BACK TO RURAL

Rethinking Suburban Housing

Mine Erdem

Chalmers University of Technology
Department of Architecture and Civil Engineering

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CHALMERS
UNIVERSITY OF TECHNOLOGY

Mine Erdem

Supervisor : Kaj Granath | Examiner : Anna Braide

Chalmers University of Technology
Department of Architecture and Civil Engineering
Master Programme Architecture and Planning Beyond Sustainability | MPDSD

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for being next to me in each process of this thesis.

ABSTRACT

It is known by everyone that the migration to urban areas is increasing. But what about rural migration? While ongoing trends such as globalization or urbanization led people to live in urban areas, for many people they are the reasons to get away from urban areas. Decreasing living standards in urban areas, the desire to be closer to nature to get away from noise and pollution, or remote-work opportunity can be counted among the reasons.

Many Swedish suburbs and rural areas are receiving migrations. Population growth is projected for many low-populated areas, especially the ones close to the cities. Due to this development, there are new housing projects in these locations. The housing plot sizes for low-populated areas are traditionally around 800-1800 sqm in Sweden. By reducing this size, the natural area can be saved, and the future expansion of the built area can be slower. This thesis focuses on projects which include many houses in the project area, and discusses how the housing density can be increased. This way, more houses can fit in the same project plot to save nature.

By increasing the number of houses for the same project plot, houses will be closer to each other. This threatens the privacy of the users. Privacy is one of the important housing qualities for people who want to move to a low-populated area. Also, to support immigration to low-populated areas, there must be suitable houses for everybody, not only for families but also for single-person, youth and the elderly. The users should be able to reorganize the interiors as their wish. Therefore, flexibility is another important quality of this design project. Due to these main goals, the design question is:

What are the potentials to build dense dwelling areas and
at the same time improve privacy and flexible space for residents?

One of the ongoing projects located in the municipality of Borås is chosen to discuss how to propose more housing units for the same plot area, but still provide privacy and flexibility in the houses. Two projects are proposed for this area. In the first design proposal, the housing density increases by 50% (14 units to 21 units), this project is proposed as a housing project for the rural area. For the second design proposal, the housing density increases by 100% (14 units to 28 units). This project is more experimental to show how it would be if the density is doubled and proposed as a suburban housing project. But also would be implemented in the chosen rural area due to many reasons.

KEYWORDS: migration to suburbs, Swedish rural housing, one-dwelling building, privacy

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AUTHOR

Mine Erdem

Izmir, Turkey | 1997

Master of Science
Architecture and Planning Beyond Sustainability
Chalmers University of Technology
Gothenburg, Sweden | 2020-2022

Erasmus program
Architecture
Koblenz University of Applied Sciences
Koblenz, Germany | 2018-2019

Bachelor of Architecture
Architecture
Yeditepe University
Istanbul, Turkey | 2015-2019

I am Mine Erdem. I grew up in İzmir, Turkey, right next to the Mediterranean sea. In 2015, I moved to one of the most beautiful cities, Istanbul for my bachelor's education. During this process, I participated in the Erasmus program for a half year in Koblenz, Germany. After working in an office for seven months in my hometown Izmir, I moved to Gothenburg, Sweden to start my master's degree in 2020.

I believe that good architecture consists of a proportionate inclusion of disciplines from engineering and the arts and it is essential to understand and analyze different local contexts to propose sustainable architectural solutions.

INTRODUCTION

Personal connection
Purpose
Aim
Research question
Delimitations
Definitions
Methodology
Reading instructions

PERSONAL CONNECTION

This is where my parents live, Sasalı, Izmir/Turkey. Here is 20 minutes away from the city center. We moved there around 10 years ago. At that time, there were just a few housing projects. Over the years, the interest in moving to the suburb got increased. Many people move out of their apartments in the city center, to move to these kinds of areas. They thought that being closer to nature will be healthier for them and their families. Also, many of them thought city centers are dangerous, and their children can not play outside alone. For many reasons like this, the sale of houses in the suburbs skyrocketed.

