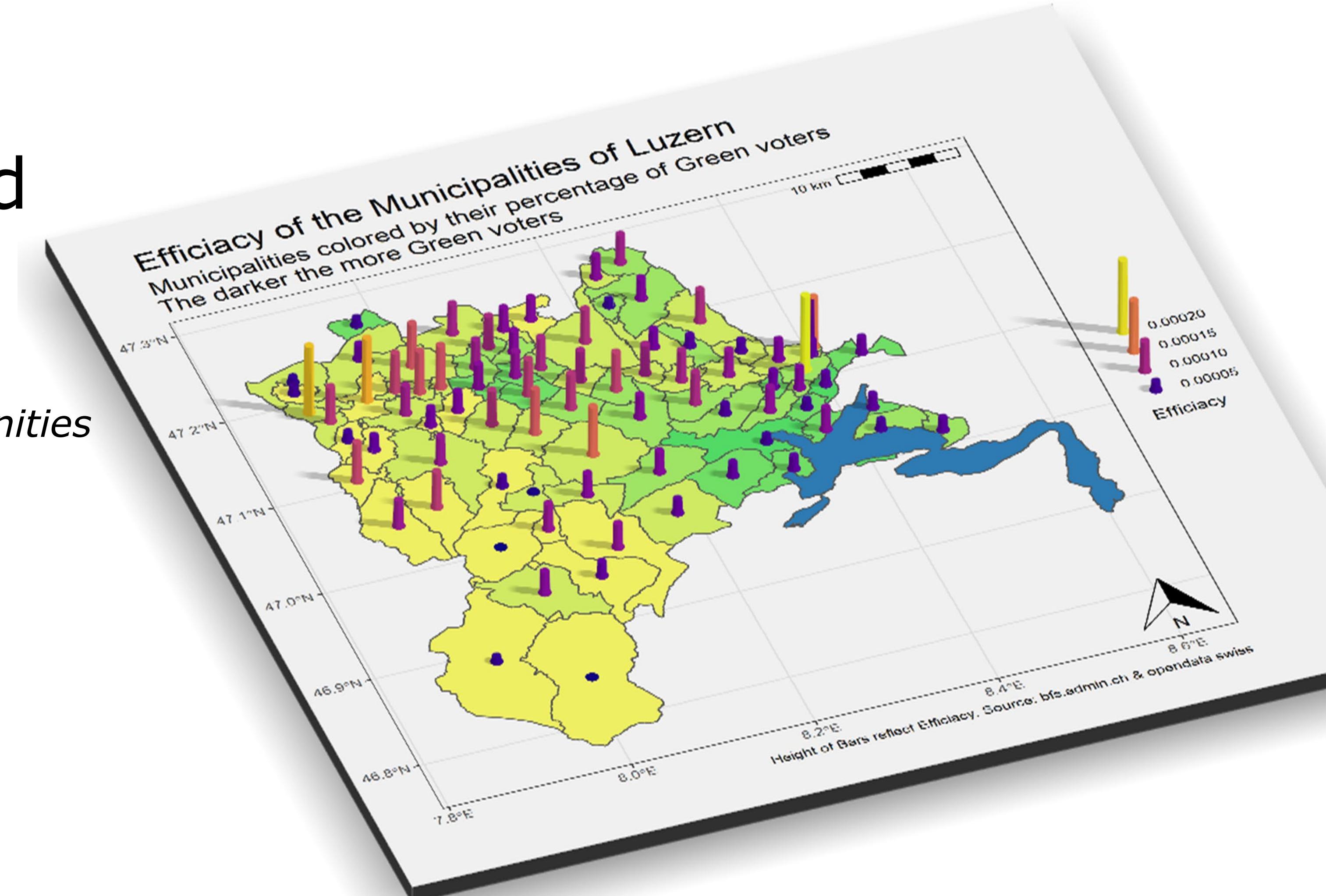


# Applied Information and Data Science

*Geospatial Data Analysis for Smart Communities*



**Wirtschaft**  
11. April 2025

# INTRODUCTION

# Link

**HSLU Hochschule  
Luzern** ILIAS HSLU

Magazin > Wirtschaft > Ausbildung > 2025 > W.MSCIDS\_DE\_GD01.F25 > W.MSCIDS\_DE\_GD01.F2501

## W.MSCIDS\_DE\_GD01.F2501

W.GD01\_Geospatial Data Analysis for Smart Communities

Ebene hoch   Inhalt   Info   Einstellungen   Mitglieder   Lernfortschritt   Metadaten   Export   Recl

Zeigen   Verwalten   Sortieren

Neues Objekt hinzufügen ▾   Seite gestalten

### Ordner

- Organisation of the Module
- Team Agreement
- Material

# Who am I? (see my profile)

Engineering and Architecture   Business   Computer Science   Social Work   Art and Design   Music

Degree Programmes

Continuing Education

Research

International

Campus

About us

News

About us > People Finder > Timo Ohnmacht

## Prof. Dr. Timo Ohnmacht

### Biography

Prof. (FH) Timo Ohnmacht, Dr. phil., Dipl. soz. tech., was born on 3 September 1979 in Rottweil am Neckar (Germany). He is married, has two children and lives in Lucerne.

Nationalities: German & Swiss.

Timo studied transport and sociology at the Technical University of Berlin (Prof. Dr. Andreas Knie), Lancaster University (UK) (Prof. John Urry) and the Swiss Federal Institute of Technology Zurich (ETHZ) (Prof. Dr. Kay Axhausen). He was also a student assistant at the Centre for Technology and Society (ZTG), Berlin (Prof. Dr. Hans-Liudger Dienel). This was followed by research trips to EPFL Lausanne (Prof. Dr. Vincent Kaufmann) and MUIC Bangkok, Thailand.

From 2004 to 2006, Timo Ohnmacht worked on the project "Mobility Biographies and Social Networks" at the ETH Zurich (Prof. Kay W. Axhausen), financed by ifmo (Institute for Mobility Research), a branch of the BMW Group, on the basis of which he wrote his doctoral dissertation on leisure transport at the University of Basle (supervised by Prof. Max M. Bergman, co-supervised by Prof. Kay W. Axhausen).

From 2009 to 2011, Timo Ohnmacht was the content project manager of the Mobility and Transport Microcensus for 2010 in the Federal Office for Spatial Development of the Federal Department for the Environment, Transport, Energy and Communications DETEC in Bern.

Since 2011, he has been researching and lecturing at the intersection of the topics of energy, the built environment, transport and society at the Lucerne School of Business's



LUCERNE SCHOOL OF BUSINESS

Room R211

Rösslimatte 48

6002 Luzern

## **Who are you?**

### **Where do you live?**

- Zurich Metropolitan Area
- Basel Metropolitan Area
- Region of Berne
- Central Switzerland
- Eastern Switzerland
- Other regions

**Raise your (virtual) hands!**



## **Who are you? (2)**

### **Where do you work?**

- Federation, canton, municipality/city
- Private Sector
- NGOs
- University / Higher Education
- Other

**Raise your (virtual) hands!**



# Your background knowledge?

**Have you ever dealt with spatial or GIS-data so far?**

- In which context?
- Which data did you apply?
- Which methods did you apply?
- Which software-tools did you apply?

**Share your information in our session!**



# Today's agenda

1. Course Conception	12.25 – 13.00
2. Geospatial Data Analysis: For what and why?	13:00 – 13:15
3. <i>Case Study: My research</i>	13.15 – 13.30
4. Your work and Q&A	13.30 – 13.45

**13.45 – 14.00 Break**

**14.00 Part 2** Senozon Mobility Model: Analytics and Examples of microscopic and dynamic mobility data  
(Dr. Michael Balmer, Senozon).

# Course conception

# The following goals are pursued and taught

The students

- have an **overview** of the *type and variety of spatial data* in Switzerland.
- **understand** theoretical **basics** about the **geo-referencing** of data  
(Swiss national coordinates, WGS-84, point data, hectare raster data, etc.)
- can **handle spatial data (e.g., merge, aggregations, point over area overlays)**
- convert them into “**simple thematic maps**” within a groupwork setting by using QGIS or Tableau.

# My course conception

**Your lecturers are data owners or main users of Federal Data Sources.**

**They are researchers (**me**), Swiss Federal office employees or consultants.**

They:

- present **nationwide**, spatially referenced **data**
- inform about **data sources** (open access, e.g. [map.geo.admin](#) (ARE WEB GIS), [opendata.swiss](#), Open Street Map OSM etc.)
- provide current **data sets**, which can be obtained without a data contract (anonymized, e.g. individual information is aggregated on a per-hectare grid -> e.g. Swiss Census)

They provide data to the students for their **own group work**, i.e. producing a map.

# Which geo-referenced data do we use?

## Examples are as follows:

- Swiss census of population (STATPOP)
- Business census (STATENT)
- Areal Statistics (Zone Statistics, e.g. identifications for areas for work, living, mixed use, commerce)
- Origin-Destination-Matrices for commuting, border crossing für work and recreation
- SwissTopo (background data)
- Open Street Map OSM
- Traffic models (UVEK, Senozon), today !

# Which software / «apps» do we use?

## Software (Opensource)

Freeware: R + QGIS + Tableau + Excel + FME Safe (Stata, SPSS ...)

