

Master Thesis

Department of Environmental Systems Science

ETH Zurich

**Drivers of Urban Sprawl at the Local Scale:
Case Study Analysis of Municipalities
in the Zurich Metropolitan Area**

Author:

Lucia Thaler

Supervisors:

Prof. Dr. Felix Kienast

Dr. Anna Hersperger

Sophie Rudolf

WSL, Birmensdorf

Zurich and Birmensdorf, September 2014



Cover Picture

Village Gibswil in the municipality Fischenthal

(own photograph, 10/09/2014)

Author Contact Details

Lucia Thaler

Friedaustasse 7

8003 Zürich

lmt@gmx.ch

+41 79 711 64 31

Introductory Quote

«[In Switzerland] over the last fifty years, as much land has been taken up by urban growth as between the very first human settlements and the middle of the 20th century.»

(Schwick, Jaeger, Bertiller, & Kienast, 2012, p. 107)

Abstract

Urban sprawl is increasingly gaining attention in many places around the world and also in Switzerland – in science, planning and political debates. There is a consensus that the negative consequences of urban sprawl prevail and that it is unsustainable and should therefore be contained. This master thesis examined the drivers of urban sprawl at the local (municipal) scale by a two-step case study analysis of the municipalities Fällanden, Fehraltorf and Fischenthal in the Zurich metropolitan area, located along the gradient urban, periurban, rural. The urban sprawl definition by Jaeger and Schwick (2014) was used: the higher the share of settlement area, and the higher the dispersion of the settlement area, and the lower the utilisation density, the higher the degree of urban sprawl. A quantitative assessment employing the Weighted Urban Proliferation (Jaeger & Schwick, 2014) showed that urban sprawl tends to be highest in suburban municipalities and has increased over time and propagated to more distant municipalities from the conurbation centre Zurich. Expert interviews and local documents were used to analyse the local development of settlement and urban sprawl as well as related policies, influential actors and discourses since about 1950. By combining the quantitative and qualitative results, political, economic, technological, cultural and natural drivers have been identified, with an emphasis on political drivers. The drivers show very similar patterns among the three municipalities, albeit in quite different spatial and temporal contexts. An imbalance of power between land utilisation and protection interests has been identified as a crucial driver of urban sprawl. Constructors have been highly influential in determining local settlement development, while landscape protection interests have not been represented accordingly. This constitutes a tragedy of the commons (Hardin, 1968). Spatial planning policies have tightened over time, but not considerably addressed this imbalance. Therefore, to tackle urban sprawl, a mutual agreement to common coercion is needed, meaning collective democratic not private decision-making on settlement development.

Key words: urban sprawl, drivers, spatial planning, land use, landscape, tragedy of the commons, sustainability, case study, Zurich metropolitan area, Weighted Urban Proliferation

Zusammenfassung

Zersiedelung wird in der Wissenschaft, Raumplanung und in politischen Debatten vermehrt diskutiert, weltweit und auch in der Schweiz. Es gibt einen Konsens, dass Zersiedelung vornehmlich negative Folgen hat und demnach nicht nachhaltig ist und eingedämmt werden sollte. Die Masterarbeit hat die Treiber der Zersiedelung auf lokaler Ebene untersucht mit einer zweistufigen Fallstudie der Gemeinden Fällanden, Fehraltorf und Fischenthal im Metropolitanraum Zürich, die auf einem Gradienten suburban, periurban, rural liegen. Die Zersiedelungs-Definition von Jaeger und Schwick (2014) wurde verwendet: Die Zersiedelung ist umso stärker, je grösser der Anteil von Siedlungsgebiet, je grösser die Streuung des Siedlungsgebiets und je geringer die Ausnützungsdichte ist. Eine quantitative Untersuchung mittels der gewichteten Zersiedelung (Jaeger & Schwick, 2014) hat gezeigt, dass die Zersiedelung tendenziell in suburbanen Gemeinden am höchsten ist und über die Zeit zugenommen und sich von Zürich in weiter entfernte Gemeinden ausgebreitet hat. Experteninterviews und lokale Dokumente wurden verwendet, um die Entwicklung von Siedlung und Zersiedelung, relevante Politikmassnahmen, einflussreiche Akteure und Diskurse seit etwa 1950 zu analysieren. Die quantitativen und qualitativen Resultate wurden kombiniert und damit politische, wirtschaftliche, technische, kulturelle und natürliche Treiber identifiziert, mit einem Fokus auf politischen Treibern. Die Treiber zeigen sehr ähnliche Muster in den drei Gemeinden, wenn auch in unterschiedlichen räumlichen und zeitlichen Kontexten. Ein Machtungleichgewicht zwischen Landnutzungs- und Schutz-Interessen hat sich als wichtiger Treiber der Zersiedelung herausgestellt. Bauinteressierte waren sehr einflussreich auf die lokale Siedlungsentwicklung, während Landschaftsschutzinteressen nicht entsprechend vertreten waren. Dies stellt eine Tragik der Allmende dar (Hardin, 1968). Die Raumplanungspolitik wurde strikter über die Zeit, aber hat dieses Ungleichgewicht nicht wirklich angegangen. Darum braucht es gegen Zersiedelung eine gemeinschaftliche Zustimmung zur Regulierung der Landnutzung, was kollektives demokratisches nicht privates Entscheiden über Siedlungsentwicklung bedeutet.

Schlagwörter: Zersiedelung, Treiber, Raumplanung, Landnutzung, Landschaft, Tragik der Allmende, Nachhaltigkeit, Fallstudie, Metropolitanraum Zürich

Glossary

English	Deutsch
Agglomeration programme	Agglomerationsprogramm
Area development	Arealüberbauung
Area-utilisation permit	Flächennutzungszertifikat
Building permit	Baubewilligung
Cultural Land Initiative	Kulturlandinitiative
Dispersion (DIS)	Dispersion / Streuung (DIS)
Federal Council	Bundesrat
Land Consumption (LC)	Flächeninanspruchnahme (FA)
Landscape fragmentation	Landschaftszerschneidung
Landscape Initiative	Landschaftsinitiative
Location competition	Standortwettbewerb
Municipal assembly	Gemeindeversammlung
Municipal Chancellor	Gemeindeschreiber
Popular initiative	Volksinitiative
Referendum	Volksabstimmung
Second Home Initiative	Zweitwohnungsinitiative
Urban Permeation (UP)	Urbane Durchdringung (UP)
Urban Permeation Unit (UPU)	Durchsiedlungseinheit (DSE)
Urban sprawl	Zersiedelung
Utilisation Density (UD)	Ausnutzungsdichte (AD)
Weighted Urban Proliferation (WUP)	gewichtete Zersiedelung (Z)
Zoning regulations	Bau- und Zonenordnung

Table of Contents

Abstract.....	3
Zusammenfassung	4
Glossary.....	5
1. Introduction	8
1.1 Definition of Urban Sprawl	9
1.2 Consequences of Urban Sprawl	11
1.3 Concept of Drivers	13
1.4 Project Context	14
1.5 Goal and Research Questions.....	14
1.6 Hypotheses	15
2. Methods and Data.....	16
2.1 Case Study Analysis	16
2.2 Spatial and Temporal System Boundaries.....	17
2.2.1 Study Area.....	17
2.2.2 Temporal System Boundaries	20
2.3 Weighted Urban Proliferation.....	20
2.4 Case Selection by Theoretical Sampling	22
2.5 Expert Interviews	23
2.5.1 Interviewees	23
2.5.2 Interview Procedure and Evaluation.....	24
3. Results	25
3.1 Propagation of Urban Sprawl.....	25
3.2 Municipalities	30
3.2.1 Suburban: Fällanden	31
3.2.2 Periurban: Fehraltorf.....	38
3.2.3 Rural: Fischenthal.....	45
3.3 Comparison between Municipalities and Summary	49
3.3.1 Settlement Development and Urban Sprawl	49
3.3.2 Actors, Construction Activities and Planning Policies.....	51
3.4 Drivers of Urban Sprawl.....	53

4. Discussion.....	54
4.1 Discussion of Methods.....	55
4.1.1 Case Study Analysis.....	55
4.1.2 Weighted Urban Proliferation	55
4.1.3 Expert Interviews	56
4.1.4 Relation between Settlement Development, Urban Sprawl and Drivers ..	56
4.2 Discussion of Results.....	57
4.2.1 Propagation of Urban Sprawl	57
4.2.2 Drivers of Urban Sprawl	58
4.3 Policy Implications for Curtailing Urban Sprawl	60
4.4 Further Research	61
5. Conclusions.....	61
6. References.....	63
List of Figures	67
List of Tables	68
Acknowledgements.....	69
Appendix.....	70
I. Interview Field Manual	70
II. Weighted Urban Proliferation Values	72

1. Introduction

For the first time in human history more than half of the world's population live in cities and this number is projected to increase to 70% by 2050 (UN, 2008). In Europe even around 80% of the population live in urban places nowadays (Antrop, 2004) and in Switzerland 73% (FSO, 2014). Cities are not static but have always been dynamic and are constantly changing. They are not only constituted by their physical-material but also by their social structures, and changes in the physical structures are interrelated to lifestyle changes (Hesse & Kaltenbrunner, 2005).

Along with the ever-increasing intensity of land use for settlement, agriculture and other purposes the pressure and competition on land and soil are exacerbating and bearing conflict potential. Hersperger and Bürgi (2009) identified urbanisation as most important process for landscape change in a case study of municipalities in the Zurich metropolitan area in the last decades.

A widespread accompaniment of urbanisation is urban sprawl. Urban sprawl transforms cities and landscapes and blurs the boundary between urban and natural places (Schwick et al., 2012). In between a space emerges that is neither city nor countryside (Hesse & Kaltenbrunner, 2005).

Recently urban sprawl is increasingly gaining attention in many places around the world including Switzerland. It is associated with manifold environmentally, socially and economically mostly negative consequences (see Section 1.2). Therefore, the opposite development, namely a compact city, is promoted by scientists and planners as sustainable (e.g. Ewing, 1997). Although Swiss authorities have already started to establish spatial and regional planning with the goal to secure a reasonable and sustainable land use decades ago, urban sprawl has doubled in the last half century and is still worsening in most parts of the country, with considerable differences in the degree of urban sprawl between regions and municipalities (Schwick et al., 2012).

Not only experts from science and planning are concerned about urban sprawl but also the broader public. In Switzerland, urban sprawl has entered the public discourse and the political agenda in recent years with several popular initiatives (Jaeger & Schwick, 2014; Muggli, 2014).

Also research on urban sprawl is intensifying. It involves multiple disciplines like urbanism, geography, landscape ecology, spatial economics, political science and environmental sciences, and can broadly be grouped into four categories:

- 1) Assessment and measurement of urban sprawl
- 2) Consequences of urban sprawl
- 3) Drivers of urban sprawl
- 4) Evaluation of policies to curtail urban sprawl and discussion of alternative urban developments

This master thesis belongs to the third category and investigates the drivers of urban sprawl at the local scale in Swiss municipalities in the last decades.

The following sections of the introduction give a definition of urban sprawl and a literature overview of its consequences, present the concept of drivers, the project context and finally the goals and research questions and hypotheses of this master thesis. Chapter 2 describes the study area and applied methods and data. Chapter 3, 4 and 5 comprise the results, discussion and conclusions.

1.1 Definition of Urban Sprawl

The term urban sprawl was supposedly introduced in the USA in 1937 (and the German equivalent «Zersiedelung» in the 1960s), but there is no commonly accepted definition of urban sprawl to date neither in everyday language nor in science (Siedentop, 2005). Different scientific studies use different definitions according to the focus of their research, which hinders comparability (Willhauck, 2013). Urban sprawl serves as an umbrella term for a range of undesired urban developments mostly related to suburbanisation in contrast to the planned and concentric high-density urban development during industrialisation in the 19th century. Johnson (2001) notes that urban sprawl is not binary with only two categories sprawl and non-sprawl but occurs to different degrees on a continuous scale. Hesse and Kaltenbrunner (2005) criticise the often ambiguous and polarised use of the term urban sprawl, not fully accounting for the complexity of underlying causal relations. Despite its ambiguity, the term has an invariably negative connotation opposing uncontrolled urban development and implying the normative valuation of a compact city as ideal (Siedentop, 2005).

A clear definition of urban sprawl is needed to study its causes and consequences, to compare the degree of urban sprawl between different regions and points in time, and to evaluate planning scenarios and policies (Jaeger & Schwick, 2014). This master thesis uses the definition introduced by Schwick, Jaeger, Bertiller, and Kienast (2010; 2012) composed of the three independent inputs settlement area, dispersion and utilisation density:

«Urban sprawl is a phenomenon that can be visually perceived in the landscape. A landscape suffers from urban sprawl, if it is permeated by urban development or solitary buildings, and when land uptake per inhabitant or job is high. The more area built over in a given landscape (amount of built-up area), and the more dispersed this built-up area in the landscape (spatial configuration), and the higher the uptake of built-up area per inhabitant or job (lower utilisation intensity in the built-up area), the higher the degree of urban sprawl.» (Jaeger & Schwick, 2014, pp. 294-296) (illustrated by Figure 1)

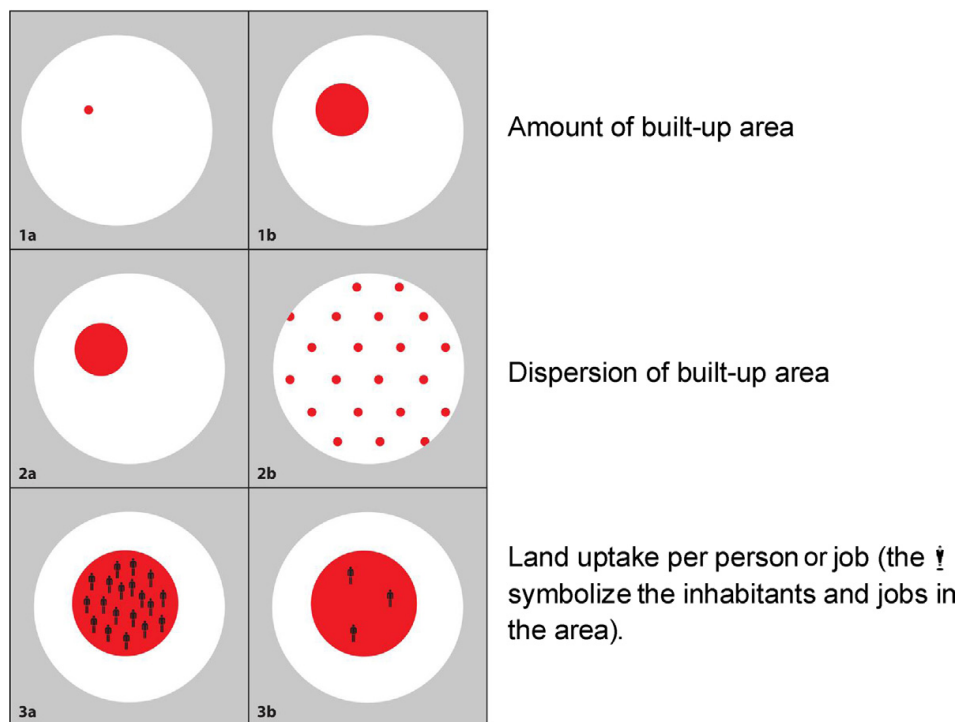


Figure 1. Illustration of the definition of urban sprawl. From left (a) to right (b) the degree of urban sprawl of the given landscape (white circle) increases with higher amount of built-up area (red circle) (1), higher dispersion of the built-up area (2), and lower utilisation density, respectively higher land uptake per person or job (3) (from Jaeger & Schwick, 2014, p. 297).

This definition is precise, reasonably accounts for the multidimensionality of urban sprawl and allows for quantitative measurements (see Section 2.3). Its particular advantage is that it regards urban sprawl as a state and not as a process, which is necessary to clearly distinguish urban sprawl from its causes and consequences (Schwick et al., 2012).

1.2 Consequences of Urban Sprawl

Manifold environmental, social and economic consequences are attributed to urban sprawl and scientifically and politically discussed. Most of the consequences are negative, but also a few neutral or positive aspects of urban sprawl are discussed in the scientific literature. As well as urban sprawl itself also its consequences are not simple to test and measure empirically, so they are afflicted with considerable uncertainties.

One of the most prominent positive arguments for urban sprawl is that some people like living in suburban areas, which feature a high degree of urban sprawl (Gordon & Richardson, 1997). They prefer to live out of the city in the green in low-density neighbourhoods, tempted by the ideal of the garden city (Howard, 1902). They seek the calmness and green spaces, and move away from the core city because of crime and social tensions, while through the modern mobility and communication systems they are still connected to the city (Adams, Fleeter, Kim, Freeman, & Cho, 1996; Ewing, 1997). They are attracted by lower land prices, respectively can afford more living area per capita than in the city (Ewing, 1997; Mieszkowski & Mills, 1993). While this argumentation focuses on individual benefits of living in suburban areas, also an economic consideration is put forward for sprawl. Gordon and Richardson (1997) argue that current sprawling city patterns are the efficient outcome of markets, just affected by external effects due to transportation subsidies, land-use regulations and other market distortions.

However, most scientists and planners share the consensus that negative consequences prevail and urban sprawl should therefore be contained. Sprawling urban development is regarded unsustainable, since it affects all three dimensions of sustainability – ecology, society and economy – and does not allocate the scarce resource land optimally (Schwick et al., 2012). The consequences span a wide range

of issues, depend on the geographical context and are complex, interrelated and involve secondary effects.

Urban sprawl occurs on the outskirts of cities and is characterised by unplanned dispersed urban development and high land consumption per capita. Natural areas are built up, meaning a loss of fertile arable land for agriculture as well as ecologically valuable habitats, and deforestation (Johnson, 2001; Miller, 2012). Environmental services like water infiltration and purification of built-up soils degrade, and risks of natural hazards like floods increase (Romero & Ordenes, 2004). These degradations are often irreversible. Urban sprawl is usually accompanied by landscape fragmentation by streets and other infrastructure lines, acting as barriers for animals and plants and dividing, isolating and diminishing their habitats, which threatens biodiversity (Schwick et al., 2012). Even the micro climate can change with heat islands (Romero & Ordenes, 2004). Scenic beauty of landscapes and their value for recreation and tourism are diminished. Loss of open space, cultural landscapes and historically grown characteristic town structures puts heritage and local identity at risk. The expanding suburban lifestyle is linked to a high environmental impact and energy consumption per capita.