People, who were happy at first, realized that also these houses are not providing for their needs. They were not feeling private in their houses. Neighbors were able to see their terraces or even rooms. The houses were unnecessarily big. They had high heating and electricity demands. It was harder to clean and maintain it.

Figure 1 : Sasalı, Izmir/Turkey (Google Maps)

Another negative outcome of this increased interest in moving to the suburb is the usage of natural land. Back in time, this area in Sasalı was owned by farmers from the closest village (left-down corner in Figure 1). But now, there are always new constructions, and the built area is expanding in the middle of farmland.

These fertile lands are disappearing and since the houses are close to each other, people do not find the privacy they seek when they move here. That's why I started to think would it be possible to provide privacy even the houses are closer to each other to save natural area. Also, I aimed to point out how housing in the low-populated areas can be improved.

PURPOSE

Many Swedish suburbs and rural areas are receiving migrations. Population growth is projected for many low-populated areas, especially the ones close to the cities.

This thesis focuses on three main subjects. The first one is about the housing density in Swedish rural and suburban areas. Since there is population growth in many low-populated areas, there are new detached housing projects in these locations. The housing plot sizes for low-populated areas are traditionally around 800-1800 sqm in Sweden. By reducing this size, the natural area can be saved, and the future expansion of the built area can be slower. This thesis focuses on projects which include many houses in the project area, and discusses how the housing density can be increased. This way, more houses can fit in the same project plot to save nature.

By increasing the number of houses for the same project plot, houses will be closer to each other. This threatens the privacy of the users. It is assumed that privacy is one of the housing qualities for people who want to move to a low-populated area. Therefore, privacy is an important subject in the design process of the suburban housing project.

To support immigration to low-populated areas, there must be suitable houses for everybody, not only for families but also for single-person, youth and the elderly. Therefore, there should be more options and floor plans should be flexible.

Overall, the purpose is to achieve privacy and flexibility on floor plans even though the housing density of housing is higher.

AIM

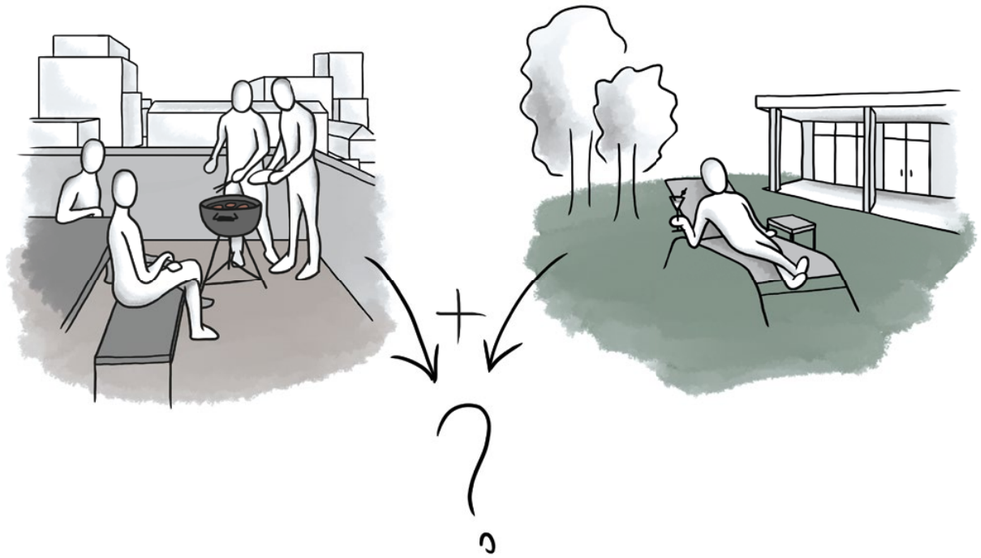
In order to be more specific during the discussion about housing density, an ongoing project in a Swedish rural area is chosen. Two design projects are proposed for the same area.