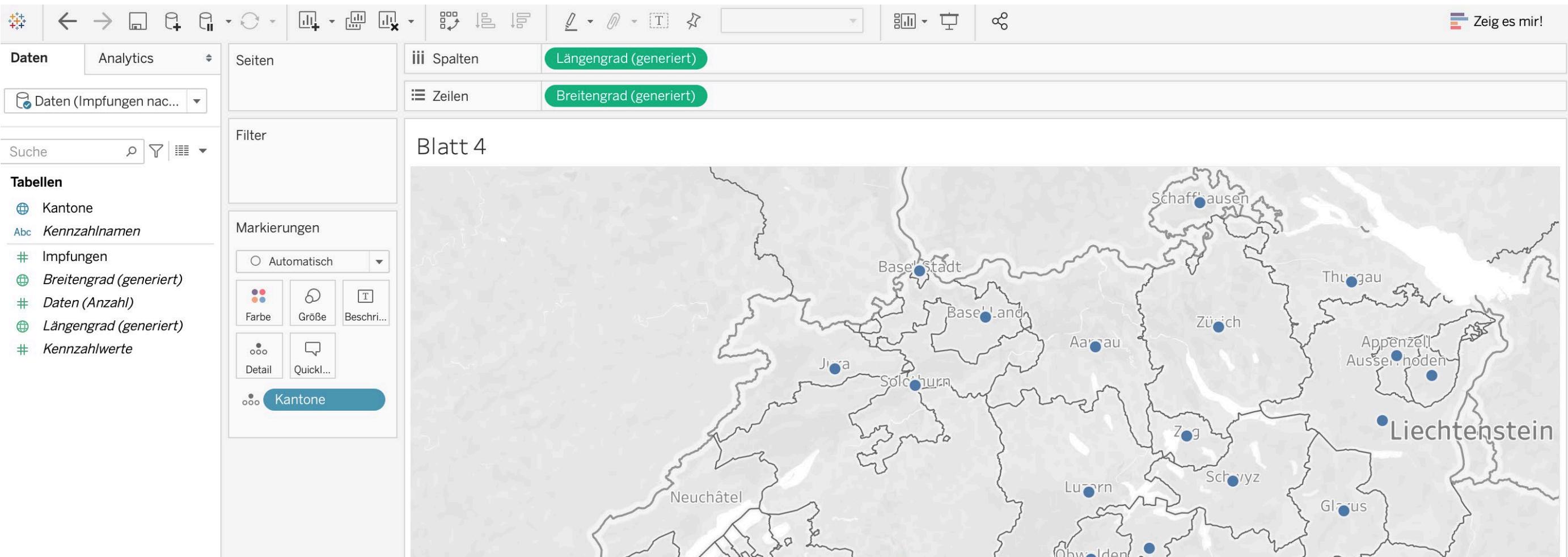


## Screenshot: QGIS

# Which software / apps do we use?

## Software (Studentversion):

Freeware: R + QGIS + Tableau + Excel + FME Safe (Stata, SPSS ...)

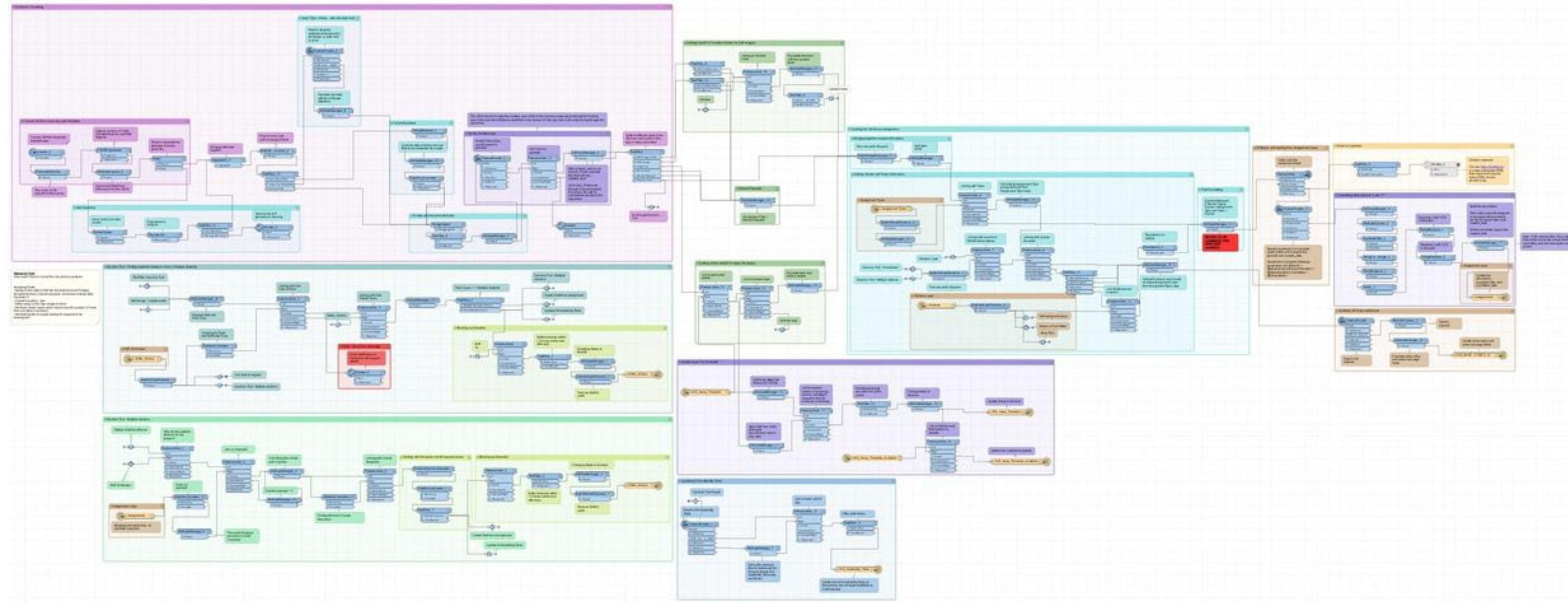


Screenshot: Tableau

# Which software / apps do we use?

## Software (Studentversion)

Freeware: R + QGIS + Tableau + Excel + FME Safe (Stata, SPSS ...)



Screenshot: FME Safe

# Lectures

## **Module management:**

- Prof. Dr. Timo Ohnmacht (Lucerne University of Applied Sciences and Arts)
- Yves Maurer (Swiss Federal Office for Spatial Development ARE, Bern)

## **External Experts:**

- Dr. Michael Balmer (Senozon) (**today !**)
- Dr. Balz Bodenmann (Strittmatter Partner, St. Gallen)

# Lectures



T. Ohnmacht



Y. Maurer



B. Bodenmann



M. Balmer

## Practice Goals

- 1. Creation of a thematic map** (e.g. of Switzerland, a canton, a region or a municipality) on the basis of provided or own spatial data
- 2. Discussion of the map** in the form of a profile against the background of the goals of “***smart communities***” (e.g., *inter alia, decarbonization, digitization, health and so forth*).
- 3. Documentation / Metadata** of the spatial data with data status and origin (data owner) in the form of main characteristics.

# How do you get your 3 ECTS?

Active, present participation in the lessons (**pose questions**).

<b>Assessments</b>	<b>Assessment 1</b>	<b>Assessment 2</b>
Type of assessment	Concept for the term paper	Supervised <b>term paper</b> in groups of up to five (includes presentation)
Evaluation type	Grades	Grades
Scope	Max. 3 pages	Term paper of max. 10 pages
Dates	During the semester, deadline 22.5 / <u>5.12</u>	Submission End of the Semester (20 June, 31 February)
Weighting	30%	70%

## Lessons (Fridays)

Time: 12:25h to 15:45h

Place: Zoom, Webex, Teams. Link will be provided on ILIAS and per Email !

**Week 15 (4 lessons), 11.04.2025 (Face-to-Face)**

**Week 16 (4 lessons), 25.04.2025 (Online)**

**Week 18 (4 lessons), 02.05.2025 (Face-to-Face)**

**Week 19 (4 lessons), 09.05.2025 (Online)**

**Week 20 (4 lessons), 16.05.2025 (Online)**

**Week 21 (4 lessons), 23.05.2025 (Face-to-Face)**

# Program (1)

## **Week 15 (4 lessons), 11.04.2025 (Face-to-Face)**

<b>Zeit</b>	<b>Lesson</b>	<b>Subject</b>	<b>Lecturer</b>
12.25 - 13.15	1	Introduction	Timo Ohnmacht
13.15 - 14.05	2		
14.05 - 14.55	3	Senozon Mobility Model: Analytics and Examples of microscopic and dynamic mobility	Michael Balmer
14.55 - 15.45	4	data.	

## **Week 16 (4 lessons), 25.04.2025 (Online)**

<b>Zeit</b>	<b>Lesson</b>	<b>Subject</b>	<b>Lecturer</b>
12.25 - 13.15	1	Introduction QGis II: Thematic maps (points, lines and polygons)	Yves Maurer
13.15 - 14.05	2		
14.05 - 14.55	3	Introduction QGis III: Thematic maps (points, lines and polygons)	Yves Maurer
14.55 - 15.45	4		

## **Week 18 (4 lessons), 02.05.2025 (Face-to-Face)**

<b>Zeit</b>	<b>Lesson</b>	<b>Subject</b>	<b>Lecturer</b>
12.25 - 13.15	1	Spatial Data for Spatial Development - An insight into the WEBGIS and the Geoinformation at the federal Office for spatial development	Yves Maurer
13.15 - 14.05	2		
14.05 - 14.55	3	Example of a GIS Analysis - Construction of a Swiss Dispersion Index	Yves Maurer
14.55 - 15.45	4		

## Program (2)

### **Week 19 (4 lessons), 09.05.2025 (Online)**

<b>Zeit</b>	<b>Lesson</b>	<b>Subject</b>	<b>Lecturer</b>
12.25 - 13.15	1	Tableau Introduction	Yves Maurer
13.15 - 14.05	2		
14.05 - 14.55	3	Tableau – Own application guided by the lecturer	Yves Maurer
14.55 - 15.45	4		

### **Week 20 (4 lessons), 16.05.2025 (Online)**

<b>Zeit</b>	<b>Lesson</b>	<b>Subject</b>	<b>Lecturer</b>
12.25 - 13.15	1	FME Introduction	Timo Ohnmacht
13.15 - 14.05	2		
14.05 - 14.55	3	Matrices of (cross-border) commuters, statistics on building zone & Population, employees and statistics of areas	Balz Bodenmann
14.55 - 15.45	4		

### **Week 21 (4 lessons), 23.05.2025 (Face-to-Face)**

<b>Zeit</b>	<b>Lesson</b>	<b>Subject</b>	<b>Lecturer</b>
12.25 - 13.15	1	Individual group work	Timo Ohnmacht
13.15 - 14.05	2		
14.05 - 14.55	3	Individual group work & coaching	Timo Ohnmacht
14.55 - 15.45	4		

# **Geospatial Data Analysis:**

For what and Why?

Regional science is social science ...  
and *Geospatial Data Analysis* is a part of it and its linked to *Data Science* !