Besides these environmental there are also many social and economic consequences. Due to low population density the supply of public amenities like shops, public transportation, restaurants, education and healthcare services, etc. is deficient, because they cannot operate economically. The locations of residents' daily activities living, working and spending leisure time are increasingly separated, inducing longer commuting distances (Travisi, Camagni, & Nijkamp, 2010). Since other modes of transport are less suitable in a suburban configuration, residents are locked into car dependency, giving rise to congestion, pollution and road accidents. Infrastructure construction and maintenance costs for streets, water pipes etc., which are usually financed by public spending, are disproportionately high per capita.

The traditional city centres are deconcentrated and weakened by shopping centres and office complexes at the edges (Garreau, 1991). The decreasing functionality of core cities could lead to a decline in creativity, innovation and productivity and therefore affect the regional economy (Siedentop, 2005).

Along with urban sprawl rich and/or poor ghettos (gated communities, slums) can form, leading to social exclusion and segregation between classes and between

locals and migrants (Zhao, 2013). Walking and social interactions decrease in the daily routine (Polidoro, de Lollo, & Fernandes Barros, 2011), ultimately affecting physical and mental health and quality of life.

Many of the consequences involve indirect and external effects. So urban sprawl also raises questions about equity and the allocation of benefits and costs. Ewing (1997, p. 107) makes the point that «the costs of sprawl are borne by all of us, not just those creating it».

1.3 Concept of Drivers

Earlier research on land use and land cover change rather focused on states and patterns, while nowadays functions and processes are increasingly studied (Hersperger & Bürgi, 2009). This opens up the field for investigating underlying causal processes called drivers or driving forces, which are responsible for landscape changes. To understand and manage land use and cover changes, it is crucial to examine the relevant drivers.

There are different ways to categorise drivers. Principally anthropogenic drivers are distinguished from natural ones (Briassoulis, 2000). Natural drivers are determined by bio-physical characteristics of the environment like topography, spatial configuration, climate, soil type, natural disturbances, etc. (Briassoulis, 2000; Hersperger & Bürgi, 2009). According to Briassoulis (2000) anthropogenic drivers can be categorised as human utilisation of land versus its mitigation respectively protection. Here, this means drivers pro versus contra urban sprawl. Instead Hersperger and Bürgi (2009) divide the anthropogenic drivers into four categories: political, economic, cultural and technological drivers. Mostly these categories are not sharply separated, since for example political and economic drivers are closely interrelated through political steering of economic mechanisms. While some studies (e.g. Gennaio, 2008) only look at certain categories of drivers, others like this master thesis holistically include all types. The five driver categories defined by Hersperger and Bürgi (2009) are intersected with the two anthropogenic driver categories given by Briassoulis (2000) to categorise the drivers of urban sprawl into the ten resulting categories (see Section 3.4).

1.4 Project Context

As in many places around the world, also in Switzerland demands and pressure on land and soil are increasing. Therefore the Swiss National Science Foundation (SNSF) has launched the National Research Programme (NRP) 68 on «Sustainable Use of Soil as a Resource» lasting from 2013 to 2017. The topics of the National Research Programmes are selected by the Swiss Federal Council and considered a «contemporary problem of national importance» (SNSF, 2012, p. 4). The NRP 68 strives for fostering a «sustainable and resource-efficient soil management in Switzerland» (SNSF, 2012, p. 5). It consists of 19 projects among which one addresses the issue of urban sprawl.

The project called «Controlling Urban Sprawl to Limit Soil Consumption (SPROIL)» is carried out by the Swiss Federal Institute for Forest, Snow and Landscape Research WSL. The project aims at investigating the political and socio-economic drivers of urban sprawl in Switzerland since about 1950. On the basis of the identified drivers, models to predict future land consumption patterns under different scenarios will be developed. Finally, recommendations for political and planning measures to contain urban sprawl will be derived to transfer and apply the gained scientific knowledge to practice (WSL, 2013).

Within this project this master thesis is conducted. Several different approaches are used in the project to complement each other to get a more holistic understanding. While on the one hand some project members examine the influences of potential drivers of urban sprawl statistically for whole Switzerland, this master thesis on the other hand looks at a small number of municipalities in more detail.

1.5 Goal and Research Questions

The actual land-use decisions regarding settlement development and urban sprawl, whether and where to construct what kind of buildings, are made on the local scale. Individual constructors decide about their construction activities and the municipalities have the authority to give building permits in accordance with the law. Switzerland is highly federalist due to its territorial, cultural and economic heterogeneity and history, so the municipalities have a high autonomy, even though the governmental responsibility for spatial planning is concentrated at the cantonal

level (Muggli, 2014). At the local (municipal) scale, all private and governmental influences come together and manifest themselves in land cover. Therefore, valuable insights from studying the drivers of urban sprawl at the local scale are expected. The goal of this master thesis is to identify the drivers of urban sprawl at the local scale. The findings should contribute to the overarching research project described in Section 1.4 and later be valuable to develop strategies to curtail urban sprawl.

The guiding question is:

Which are the drivers of urban sprawl at the local (municipal) scale?

The guiding question will be answered by examining the following research questions:

- 1) How has urban sprawl propagated over space and time in the study area?
- 2) How have settlement, urban sprawl and related policies developed in the study municipalities? Which actors and discourses have influenced the developments?

To answer the research questions, a case study analysis of municipalities in the Zurich metropolitan area is conducted. The first research question is addressed with quantitative data, while the second research question is tackled qualitatively. Finally, the guiding question is answered by combining the results.

1.6 Hypotheses

While the investigation of the guiding question is exploratory, the analysis is based on two hypotheses corresponding to the two research questions:

- 1) Urban sprawl is highest in suburban areas, and over time has increased and propagated to more distant areas from the conurbation centre.

Urban sprawl has started at the edge of the core city Zurich in the mid 20th century, along with the suburbanisation wave of the 1960s (Amt für Raumordnung und Vermessung, 2001). Urban sprawl has not been successfully contained and has increased (Schwick et al., 2012). Over time, the conurbation area has expanded, and alongside urban sprawl has propagated to the new urban edges.

- 2) Settlement development has been dominated by land utilisation not protection interests. Though, awareness of environmental and land protection have increased over time, leading to tighter spatial planning policies.

Urban sprawl is characterised by an excessive utilisation of the finite resource land (Jaeger & Schwick, 2014). It constitutes a tragedy of the commons: The constructors have individual benefits from taking up more land for (sprawling) settlement, since they benefit from utilising the buildings directly or renting/selling them for profit. At the same time, the prevailing negative consequences of urban sprawl (see Section 1.2) are borne by the whole community. As long as the community do not agree to common coercion to limit individual utilisation of the resource for the benefit of all, the resource is being depleted (Hardin, 1968; Jaeger & Schwick, 2014).

However, along with the acceleration of different environmental problems over time, also environmental awareness and calls for protection have augmented. In Switzerland, public debate about landscape protection and urban sprawl has intensified in recent years (Jaeger & Schwick, 2014; Muggli, 2014). Several popular initiatives and referenda bear testimony to this trend: the launch of the Landscape Initiative in 2007, the acceptance of the Second Home Initiative in 2012, the acceptance of the revision of the Federal Act on Spatial Planning in 2013, and the acceptance of the cantonal Cultural Land Initiative in Canton Zurich in 2012.

2. Methods and Data

To answer the research questions outlined in Section 1.5, a two-step case study analysis was conducted that involved different methods described in this Chapter. First, the degree of urban sprawl of municipalities along a gradient from urban to rural was assessed with the quantitative urban sprawl measurement method «Weighted Urban Proliferation (WUP)» developed by Schwick et al. (2012). Second, three case study municipalities were selected along this gradient using the concept of theoretical sampling (Glaser & Strauss, 1967). In the selected municipalities, experts were interviewed and local documents reviewed to identify the drivers of urban sprawl.

2.1 Case Study Analysis

Case study analysis is an «appropriate approach to real, complex, current problems that cannot simply be treated by one of the known analytic methods» (Scholz & Tietje, 2002, p. 5). Even though a case is unique, it also has common features that can be generalised (Stake, 1995). It allows integrating knowledge from different

disciplines, perspectives and sources generated by different quantitative and qualitative methods to comprehend the case in its context and to support decision-making (Scholz & Tietje, 2002). Case studies have a long tradition in several disciplines, among them planning and environmental sciences (Scholz & Tietje, 2002).

Since urban sprawl is a contemporary contextualised problem that is difficult to study with a single method, case study analysis is highly suitable. While case studies are often applied to develop and evaluate alternatives to improve the case, the case study analysis for this master thesis is mainly explanatory given by the research questions. The case study area and time period as well as methods and data are presented in the following sections.

2.2 Spatial and Temporal System Boundaries

This section gives the spatial and temporal system boundaries for the analysis – the study area and time period – and their rationale.

2.2.1 Study Area

This master thesis focuses on a small number of Swiss municipalities located in the Zurich metropolitan area along a gradient from urban to rural. Zurich is the biggest Swiss city with a population of just under 400'000 inhabitants and functions as a dynamic and attractive economic and cultural centre (Stadt Zürich, 2014). The Zurich metropolitan area counts a population of 1 to 2 million, depending on definition (FSO, 2014; Kuster & Meier, 2008). It is prone to urban sprawl. The Weighted Urban Proliferation values of the area lie considerably above the Swiss average (Schwick et al., 2012). Therefore, municipalities in the Zurich metropolitan area were selected for the case study analysis. To study the propagation of urban sprawl over space and time (research question 1), the municipalities were selected along a transect from urban to rural. The most suitable transect for this study is located south-eastern of Zurich in the regions Glattal and Zürcher Oberland. All other transects are less suitable, because they are either dominated by Lake Zurich, or the metropolitan area involves two cantons with distinct legislative differences. Additionally, the selected transect avoids interference with another central place, the smaller city Winterthur.

The selection of the municipalities in the region follows the perimeters of the agglomeration programmes. An agglomeration programme is a cantonal planning instrument to coordinate the development of settlement, landscape and traffic in conurbation areas between policy sectors and state levels (Kanton Zürich, 2012c). Agglomeration programmes are employed in regions, where the challenges of urban development are particularly pronounced. Figure 2a shows the perimeters of the four current agglomeration programmes of Canton Zurich.

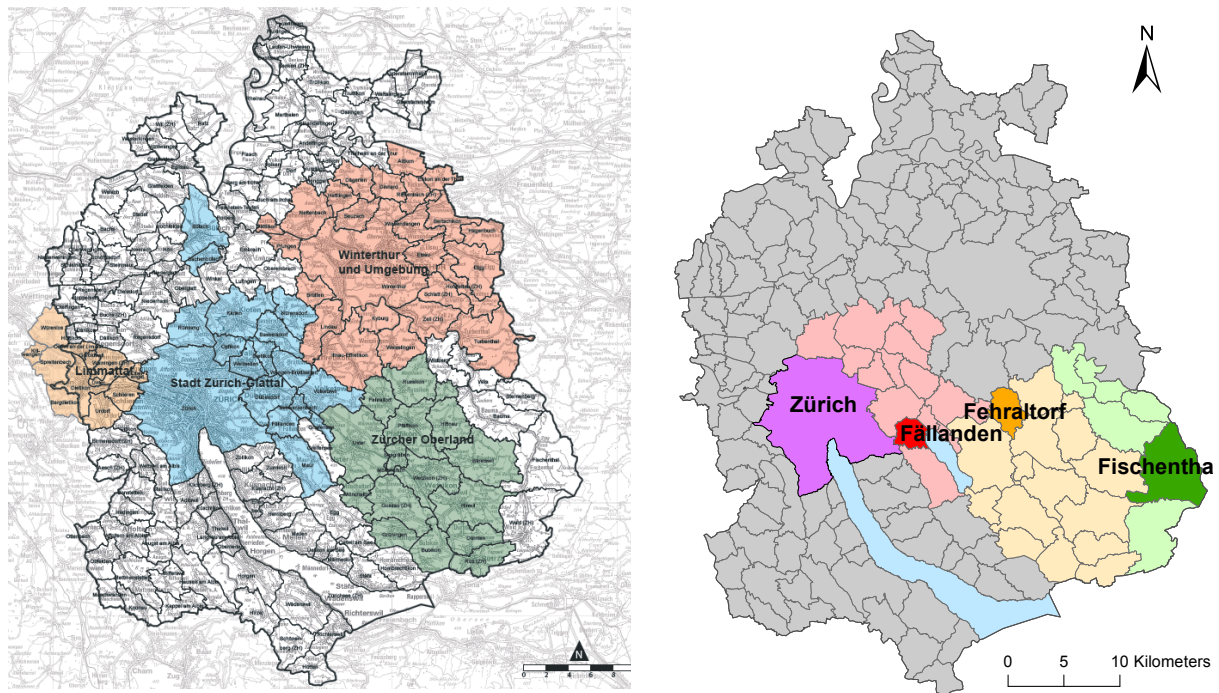


Figure 2. 2a (left). Perimeters of the four current agglomeration programmes of Canton Zurich (from Kanton Zürich, 2012c, p. 415). 2b (right). Study area and the three selected municipalities Fällanden, Fehraltorf and Fischenthal.

For the case study analysis the municipality Zurich is considered the urban centre. The 14 remaining municipalities in the agglomeration programme Stadt Zürich - Glattal (coloured blue in Figure 2a), excluding the two northern municipalities Bülach and Bachenbülach, are considered suburban municipalities. The 15 municipalities in the agglomeration programme Zürcher Oberland (coloured green in Figure 2a) are considered periurban. The 6 municipalities located in the east of Canton Zurich that are not part of any agglomeration programme (coloured white in Figure 2a) are considered rural. This sums up to 36 municipalities in total, which are comprised in Table 1.

Table 1. The 36 municipalities in the study area

Municipality	Distance Category	Distance to Conurbation Centre Zurich [km]	Area [m ²]	Inhabitants + Jobs (in 2010)
Zürich	urban	0	87930000	675395
Wallisellen	suburban	6	6420150	25475
Opfikon	suburban	7	5589900	30791
Dübendorf	suburban	7	13621050	39662
Fällanden	suburban	7	6384150	10024
Dietlikon	suburban	8	4245750	11976
Kloten	suburban	9	19268550	45891
Rümlang	suburban	9	12414600	11314
Schwerzenbach	suburban	9	2656575	6867
Wangen-Brüttisellen	suburban	9	7920450	10636
Bassersdorf	suburban	10	9025200	13911
Greifensee	suburban	10	2324025	6382
Maur	suburban	10	14769450	11012
Volketswil	suburban	10	14039325	25247
Nürensdorf	suburban	12	10045125	5850
Uster	periurban	14	28508625	43425
Mönchaltorf	periurban	15	7593075	4383
Fehraltorf	periurban	16	9477450	8488
Gossau (ZH)	periurban	18	18262800	11421
Seegräben	periurban	18	3394800	1553
Pfäffikon	periurban	18	17345925	14259
Russikon	periurban	18	14209875	4820
Grüningen	periurban	19	8789850	4254
Wetzikon (ZH)	periurban	20	16376625	31038
Hittnau	periurban	21	12964050	4026
Bäretswil	periurban	24	22198500	5529
Bubikon	periurban	24	11610900	8708
Hinwil	periurban	24	22281975	15789
Dürnten	periurban	25	10221300	7642
Rüti (ZH)	periurban	27	10060650	15371
Wildberg	rural	22	10557675	1089
Wila	rural	24	9193050	2345
Bauma	rural	25	20807325	5463
Sternenberg	rural	28	8709975	409
Fiscenthal	rural	29	30258900	2671
Wald (ZH)	rural	30	25260525	11397

Note. Area and inhabitants + jobs data from Schwick et al. (2012).

From each of the distance categories one municipality with average urban sprawl development was afterwards selected for detailed analysis for the second step of the case study: Fällanden (suburban), Fehraltorf (periurban) and Fischenthal (rural) (see Figure 2b). The selection of these municipalities is described in Section 2.4.

On the one hand, the different distances of the case study municipalities to the city centre of Zurich are characterised by the four distance categories urban, suburban, periurban and rural, given by the perimeters of the agglomeration programmes. On the other hand, a more detailed representation of the distance to the city centre is needed to answer research question 1. Therefore the air-line distance in kilometres from the city centre of Zurich (Niederdorf) to the town centre of the municipalities was measured on the 1:150'000 map of the web GIS of Canton Zurich (Kanton Zürich, 2014b).

2.2.2 Temporal System Boundaries

The time period considered for the analysis follows the research project «Controlling Urban Sprawl to Limit Soil Consumption (SPROIL)» (see Section 1.4), and ranges from around 1950 to present including prospects. Weighted Urban Proliferation data is available from 1885 to 2010. Therefore, the quantitative part of the analysis covers this extended time period. Hersperger and Bürgi (2009, p. 640) advocate for long time frames as «only a historical perspective provides an appropriate understanding of the present land use and land cover.»

2.3 Weighted Urban Proliferation

To assess the propagation of urban sprawl, quantitative urban sprawl data is used. Since there is no common definition of urban sprawl (see Section 1.1), there is also no common operationalisation how to measure the degree of urban sprawl. A variety of different approaches can be found in the literature (Siedentop, 2005).

This master thesis uses the quantitative urban sprawl measurement method Weighted Urban Proliferation developed by Schwick et al. (2012). It is based on their definition of urban sprawl given in Section 1.1. Weighted Urban Proliferation is calculated from three independent variables and two weighting factors expressed in the following formula (Jaeger & Schwick, 2014; Schwick et al., 2012):

$$WUP = UP * w_1(DIS) * w_2(UD)$$

WUP: Weighted Urban Proliferation [Urban Permeation Units (UPU)/m² of land]

UP: Urban Permeation [Urban Permeation Units (UPU)/m² of land]

UP measures the share of settlement area on total land and dispersion.

DIS: Dispersion [Urban Permeation Units (UPU)/m² of settlement area]

DIS characterises the geometric settlement pattern. It is calculated from the average distance between all possible pairs of points within the settlement area. The longer the distance between two points, the higher is the contribution to dispersion. To emphasise dispersion, in dispersed settlement areas DIS is weighted with $w_1 > 1$ and in compact ones with $w_1 < 1$. $w_1 = 1$ when dispersion equals the 1960 Swiss average (43.986 UPU/m²).