In the first design proposal, the housing density is increased by 50% (14 units to 21 units). This project is proposed as a housing project especially for this rural location and community.

For the second design proposal, the housing density increased by 100% (14 units to 28 units). This project is more experimental to show how it would be if density doubled. This proposal is designed as a suburban housing project. But also would be implemented in the chosen rural area due to many reasons.

Aimed to showed that privacy and flexibility can be improved even though the plot sizes of each house are smaller.

RESEARCH QUESTION



What are the potentials to build dense dwelling areas and at the same time improve privacy and flexible space for residents?

DELIMITATIONS

This thesis explores why and which suburbs and rural areas receive immigration, researches what people expect from a house when they are moving to a suburb or a rural area, and searches for a way to have more housing units for the same land area but still provide privacy and flexibility. The project is valid for housing projects that includes many detached houses.

The thesis excludes the emigration from suburbs or rural areas, the transformation of existing buildings, and the subjects of finance.

EXPLORED

population growth in suburbs and rural areas

ongoing projects

housing preferences of specific users

new construction

housing project that includes many one-dwelling buildings

NOT EXPLORED

urban population growth (rural-to-urban migration)

finance (cost of materials/ construction)

other functions in the area (cafe-market...)

transformation of existing houses

housing project with one one-dwelling building

DEFINITIONS

Rural area : Countryside. Rural areas are outside of cities, further away than suburbs. Rural lifestyles tend to have a strong connection to nature. Therefore, the dwellings are generally detached houses and quite away from each other. These areas often have locally-owned stores, restaurants, etc. The rural locations and projects for these areas are colored with ***blue***.

Suburban area : Suburb. The locations are built up around the outside of urban areas. The population density tend to be higher than in a rural area. Generally, the dwellings are detached or semi-detached houses and the residents commute to the closest cities for work or shopping. The suburbs and projects for these areas are colored with ***gray***.

Urban area : City. Urban areas are densely populated. Urban areas are locations with a density of at least 300 inhabitants per km² and a minimum population of 5,000. Multi-story apartment buildings are common in these locations. The urban location and projects for these areas are colored with ***orange***.

Low-populated area: A rural or a suburban area that needs to receive migration to not get disappear in the future is defined as a low-populated area.

Suburban housing project : A housing project that includes many houses in the project lot. The houses tend to be detached or semi-detached houses. The houses generally have the same or similar designs. These projects generally are designed for the suburbs which are expanding fast due to increasing interest.

METHODOLOGY

Many methods were used in parallel to reach the final result.

background research

A literature review is done. To understand the potential newcomers, the reasons behind migrations to suburbs and rural areas are researched. The housing preferences and the housing challenges in Swedish rural areas are searched to use as input in the design process. The information is supported by surveys and statistics.

case study

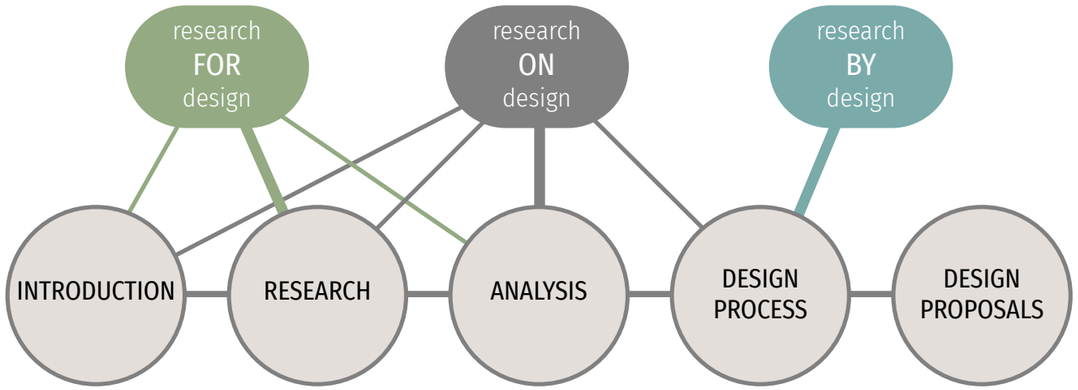
Different housing projects are examined. These projects are projects that include many houses in the project area. Aimed to determine the common architectural qualities of these projects, which are carried out in the low-populated areas of Sweden. After defining the qualities that provide or oppose, guidelines and goals are created for the final design process.