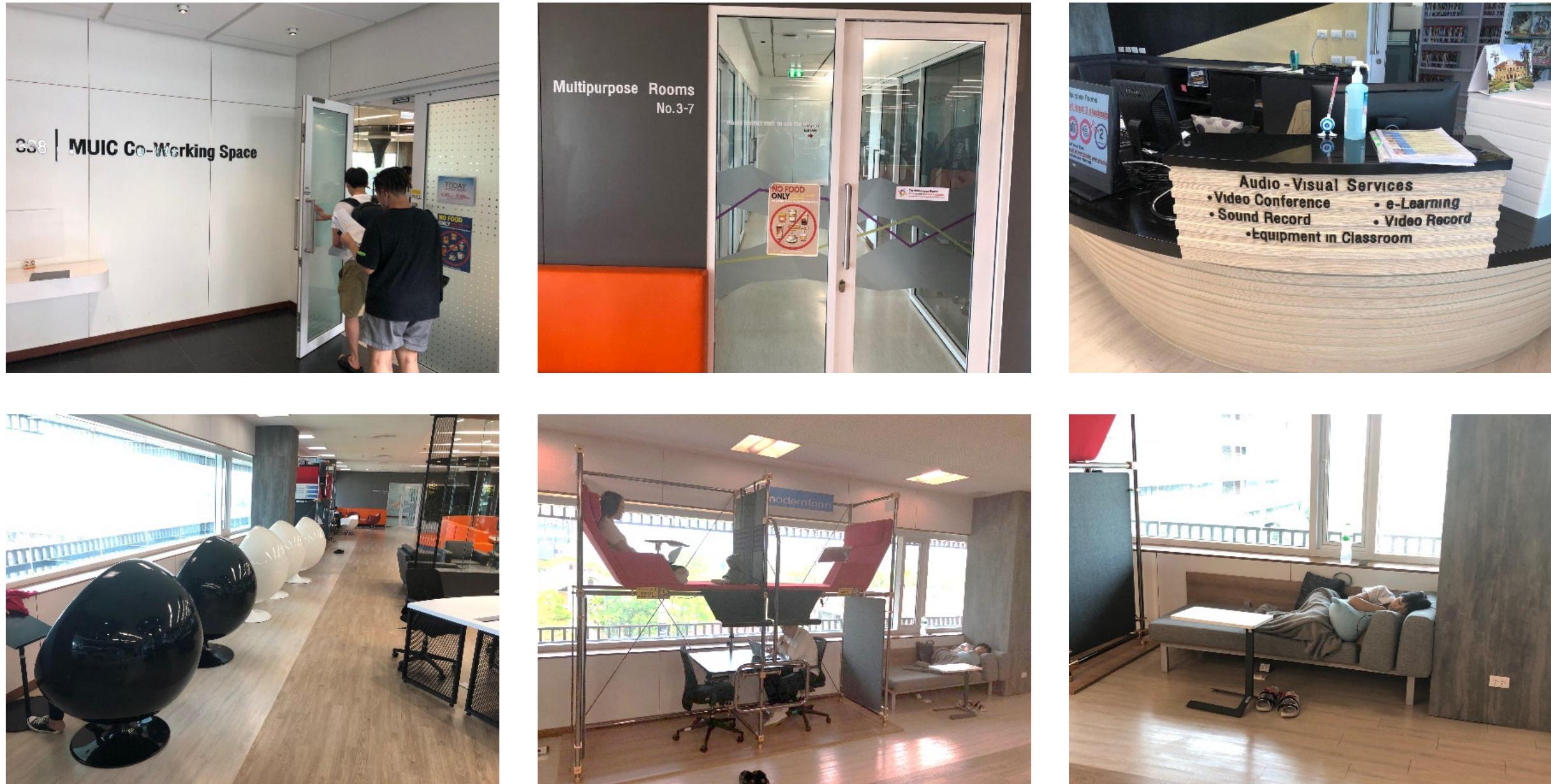
<b>Theory</b>	When considering spatial disparities, <b>the question arises what are the determining factors and effects of unequal spatial/regional development?</b>  e.g., accessibility to public transportation infrastructure, distribution of Car-Sharing-stations
<b>Data</b>	The unequal spatial development of living and economic conditions lead to spatially (undesirable) disparities that can be <b>operationalized</b> and <b>measured</b> .  e.g., X-Y coordinates that indicate public transportation or Car-Sharing spaces.
<b>Policy</b>	Data analytics can provide a <b>decision basis for planning and policy</b> The political process raises the question of how spatial processes can be influenced.  e.g., formulation of spatial goals and ideas of effect, implementation of appropriate spatially effective measures.

# **Case Study:**

*My research*

# Coworking Spaces

**Coworking spaces** are places for community networking and learning, as well as for sharing infrastructure and work spaces (Spinuzzi, Bodrožić, Scaratti, & Ivaldi, 2019).



# Theory: Transformation of work life

## Four major transformations

- 1. Industrialisation:** Shift from rural work to industrial labor
- 2. "Automatisation":** Mass production, piece rate and production line
- 3. Globalisation:** Cross-border markets and production, the network society

These developments have had a positive influence on **urbanisation** (Castell, 1996; Davis, 2000; Sassen, 2008).

## 4. Digitalisation

Assumption: **Digitalisation** has work-life decoupled from spatial centralisation,

which was ushered in and reinforced by the first three transformations (**industrialisation, automatisation, globalisation**).

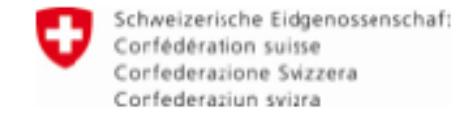
# **Work Smart Initiative**

... has been started by an alliance of Swiss government institutions and companies promoting **new forms of remote and flexible working**.

WORK SMART LEADER



WORK SMART PARTNER



AREMIS

**Their common assumption is:**

Flexible forms of work have beneficial effects

on **society**,

the **environment**,

and the **economy**.

## Possible effects of new forms of work (triple bottom line model of sustainability)

- **Social**

increasing employees' motivations, productivity and work-life balance, e.g. more family time.

- **Environment**

a positive effect on CO<sub>2</sub> emissions by reducing or even avoiding work related travel,  
e.g. shorter commuting distances or fewer business trips

- **Economic**

increasing the recruitment potential for companies,  
e.g. new job opportunities, more job applications

### But from an academic perspective

The positive outcomes of **digital, remote** and **flexible forms** of working are still a **subject of debate (e.g., rebound effects)**.

# DATA

# One of my examples: Coworking

IOP Publishing

Environ. Res. Commun. 2 (2020) 125004

<https://doi.org/10.1088/2515-7620/abd33e>

Environmental Research Communications

PAPER



CrossMark

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14 December 2020

PUBLISHED  
23 December 2020

## Relationships between coworking spaces and CO<sub>2</sub> emissions in work-related commuting: first empirical insights for the case of Switzerland with regard to urban-rural differences

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<sup>1</sup> Institute of Tourism and Mobility - Lucerne School of Business, Lucerne University of Applied Sciences and Arts, Switzerland

<sup>2</sup> Institute of Business and Regional Economics - Lucerne School of Business, Lucerne University of Applied Sciences and Arts, Switzerland

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**Keywords:** coworking spaces, CO<sub>2</sub> emissions, climate gas mitigation, work commuting, sustainable transport, new forms of work

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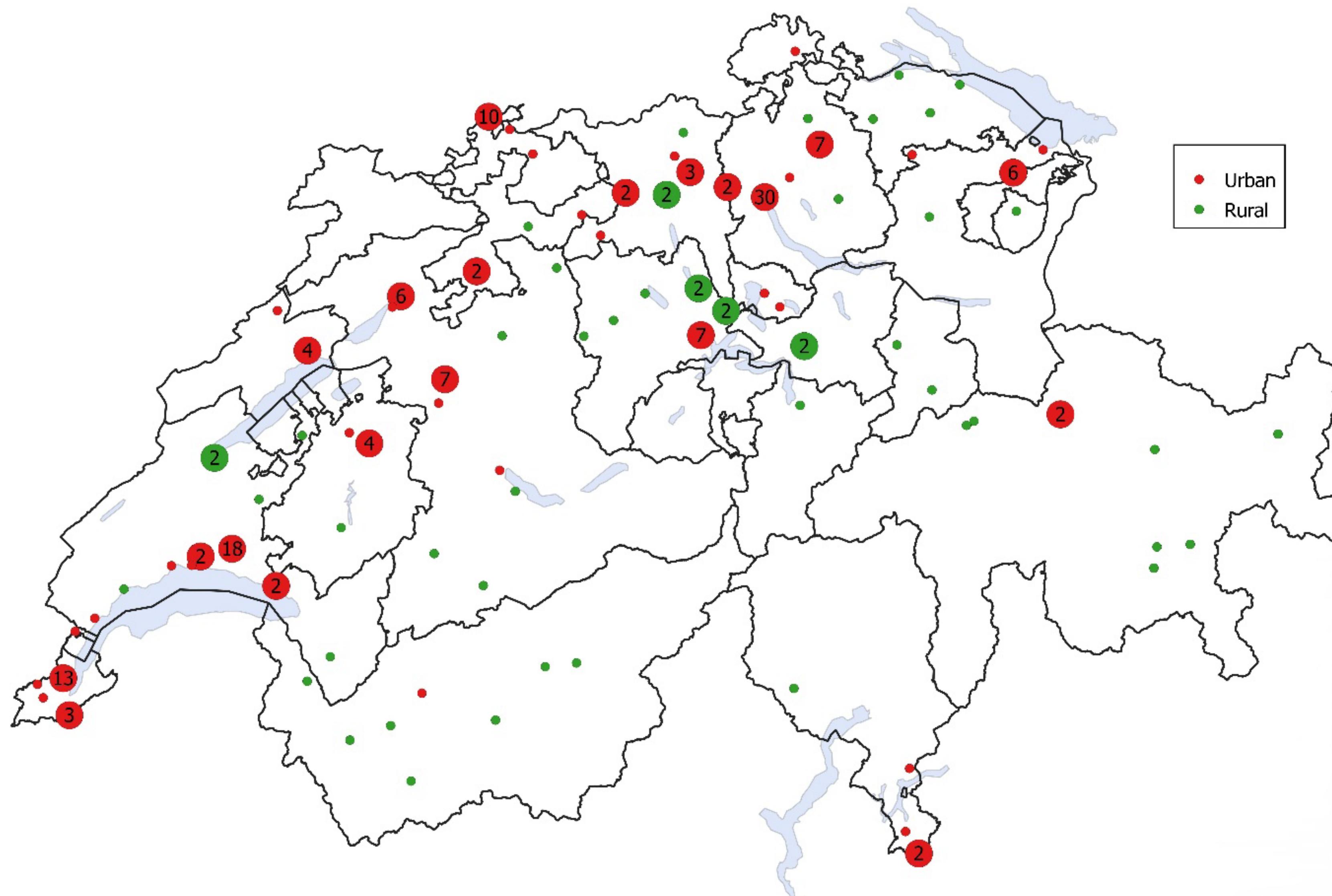
Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.