UD: Utilisation Density [(inhabitants + jobs)/m² of settlement area]

UD represents the number of inhabitants plus jobs per settlement area. The weighting factor w_2 tends to 1, when UD is low (less than 40 inhabitants + jobs per hectare), and tends to 0, when UD is high (more than 100 inhabitants + jobs per hectare).

w_1 : weighting factor [1], $0.5 < w_1 < 1.5$

w_2 : weighting factor [1], $0 < w_2 < 1$

The settlement area is assessed with maps, hence the built-up area is considered independent of its zoning. Schwick et al. (2012) calculated Weighted Urban Proliferation for the Swiss cantons, municipalities and different regions as well as on a 100m*100m raster grid for the whole country for the years 1885, 1935, 1960, 1980, 1990, 2002 and 2010. To enhance comparability between regions, unproductive areas like waters and forests are excluded, because they cannot be built up. (In Switzerland, forest is strongly legally protected since the beginning of the 20th century, hence it cannot – or only in very rare cases – be cleared for any other land use.) The values of Weighted Urban Proliferation range from zero (no urban sprawl) to more than 100 UPU/m².

Siedentop (2005) lists weaknesses from which many urban sprawl measurement methods suffer:

- 1) considering urban sprawl as process of change not as state
- 2) operating with highly aggregated data of whole metropolitan areas not accounting for local heterogeneity
- 3) difficulty to distinguish between sprawl and non-sprawl

The method Weighted Urban Proliferation avoids the first two shortcomings:

- 1) It is temporally explicit and considers urban sprawl as state, which is necessary to study its drivers.
- 2) It is also spatially explicit and can be applied to different scales ranging from a whole country to individual parcels of land, accounting for local variability and heterogeneity (Schwick et al., 2012). For a case study analysis with a small study area, small-scale data is particularly crucial.
- 3) The third critical aspect, how to distinguish between sprawl and non-sprawl, is not solved in the Weighted Urban Proliferation method itself. The measurement is continuous and not binary, leaving the determination of a critical value of urban sprawl to scientific and political discussion.

2.4 Case Selection by Theoretical Sampling

From the 36 municipalities described in Section 2.2.1 a small number was selected for detailed analysis. The selection is based on theoretical sampling, a sampling approach from qualitative social research introduced by Glaser and Strauss (1967). The idea of theoretical sampling is not to get a random or representative sample, but to choose the cases based on some criteria, aiming for variation between the cases or even choosing extreme cases (Strauss, 1991).

For this master thesis, one municipality from each of the distance categories urban, suburban, periurban and rural was selected. The selection is strongly influenced by the quantitative urban sprawl data. Average municipalities along the gradient were selected as follows:

- 1) Urban sprawl development of each municipality was determined by its Weighted Urban Proliferation, Urban Permeation, Dispersion and Land Consumption values (inverse of Utilisation Density, so that higher values of all

variables stand for higher degree of urban sprawl) for all available years (see Section 2.3).

- 2) Since the four indicators for sprawl have different units and ranges, the values were standardised to Z scores using the programme SPSS Statistics. The standardisation was done per indicator with all values of the 36 municipalities of all available years. For each of the indicators for each available year, the average Z score per distance category and afterwards the absolute deviations of the municipalities' values from the averages were calculated.
- 3) Finally, the deviation was summed up over all indicators and available years per municipality to a value representing the total deviation from the average of all municipalities. The lower the value, the closer the municipality represents the average municipality per distance category.

After numerous negotiations, the following municipalities were selected: Fällanden (suburban), Fehraltorf (periurban) and Fischenthal (rural). No municipality of the distance category «urban» could be selected, because Zurich – the only «urban» municipality – did not answer the request for an interview.

2.5 Expert Interviews

Besides quantifying urban sprawl by Weighted Urban Proliferation, its drivers were identified qualitatively by expert interviews and review of local documents. For a case study analysis it is crucial to gain local context-specific knowledge. This is usually not available in the scientific literature. Here, knowledge about local settlement development and planning is needed. Therefore, the method of expert interviews according to Mieg and Näf (2005) was applied. They define an expert as someone that has specific knowledge in a field, a role in an institution, and access to decision-making. To structure the interview, an interview field manual, comprising the questions organised in several thematic blocks as well as the introduction and closure of the interview, was developed as guideline through the interview.

2.5.1 Interviewees

In each of the three selected municipalities a local expert was interviewed. The experts were chosen according to their position in the municipality. In Fehraltorf and

Fischenthal it was the municipality's responsible for spatial planning. In Fällanden the contacted person referred to the ex-mayor with longer experience, who in turn agreed to an interview. To complement his answers, the responsible for building engineering of Fällanden was interviewed by email with the same interview field manual. The interviewees did not claim anonymity. Table 2 shows the interviewees.

Table 2. Interviewees

Municipality	Interviewee	Interviewee's Position in Municipality	Years in Position	Interview Date	Interview Mode
Fällanden	Richard Hirt	Ex-Mayor (alt-Gemeindepräsident (CVP))	12	10/06/14	face-to-face
Fällanden	Fabio Wintsch	Building Engineering Secretary (Hochbausekretär)	1.5	15/07/14	by email
Fehraltorf	Stefan Mathys	Head of the Building Department (Leiter Bau und Werke)	7	17/06/14	face-to-face
Fischenthal	Rolf Knechtle	Building Secretary (Bau- und Liegenschaftensekretär)	0.5	09/07/14	face-to-face

2.5.2 Interview Procedure and Evaluation

As preparation for the interviews, a literature and internet research was conducted to get an overview of the characteristics of the three municipalities. Based on the research questions and hypotheses the interview field manual was developed (see Appendix I, in German). About one week prior to the interviews the interview field manual, which was the same for all of the interviews, was sent to the interviewees by email, so that they had the opportunity to prepare themselves to the questions.

The three interviews were conducted in German in the interviewee's office in Fehraltorf and Fischenthal, respectively at ETH Zurich for Fällanden, in June and July 2014. The interviews were recorded by a digital voice recorder and took between 1.5 and 3 hours.

Even though the questions were determined by the interview field manual, the interviews were rather open, leaving room for spontaneous questions and details considered relevant by the interviewees not explicitly covered by one of the questions. In the end, the Weighted Urban Proliferation data of the municipality was

shown to the interviewees to comment. The interviewees were asked for relevant local documents.

The interviews were fully transcribed using the programme f5, and afterwards a qualitative content analysis was conducted. The text passages were coded thematically according to what is relevant for the research questions.

3. Results

This chapter first presents the quantitative Weighted Urban Proliferation data of the 36 municipalities to indicate the degree of urban sprawl. Afterwards, the qualitative results for the three selected municipalities are presented. Finally, the quantitative and qualitative results are combined and compared between the three municipalities.

3.1 Propagation of Urban Sprawl

This section answers research question 1, i.e. how urban sprawl has propagated in the 36 municipalities along the gradient from urban to rural from 1885 to 2010. Figure 3 shows the Weighted Urban Proliferation value of each municipality in 2010 as a function of the distance to the conurbation centre Zurich. The urban municipality Zurich features the lowest WUP value of 1.8 UPU/m^2 and the suburban municipality Kloten the highest of 25.6 UPU/m^2 . For comparison: In 2010 Switzerland had a WUP of 5.7 UPU/m^2 . Canton Zurich had the fourth-highest WUP value, 10.6 UPU/m^2 , of the 26 Swiss cantons after Ticino, Basel-Land and Aargau.

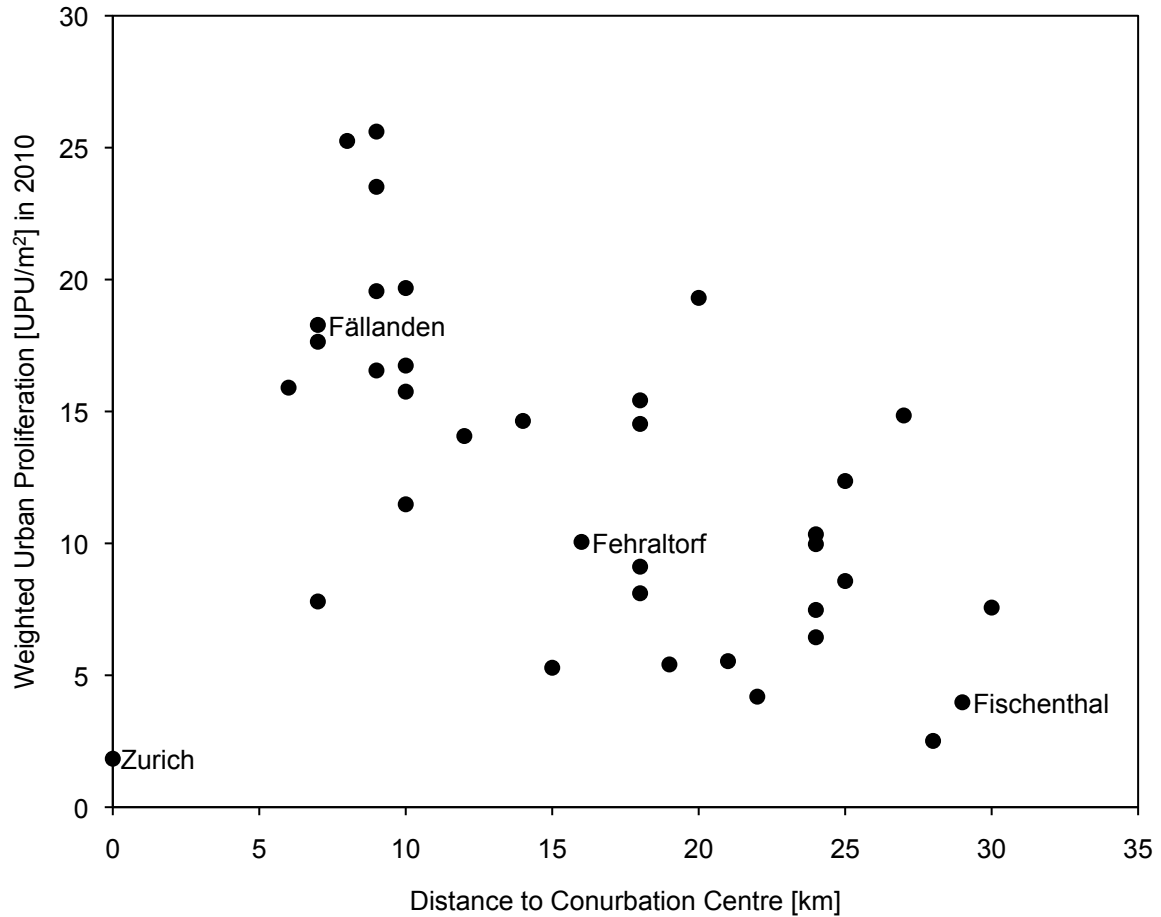


Figure 3. Weighted Urban Proliferation values in 2010 of the 36 municipalities as a function of the distance to the conurbation centre Zurich (WUP data from Schwick et al., 2012).

Figure 4 shows the average WUP value per distance category for each available year from 1885 to 2010. WUP has increased over time. There is a pattern of decreasing WUP values along the gradient from suburban over periurban to rural municipalities since around 1960. The WUP values of all 36 municipalities for all available years are given in Appendix II.

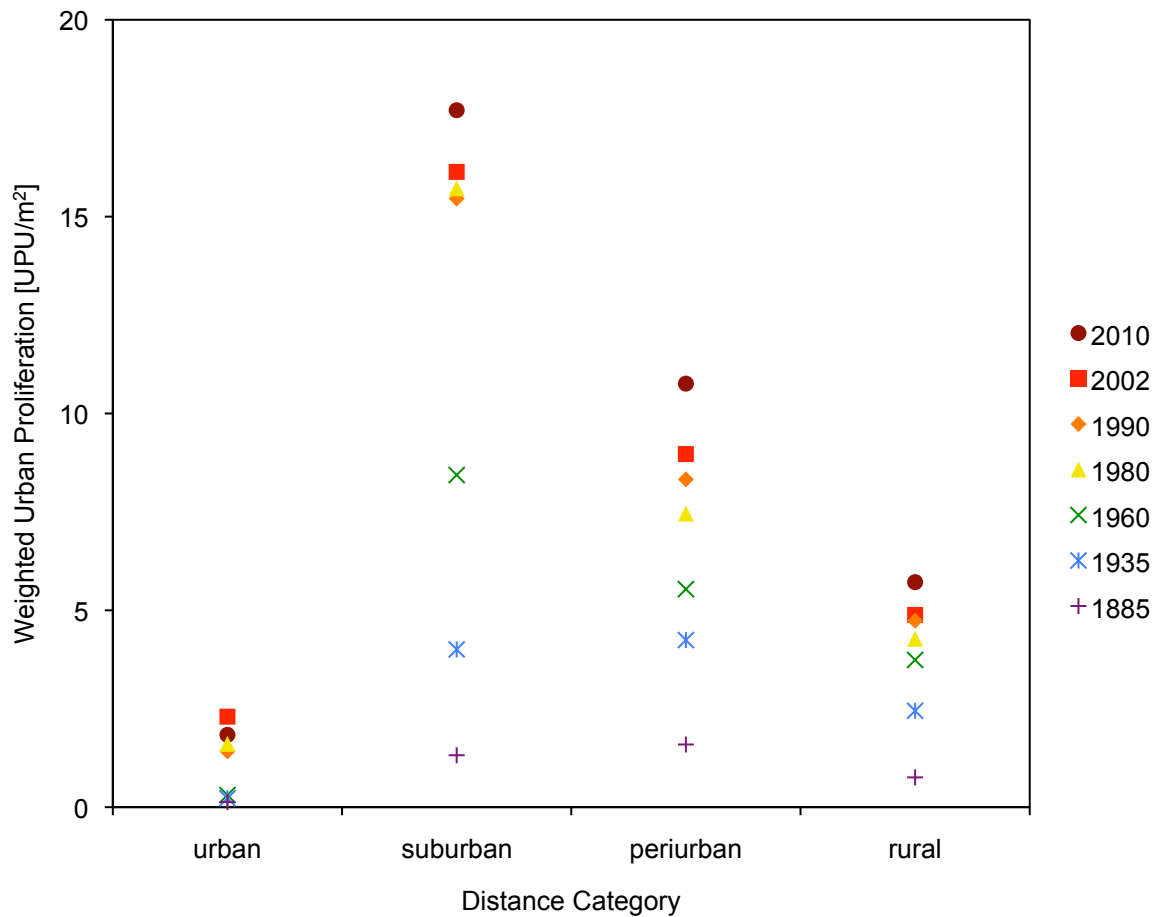


Figure 4. Average Weighted Urban Proliferation values from 1885 to 2010 per distance category (WUP data from Schwick et al., 2012).

Figure 5 shows the development of Weighted Urban Proliferation and number of inhabitants plus jobs, while Figure 6 shows the individual variables from which WUP is calculated – Urban Permeation, Dispersion and Land Consumption (LC, the inverse of Utilisation Density) – for the three selected municipalities and Zurich as a function of time.

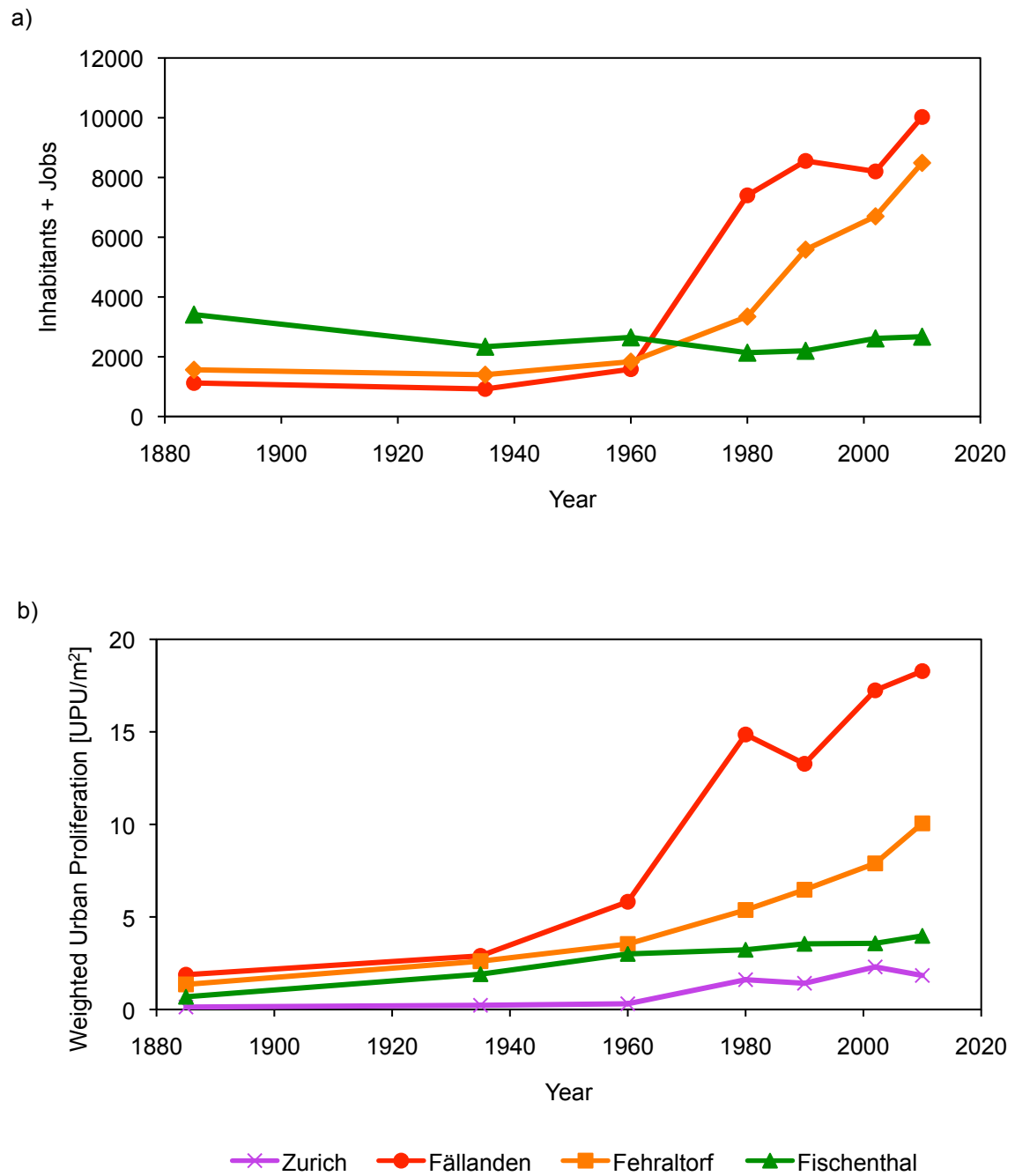


Figure 5. 5a (top). Development of the number of inhabitants plus jobs. 5b (bottom). Development of Weighted Urban Proliferation (data from Schwick et al., 2012).