A/B testing

In order to be more specific during the discussions, an ongoing project in a Swedish rural area is chosen. Two design projects are proposed for the same area. The number of units is increased by 50% for the first proposal, and by 100% for the second proposal. A comparison is done between the proposals and the ongoing design project for each architectural quality.

READING INSTRUCTIONS

This thesis has five main chapters. Literature reviews, surveys, and statistics are shared in the “research” chapter. The examination of reference projects, site and project analysis are shared in the “analysis” chapter. The outcomes from these chapters are discussed in the “design process” chapter. The final design proposals are shared in the “design proposals” chapter.



RESEARCH

Migration to suburbs and rural areas
Urbanization issues
Improvements in infrastructure
Digitalization
International immigration
Future vision for rural development
Vision for European rural areas
Housing in Sweden
Size of dwellings
Rural Housing Challenges

RESEARCH

This thesis focuses on the new constructions in the low-populated areas and discusses how these constructions can affect the future of these areas. A few low-population areas receive migrations but this varies from country to country and region to region. The research was conducted to understand which low-populated areas receive migration and the reason behind it. Firstly, the projected population changes for the European continent were shared.

While the total population is increasing, the population change differs for different countries. Figure 2 is a graphic of projected population changes for European countries by 2050. While there will be an increase in population for Ireland, Sweden, Iceland, Norway, and Switzerland; for Bulgaria, Portugal, Hungry, and Lithuania there is a decrease. (Eurostat, NUTS)

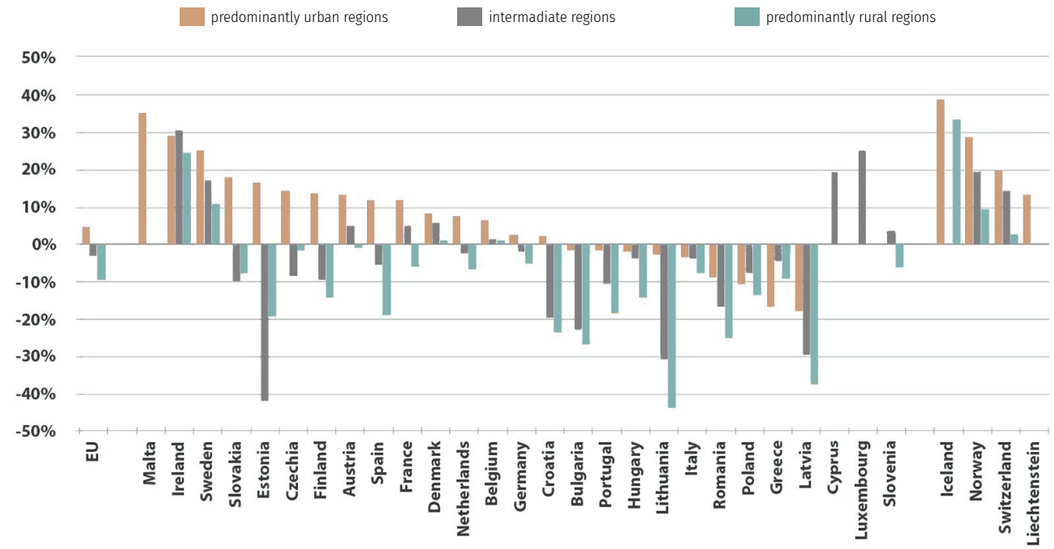


Figure 2 : Relative population change by urban-rural typology, 2019-50 (Eurostat, NUTS)

As Figure 2 shows, there will be a population decrease in rural areas for most of the European countries. The population growth is projected only for a few of them. These countries are Ireland, Sweden, Iceland, Norway and Switzerland. This thesis focuses on population growth in low-populated areas of Sweden, and discussed how the new housing projects can be improved.