### Abstract

Today in transport policy it is assumed that new forms of work are producing falls in greenhouse gas (GHG) emissions from work-related commuting. So far, research on the effects of teleworking generally report positive environmental outcomes. However, no study has so far compared and contrasted the greenhouse gas (GHG) mitigation potential of the new phenomenon of coworking spaces with regard to urban-rural differences. Our results based on a representative sample of Swiss coworkers indicate that CO<sub>2</sub> emissions from commuting for work are significantly lower for urban coworking spaces (350 kilograms/year) than for rural coworking spaces (940 kilograms/year). If coworkers only would have worked in their coworking spaces, there would be a 10% reduction in CO<sub>2</sub> emissions of their commutes. Overall, our results indicate that coworking spaces, especially in urban areas, have the potential to support Switzerland's commitment to reduce greenhouse gas (GHG) emissions in the transport sector in line with the Paris Climate Agreement.

# CWS in Switzerland



# Empirical Evidence: The rise of CWS

Deskmag (2017): Coworking spaces have seen remarkable growth globally, **from 75 in 2007 to 13,800 in 2017.**

2007 to 2018: the number of individual coworkers in Switzerland increased **from 3,000 to 10,000** (Coworking Switzerland and Deskmag, 2018)

Coworking Switzerland: 155 coworking spaces in 2019 (5x higher than 2007)

+ 64 coworking spaces that are not organised in this network = **219 CWS**

**Table 1.** Swiss Coworking Spaces differentiated by spatial categories (2019)

	<b>Urban</b>	<b>Conurbation</b>	<b>Rural</b>	<b>Total</b>
#	122	56	41	219
%	56	26	18	100

Source: Calculations based on Coworking Switzerland Database and own desk research on additional Swiss coworking spaces

# Data

## **Quantitative Fieldwork: July – November 2019**

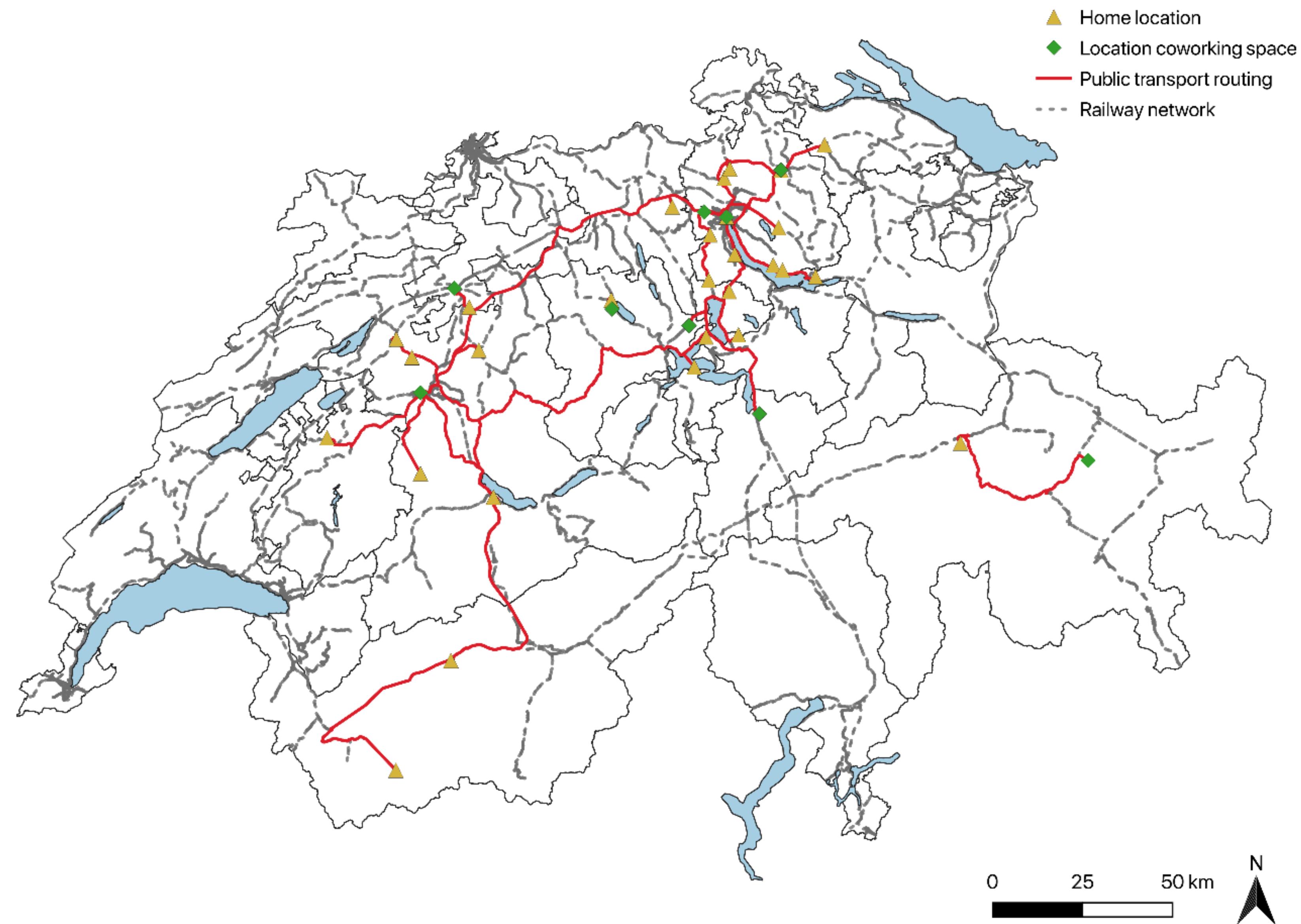
- invitation-letter to n=2019 CWS in CH
- online survey with CW
- recruitment on Facebook, LinkedIn, Newsletter
- convenience sample -> no clear universe

## **Content:**

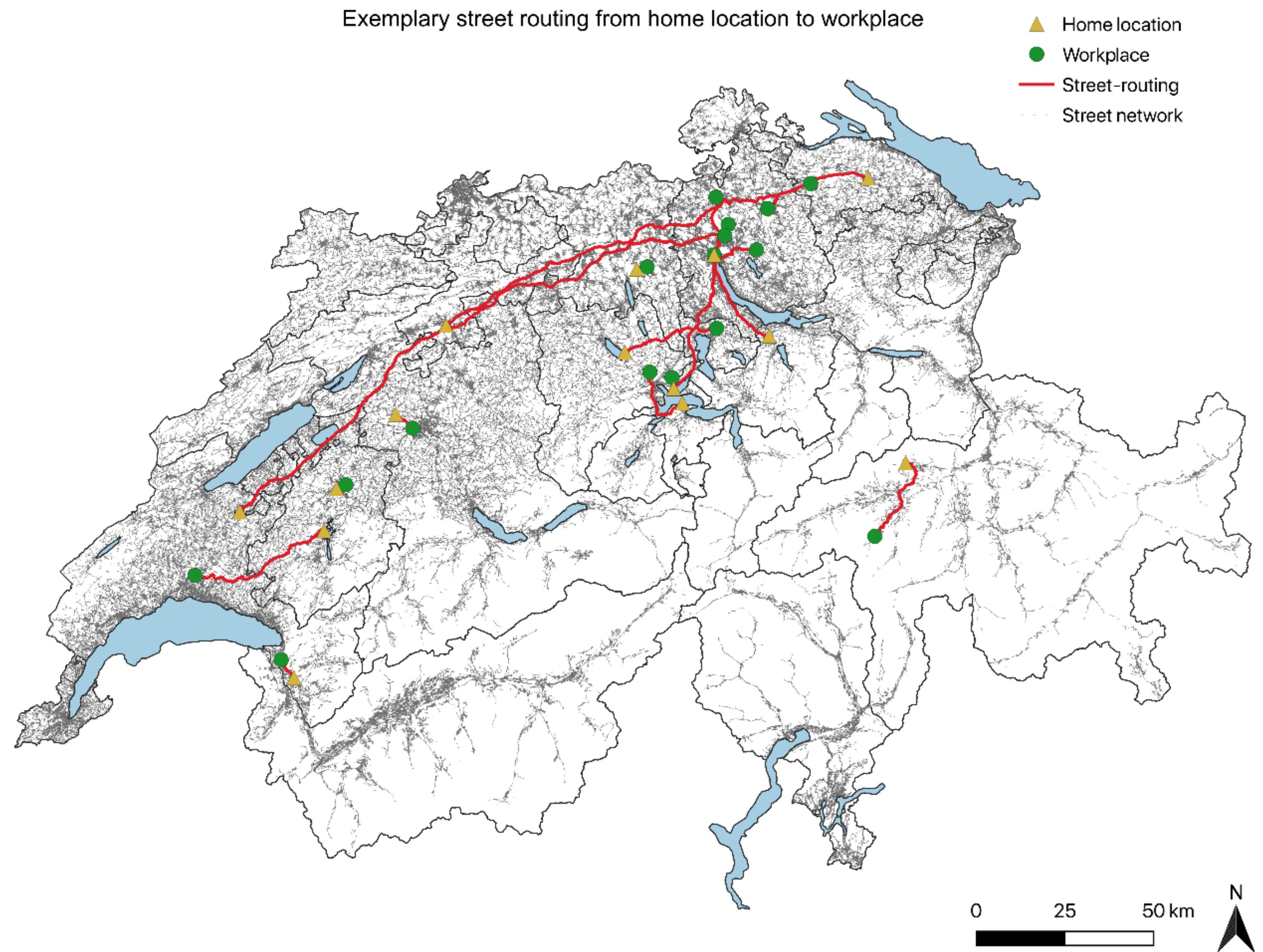
- Socio-demographics
- profiles of “mobility biographies”
  - home location
  - work location(s)
  - CWS-locations
  - frequencies of usage CWS)
  - MoT usage
- Likert-scales on preferences, statements on Work-Life, CWS