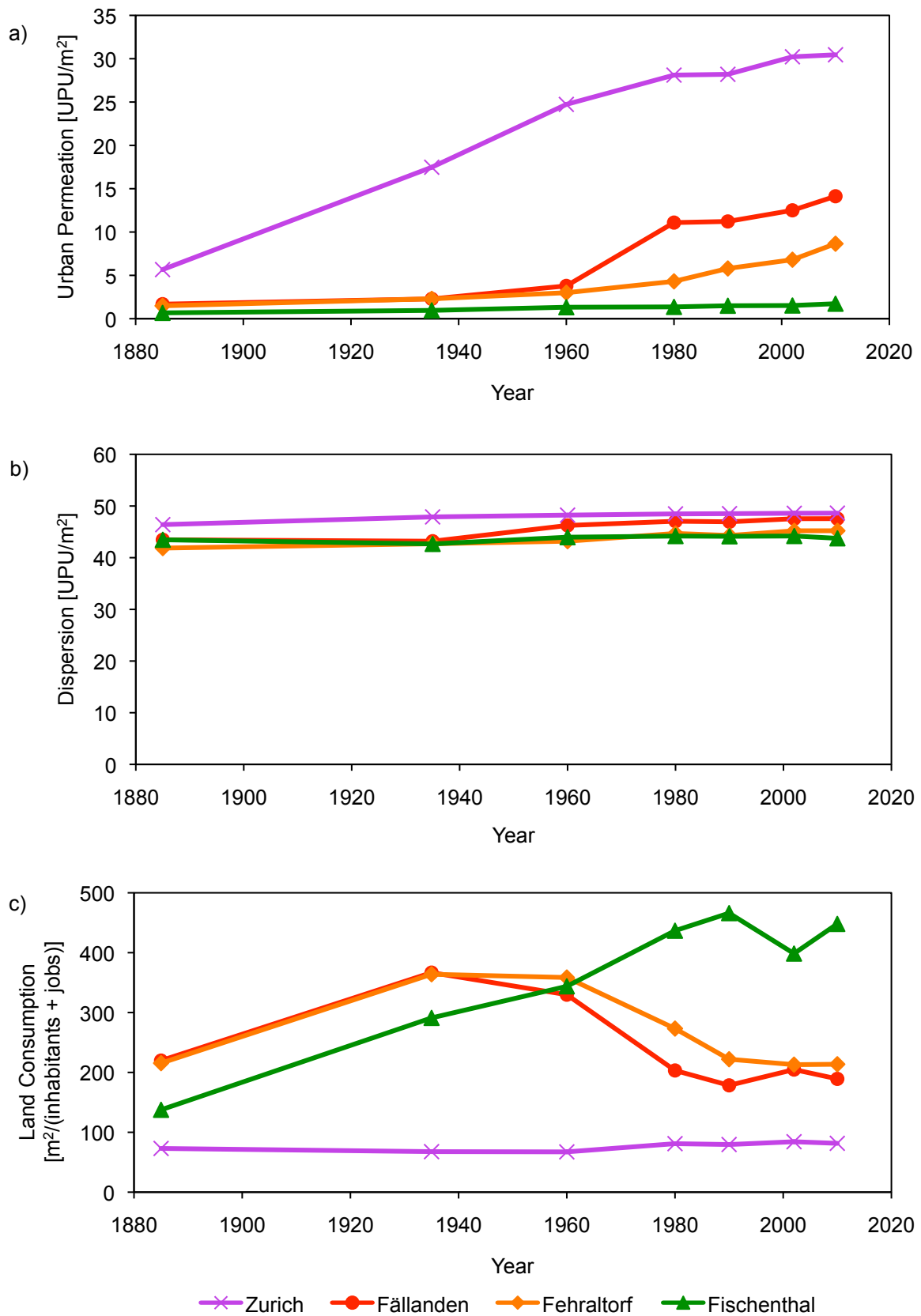


Figure 6. 6a (top). Development of Urban Permeation. 6b (middle). Development of Dispersion. 6c (bottom). Development of Land Consumption (data from Schwick et al., 2012).

UP has considerably increased over time with by far highest values for Zurich and decreasing values with distance to conurbation centre. DIS only features slight differences between the four municipalities and a slight increase over time. LC in Zurich has stayed low over the whole period of time, while in Fällanden and Fehraltorf it first increased and peaked between 1935 and 1960 and afterwards decreased to around 200 m² of settlement area per inhabitant or job, more than twice as much as in Zurich. In Fischenthal LC increased in the first time period from 1885 to 1935 with the same rate as in Fällanden and Fehraltorf, but constantly grew until 1990. This corresponds to the development of number of inhabitants plus jobs. In Fällanden and a bit less and later in Fehraltorf a rapid population growth took place since 1960. In this last half century the number increased six fold in Fällanden and four fold in Fehraltorf. In Fischenthal the number slightly decreased until 1980 and has afterwards slightly increased.

The WUP data in Figures 3, 4, 5 and 6 confirms hypothesis 1. Urban sprawl has increased over time in the study area. Urban sprawl tends to be highest in suburban municipalities and decrease with increasing distance to the conurbation centre Zurich, even though the WUP values between the individual municipalities vary considerably. Zurich city has a low degree of urban sprawl. Whether urban sprawl has propagated over time to more distant municipalities from the conurbation centre, is not very clear from this data, but is confirmed by the comparison of the three case study municipalities Fällanden, Fehraltorf and Fischenthal (see Section 3.3). Section 4.2.1 discusses whether the degree of urban sprawl in the study area should be considered problematic.

3.2 Municipalities

This section answers research question 2 and presents the results for the three selected municipalities: their general characteristics, development of settlement and urban sprawl, local spatial planning discourse and policies, influential actors and examples of construction projects. The description is done in episodes and incidences for which information is available.

3.2.1 Suburban: Fällanden

The municipality Fällanden is adjacent to Zurich. It is composed of three villages: Fällanden itself, Pfaffhausen and Benglen (Gemeinde Fällanden, 2014). In the first half of the 20th century the inhabitants of Fällanden were rather poor and many were farmers (interview R. Hirt). After the Second World War the economy grew and the 1960s were an economic boom time. Along with this boom, many middle to upper class families moved from other municipalities to Pfaffhausen and Benglen. They were attracted by the idea of living in the green and still close to the city of Zurich, where most worked and commuted by car. Pfaffhausen developed to a single-family house quarter. Nowadays the municipality Fällanden has rather middle to upper class inhabitants (interview R. Hirt).

The town hall of Fällanden, projected in the 1960s and constructed 1972-1974, demonstrates the growth euphoria of the boom time (interview R. Hirt). It was dimensioned for a municipality of 20'000 inhabitants. A complete storey of the town hall is not used by the municipality but rented out (interview R. Hirt). Fällanden has by far not reached the forecasted population number, but counted 8'100 inhabitants in 2012 (FSO, 2014).

Furter and Schoeck-Ritschard (2013) documented the development of Benglen. This text passage is closely taken from their book (Chapter «Benglen. Eine kleine Welt für sich», p. 131-151): Before 1971 Benglen consisted of nine farmhouses, cultivated land, grassland, a tree nursery and the single-family house of the architect Hans Litz, erected in 1961. In 1962 the municipal assembly of Fällanden approved the revision of the zoning regulations with the rezoning of Benglen from agricultural to building reserve zone. Shortly after, two cantonal main roads were planned close-by, which would give Benglen an advantage for commuting. That is why the cantonal government wanted the municipal authorities of Fällanden to define clearly their plans for the reserve zone Benglen. So the municipal assembly mandated Litz in 1963 to develop zoning regulations for Benglen for construction. Litz's study used the concept of a garden city (see Howard, 1902), which had been developed in England and spread across Europe, as role model. The zoning regulations stated that three fourth of the area has to be vegetated, parking must be below ground, only three storeys and an utilisation factor of 0.5 are allowed, and rooms have to have an average size of 30 m² (Litz, 1964). Even though Litz was only responsible to develop

the zoning regulations, he wanted to seize the opportunity to plan the whole town of Benglen. So he needed an investor and contacted the building company Ernst Göhner AG, for which he had previously worked. Also Peter Steiger, who was at that time Fällanden's town planner and worked as an architect for Ernst Göhner AG, had good connections to both the municipality and the company. Ernst Göhner AG was interested in the project, and their land acquirer, the local Albert Schellenberg, could buy a lot of the land in Benglen. The plan was to fully build-up Benglen to house 4'000 inhabitants. The municipal authorities were sceptical because of the expected infrastructure costs especially for canalisation and sewage treatment. They only agreed in 1968 as the company promised to guarantee the prospective tax revenue of more than two million Swiss Francs by a grant. The building application for the first building stage was ready in 1970. Litz developed the architectural plans for Ernst Göhner AG. Even though he himself had previously set up the zoning regulations for the municipality, he wanted an exception. This was the reason for another revision of the zoning regulations for Benglen, and again Litz developed them for the municipality. His proposition was an increase of the utilisation factor by 20%. «The locals Hans Litz and Albert Schellenberg emphatically lobbied for the interests of the property owners [mainly Ernst Göhner AG]» (Furter & Schoeck-Ritschard, 2013, p. 138, own translation). To persuade the municipal assembly to accept the revision of the zoning regulations, Ernst Göhner AG in turn agreed to give 4'000 m² of their land in Benglen to the municipality for a kindergarten, and they promised to sell instead of rent two thirds of the apartments. This should attract good taxpayers to Fällanden. This argument finally convinced the municipal assembly to agree. The deal gave Ernst Göhner AG a profit of several million Swiss Francs due to higher property value, and construction work began. Litz's double role – working for the municipality and an involved building company – was not unique. A very similar constellation occurred in the municipality Volketswil in the 1960s, where Wendel Gelpke was at the same time Volketswil's town planner and worked for Ernst Göhner AG (Furter & Schoeck-Ritschard, 2013).

The first people moved into the Göhner apartments in Benglen in 1972 (Furter & Schoeck-Ritschard, 2013). They were homogenously young upper middle class families. Most of the men worked out of town, mainly in Zurich. Infrastructure was not ready yet, which was not unusual at that time in the fast growing conurbation of Zurich. There were no shops and no public transportation connection but 1.5 parking

lots per apartment. In 1973 a bus connection subsidised by Ernst Göhner AG went into service, and in 1974 a big shopping centre and school opened. This shopping centre was demolished in 2012, because it was far overdimensioned, and replaced by a small shop in 2014. In the 1980s different investors realised single-family and row houses instead of apartment blocks on the remaining estates in Benglen (Furter & Schoeck-Ritschard, 2013). Nowadays the building zones in Benglen are built-up (Gemeinde Fällanden, 2014). Benglen reached its population peak in the 1980s with 2'100 inhabitants, far below the forecasted 4'000 (Furter & Schoeck-Ritschard, 2013). Since then, the population is decreasing. In 2010 Benglen counted 1'900 inhabitants (Gemeinde Fällanden, 2014). According to R. Hirt (interview) many initial dwellers still live there, but now without their children, lowering utilisation density. The Göhner project in Benglen provoked big public debate in town at that time. Some farmers substantially benefited from the rezoning of their land from agricultural to building zone due to the considerably higher land price. Several other farmers were envious. It was the biggest greenfield construction project of all times in the municipality Fällanden (interview R. Hirt). Figure 7 shows two of the – in the meantime renovated – Göhner apartment blocks in Benglen.



Figure 7. Göhner apartment blocks in Benglen in the municipality Fällanden (own photograph, 10/09/2014).

While construction in Benglen took mainly place in the 1970s and 1980s, in Fällanden construction for the new quarter Unterdorf started in the 2000s. R. Hirt reported on Unterdorf in the interview: Unterdorf was constructed on previously non-built-up land, and brought about 800 additional inhabitants to the municipality. Before, the property was fragmented and the individual owners did not come to an agreement. Then a big private investor bought up the small parcels and developed a project, exploiting the maximally allowed utilisation factor. «The investor of course wants to get as much money out of it as possible. And this is also in accordance with the contemporary principles of building densely» (interview R. Hirt, own translation). These apartments are expensive, so the residents are rather rich. The municipal authorities expected that therefore tax revenue per capita would increase. But this did not happen, because most of the residents have a mortgage, which they can deduct from taxes. The new residents of Unterdorf are not yet well integrated into the local community life of Fällanden. There was no opposition against this project, but

many long-term inhabitants of Fällanden do not like the aesthetic style of this housing project (interview R. Hirt). Figure 8 shows apartment blocks in the quarter Unterdorf and the adjacent parcel Huebwis.



Figure 8. Apartment blocks in the new quarter Unterdorf (in the back) and the parcel Huebwis with an industrial building (in the front and left) in Fällanden (own photograph, 10/09/2014).

In 2014 the revision of the zoning regulations from 2007 is under way. The reason for the revision is mainly the proposed rezoning of the parcel Huebwis in Fällanden from industrial to mixed-residential use (Planpartner AG, 2014). The three property owners of this parcel are the ones pushing for the rezoning (interview R. Hirt). The parcel is partly built-up and hosts small-scale industry and agriculture at the moment. About 150 housing units are projected. There was a project delay, because the private project planners did not realise that this rezoning was required by law for the project. Delays are expensive for the investors, therefore the municipal authorities feel obliged to bring forward the revision quickly. The revision is anticipated to be brought to the municipal assembly for approval in autumn 2014. The same rezoning proposal has already been brought to vote in 2007 (Gemeinde Fällanden, 2014). Back then, one municipal councillor lobbied against the revision, because his company is located next to the proposed residential project, and he was afraid that the prospective residents could complain about noise. Due to his opposition the rezoning was rejected by the municipal assembly in 2007 with 81 no to 50 yes votes (interview R. Hirt) (Gemeinde Fällanden, 2014). Now, this municipal councillor is in favour of the revision, because he now has mitigated the noise (interview R. Hirt). R. Hirt expects that the rezoning will be accepted this time, and that only a minority – individuals, no organised groups – will vote no. There are «not in my backyard» arguments against

the rezoning and the argument that there is already enough built in town (interview R. Hirt).

In 1992 § 69 and § 71 were introduced to the cantonal building law to give the municipalities the opportunity to create special regulations for the development of large areas (Kanton Zürich, 2014c). Fällanden introduced this option called area developments to their zoning regulations in 1994. If the area developments fulfil high-quality criteria, the investors get a bonus of a 10% increase in utilisation factor, which results in an increase in building density (Gemeinde Fällanden, 2007). In 2008 Fällanden specified the quality requirements for area developments more precisely than the cantonal building law (Gemeinde Fällanden, 2008). Area developments are increasingly applied in Fällanden in recent years (interview F. Wintsch). Also the construction projects Unterdorf and Huebwis are both area developments. The projects are usually financially more profitable for the investors with this utilisation factor bonus of 10% (interview R. Hirt).

Nowadays Fällanden suffers from heavy car traffic. The main road through the town centre is regularly congested, which also blocks buses (Kanton Zürich, 2012a). A bypass road is under discussion, but politically contested and a decision is not made yet (interview R. Hirt). While some years ago the majority of locals seemed to be in favour of the road, it has now reversed. The contra-arguments are mostly environmental ones, like more roads create more traffic, more air pollution and landscape fragmentation. But the main opponents against the bypass road are residents of one new residential settlement, where the planned road would closely pass by. When they moved in, they were already aware of the planned bypass road, because the road layout had been defined decades ago. These residents started a petition against the planned bypass road, collected 300 signatures and submitted them to Richard Hirt in his role as mayor (interview R. Hirt).

In 1932 the bird protection organisation ALA and landowners in Fällanden signed an agreement to protect areas around Lake Greifensee, on which Fällanden borders. In 1941 the cantonal Ordinance for the Protection of Lake Greifensee was enacted, which was progressive at that time. «The lakeside was declared protected area and thereby prevented from being built-up» (Greifensee-Stiftung, 2003, p. 14, own translation). Fällanden has got a municipal Nature Protection Ordinance. It was installed in 1986 and revised in 1995 and 2009 (Gemeinde Fällanden, 2009). In the

1980s nature conservation was trend and one municipal councillor at that time was particularly interested in the subject (interview R. Hirt). He was also a member of a nature protection association. His engagement was the reason for the enacting of the Nature Protection Ordinance in 1986. The Ordinance prohibits construction in the protected areas. This is highly accepted and strictly implemented (interview R. Hirt).

According to R. Hirt (interview), after the enormous population and settlement growth and related growth euphoria in previous decades, the mentality in Fällanden has changed to stagnation or even conservation. Most of the building zones are built-up, so the settlement area of Fällanden will not grow much in the medium term. Rezoning of agricultural to building zones is neither sought by the municipality nor legal because of the cantonal Cultural Land Initiative. Therefore «measures for building more densely must increasingly be taken» in the future (interview F. Wintsch, own translation). But R. Hirt (interview) does not see much potential for densification in Fällanden, especially not in Benglen and Pfaffhausen, because the different property owners would fight against densification plans to keep the green spaces. Some house owners individually speak up for an increased utilisation allowance for basement and attic storeys, which might be taken up in a future zoning regulations revision. According to R. Hirt (interview) the municipal authorities do not attempt to become more active concerning municipal land ownership. The municipality does not want to be a landowner. Existing land in building leases is rather sold to companies. The municipal council wants to leave settlement development to the market (interview R. Hirt). Urban sprawl is only sometimes an issue of debate in connection with area developments (interview F. Wintsch).