According to this figure, the total population of urban, intermediate and rural areas is increasing for Sweden. To support this information, three housing projects are shared. These projects are located in an urban, an intermadiate (suburb), and a rural area of the same Swedish municipality. These projects are in the construction process right now and this shows that there is an interest in moving to these locations.

Borås municipality is chosen to have a closer look at how population trends affect the housing situation for urban, intermediate (suburb), and rural areas. Three ongoing housing projects, which include many houses, are chosen to compare with each other in relation to the population density of their locaties.

The population of Borås municipality is increasing. In 2018, there were 112,178 inhabitants and 9.6% of the inhabitants (10,817 inhabitants) lived outside an urban area. In the middle of 2021, there were 113,964 inhabitants. Between 2015 and 2020, 3 rural areas became an urban area and in 2020, there were 20 urban areas in Borås (Municipality of Borås (web)).

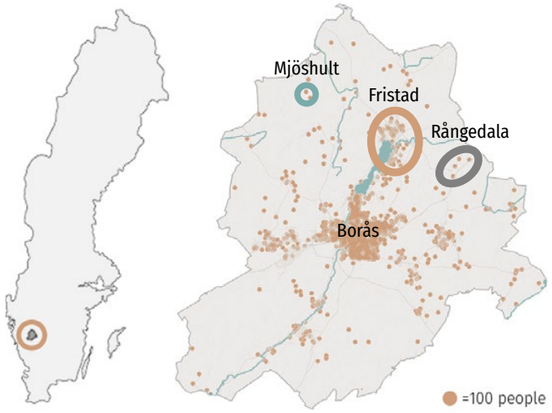


Figure 3 : Population density in Borås municipality
(SCB, OpenStreetmap contributors, EEA)

Borås (Municipality)

113,714 Population [2020]
909.9 km² Area
125/km² Population Density [2020]
0.94% Annual Population Change [2015 → 2020]

Borås (City)

81,201 Population [2020]
38.70 km² Area
2,098/km² Population Density [2020]
1.0% Annual Population Change [2015 → 2020]

Source: Statistiska Centralbyrån, Sverige (web)
([2020] =2020-12-31, [2015] =2015-12-31)

*sourse of the ongoing projects and the images: hemnet.se, February 2022

Fristad

17 minutes to Borås (city) by car
5,833 Population [2020]
7.620 km² Area

Units : 41 terraced houses & 7 detached houses
Size : 3 rooms (85 sqm) & unknown

\+ density, options, lower energy demand, view
\- privacy, larger floor plan

This project is located on the outskirts of Fristad city. The project area is close the nature, people can walk to Lake Ärtingen and Öresjö and swim. The city center is only 1.5 km away, people can reach services there such as grocery stores, and restaurants.

All unit has solar panels on their roofs and their own green area. Terraced houses have 3 rooms, a separate laundry room, and an outside storage area. Unfortunately, the terrace and garden areas are easily seeable by neighbors which threatens privacy.

Rångedala

16 minutes to Borås (city) by car
421 Population [2020]
1.110 km² Area

Units : 10 semi-detached houses
Size : 3 rooms (87 sqm)

\+ density, privacy, material, view
\- options

Rångedala is a low-populated area next to the high road. Inhabitants can feel nature and greenery at a high level. The plot sizes and floor areas of each unit are larger than in the previous example.

There is only one option which has 3 rooms. The semi-detached house is built of wood and heated by an exhaust air heat pump. The master bedroom and living rooms are facing the backyard and are not visible from other units or the roadway. To limit the visibility of terrace and garden areas, planned to have walls and bushes. All units have a view of trees.