# Routing

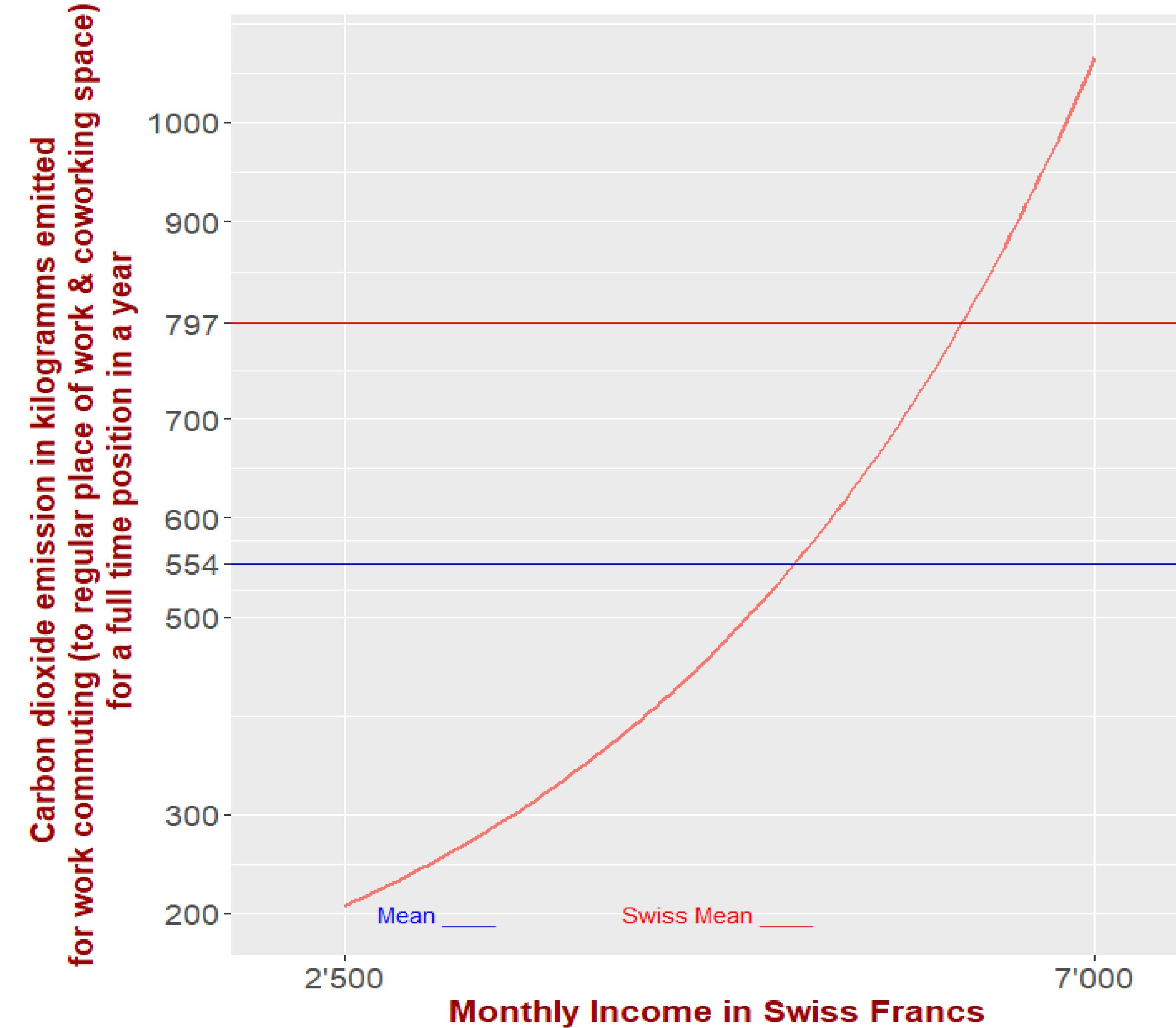
Exemplary public transport routing from home location to coworking space



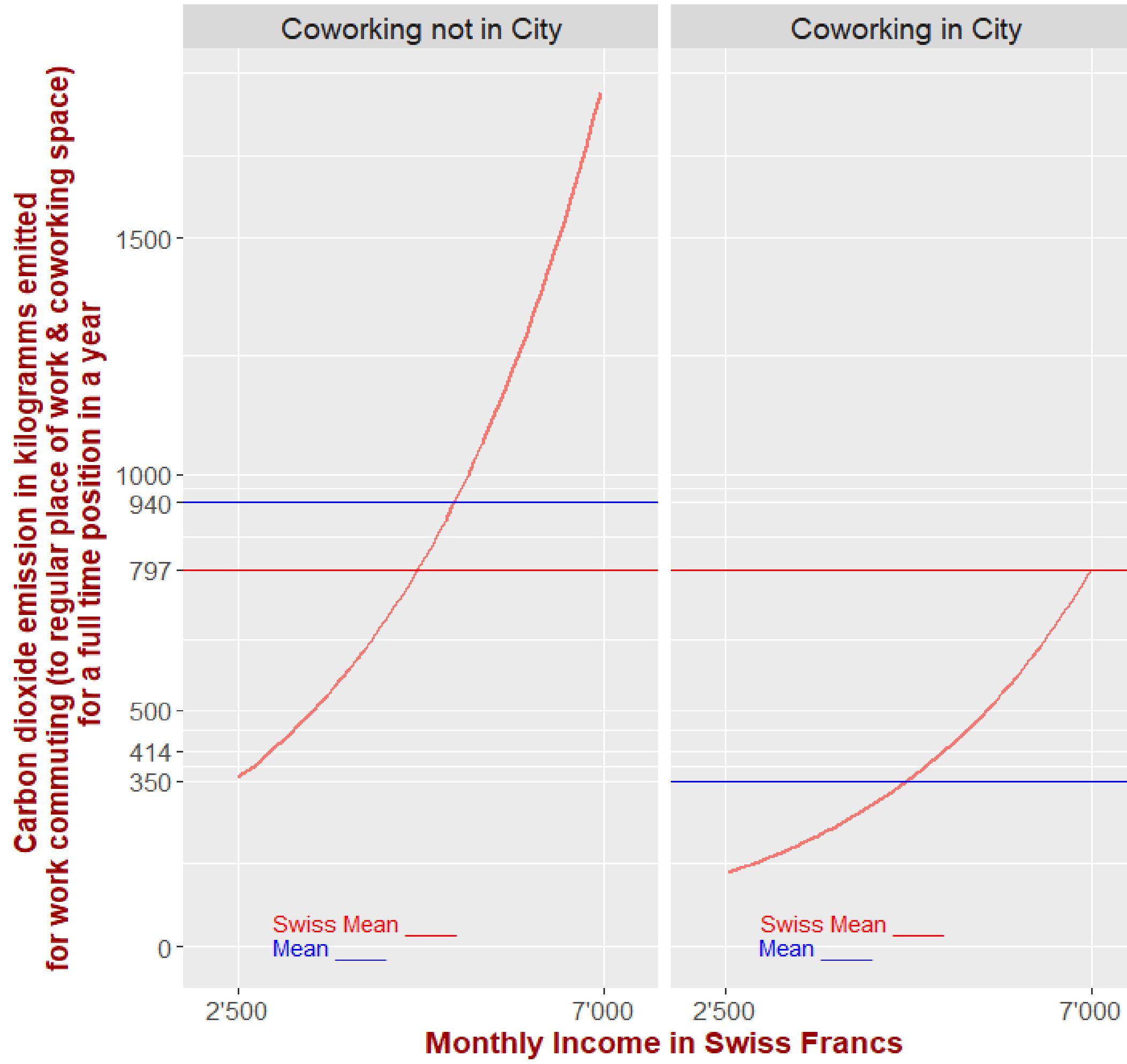
# Routing



# Some results



## Some results (2)



# POLICY

# Swiss Energy Strategy and the transport sector

## UNFCCC 2015

- Paris Climate Agreement (UNFCCC 2015), reduce GHG emission to **limit temperature increase to not more than 2 degrees till 2100.**

## Swiss Federal Council

- The Swiss Federal Council declared in its Energy Strategy 2050 **to cut GHG by 40% until 2050.**

## Transport 1/3

- The transport sector is responsible for almost **a third of Switzerland's GHG emissions** (SFOS 2018).

!

- **40% reduction of GHG** is only feasible if cuts are reached in the transport sector.  
**... but transport is growing !**

# Trends that jeopardize Energy Reduction in the transport sector

## Population is growing

- 2019: 8.6 million people
- 2035: 10 million inhabitants (forecast of FSO)

## Distances are growing (BFS/ARE, 2017)

- The Swiss citizen travels 37 km a day (+17 %, 1994-2015).
- Travel time is constant (~90 min/day)

## Urban sprawl is continuing

- One quarter of building area is located outside of the construction zone (Schwick et al. 2010).

## Infrastructure costs are rising

- In 2015, the cost of constructing and maintaining roads and public transportation was CHF 15.6 billion.

# Coping strategies: Ambitious targets and conflicting trends

De-carbonisation	<ul style="list-style-type: none"><li>Promotion of human powered mobility (HPM), electromobility, public transportation</li></ul>
Decrease Activity Spaces	<ul style="list-style-type: none"><li>“Life style of short distances”</li><li>Work, Leisure, Shopping in the same area</li></ul>
Policy Aim	<ul style="list-style-type: none"><li>Work-related travel = 24 percent of daily distances (SFOS/ARE, 2017, p. 38). → reduce commutes / work travel</li></ul>
RQ	<ul style="list-style-type: none"><li>Can <b>digital, remote</b> and <b>flexible</b> working conditions mitigate GHG?</li></ul>