Figure 9 shows the settlement structure and small-scale Weighted Urban Proliferation values of the municipality Fällanden in 2010. All three villages – Fällanden, Benglen and Pfaffhausen – feature high urban sprawl values, corresponding to the overall high value of the municipality. The highest WUP values of more than 90 UPU/m² features Pfaffhausen, which is dominated by single-family houses. The Göhner apartment blocks in Benglen mostly have WUP values of 18 - 90 UPU/m². Since the architectural idea was to have a lot of green spaces around the blocks, they are not very closely located to each other. The southern area of Benglen, consisting mostly of row-family houses constructed in the 1980s, has higher WUP values than the Göhner apartment blocks. The small historical town centre of

Fällanden – located around the conjunction of Schwerzenbachstrasse/Maurstrasse – has rather low WUP values, while the industrial area along Schwerzenbachstrasse in the north of Fällanden has very high WUP values. The new-built quarter Unterdorf was not completed in 2010, so its WUP values are not available. There are nearly no buildings – and therefore no urban sprawl – at the shore area of Lake Greifensee, thanks to the early protection.

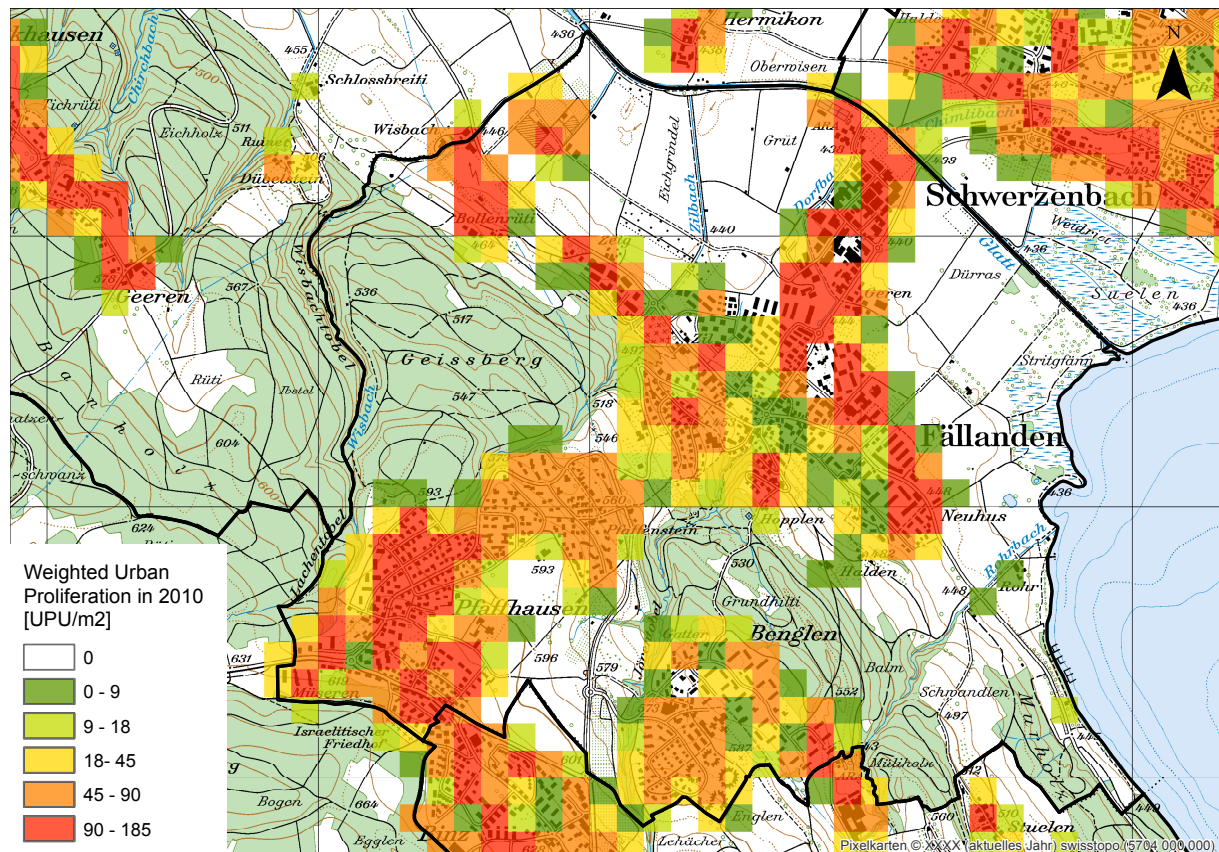


Figure 9. Settlement pattern and Weighted Urban Proliferation of Fällanden in 2010. The WUP pixels have a size of 100m*100m (data from Schwick et al., 2012).

3.2.2 Periurban: Fehraltorf

Fehraltorf is a street town, located on Kempttalstrasse, which is an important connection to the region Zürcher Oberland. Since the 19th century Fehraltorf has a train station. So Fehraltorf has been rather well connected by road and rail. The municipality consists of one central town and no outer villages (interview S. Mathys). While in the first half of the 20th century it was still dominated by agriculture, in the second half it has become part of the conurbation of Zurich (Frei, 2000). In 2012 Fehraltorf had 5'900 inhabitants (FSO, 2014).

Frei (2000) describes the development of municipal town planning in Fehraltorf and its failures since the beginning: In 1945 a representative of the cantonal Office for Regional Planning spoke at a municipal assembly in Fehraltorf and prompted the municipality to develop zoning regulations. He argued that housing shortage in the city of Zurich had become so massive that no more people should migrate to the city. Municipalities in the conurbation area should create favourable conditions for housing development by municipal zoning regulations, so that city dwellers relocate to the outer conurbation area. The municipal assembly agreed unanimously to develop their first zoning regulations. These regulations only allowed one- and two-storey buildings and considered the area Halden, which was mostly owned by the municipality, for new construction. But when the regulations came into force in 1948, it was already too late to steer construction activities well, since the first buildings at Halden had already been constructed. The selling of the municipal land, infrastructure development and construction occurred simultaneously and the constructors did not observe the quarter plan. An external expert stated in 1958 that the arrangement of the buildings at Halden ruined the potential of the quarter (Frei, 2000, p. 46). The first apartment block in Fehraltorf was constructed in 1955/56 with a special permit, because it had three instead of two storeys. In 1958 the municipal building commission started the revision of the zoning regulations with two goals: on the one hand to make concessions to the changed expectations of the constructors, and on the other hand to conserve the traditional character of the town. The revision was approved in 1963 and introduced zones for three-storey buildings and the large industrial zone Undermüli at the western edge of town. Building activities accelerated and several apartment blocks were constructed. Their style with flat roofs was contested (Frei, 2000).

In the early 1960s the municipal authorities rezoned the area Rumpis to building zone for single-family houses, developed the infrastructure and sold the formerly municipal land parcels. Beside Rumpis also in the area Chriesbaumweid another single-family house quarter developed. Richard Brun, a sculptor from Zurich, bought a parcel at Chriesbaumweid in 1960 and submitted a building application to the municipal authorities. The municipal authorities were challenged, since Chriesbaumweid was neither in the zoning regulations of 1958 nor 1963 within the building zone. After the municipal authorities' attempt to convince Brun to construct his house instead at Halden was unsuccessful, they gave him a special permit for

Chriesbaumweid. Soon other constructors followed Brun's example. In 1964 the municipal council informed the citizens at a municipal assembly: «It is a fact that Chriesbaumweid is being built up with single-family houses», and a single-family house zone was approved for the area (Frei, 2000, p. 49). After this decision the infrastructure for Chriesbaumweid was developed, paid one third by the municipality and two thirds by the private land owners (Frei, 2000). Figure 10 shows the quarter Chriesbaumweid.



Figure 10. Single-family house quarter Chriesbaumweid, which is separated from the central town Fehraltorf (own photograph, 10/09/2014).

The big building company Ernst Göhner AG bought up a lot of land mostly from farmers in Fehraltorf during the 1960s, like they did in several municipalities in the region (Frei, 2000). They preferred land outside of building zones, because it was cheaper and therefore guaranteed higher profit. «Such a land acquisition strategy was usual at that time», states Frei, «for town planning this strategy had the undesired side effect that land sales in building zones stagnated due to higher prices» (2000, p. 50). For several years the municipal authorities and citizens watched Göhner's acquisition activities, but did not know their plan. They were worried, because Göhner's land lied idle and the future development of the whole municipality depended on the company's plan. In 1970 Ernst Göhner AG publicly presented their plan in Fehraltorf: They wanted to relocate the research and development department of the company Alusuisse to Fehraltorf and create a new town with 1'000 jobs and 1'400 housing units for 5'000 inhabitants building up the area Ehrenbüel between Fehraltorf and Mesikon, a village in the neighbouring municipality Illnau-Effretikon. The municipal council held an extraordinary meeting to discuss advantages and disadvantages of Göhner's project, which was huge in

relation to Fehraltorf's population of about 2'000 at that time. Nevertheless, they expected Fehraltorf to exceed 10'000 inhabitants within a couple of years anyway. They considered it positively that the company Alusuisse wanted to relocate to Fehraltorf, especially because it was free from emissions and had highly qualified workers, who are good taxpayers. Even though the municipal councillors also discussed critical aspects, they thought they had no choice: «It is a fact that Göhner's project will be realised», «now our municipality is sold» (Frei, 2000, p. 52). They decided to collaborate with Ernst Göhner AG and prepared the accordant revision of the zoning regulations. But broad opposition against the project formed in town, led by the group «Pro Fehraltorf», which was related to the liberal party FDP. The citizens demanded more democracy in planning and qualitative instead of quantitative growth. Aside, the economic situation of Alusuisse became difficult after the oil crisis in 1973 and they did not promise anymore to relocate to Fehraltorf definitely, which put the whole project into question. Because of the citizens' opposition the municipal council gave up the rezoning of Göhner's land at Eschenbüel to building zone and presented the revision of the zoning regulations in 1974 without this rezoning to the municipal assembly. The building zones stayed unchanged except for the extension of the industrial zone. The municipal assembly clearly voted in favour of the revision. Ernst Göhner AG went to court to fight for the rezoning, but lost contrarily to a similar case in Volketswil, which meant the end of the project. Alusuisse finally did not relocate to Fehraltorf due to financial reasons (Frei, 2000). S. Mathys (interview) regards the opposition against the Göhner project as initialisation of local awareness for town planning.

The recession after the oil crisis led to low building activities in Fehraltorf until the end of the 1970s. In the early 1980s there was again a building boom in Fehraltorf, even more pronounced than the one of the 1960s (Frei, 2000). In 1982 and 2009 Fehraltorf had the highest population increase – relative as well as absolute – of all municipalities in Canton Zurich (Frei, 2000; Gemeinde Fehraltorf, 2014). The next building boom in Fehraltorf came in the 1990s after the initialisation of the S-Bahn rail system in Canton Zurich (Frei, 2000).

According to S. Mathys (interview) from the 1990s until present many housing developments have been realised. All area development projects exploited the maximally allowed building density. In the mid 2000s planning for the greenfield

project of the new quarter Berg has started and the first residents moved in in 2011 (Architekten rlc, 2014). Figure 11 shows apartment blocks in the new quarter Berg.



Figure 11. Apartment blocks in the new quarter Berg in Fehraltorf (own photograph, 10/09/2014).

Chriesbaumweid has gradually become a satellite village consisting of more than hundred single-family houses (Frei, 2000). The industrial area Undermüli at the western edge of town is of regional importance and many of the workers commute from other towns (interview S. Mathys).

The size of the building zones has stayed nearly unchanged since 1974 (interview S. Mathys). Nowadays only very few non-built-up parcels in building zones are left. Due to the cantonal Cultural Land Initiative new rezoning from agricultural to building zone is not allowed. Hence, the settlement area in Fehraltorf legally cannot expand anymore. Therefore the municipal authorities look for ways for inner development and quality improvements. The revision of the zoning regulations from 1994 is underway. A main subject of the revision is densification, so the new regulations will allow a 10-15% higher building density. Area developments with a 10% bonus in building density are possible since 1994 (interview S. Mathys). Already in the revision in 1994 densification was a main subject (Frei, 2000).

There is a quarter in the centre of town where the small size and shape of individual parcels limits construction. To overcome this situation, the municipality conducts and finances a planning study to motivate the property owners for concerted construction (interview S. Mathys).

Most of the settlement area in Fehraltorf is located north-eastern of the railway line. South-western of the railway line lies an important groundwater aquifer, which the municipality does not want to compromise by settlement, since they get nearly 80% of their drinking water supply from this aquifer (interview S. Mathys).

The street Kempptalstrasse, along which Fehraltorf has developed, is an important connection to the region Zürcher Oberland and the town is burdened by its heavy traffic (Kanton Zürich, 2012b). Since the early 1960s the municipal and cantonal authorities were discussing and projecting different routeing variants of a bypass road (Frei, 2000). A northern variant was given up in 1963 due to opposition of close-by residents. A variant along the railway line was prohibited in 1966 by the cantonal authorities to protect the groundwater aquifer. In 1980 the municipal council presented a southern variant to the municipal assembly, which was rejected by the citizens in the vote due to various reasons: farmers opposed the routeing through cultural land, some regarded the two projected overpasses as destroying landscape beauty, others considered the bypass road too expensive or not useful or a cantonal not municipal matter (Frei, 2000). Nowadays a bypass road is not under discussion anymore. Beside the heavy traffic on the street Kempptalstrasse also rail has reached its capacity limit and additional train services are planned for 2015 (Kanton Zürich, 2012b).

Location competition and tax competition are all the time a prominent subject in Fehraltorf since about the 1990s (interview S. Mathys). «An attractive taxpayer is always treated preferentially. If a company accounts for a considerable amount of the municipality's tax revenue, than the municipality undertakes everything that the company stays at the location and experiences favourable conditions. This is the case in each municipality», states S. Mathys (interview) and gives the example of the company Mägerle: Due to a capacity constraint at their previous location in Uster the company approached the municipality Fehraltorf. To definitely attract the company Mägerle and offer them favourable conditions, the municipal authorities initiated a bus line from Uster to Fehraltorf and Mägerle relocated to Fehraltorf in the early 2000s (interview S. Mathys).

S. Mathys (interview) describes the municipal authorities' attitude towards town planning as follows: They do not want to just leave it to the individuals interested in construction and if a project turns out not very well say they could not influence it, but they want to exert influence from the beginning and steer the development. Still, «We attempt of course to bend the building regulations in the interest of the constructors as far as possible within the legal frame, but breaking the regulations is not possible anymore. There is much more watching nowadays.» (interview S. Mathys, own

translation). The locals do not want the municipality to grow as fast as in previous decades. But urban sprawl is no issue of debate in Fehraltorf (interview S. Mathys). Figure 12 shows the settlement structure and small-scale Weighted Urban Proliferation values of the municipality Fehraltorf in 2010. The single-family house quarters Chriesbaumweid in the north and Halden in the east as well as the industrial area Undermüli in the west and the sport area in the south feature high WUP values. The town centre has medium WUP values. The area Ehrenbüel in the north, where the Göhner project was planned, is nearly free from buildings and therefore urban sprawl. The satellite village Chriesbaumweid not only has a low utilisation density, but has also increased dispersion, since it is separated from the rest of the town Fehraltorf.

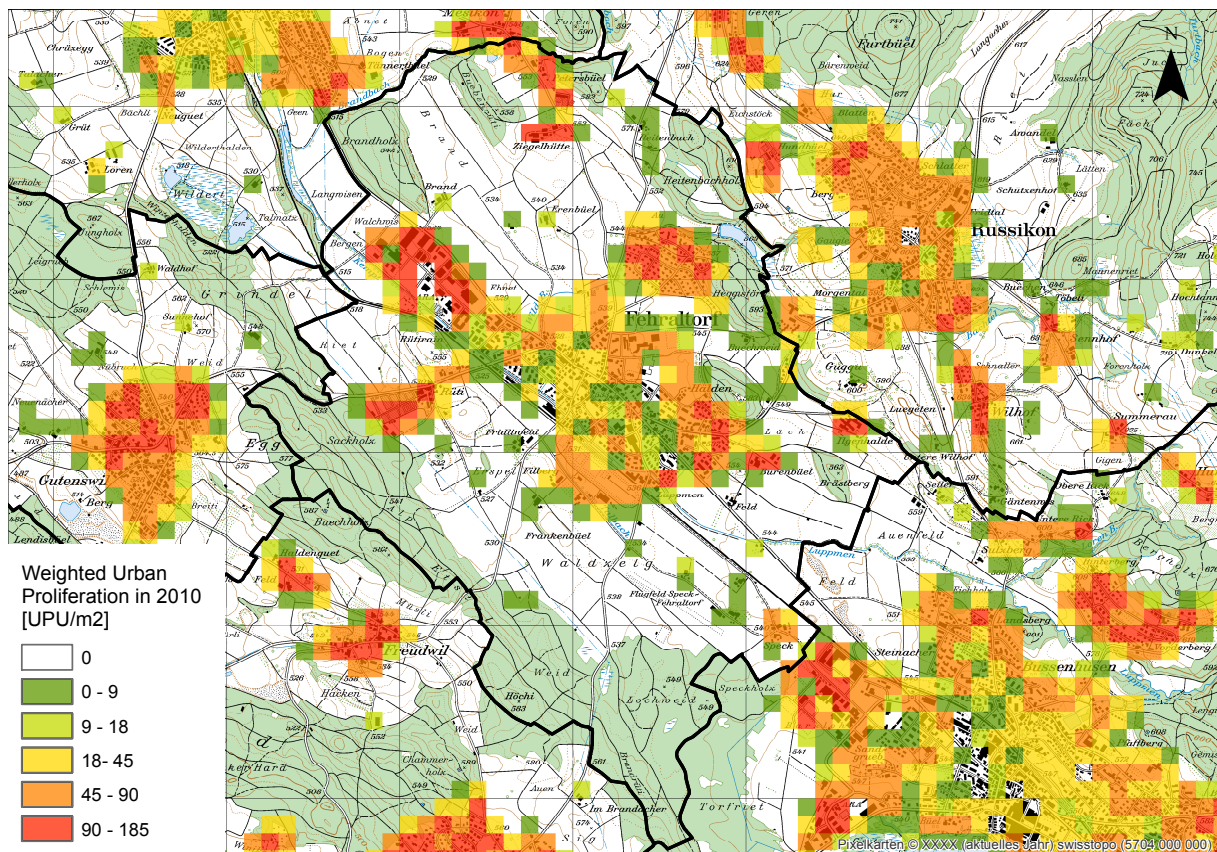


Figure 12. Settlement pattern and Weighted Urban Proliferation of Fehraltorf in 2010. The WUP pixels have a size of 100m*100m (data from Schwick et al., 2012).