Mjöshult

23 minutes to Borås (city) by car
61 Population [2015]
0.34 km² Area

Units : 14 detached houses
Size : 2 rooms (77 sqm) & 4 rooms (154 sqm)

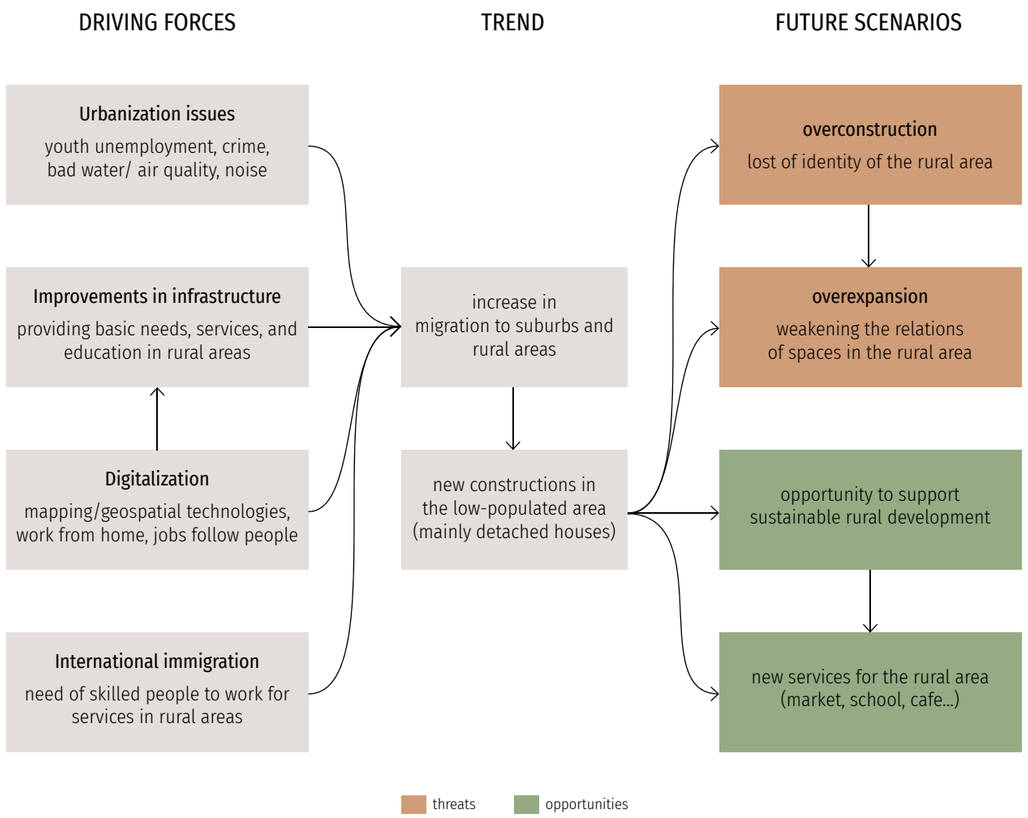
\+ privacy, view, options, larger floor plan
\- density

Mjöshult is a rural area with a strong community. Even though it is not easy to reach here without a car there must be an interest in moving here. 14 detached houses will be constructed. The plot sizes of units are changing between 1 200 - 1 900 sqm.

Newcomers have 2 options. They can choose to build one storey house with 2 rooms or two storey house with 4 rooms. Since the houses are far away from each other and it is planned to have bushes between plots, users will not be easily visible from other units.

These ongoing projects were chosen because they have common architectural qualities for the areas with similar population sizes. While the location of the project gets away from the city center, the plot size and floor area of one housing unit get larger.