## Abstract

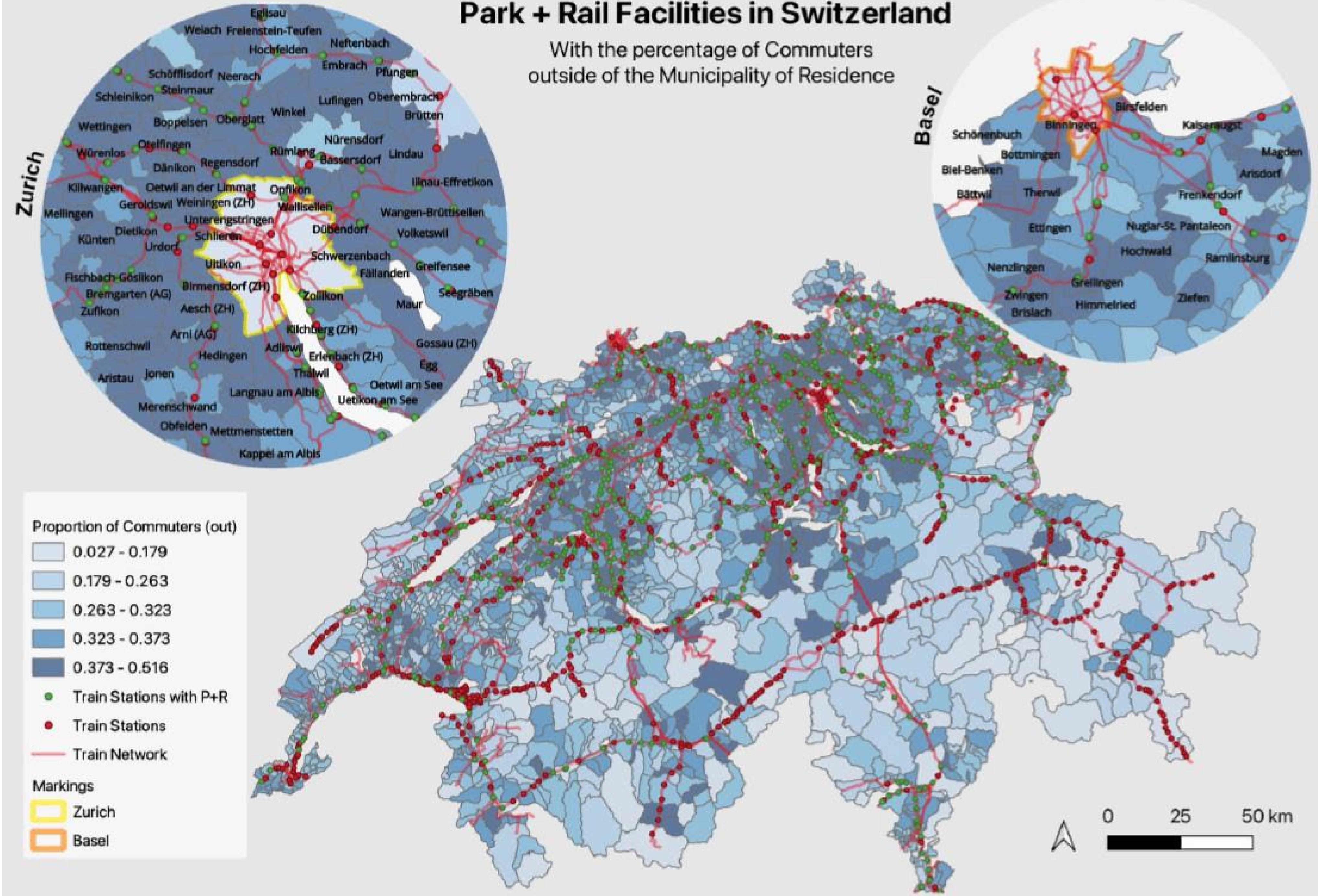
Today in transport policy it is assumed that new forms of work are producing falls in greenhouse gas (GHG) emissions from work-related commuting. So far, research on the effects of teleworking generally report positive environmental outcomes. However, no study has so far compared and contrasted the greenhouse gas (GHG) mitigation potential of the new phenomenon of coworking spaces with regard to urban-rural differences. Our results based on a representative sample of Swiss coworkers indicate that CO<sub>2</sub> emissions from commuting for work are significantly lower for urban coworking spaces (350 kilograms/year) than for rural coworking spaces (940 kilograms/year). If coworkers only would have worked in their coworking spaces, there would be a 10% reduction in CO<sub>2</sub> emissions of their commutes. Overall, our results indicate that coworking spaces, especially in urban areas, have the potential to support Switzerland's commitment to reduce greenhouse gas (GHG) emissions in the transport sector in line with the Paris Climate Agreement.

# **EXAMPLE**

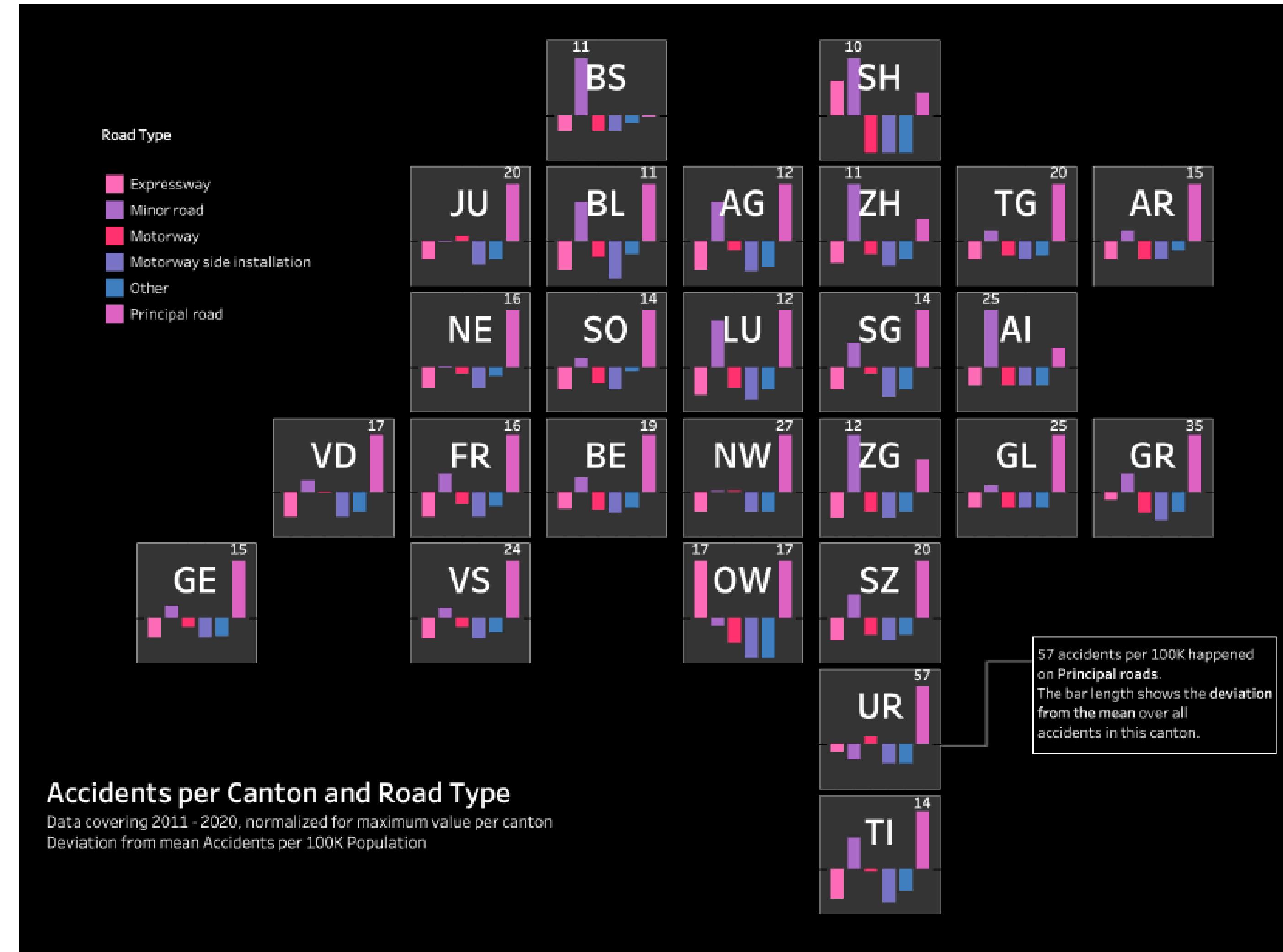
What did other Students do?

# Park + Rail Facilities in Switzerland

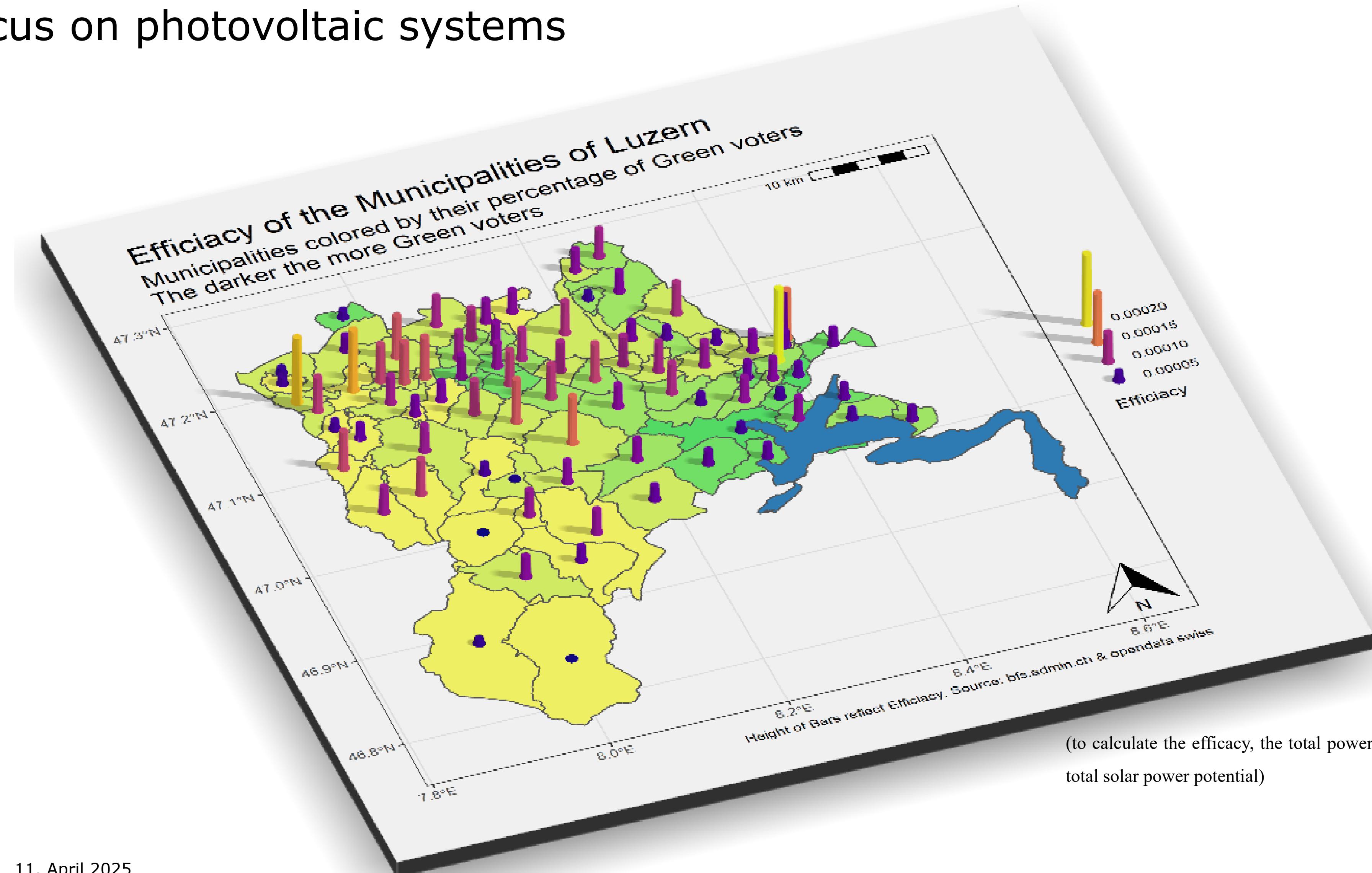
With the percentage of Commuters  
outside of the Municipality of Residence