3.2.3 Rural: Fischenthal

The municipality Fischenthal consists of the three villages Fischenthal itself, Gibswil and Steg and several scattered (former) farmhouses. The three villages are located along Tösstalstrasse, so they are street villages. Area-wise Fischenthal is the third biggest municipality of Canton Zurich after the cities Zurich and Winterthur and features its highest mountain Schnebelhorn with an elevation of nearly 1'300 m above sea level and two small ski resorts (Gemeinde Fischenthal, 2014). In 2012 the municipality Fischenthal had 2'300 inhabitants (FSO, 2014).

Fischenthal has traditionally been dominated by agriculture (interview R. Knechtle). Because of the general economic structural change in Switzerland it is becoming increasingly difficult for farmers to survive and many give up or take up another job. Fischenthal is financially poor compared to other municipalities in Canton Zurich. It has low tax revenues per capita, even though it has the highest tax rate in Canton Zurich. And it has high expenditures for maintaining its infrastructure (interview R. Knechtle).

Fischenthal has functionally become part of the Zurich metropolitan area in the 1990s with the improvements in rail connectivity. Comparably low land prices and its natural spaces for local recreation make it attractive for newcomers. According to R. Knechtle (interview, own translation) «most newcomers work out of town. They already have a job and keep it. Few find a job here.» Since there are not many cultural activities – only some town societies –, and commuting distances are long, some newcomers move back to the city after a while. In the villages Fischenthal and Steg only few buildings have been constructed recently (interview R. Knechtle). Figure 13 shows that the village Fischenthal has not changed much over the last half century.

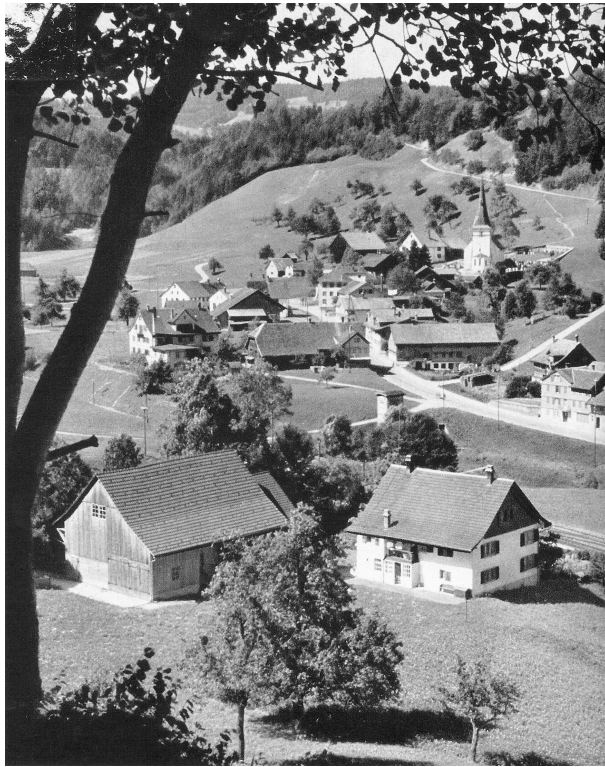


Figure 13. 13a (left). Fischenthal in 1950 (by J. Bertschinger, from Schaufelberger, 1950). 13b (right). Fischenthal in 2014 (own photograph, 10/09/2014).

In the late 1990s the area Rosenberg in Gibswil was rezoned to building zone and a quarter plan was approved. Then the project stood still for some years. Investors realised that this was a good business opportunity and construction took place in the mid 2000s. The land price in building zones in Gibswil has doubled between the early 2000s and present, which tends to lower property size. There is not much green space and R. Knechtle (interview) considers the settlement quality rather deficient. At the moment the quarter plan for the area called Am Leebach in Gibswil is in the approval stage. Five multi-family houses and ten single-family houses are projected. This time, the municipal authorities have pushed for enough green spaces in the quarter plan because of the experiences with of the last project.

A local newspaper reported that there has been a building boom in Gibswil since the mid 2000s until present (Legnini, 2014). The townscape of Gibswil has considerably changed during that time period. Several single- and multi-family houses have been constructed in different projects in Gibswil summing up to about 100 new housing units. Figure 14 shows the village Gibswil with the recently constructed houses. Municipal Chancellor Roger Winter makes the low land price responsible for Gibswil's

attractiveness and expects the building boom possibly to be ongoing in the coming years, because there is still non-built-up land in building zones (Legnini, 2014). Mayor Sepp Gübeli seems to consider the building boom optimistically: «The municipality Fischenthal [...] has experienced a little upsurge in recent years along with the astir building activities» (Gemeinde Fischenthal, 2014, own translation).



Figure 14. Village Gibswil in the municipality Fischenthal (own photograph, 10/09/2014).

Since Fischenthal is a street village, there is in many places one row of houses along the road. In most areas the zoning regulations allow a second row of houses, but building there would be expensive because of the steepness and difficult soil conditions. The mountainous topography limits the sprawling of the settlement area. Natural hazards namely flooding are an issue in Fischenthal. The cantonal Cultural Land Initiative has not hit Fischenthal, since the municipality does not have many building reserve zones (interview R. Knechtle).

The only active actors regarding settlement development in Fischenthal are people interested in constructing, investors as well as individual families (interview R. Knechtle). Some house owners push for an increased utilisation allowance of basement and attic storeys, but not in an organised group, rather in an informal way, since the relevant people are well connected in the municipality. Regularly this issue of utilisation allowance of basement and attic storeys leads to debates in the municipal building commission and might lead to a zoning regulations revision in the future. Referring to this issue, R. Knechtle (interview) stated: «The municipality does not look ahead and say, what do we actually do regarding our landscapes, what would be wise, but input comes from people who feel constrained.» The general local

political credo is above all less governmental steering. The last zoning regulations revision in 2010 did not include any considerable changes. The goal of the revision was to simplify the regulations. Despite the generally loose political steering, the regulations concerning roof style are very tight. Flat roofs are banned in the building regulations for the reason of heritage protection (interview R. Knechtle).

According to R. Knechtle (interview) there is no pressure in Fischenthal to build denser. There are still considerable areas of non-built-up building zones, but the remaining parcels are decreasingly attractive because of steepness. Urban sprawl, related measures and landscape protection in general are no issue of debate in the municipality. The locals generally do not have any such awareness (interview R. Knechtle). Only a few newcomers, who moved to Fischenthal from the city, think the landscapes should be protected, but they are not organised and do not politically lobby for it. Some conservative locals regard the newcomers negatively and want the municipality to stay as it is, but not referring to landscape protection. Others regard the newcomers positively, because they hope for an increase in tax revenue and more open-mindedness (interview R. Knechtle).

Figure 15 shows the settlement structure and small-scale Weighted Urban Proliferation values of the municipality Fischenthal in 2010. It is clearly visible how the settlement area and urban sprawl follows Tösstalstrasse instead of being compact. In the other areas of the municipality there are a few scattered (former) farmhouses, but nearly no urban sprawl. The small villages Fischenthal and Gibswil feature rather high WUP values, and utilisation density is low. But the settlement area only takes up a very small area in relation to the size of the municipality.

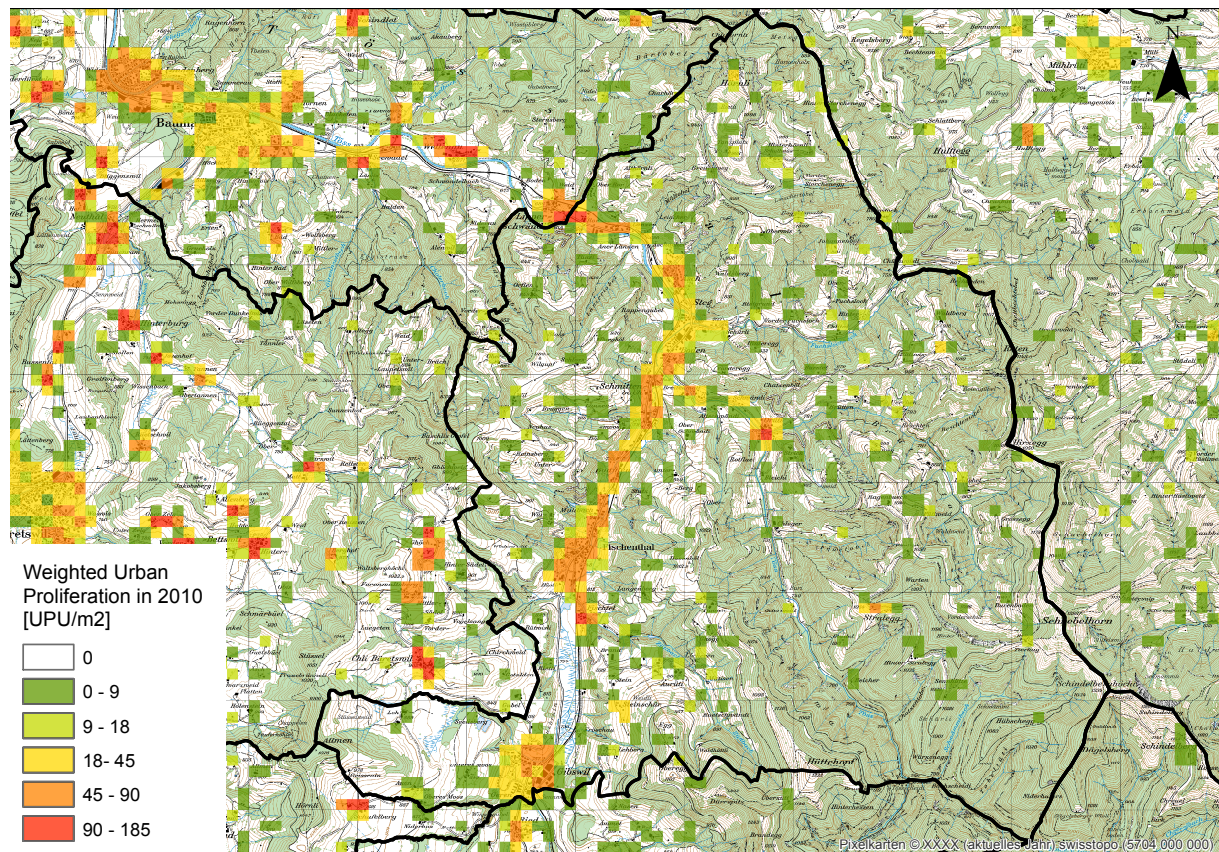


Figure 15. Settlement pattern and Weighted Urban Proliferation of Fischenthal in 2010. The WUP pixels have a size of 100m*100m (data from Schwick et al., 2012).

3.3 Comparison between Municipalities and Summary

This section compares and summarises the results of the three municipalities from Section 3.2 to derive the drivers of urban sprawl in a next step in Section 3.4.

3.3.1 Settlement Development and Urban Sprawl

The municipalities Fällanden, Fehraltorf and Fischenthal have changed over the last decades. The number of farmers has considerably decreased analogue to the general trend in Switzerland and farmers have often been willing to sell their land to constructors. The formerly self-contained towns have gradually become part of the Zurich metropolitan area and many local residents commute to the city of Zurich to work. Population and wealth have grown. Building booms took place in several waves, expanding the settlement area and changing the settlement structure. The timing of the building booms and according expansion of settlement area and urban sprawl follow the distance gradient from the core city: Fällanden experienced its

biggest boom in the 1960s, Fehraltorf in the 1980s ongoing until present and the first boom in Fischenthal has just started in the 2000s. The building booms have also been related to general economic boom times. While the recession after the worldwide oil crisis in 1973 curbed building activities temporarily, the crisis in 2007 has not hit the municipalities remarkably regarding construction. Besides the economic situation also trend waves between suburbanisation and reurbanisation are changing.

Construction occurred in the three municipalities generally at the edges of the existing settlement area. So the settlement area expanded and urban permeation increased. An exception was the single-family house quarter Chriesbaumweid in Fehraltorf, which constituted a satellite village without any historical core, separated from Fehraltorf. Therefore it increased dispersion more distinctly. On the other hand, Fällanden and Fischenthal historically consist of three villages. There was no considerable infill development in any of the three municipalities, since there was no waste land. No large areas were demolished and built anew. The small historic town centres of the three municipalities do not reach the utilisation density of Zurich city. Still, the town centres of Fällanden and Fehraltorf feature a bit lower WUP values than the areas in the municipality built up in the last half century. There are no new-built areas with particularly low WUP values. Even though area developments in Fällanden and Fehraltorf since the mid 1990s have exploited the maximum allowed utilisation factor (interviews F. Wintsch, S. Mathys), utilisation density might not be especially high due to high living area per capita. R. Hirt (interview) stated that rather wealthy newcomers moved to the new-built quarter Unterdorf and that they have a rather high living area per capita. Fällanden experienced a decrease in WUP from 1980 to 1990, because urban permeation stayed constant and utilisation density slightly increased during this time period. The interviews and local documents have brought no explanation for this short trend reversal. However, in the following two time periods WUP increased again in Fällanden. Fehraltorf and Fischenthal have not experienced any time periods with decreasing WUP values. No examples of explicitly non-sprawling settlement development could be identified.

3.3.2 Actors, Construction Activities and Planning Policies

Building activities have clearly been dominated by private constructors, following their individual interests. These interests have on the one hand been the interest of individual families to construct their own single-family house (e.g. Brun in Fehraltorf) and on the other hand the interest of building companies and investors like Ernst Göhner AG to construct and sell or rent buildings for profit. To be in these functions, these actors are necessarily rather wealthy, which is usually related to higher political influence. There was no considerable construction led by the government or a cooperative in any of the three municipalities. So construction activities have been determined privately, guided by individual not collective interests. There was not much coordination between different construction projects. Apart from zoning regulations, there was no democratic control on construction activities, since private constructors made the construction decisions. Even zoning decisions were strongly influenced by private interests. Investors often successfully lobbied for their interests and benefitted from their good connections to the municipal authorities (e.g. Ernst Göhner AG in Fällanden).

The municipal authorities – the municipal council as well as public administration – have played a rather passive role, mostly just reacting upon private construction project proposals instead of proactively steering settlement development. An exception was the declaration of an industrial zone in Fällanden and Fehraltorf at the edge of the towns in the early second half of the 20th century with the goal to create jobs and tax revenue. Until about the 1970s it even seemed that rather private construction plans steered zoning regulations instead of vice versa. During that early period there are examples of actors with a double role (Litz in Fällanden, Gelpke in Volketswil): on the one hand being mandated by the municipality for zoning regulations and on the other hand working for a building company and pursuing their interests. Generally actors interested in construction seem to be well connected to municipal authorities. Still, municipal spatial planning policies have advanced and tightened over time. This was influenced by tighter policies at the cantonal and national level, like the adoption of the cantonal Cultural Land Initiative in 2012. The attitude of the municipal authorities concerning town planning diverges between the three municipalities. In Fällanden and Fischenthal they do not pay much attention, are not interested in landscape protection from urban sprawl or actively steering

settlement development and leave it to private constructors and the market, while on the contrary in Fehraltorf they proactively look at the improvement potential of quarters and try to influence private construction activities. Nevertheless, the influence they can exert is limited within the political and legal framework, since private property is highly respected and governmental influence limited. Municipalities consider themselves in a location competition to attract companies for tax revenue and jobs. Therefore they attempt to create favourable conditions for companies, which might compromise spatial planning goals.

Citizens and/or municipal authorities can form opposition against individual construction projects, which can successfully stop projects (e.g. Göhner project in Fehraltorf). Generally constructors have a high stake and are well connected to other influential actors, while individual citizens concerned about landscape protection have a low stake and are not that organised and powerful. Political parties have not occurred in any municipality as influential actors concerning urban sprawl. Special natural features like lake Greifensee in Fällanden and the groundwater aquifer in Fehraltorf can raise awareness for protection including protection from being built up, which has led to a protection ordinance in Fällanden due to a particularly concerned municipal councillor. Natural features that make construction difficult and expensive hinder construction like soil type, mountainous topography and natural hazards in Fischenthal. General trends like demographic changes related to smaller household sizes and a gradual increase in living area per capita also affect urban sprawl in these municipalities.

The results from the three municipalities confirm the first part of hypothesis 2: Settlement development has been dominated by land utilisation not protection interests. The answer to the second part of hypothesis 2, whether municipal planning policies have tightened over time due to increased awareness for landscape protection, is less unambiguous. Calls for stricter landscape protection and for measures to contain urban sprawl have intensified on the cantonal and national level in recent years (Jaeger & Schwick, 2014; Muggli, 2014), but have not occurred very pronouncedly on the local scale in the three municipalities. Still, municipal spatial planning policies have tightened over time. Most prominently, bounteous new rezoning to building zone has not occurred anymore recently. So the tightening of municipal spatial planning policies has happened by a detour to the higher state

levels (cantonal and national), not directly through local lobbying activities for stricter protection. However, whether these somewhat tighter spatial planning policies succeed in curtailing urban sprawl, is another question.

3.4 Drivers of Urban Sprawl

Based on Section 3.3, the drivers of urban sprawl on the local scale in the case study municipalities are identified. Even though the three municipalities differ somewhat in their characteristics and especially in the time of their suburbanisation, the identified drivers are generally the same. Table 3 compiles the identified drivers of urban sprawl from the cases of the three municipalities, categorised along the intersection of the five driver categories defined by Hersperger and Bürgi (2009) – political, economic, technological, cultural, natural – and the two anthropogenic driver categories given by Briassoulis (2000) – pro versus contra urban sprawl. The drivers are discussed in Section 4.2.2.

