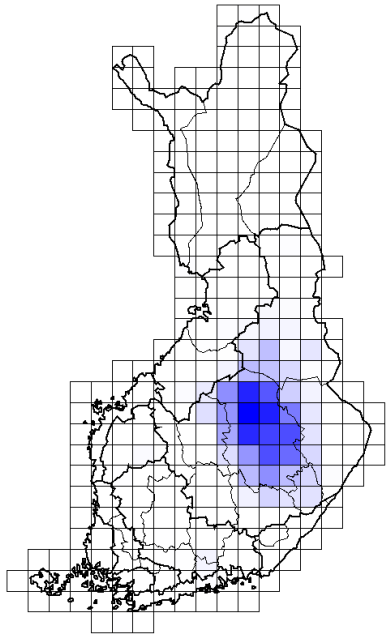
Onomastic Regions

Savonia



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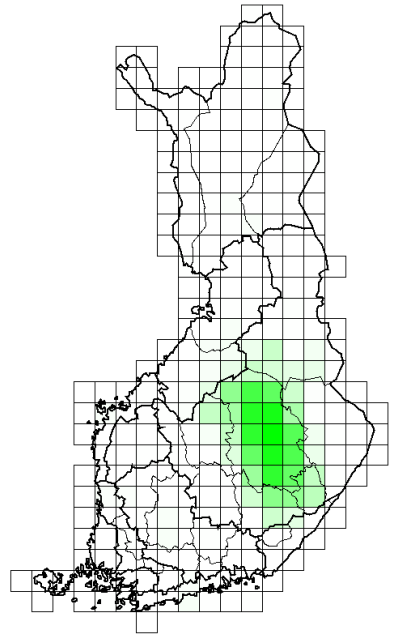

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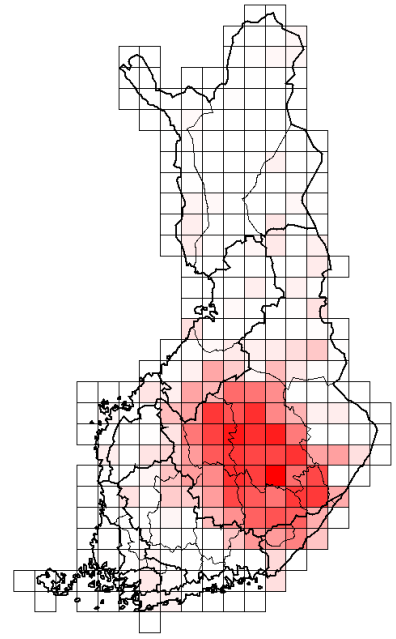

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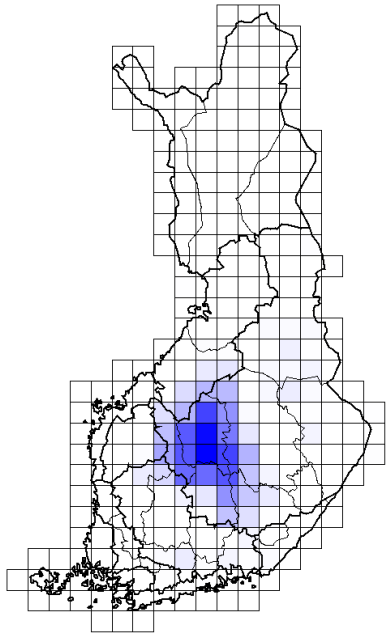
Onomastic Regions