Since population growth is projected for many Swedish suburbs and rural areas, there will be more housing projects like these. New housing projects in rural areas are mainly detached houses with larger plot sizes. This thesis discusses that if the plot sizes of new housing projects will be large (1 200 - 2 000 sqm), the built area may quickly expand in the natural area. In this case, the more natural area will be harmed unnecessarily and the identity of the rural area may be lost.



The driving forces that increase the migrations to low-populated areas are researched, and the outcomes are shared in the next pages. It was important to understand why the population growth is projected for many Swedish suburbs and rural areas, to use this knowledge in the design process.

For instance, one of the driving forces is an increase in the “work from home” trend. More and more people are working from their homes. Maybe not every day but working from home for one or two days a week gets more popular. Briefly, more people need a working area in their homes. Therefore, flexible living areas are designed for each unit. People can have an open working area next to their living spaces or surround this working area with walls. Another driving force is the desire to be closer to nature. Some people are moving to suburbs or rural areas to get away from the stress of the cities. Therefore, all rooms of each unit have large windows and many of them have a glass door to the private garden of the unit. Being more connected with nature and greenery will reduce users’ stress levels.

MIGRATION TO SUBURBS AND RURAL AREAS

Of course, population growth is not projected for every Swedish suburb and rural area. There is a strong connection between the projected population change and the location of the area. To have an overview 2 maps of municipalities of Sweden and its neighbors are shown. Figure 4 shows the degree of urbanization. In this map, a municipality is defined as a rural area if at least half of the population lives in rural areas. 69% of the municipalities are defined as rural areas, 24% of them as suburbs, and only 6% as cities.

> Definition of “rural areas” according to Eurostat (web):
> “Rural areas are all areas outside urban clusters; urban clusters are clusters of contiguous grid cells of 1 km² with a density of at least 300 inhabitants per km² and a minimum population of 5,000.”

Figure 5 shows the population forecast for 2040 and the information is shared with a percentage of population change that will occur between 2017-2040. As shown in the figure, there will be depopulation in most of the municipalities in the northern and middle parts of Sweden.

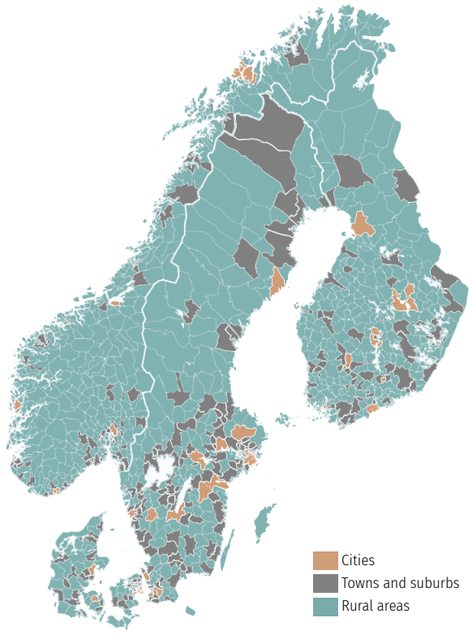


Figure 4 : Degree of urbanization
(NSIs, Tillväxtanalys)

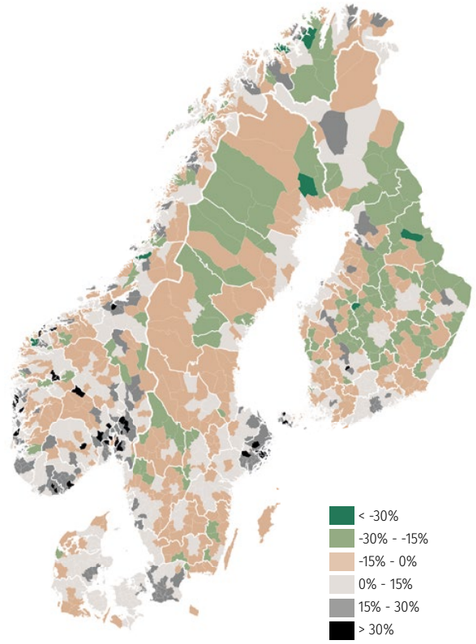


Figure 5 : Population projection 2017-2040
(NSIs, Tillväxtanalys, Byggðastofnun)