Table 3. Drivers of urban sprawl

Driver Categories	Pro Urban Sprawl	Contra Urban Sprawl
Political	<p>passivity of municipal authorities concerning spatial planning</p> <p>high influence of people interested in construction (because they have a high individual stake, close connections to municipal authorities and are well organised and rather wealthy); power imbalance between construction versus protection interests</p> <p>limited governmental influence on private property and lack of democratic control of construction activities</p> <p>location competition (between municipalities)</p>	<p>engagement of municipal authorities for inner development</p> <p>low influence of people interested in protection (because they have a low individual stake and are not or only weakly organised)</p> <p>tight land use policies on cantonal and national level</p>
Economic	<p>construction not only motivated by utilisation of the buildings but also by profit</p> <p>distinctly higher land prices for building land than agricultural land</p> <p>former farmers giving up agriculture and their land</p>	<p>high land prices lead to higher building density</p>
Technological	<p>high connectivity by car and public transportation</p>	-
Cultural	<p>big size of functional spaces (e.g. increased distance between place of residence and work)</p> <p>suburbanisation trend</p> <p>population growth</p> <p>demographic changes, smaller household sizes</p>	<p>high awareness for environmental and in particular land protection</p> <p>reurbanisation trend</p>
Natural	<p>proximity to conurbation centre (except dense core city)</p>	<p>special natural features raising awareness for protection (e.g. lake, groundwater aquifer)</p> <p>difficult/expensive conditions for construction (e.g. mountainous topography, soil type, natural hazards)</p>

4. Discussion

In this chapter first the strengths and limitations of the methods and afterwards the results are discussed.

4.1 Discussion of Methods

In this section the applied methods case study analysis, Weighted Urban Proliferation and expert interviews, as well as the challenge of distinguishing between settlement development and urban sprawl and of relating them to drivers are discussed.

4.1.1 Case Study Analysis

The case study analysis with its small study area allowed studying the selected cases in a high level of detail. Another advantage was the combination of different methods within the case study analysis: Weighted Urban Proliferation to assess the degree of urban sprawl and expert interviews to examine its drivers. Especially the political drivers of settlement development and urban sprawl, namely the influence of actors and their interests and attitudes as well as their relations and balance of power, could be well examined.

At the same time, to investigate the influence of societal trends like e.g. changes in demography and average household size, other mainly statistical methods are more suitable than a case study analysis. A limitation of case studies is the rather small size of the study area, because the results – the identified drivers – are specific for the small study area and generalisations to other regions need to be done with care. Here, the selection and comparison of three municipalities as cases provides generalisability to some extent, especially because the cases were selected by theoretical sampling to have some variability in their urban sprawl development.

4.1.2 Weighted Urban Proliferation

The method Weighted Urban Proliferation provided a reasonable quantitative measurement of urban sprawl as basis for the identification of drivers. A particular advantage was that it is composed of three easily comprehensible indicators – Urban Permeation, Dispersion and Utilisation Density –, which could also be described to the interviewees. The small-scale resolution of the WUP-values was useful for the case studies to assess the degree of urban sprawl of the municipalities and their different quarters. However, the effect of past individual building projects on urban sprawl could not be quantified but only estimated. The WUP method itself does not define a critical value, above which urban sprawl should be considered a problem

(see Section 2.3). Therefore Section 4.2.1 discusses, whether the degree of urban sprawl in the case study area is problematic.

4.1.3 Expert Interviews

The interviewed experts provided valuable local information, but the level of detail varied, especially between different time periods. While the interviewees had good knowledge about the recent time, local books documented earlier decades. The review of local documents complemented the information from the interviews and reduced the inherent subjectivity of the interviews, but it could not be made sure whether the obtained information is complete. There were no contradictions between experts' answers and local documents. The rather open structure of the interviews gave the interviewees the opportunity to tell more details that were not explicitly covered by the individual questions. Due to their functions they could not only provide information about facts and incidents concerning urban sprawl, but also about the attitude of the municipal authorities. Big building projects might be over-represented in comparison to many small projects in the interviews as well as in local documents. But since the drivers of urban sprawl were identified qualitatively not quantitatively this should not compromise the results remarkably. Due to the qualitative assessment of the drivers their strengths of influence on urban sprawl cannot be quantified with this approach.

4.1.4 Relation between Settlement Development, Urban Sprawl and Drivers

Not all kinds of settlement development should be considered increasing urban sprawl, but only those increasing Weighted Urban Proliferation values (Schwick et al., 2012). In the quantitative part of the analysis urban sprawl was readily distinguished from settlement development by considering WUP values and not the expansion of settlement area. The biggest methodological challenge of this master thesis was to distinguish between settlement development and urban sprawl in the information from the interviews and local documents. This information was rather about settlement development (mainly building projects and zoning regulations) and not urban sprawl directly. Similarly, the interviewees mainly referred to building density, while for WUP utilisation density matters. Therefore I had to broadly estimate

the effect on local urban sprawl along the three sprawl dimensions Urban Permeation, Dispersion and Utilisation Density qualitatively, since data was not available in a high enough level of detail to conduct WUP calculations. However, Schwick et al. are developing a tool for municipal authorities to calculate the WUP effect of different variants of planned building projects and zoning regulations in the future (personal communication, 06/06/2014).

This limitation affected the identification of drivers. It was difficult to distinguish drivers of urban sprawl from drivers of non-sprawling settlement development. This differentiation was attempted by focusing on the three sprawl dimension UP, DIS and UD. However, settlement development in the three municipalities generally has been sprawling with nearly constantly increasing Weighted Urban Proliferation values over time.

4.2 Discussion of Results

This section first discusses the propagation of urban sprawl in the case study area and whether the degree of urban sprawl in the municipalities should be regarded problematic. Afterwards the drivers of urban sprawl and policy implications are discussed and need for further research is indicated.

4.2.1 Propagation of Urban Sprawl

Hypothesis 1 is confirmed in Section 3.1 with the Weighted Urban Proliferation data, though a statistical test of the hypothesis was not conducted. That urban sprawl is highest in suburban and not periurban or rural areas might be counter-intuitive at first sight, because public media and discourse usually focus on new sprawling development in periurban/rural areas, under-representing sprawling development in suburban areas in past decades. Often it is assumed that after a period of sprawling development, suburban areas densify and their degree of urban sprawl decreases. Fällanden and Fehraltorf did not show this development. Even though land consumption per inhabitant or job has decreased in Fällanden from about 1940 to 1990 and in Fehraltorf from about 1960 to 2000 and has stagnated since then on a more than twice as high level than Zurich city (see Figure 6), Weighted Urban Proliferation has increased.

Based on the WUP data, the urban sprawl development in the three selected municipalities Fällanden, Fehraltorf and Fischenthal can be regarded typical for a suburban, periurban, respectively rural municipality in the study area. Since the three municipalities served as case studies to identify the local drivers of urban sprawl, it is worthwhile to discuss whether their degree of urban sprawl should be considered problematic at all or not. No critical value of Weighted Urban Proliferation is defined, neither scientifically nor politically, above which urban sprawl can be considered problematic (see Section 2.3). «It is often not clear, which degree of urban sprawl should be assessed as so harmful that further negative development should be strongly avoided» (Wissen Hayek, Jaeger, Schwick, Jarne, & Schuler, 2011, p. 250). However, urban sprawl has nearly constantly increased over time in the three municipalities, moving away from the goal of low Weighted Urban Proliferation values. Also in the most recent time period from 2002 to 2010 WUP has still increased, indicating that the sprawling development is ongoing and has not stopped yet. Bar the quantitative assessment, negative consequences of sprawling development have occurred, like high infrastructure costs burdened on the municipal budget (see Section 3.2). So it is reasonable to consider urban sprawl problematic in the three municipalities, and the municipalities therefore suitable to study the local drivers of urban sprawl. Jaeger and Schwick (2014, p. 306) reason that «the current [urban sprawl] changes have modified the [Swiss] landscapes to a larger degree and faster than ever before.» Notwithstanding, urban sprawl is no prominent issue of local public debate in the three municipalities (interviews R. Hirt, F. Wintsch, S. Mathys, R. Knechtle). Still, about half of the citizens voted in favour of the cantonal Cultural Land Initiative in 2012: 50.56% in Fällanden, 49.40% in Fehraltorf and 48.58% in Fischenthal (Kanton Zürich, 2014a), indicating that urban sprawl discourse rather takes place at a higher – cantonal or national – state level.

4.2.2 Drivers of Urban Sprawl

This master thesis has found different drivers pro and contra urban sprawl in all of the five driver categories defined by Hersperger and Bürgi (2009). The drivers are similar in the three case study municipalities Fällanden, Fehraltorf and Fischenthal. Several of the identified drivers of urban sprawl are also discussed as drivers in other studies, e.g. the increased connectivity by car and public transportation. The applied

approach has particularly provided evidence for political drivers of urban sprawl at the local scale, so the identified political drivers are discussed in this section. Most studies of political drivers of urban change focus on the effect of specific policies. «Generally, these studies [...] fail to understand the relevant elements for explaining decision-making such as power distributions and actors' motivations» (Gennaio, 2008, p. 26). This master thesis supports Gennaio's assessment: The actors interested in construction have been more influential regarding settlement development and urban sprawl than the municipal zoning regulations, particularly pronounced until the 1970s. The possession of land has given actors high influence on municipal land-use decision-making, which Gennaio (2008) also found in her case study in the region Agglomeration Obersee. Like this master thesis, also Auer et al. (2014) conclude that land use in Switzerland has been dominated by private interests of individuals and companies pursuing their own private not public interests. The municipal authorities have rather been passive regarding settlement development. Ewing (1997, p. 118) similarly states for the US: «The posture usually assumed by local governments in the US, waiting for property owners to come forward with rezoning requests, is not planning but reacting.» But the municipal authorities of Fehraltorf have adopted a more active attitude in recent years. Because the building zones in Fehraltorf are almost completely built up and new rezoning is not allowed due to cantonal regulations, they motivate private property owners for inner development. Still, the options of the municipal authorities – and governmental bodies at all Swiss state levels generally – to exert influence are limited, since private property is highly protected by the Swiss constitution. Power and influence is distributed unequally concerning urban sprawl at the local scale. While the private property owners and constructors have been quite successful in pursuing their construction interests, the common interest in landscape protection and containing urban sprawl could not influence settlement development remarkably.

Even though spatial planning regulations at all state levels in Switzerland have become stricter in recent years, the drivers pro urban sprawl still outweigh drivers contra urban sprawl by far. The underlying imbalance of power between land utilisation and protection interests has not changed. Jaeger and Schwick (2014) also acknowledge this imbalance and the resulting tragedy of the commons. Therefore to curtail urban sprawl, other effective policy measures are necessary, which are discussed in Section 4.3.

The comparison between the three municipalities and with Gennaio's (2008) findings have shown, that the identified drivers of urban sprawl are not limited to the case study municipalities. They might also be valid for other municipalities in the Swiss Lowlands and some of them also for other regions and countries.

4.3 Policy Implications for Curtailing Urban Sprawl

This master thesis has identified the imbalance of power between land utilisation and land protection interests as one of the main fundamental drivers of urban sprawl at the local scale. This imbalance must be addressed politically in order to reach a degree of land utilisation and urban sprawl that is sustainable and optimal for society. Since the excessive utilisation of land respectively urban sprawl constitutes a tragedy of the commons, the typical solution for a common resource problem must be applied to solve it (Hardin, 1968): «All potential users mutually agree to collective coercion» (Jaeger & Schwick, 2014, p. 307). This requires that land really becomes a common (collective) property and all residents of the area (here the municipality) democratically decide about the land's utilisation. This will lead to an equal representation of the utilisation and protection interests and result in an optimal lower degree of utilisation and urban sprawl.

The hitherto private and market-based property regime has lead to an unsustainably high degree of urban sprawl, and the tightening of spatial planning policies at all state levels over time has not been able to stop this trend. But despite the excessive utilisation of land for sprawling settlement development, recurring housing shortages testify that this regime has also failed in providing decent housing for all. Therefore, it cannot be expected that the introduction of additional market-based instruments, like the contemporarily discussed tradable area-utilisation permits (e.g. Auer et al., 2014; Muggli, 2014) could curtail urban sprawl.

Of course, the proposed policy approach is politically highly contested, since a small minority – property owners, constructors and investors – have considerable private benefits from the contemporary excessive utilisation of land for sprawling settlement development, while the whole community have to bear the consequences. Since these benefitting actors are well organised and politically highly influential as the analysis has shown, they will very actively lobby for keeping their privileges and therefore heavily oppose any measures that could effectively curtail urban sprawl.

But the majority benefits from a regime shift. Schwick et al. (2012, p. 109) cite Burckhard, Frisch, and Kutter (1955): «Planning should not be understood as limiting freedom, but as being necessary to safeguard freedom for all.»

4.4 Further Research

Urban sprawl is a highly complex issue and many relations are not understood well yet. In this master thesis, especially the differentiation between drivers of sprawling and non-sprawling settlement development has turned out to be difficult, which needs further research. It should be tested, whether the identified drivers of urban sprawl can be generalised to other regions. Also an attempt to quantify the relative influence of different drivers of urban sprawl could be valuable.

Since functional spaces like the Zurich metropolitan area are expanding, another line of research is to study how cities could expand with high utilisation density. Even though Fällanden functionally became part of the Zurich metropolitan area in the 1960s, it has by far not reached Zurich's utilisation density and has not become «city». In 1893 and 1934 former adjacent municipalities got incorporated into the municipality Zurich as new quarters (Stadt Zürich, 2014). The examined gradient from urban to rural municipalities could be completed by including these previously individual municipalities, to have more urban sprawl data points along the gradient.

5. Conclusions

The first step of the case study analysis has shown that urban sprawl has nearly constantly increased in the three study municipalities Fällanden, Fehraltorf and Fischenthal and has propagated over time to more distant municipalities from the conurbation centre Zurich: Fällanden experienced its biggest building boom and urban sprawl increase in the 1960s, Fehraltorf in the 1980s and Fischenthal since the 2000s. The degree of urban sprawl in the municipalities is considered problematic, since negative consequences like disproportionately high infrastructure costs occur.

In the second step of the analysis, several political, economic, technological, cultural and natural drivers of urban sprawl at the local scale could be identified. The drivers are similar between the three municipalities. However, it has been difficult to differentiate between drivers of sprawling and non-sprawling settlement

development. But no examples of particularly non-sprawling settlement development were found. The applied methods especially provided insights in the political drivers of urban sprawl. The imbalance of power between land utilisation and protection interests has been identified as a main driver of urban sprawl. The actors interested in construction – property owner, constructors and investors – have been rather well organised and well connected, and have been very influential on local settlement development. The common interest for land protection has not much been articulated at the municipal level and has not exerted remarkable influence. Even though spatial planning has tightened over time, this imbalance of power is persisting and needs to be addressed in order to change to a sustainable non-sprawling land-use.

6. References

- Adams, C. F., Fleeter, H. B., Kim, Y., Freeman, M., & Cho, I. (1996). Flight from Blight and Metropolitan Suburbanization Revisited. *Urban Affairs Review*, 31(4), 529-543. doi: 10.1177/107808749603100405
- Amt für Raumordnung und Vermessung. (2001). *Siedlungsentwicklung im Kanton Zürich – Ein Rückblick auf 50 Jahre Raumplanung*. Zürich: Colliers CSL AG.
- Antrop, M. (2004). Landscape Change and the Urbanization Process in Europe. *Landscape and Urban Planning*, 67, 9-26.
- Architekten rlc. (2014). *Neubau Wohnsiedlung Berg 'Obstgarten' Fehraltorf*. Retrieved 5 September, 2014, from <http://www.rlc.ch/default.asp?id=11000117&siteid=1&o=444>
- Auer, A., Bühlmann, L., Christ, B., Frey, R. L., Griffel, A., Kübler, D., Muggli, R., Schuler, M., & Waldmann, B. (2014). *Fünf Thesen zu Raumplanung und Zersiedelung*. Zürich: Verlag Neue Zürcher Zeitung.
- Briassoulis, H. (2000). *Analysis of Land Use Change: Theoretical and Modeling Approaches*. Retrieved from <http://www.rri.wvu.edu/webbook/briassoulis/contents.htm>
- Burckhard, L., Frisch, M., & Kutter, M. (1955). Achtung: Die Schweiz: Ein Gespräch über unsere Lage und ein Vorschlag zur Tat. *Basler politische Schriften*, 2.
- Ewing, R. (1997). Is Los Angeles-Style Sprawl Desirable? *Journal of the American Planning Association*, 63(1), 107-126. doi: 10.1080/01944369708975728
- Frei, B. (2000). *Fehraltorf im Umbruch 1900 - 2000*. Fehraltorf: Gemeinde Fehraltorf.
- FSO (Federal Statistical Office). (2014). *Swiss Statistics*. Retrieved 30 August, 2014, from <http://www.bfs.admin.ch/bfs/portal/en/index.html>
- Furter, F., & Schoeck-Ritschard, P. (2013). *Göhner Wohnen: Wachstumseuphorie und Plattenbau*. Baden: Hier und Jetzt.
- Garreau, J. (1991). *Edge City: Life on the New Frontier*. New York: Doubleday.
- Gemeinde Fällanden. (2007). *Bau- und Zonenordnung – Teilrevision 2007*. Fällanden: Gemeinde Fällanden.
- Gemeinde Fällanden. (2008). *Kommunale Empfehlung für Arealüberbauung*. Fällanden: Gemeinde Fällanden.
- Gemeinde Fällanden. (2009). *Naturschutz-Verordnung*. Fällanden: Gemeinde Fällanden.
- Gemeinde Fällanden. (2014). *Fällanden*. Retrieved 31 August, 2014, from <http://www.faellanden.ch/de/>