Western Savonia / old Tavastian wilderness



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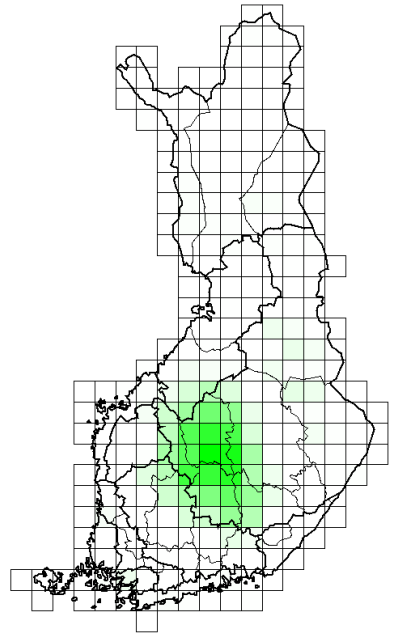
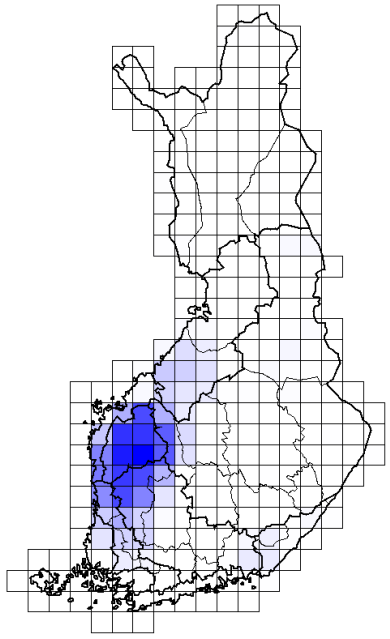


Finnish first parts

Finnish last parts

Onomastic Regions

Southern Ostrobothnia



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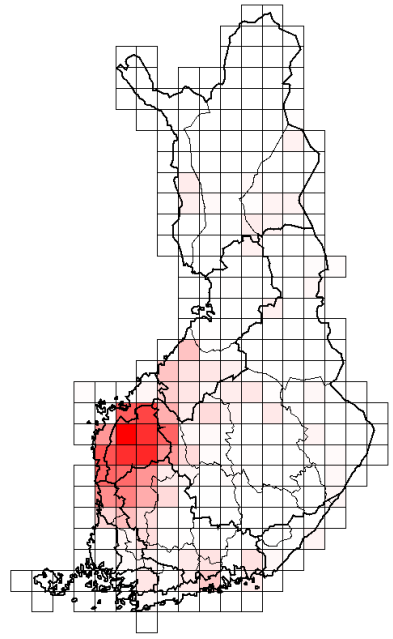

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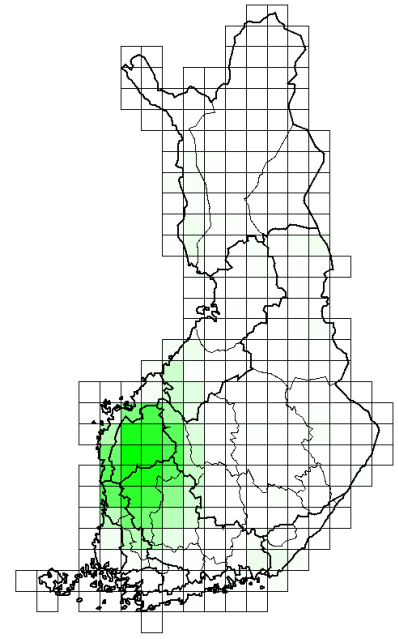

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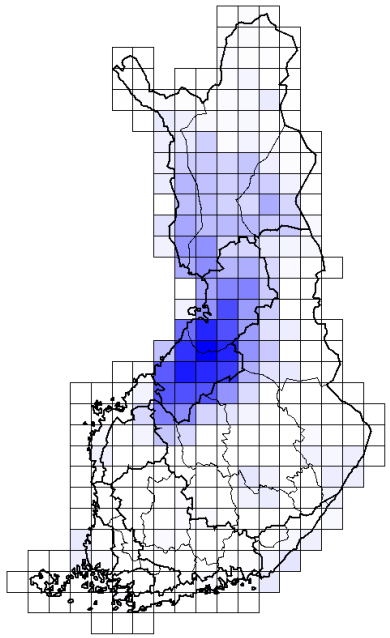
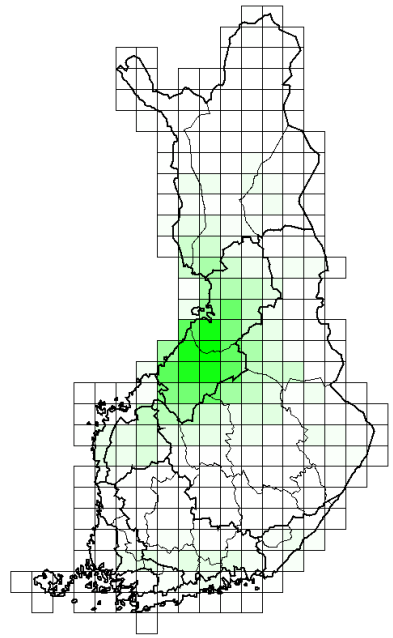
Onomastic Regions