# Accidents Deviation from the mean in the Canton (Tableau).



# Sustainable energy production and political orientation of Swiss municipalities, with a focus on photovoltaic systems



# Current public EV charging stations in Switzerland

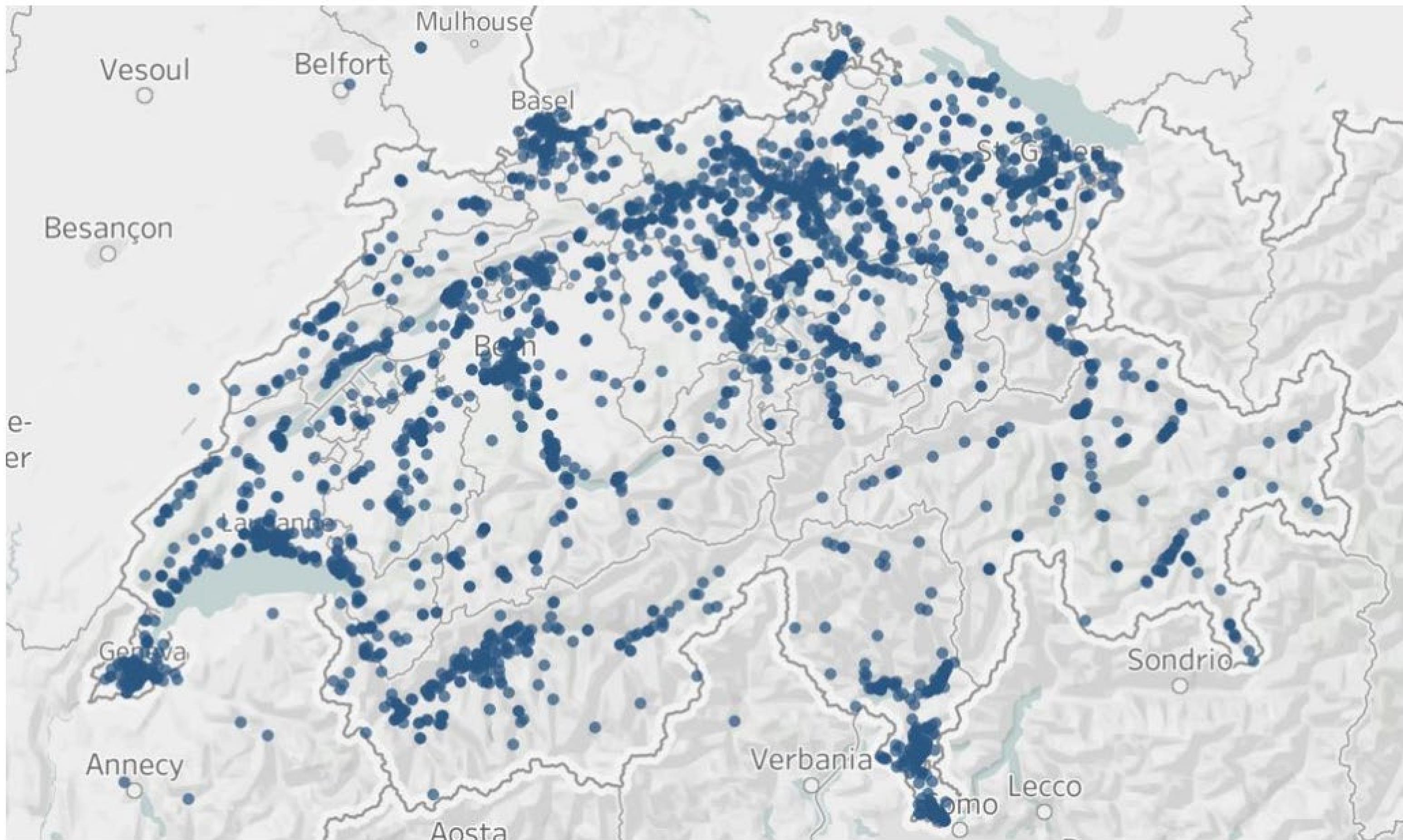
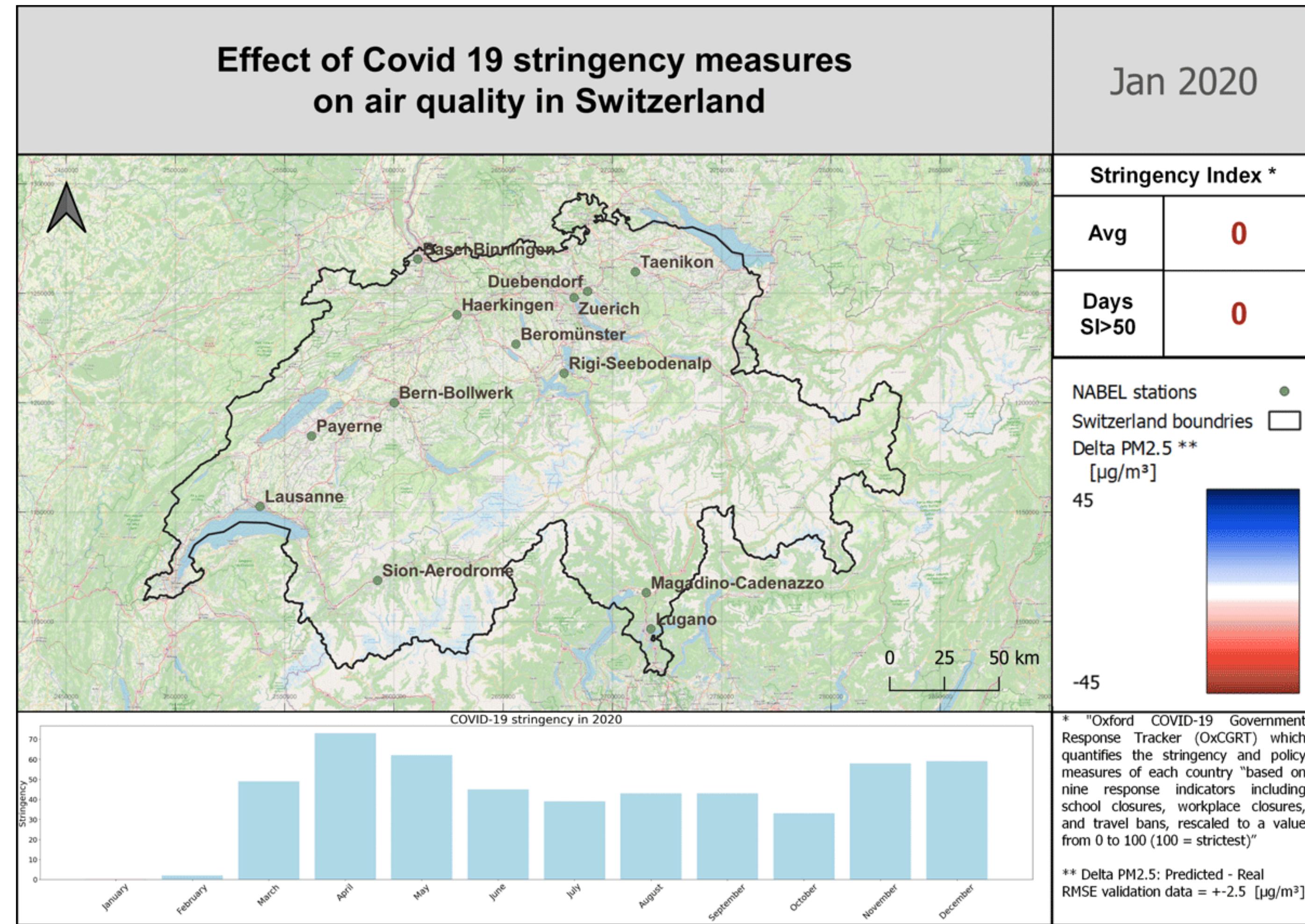
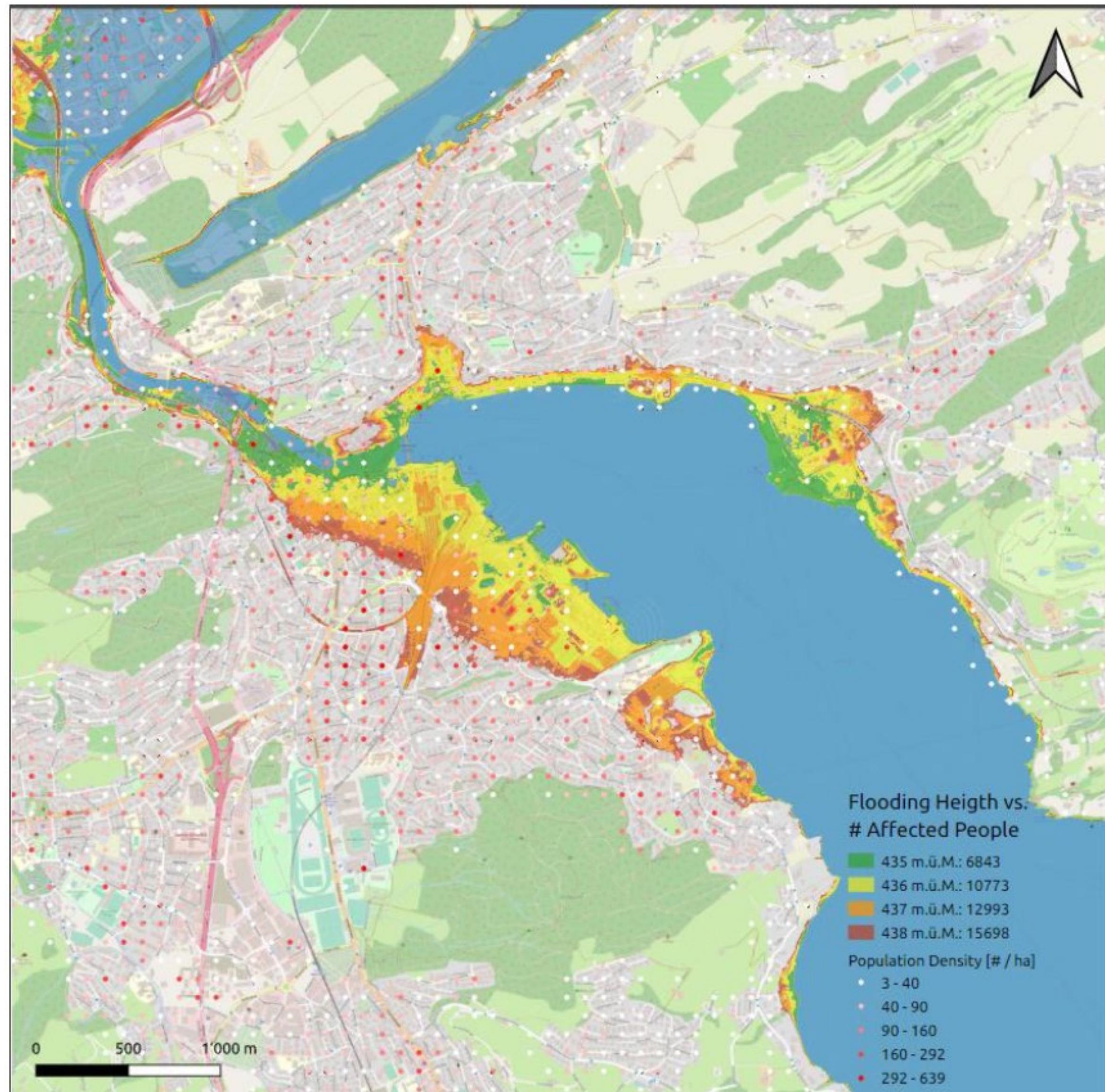