- Gemeinde Fehraltorf. (2014). *Fehraltorf*. Retrieved 5 September, 2014, from <http://www.fehraltorf.ch/>
- Gemeinde Fischenthal. (2014). *Fischenthal*. Retrieved 1 September, 2014, from <http://www.fischenthal.ch/>
- Gennaio, M. P. (2008). *Political Driving Forces of Urban Change in the Region Agglomeration Obersee*. (Dissertation), ETH, Zurich.
- Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine.
- Gordon, P., & Richardson, H. W. (1997). Are Compact Cities a Desirable Planning Goal? *Journal of the American Planning Association*, 63(1), 95-106. doi: 10.1080/01944369708975727
- Greifensee-Stiftung. (2003). *Veränderungen am Greifensee im Verlaufe der letzten 12'000 Jahre: Eine Zusammenstellung*. Uster: Greifensee-Stiftung.
- Hardin, G. (1968). The Tragedy of the Commons. *Science*, 162, 1243-1248.
- Hersperger, A. M., & Bürgi, M. (2009). Going beyond Landscape Change Description: Quantifying the Importance of Driving Forces of Landscape Change in a Central Europe Case Study. *Land Use Policy*, 26, 640-648.
- Hesse, M., & Kaltenbrunner, R. (2005). Zerrbild «Zersiedelung»: Anmerkungen zum Gebrauch und zur Dekonstruktion eines Begriffs. *disP – The Planning Review*, 41(160), 16-22. doi: 10.1080/02513625.2005.10556902
- Howard, E. (1902). *Garden Cities of Tomorrow*. London: S. Sonnenschein & Co.
- Jaeger, J. A. G., & Schwick, C. (2014). Improving the Measurement of Urban Sprawl: Weighted Urban Proliferation (WUP) and its Application to Switzerland. *Ecological Indicators*, 38, 294-308.
- Johnson, M. P. (2001). Environmental Impacts of Urban Sprawl: A Survey of the Literature and Proposed Research Agenda. *Environment and Planning A*, 33(4), 717-735. doi: 10.1068/a3327
- Kanton Zürich. (2012a). *Agglomerationsprogramm Stadt Zürich - Glattal 2. Generation*. Zürich: Kanton Zürich.
- Kanton Zürich. (2012b). *Agglomerationsprogramm Zürcher Oberland 2. Generation*. Zürich: Kanton Zürich.
- Kanton Zürich. (2012c). *Agglomerationsprogramme 2. Generation: Dachkonzept*. Zürich: Kanton Zürich.
- Kanton Zürich. (2014a). *Statistisches Amt*. Retrieved 8 September, 2014, from http://www.statistik.zh.ch/internet/justiz_inneres/statistik/de/home.html

- Kanton Zürich. (2014b). *GIS-Browser*. Retrieved 2 April, 2014, from <http://maps.zh.ch/>
- Kanton Zürich. (2014c). *Gesetz über die Raumplanung und das öffentliche Baurecht (Planungs- und Baugesetz)*. Zürich: Kanton Zürich.
- Kuster, J., & Meier, H. R. (2008). *Metropolitanraum Zürich: Porträt*. Zürich: Metropolitankonferenz Zürich.
- Legnini, P. (2014, 12 February). Gibswiler Neubauten sind sehr begehrt. *Zürcher Oberländer*. Retrieved from <http://zol.ch/bezirk-hinwil/fischenthal/Gibswiler-Neubauten-sind-sehr-begehrt/story/27399429>
- Litz, H. (1964). *Gartenstadt Benglen*. Fällanden: Municipality Fällanden.
- Mieg, H. A., & Näf, M. (2005). *Experteninterviews in den Umwelt- und Planungswissenschaften: Eine Einführung und Anleitung* (2nd ed.). Zürich: Institut für Mensch-Umwelt-Systeme, ETH Zürich.
- Mieszkowski, P., & Mills, E. S. (1993). The Causes of Metropolitan Suburbanization. *Journal of Economic Perspectives*, 7(3), 135-147. doi: 10.1257/jep.7.3.135
- Miller, M. D. (2012). The Impacts of Atlanta's Urban Sprawl on Forest Cover and Fragmentation. *Applied Geography*, 34, 171-179.
- Muggli, R. (2014). *Ist der Föderalismus an der Zersiedelung schuld? Pilotstudie und Thesen*. Zürich: Verlag Neue Zürcher Zeitung.
- Planpartner AG. (2014). *Teilrevision Ortsplanung 2014 – Bericht Entwurf*. Fällanden: Gemeinde Fällanden, Kanton Zürich.
- Polidoro, M., de Lollo, J. A., & Fernandes Barros, M. V. (2011). Environmental Impacts of Urban Sprawl in Londrina, Paraná, Brazil. *Journal of Urban and Environmental Engineering*, 5(2), 73-83.
- Romero, H., & Ordenes, F. (2004). Emerging Urbanization in the Southern Andes: Environmental Impacts of Urban Sprawl in Santiago de Chile on the Andean Piedmont. *Mountain Research and Development*, 24(3), 197-201.
- Schaufelberger, O. (1950). *Das Zürcher Oberland in seinen Herzkammern*. Bern: Verlag Paul Haupt.
- Scholz, R. W., & Tietje, O. (2002). *Ebedded Case Study Methods: Integrating Quantitative and Qualitative Knowledge*. Thousand Oaks: Sage.
- Schwick, C., Jaeger, J., Bertiller, R., & Kienast, F. (2010). *Zersiedelung der Schweiz – unaufhaltsam? Quantitative Analyse 1935 bis 2002 und Folgerungen für die Raumplanung*. Bern, Stuttgart, Wien: Haupt.

- Schwick, C., Jaeger, J. A. G., Bertiller, R., & Kienast, F. (2012). *L'étalement urbain en Suisse – Impossible à freiner? Analyse quantitative de 1935 à 2002 et conséquences pour l'aménagement du territoire. Urban Sprawl in Switzerland – Unstoppable? Quantitative Analysis 1935 to 2002 and Implications for Regional Planning* (Bristol-Stiftung Ed.). Berne, Stuttgart, Vienna: Haupt.
- Siedentop, S. (2005). Urban Sprawl – verstehen, messen, steuern: Ansatzpunkte für ein empirisches Mess- und Evaluationskonzept der urbanen Siedlungsentwicklung. *disP – The Planning Review*, 41(160), 23-35. doi: 10.1080/02513625.2005.10556903
- SNSF (Swiss National Science Foundation). (2012). *Sustainable Use of Soil as a Resource: National Research Programme NRP 68 Implementation Plan*. Berne: SNSF.
- Stadt Zürich. (2014). *Stadt Zürich*. Retrieved 20 August, 2014, from <https://www.stadt-zuerich.ch>
- Stake, R. E. (1995). *The Art of Case Study Research*. Thousand Oaks: Sage.
- Strauss, A. L. (1991). *Grundlagen qualitativer Sozialforschung*. München: W. Finck.
- Travisi, C. M., Camagni, R., & Nijkamp, P. (2010). Impacts of Urban Sprawl and Commuting: A Modelling Study For Italy. *Journal of Transport Geography*, 18(3), 382-392.
- UN (United Nations). (2008). *World Urbanization Prospects: The 2007 Revision*. New York: UN.
- Willhauck, R. (2013). *Zersiedelung in der Schweiz: Explorative statistische Untersuchung wichtiger Einflussgrößen*. (Masterarbeit), ETH, Zürich.
- Wissen Hayek, U., Jaeger, J. A. G., Schwick, C., Jarne, A., & Schuler, M. (2011). Measuring and Assessing Urban Sprawl: What are the Remaining Options for Future Settlement Development in Switzerland for 2030? *Applied Spatial Analysis and Policy*, 4, 249-279. doi: 10.1007/s12061-010-9055-3
- WSL (Swiss Federal Institute for Forest Snow and Landscape Research). (2013). *NFP 68 Project: Controlling Urban Sprawl to Limit Soil Consumption (SPROIL)*. Retrieved 11 August, 2014, from http://www.wsl.ch/fe/wisoz/projekte/nfp68/index_EN
- Zhao, P. (2013). The Impact of Urban Sprawl on Social Segregation in Beijing and a Limited Role for Spatial Planning. *Tijdschrift voor Economische en Sociale Geografie*, 104(5), 571-587. doi: 10.1111/tesg.12030

List of Figures

Figure 1. Illustration of the definition of urban sprawl	10
Figure 2. 2a. Perimeters of the four current agglomeration programmes of Canton Zurich. 2b. Study area and the three selected municipalities Fällanden, Fehraltorf and Fischenthal.....	18
Figure 3. Weighted Urban Proliferation values in 2010 of the 36 municipalities as a function of the distance to the conurbation centre Zurich.....	26
Figure 4. Average Weighted Urban Proliferation values from 1885 to 2010 per distance category	27
Figure 5. 5a. Development of the number of inhabitants plus jobs. 5b. Development of Weighted Urban Proliferation	28
Figure 6. 6a. Development of Urban Permeation. 6b. Development of Dispersion. 6c. Development of Land Consumption	29
Figure 7. Göhner apartment blocks in Benglen in the municipality Fällanden.....	34
Figure 8. Apartment blocks in the new quarter Unterdorf and the parcel Huebwis with an industrial building in Fällanden	35
Figure 9. Settlement pattern and Weighted Urban Proliferation of Fällanden in 2010	38
Figure 10. Single-family house quarter Chriesbaumweid, which is separated from the central town Fehraltorf.....	40
Figure 11. Apartment blocks in the new quarter Berg in Fehraltorf	42
Figure 12. Settlement pattern and Weighted Urban Proliferation of Fehraltorf in 2010	44
Figure 13. 13a. Fischenthal in 1950. 13b. Fischenthal in 2014	46
Figure 14. Village Gibswil in the municipality Fischenthal	47
Figure 15. Settlement pattern and Weighted Urban Proliferation of Fischenthal in 2010.....	49

List of Tables

Table 1. The 36 municipalities in the study area	19
Table 2. Interviewees.....	24
Table 3. Drivers of urban sprawl.....	54
Table 4. Weighted Urban Proliferation values of the 36 municipalities 1885 - 2010 .	72

Acknowledgements

The six-months master thesis lasting from March to September 2014 gave me many valuable new insights. This master thesis would not have been possible without the support of the following people, whom I would like to thank very much.

First of all big thanks to the supervisors Felix, Anna and Sophie for giving me the opportunity for this thesis. Thank you for your helpful inputs and taking the time for regular meetings. Thanks to the colleagues at WSL for the comfortable working atmosphere. Thanks Gierina for your support with data and figures.

Thanks to the interviewees Prof. Dr. Richard Hirt, Stefan Mathys, Rolf Knechtle and Fabio Wintsch for taking the time for the interviews and answering my questions. All the interviews provided interesting and useful local information about the three municipalities.

Thanks Gregor for proofreading.

Thanks Nadine and Maria for our inspiring discussions about contemporary challenges in architecture and urbanism.

Last but not least thanks to Timon, friends and family for your love and support.

Appendix

I. Interview Field Manual

Begrüssung, Beschreibung Masterarbeit, Tonband-Aufnahme, Anonymität

Interviewpartner

- 1) Was ist Ihre Funktion in der Gemeinde? Seit wann (bis wann)?
- 2) Was ist Ihr beruflicher Hintergrund?

Zersiedelungs-hemmende und -fördernde Massnahmen

- 3) Ist Zersiedelung ein Thema in Ihrer Gemeinde?
- 4) Wann gab es in Ihrer Gemeinde die erste Bau- und Zonenordnung? Wann gab es Revisionen, und warum?
- 5) Welche Massnahmen mit Einfluss auf die Zersiedelung (Siedlungsfläche, -Streuung, bauliche und Nutzungsdichte) wurden in Ihrer Gemeinde beschlossen?
- 6) Seit wann (bis wann) sind die Massnahmen in Kraft?
- 7) Welche Massnahmen standen zur Diskussion, wurden aber nicht beschlossen?
- 8) Welche Akteure haben sich mit welchen Argumenten für oder gegen die Massnahmen eingesetzt?
- 9) Werden die beschlossenen Massnahmen auch umgesetzt?
- 10) Welchen und wie starken Einfluss auf die Zersiedelung haben die beschlossenen Massnahmen? Beispiele?
- 11) Welche Massnahmen stehen momentan oder voraussichtlich in Zukunft zur Diskussion?
- 12) Wie hat sich der Diskurs über Siedlungsentwicklung, Zersiedelung und Raumplanung in Ihrer Gemeinde über die Zeit verändert? War der Diskurs eher lokal oder national/international geprägt?

Einflussstärken

- 13) Wie stark schätzen Sie die Einflussmöglichkeit der Politik im Vergleich zu wirtschaftlichen und gesellschaftlichen Entwicklungen auf die Zersiedelung ein?
- 14) Wie stark schätzen Sie die Einflussmöglichkeit der Politik auf Gemeindeebene im Vergleich zur Politik auf Kantons- und Bundesebene auf die Zersiedelung ein?

- 15) Wie hat sich die Einflussnahme der Politik (auf Gemeindeebene) auf die Siedlungsentwicklung über die Zeit verändert? Was waren die Gründe/Argumente dahinter?

Standortwettbewerb

- 16) Ist Standortwettbewerb in Ihrer Gemeinde generell ein Thema?
17) Wenn ja, seit wann (ungefähr)?
18) Welchen Einfluss hat der Standortwettbewerb auf die Raumplanung, Siedlungsentwicklung und Zersiedelung in Ihrer Gemeinde?

Gentrifizierung

- 19) Hat sich die Zusammensetzung der Einwohner und Arbeitsplätze Ihrer Gemeinde über die Zeit verändert? Wenn ja, wie (Einkommen, Beschäftigungssektor, Pendelverhalten, etc.) und warum?
20) Gibt es in Ihrer Gemeinde Areale, die verdichtet wurden, und danach trotz höherer baulicher Dichte (mehr Geschossfläche) eine unveränderte oder tiefere Nutzungsdichte (weniger Einwohner + Arbeitsplätze) aufwiesen? Wenn ja: Welche Areale/Beispiele?
21) Wenn ja, was war die Ursache dafür? (Gab es eine Verschiebung von ärmeren zu reicheren Nutzern aufgrund gestiegener Mietpreise?)
22) Wenn ja, möchte die Gemeinde solche Fälle in Zukunft verhindern? Wie?

Zersiedelungswerte

- 23) Inwiefern schätzen Sie die Siedlungsentwicklung/Zersiedelung Ihrer Gemeinde als typisch oder untypisch ein im Vergleich zu anderen urbanen/suburbanen/periurbanen/ruralen Gemeinden, insbesondere im Vergleich zu den Nachbargemeinden?

Zersiedelungskarte und -Werte zeigen

- 24) Wie beurteilen Sie die vorgelegten Zersiedelungswerte Ihrer Gemeinde?
25) Wie schätzen Sie die zukünftige Siedlungsentwicklung Ihrer Gemeinde ein?
26) Haben Sie weitere Anmerkungen oder Fragen?

Frage nach Quellen, Dank

II. Weighted Urban Proliferation Values

Table 4. Weighted Urban Proliferation values of the 36 municipalities 1885 - 2010

Municipality	Distance Category	Distance to Conurbation Centre Zurich [km]	Weighted Urban Proliferation [UPU/m ²]						
			1885	1935	1960	1980	1990	2002	2010
Zürich	urban	0	0.1	0.2	0.3	1.6	1.4	2.3	1.8
Wallisellen	suburban	6	2.2	8.4	12.1	15.9	13.3	18.5	15.9
Opfikon	suburban	7	2.0	2.3	8.6	24.0	16.3	2.9	7.8
Dübendorf	suburban	7	0.8	7.0	12.7	18.2	18.2	21.2	17.6
Fällanden	suburban	7	1.9	2.9	5.8	14.9	13.3	17.2	18.3
Dietlikon	suburban	8	1.1	6.6	8.2	26.6	26.8	26.7	25.3
Kloten	suburban	9	0.6	1.3	19.6	28.2	25.5	26.4	25.6
Rümlang	suburban	9	0.5	1.0	10.8	21.0	21.2	23.0	23.5
Schwerzenbach	suburban	9	0.9	3.2	5.5	13.5	16.8	13.0	19.6
Wangen-Brüttisellen	suburban	9	1.9	6.4	11.0	14.1	14.6	13.4	16.6
Bassersdorf	suburban	10	0.9	5.2	7.6	11.2	14.5	16.4	16.7
Greifensee	suburban	10	1.5	2.1	2.1	5.9	6.6	14.4	19.7
Maur	suburban	10	1.3	2.1	3.3	8.8	8.9	9.4	11.5
Volketswil	suburban	10	2.5	3.4	4.5	9.4	10.1	10.9	15.8
Nürensdorf	suburban	12	0.5	4.3	6.5	8.6	10.3	12.4	14.1
Uster	periurban	14	2.6	4.6	6.3	9.1	11.2	12.1	14.6
Mönchaltorf	periurban	15	0.5	2.1	2.3	2.1	3.2	4.2	5.3
Fehraltorf	periurban	16	1.4	2.6	3.5	5.4	6.5	7.9	10.1
Gossau (ZH)	periurban	18	1.9	3.9	5.0	6.9	7.4	7.3	8.1
Seegräben	periurban	18	4.1	9.2	9.7	12.1	12.8	12.6	15.4
Pfäffikon	periurban	18	2.7	4.9	7.5	10.9	11.8	13.5	14.5
Russikon	periurban	18	2.0	3.5	4.7	6.9	7.4	7.4	9.1
Grüningen	periurban	19	1.5	2.8	3.3	3.7	4.0	3.7	5.4
Wetzikon (ZH)	periurban	20	0.2	8.3	13.5	14.7	16.1	18.8	19.3
Hittnau	periurban	21	2.5	3.2	4.4	4.6	4.7	5.0	5.5
Bäretswil	periurban	24	1.1	3.4	3.8	4.7	4.8	4.9	6.4
Bubikon	periurban	24	1.1	2.6	3.8	7.0	7.8	7.7	10.3
Hinwil	periurban	24	1.6	3.6	3.9	7.3	8.4	8.8	10.0
Dürnten	periurban	25	0.7	4.2	6.1	9.3	9.3	8.6	12.4
Rüti (ZH)	periurban	27	0.0	4.5	5.4	7.4	9.6	12.1	14.8
Wildberg	rural	22	1.3	2.2	2.8	3.4	3.6	3.5	4.2
Wila	rural	24	0.9	2.8	4.6	5.2	6.2	6.5	7.5
Bauma	rural	25	0.8	4.1	5.4	6.4	7.3	7.4	8.6
Sternenberg	rural	28	0.8	1.6	1.9	2.1	2.1	2.2	2.5
Fiscenthal	rural	29	0.7	1.9	3.0	3.2	3.5	3.6	4.0
Wald (ZH)	rural	30	0.1	2.0	4.8	5.5	5.7	6.0	7.6

Note. Weighted Urban Proliferation data from Schwick et al. (2012).