Central / Northern Ostrobothnia



All
names



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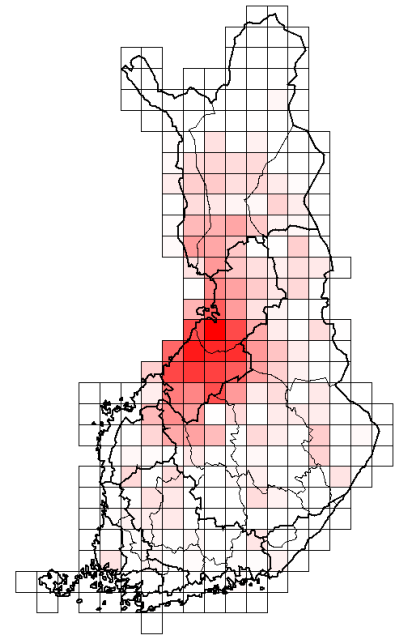
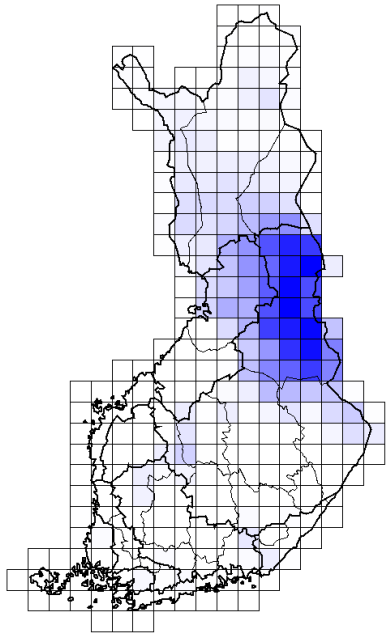


Finnish
last parts

Onomastic Regions

Kainuu



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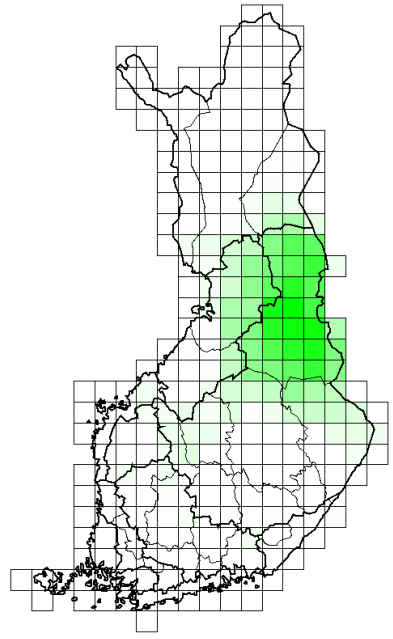

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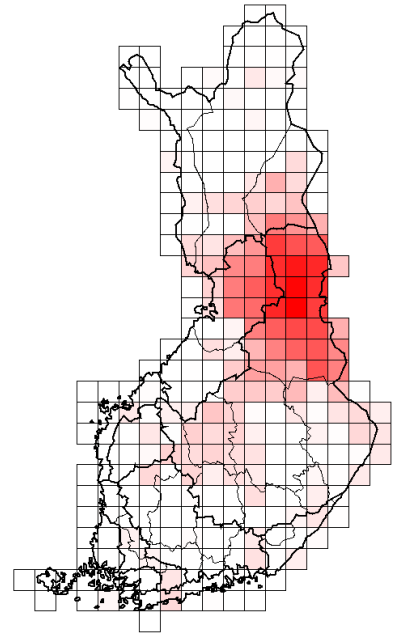