Figure 2: Current public charging stations in Switzerland (2020)

# Effects of Covid 19 stringency measures on air quality in Switzerland



# Lucerne Flooding Simulation



# New EV Cars / Charger

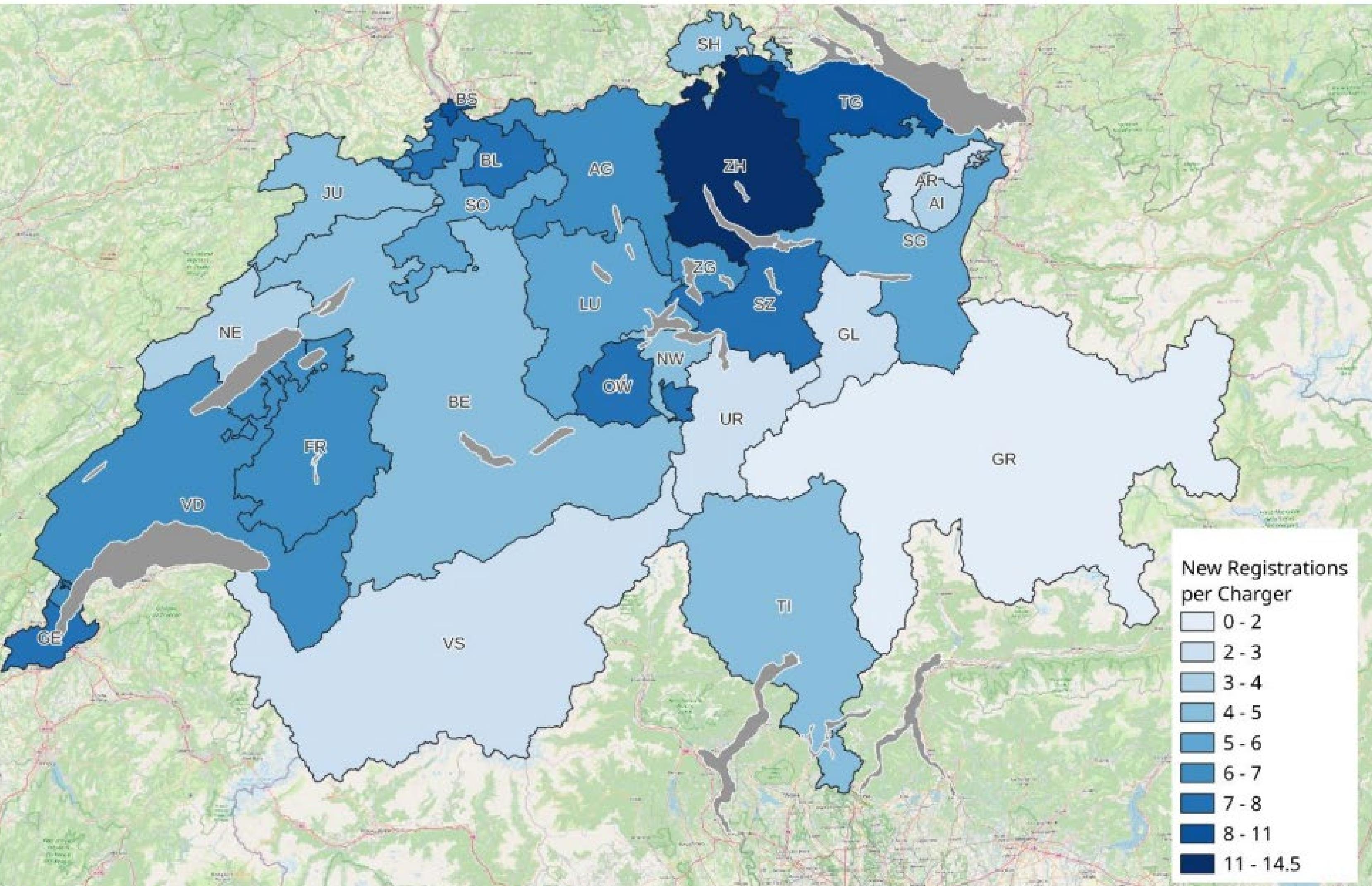


Figure 5: NewCar-Charger-Ratio - canton level (2020)



Abbildung 2: Anzahl PAX nach Zielland in Europa (Sommer).

## Anzahl Logiernächte aus europäischen Ländern

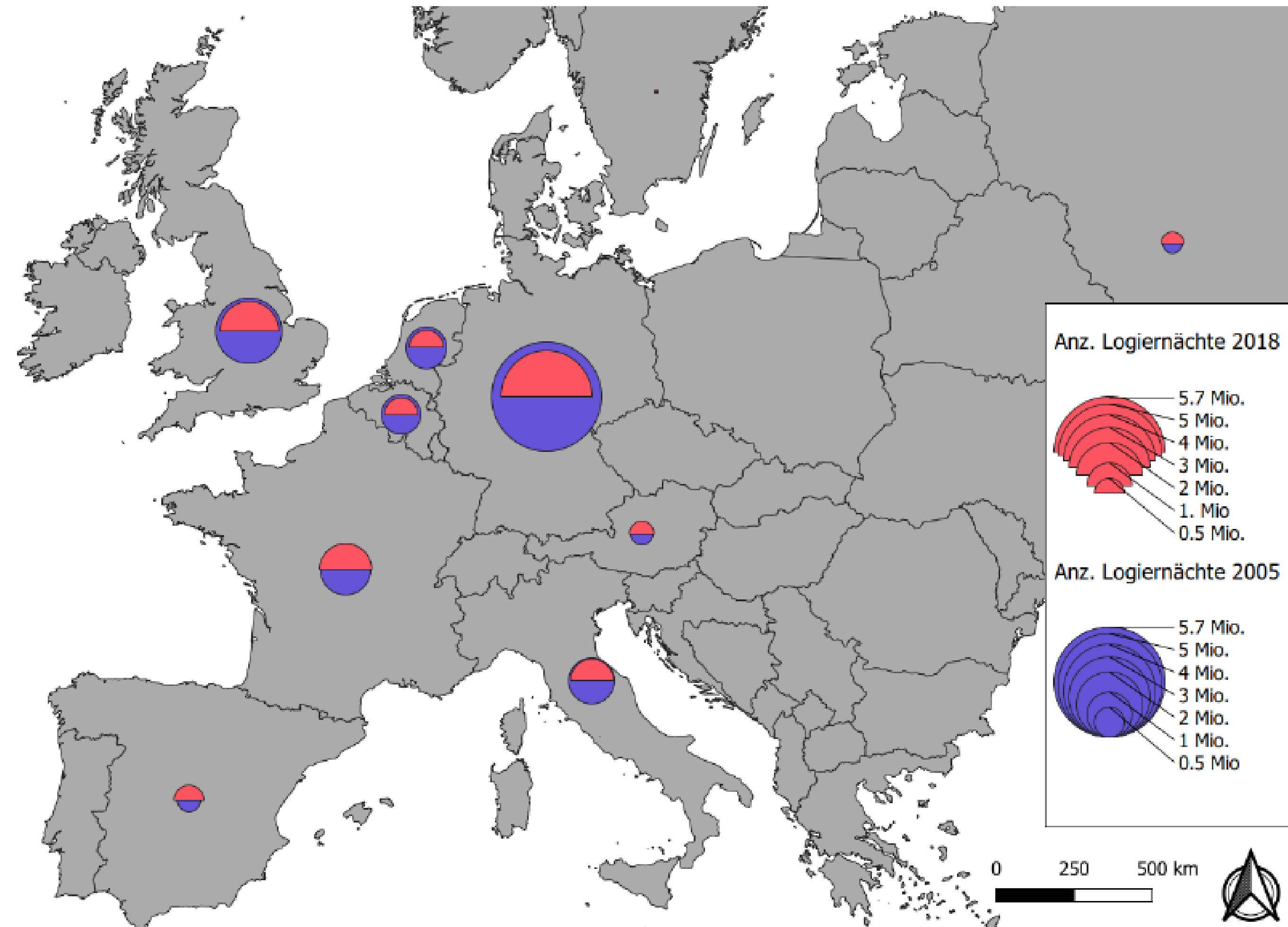


Abbildung 2 Anzahl Logiernächte aus europäischen Ländern

# **Group work:**

## **Which information would you like to display as a map?**

## Group work (groups of 4 persons)

- Assuming you have various spatial data at your disposal, such as :
- Population, employees, working population, rail and road networks, Points of Interests POIs (railroad stations, post offices, cultural institutions) and demand data (loads on the network, movement data)Y
- You also have background maps available for the spatial unit, such as:
- Borders of the cantons, municipalities of Switzerland, spatial units, quarters

**What differences would you like to see in Switzerland with this data on your own map?**

## Step 1

- Write down!
- Take notes for yourself:
  - **Theory:** What are the theoretical connections?
  - **Data:** Which spatial data do I know?
  - **Policy:** What differences do I want to **present?**

# Mission

- Form groups of up to 5 people.
- Discuss your ideas.
  - Discuss possible interesting applications,
  - which differences could be represented?
  - In what form could the differences be represented spatially?
- Use pens to sketch the map:
- spatial units, visualization of the data, legend
- Present your drawings in a short presentation.
- Please insert the groups here:

## Etherpads



Form your group ! (max. 5 persons per group)



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