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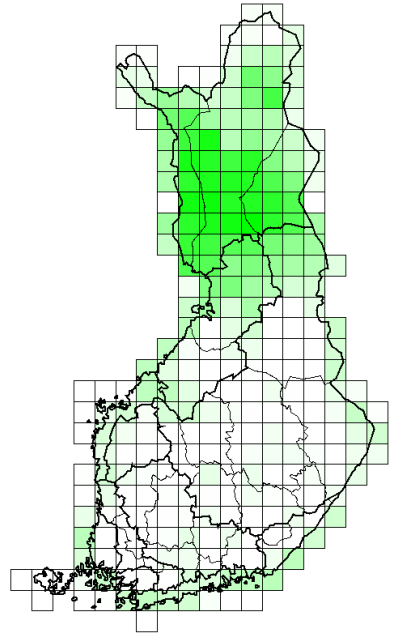
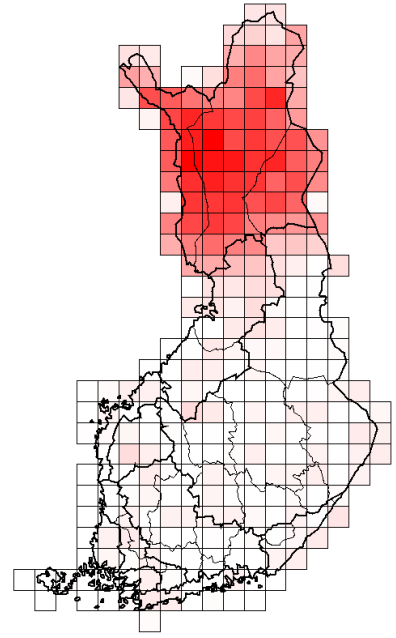
Onomastic Regions

Lapland





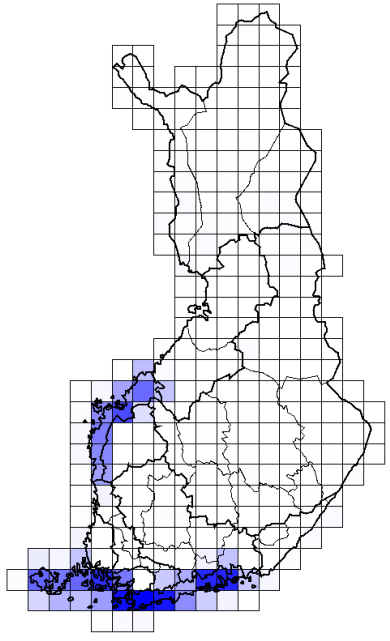
All names

Finnish first parts

Finnish last parts

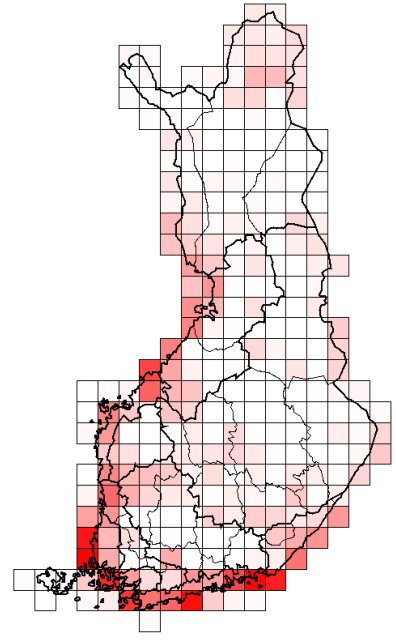
Onomastic Regions

Swedish-language coast



All
names

Finnish
first parts



Finnish
last parts

Summary

- Some processing is required to get a one-glance overview of a large onomastic corpus
- There are various computational methods that can be used
  - Name counts for grid cells
  - Most common names / elements in grid cells
  - Factor analysis
  - Plenty of others
- Visualisation in the form of maps
- Choice of tools depends on the goals of the onomastic study

Thank you