With the relation of the two figures, the inference is that there will be an increase in population in all cities, in most of the towns and suburbs, and also in rural areas close to cities. This inference is supported by Boverket. According to Boverket (2014) not all Swedish rural areas will manage to survive and develop. Many of them will not be able to develop their attractiveness and receive new inhabitants. With the aging population, these areas will disappear over time. But meanwhile, the population is increasing in many Swedish suburbs and rural areas, especially the ones close to the cities.

Eliasen et al. (2020) highlight the ongoing trends that are effective in population changes. The trends such as out-migrations, urbanization, the rise of emerging economies, technological breakthroughs, global shifts in production or climate changes challenge rural areas. But they can also create opportunities with the right understanding and orientation.

There are many reasons and ongoing trend that make people moving to suburbs or rural areas. In the following subchapters, increasing trends of urbanization issues, improvements in infrastructure, digitalization, and international immigration are discussed.

Urbanization issues

Urbanization is one of the megatrends. While this megatrend led many people to live in urban areas, for some people they are the reasons to get away from urban areas. As Borges (2017) mentions, cities are places where there are generally challenges such as youth unemployment, homelessness, crime, or exclusion of vulnerable groups.

Between 2012 and 2020, the average employment rates increased both for urban and rural areas but rates for rural areas got higher. While employment rates in the EU's rural areas increased from 67.5% to 73.1%, the unemployment rates decreased from 10.4% to 5.9%. (European Commission 2021)

The environmental impact of urbanization is another important subject to discuss. Orîndaru et al. (2020) defined five urbanization issues: Air quality, water quality, urban heat islands, greenhouse effect, and disconnection from nature. A survey is done with 500 participants which are 18 to 35 years old. Aimed to understand their thinking about moving out from the cities concerning these urbanization issues. One of the main questions of this survey was if the responders would like to move from the city and move to a house in a greener place in the next 3 years.

Staying or leaving? Desicions linked to urbanization issues.

In the next 3 years, do you plan to move from the city to:	I will stay in the city	Suburbs	Rural areas
	83.8%	**12.6%**	**3.6%**

16,2% of the responders stated that they want to move from the city to suburb or rural area due to defined urbanization issues.

As urbanization issues, air quality and urban heat islands had the highest average (7.99 out of 10), while disconnection from nature was the second highest (7.69 out of 10). But disconnection from nature was the most impactful issue since it had a connection to all six actions.

Another question was what responders are willing to do as an action toward urbanization issues. 48.6% of the responders chose "endowing their home with more green plants", 18.8% chose "Growing vegetables and fruits in their own home", while 38.6% of them chose "moving to greener areas".

Urban slums are another issue that can be added to this chapter. According to Zhongming et al. (2020) even though maternal and childcare are generally better in urban areas than in rural areas, in urban slums and underserved neighborhoods they can be worse than in rural areas.

Improvements in infrastructure

Since only 6% of the municipalities in the Nordic region are defined as cities (Figure 3), remote and accessible rural areas account for the huge area of the land. Lindberg (2017) mentions that urban and rural areas are getting affected by ongoing trends differently and the inequalities between areas are increasing. Some of the Sustainable Development Goals (sdgs.un.org) are shared below and according to these goals, it is important to fight against the inequalities and provide basic needs, services, and education to everyone. These can be counted as the reasons why Nilsson (2017) emphasizes that sustainable rural development and connecting urban and rural areas are highly important topics for Nordic cooperation.

related Sustainable Development Goals.

To improve the accessibility of Swedish rural areas, infrastructural investments are made, and public transportation is improved. Pedestrian and cycle routes are getting developed. Since the fast cycle routes are getting popular, more people use their bicycles to go to school or work. When the distance is long, it is easy to get on the train or bus with a bicycle (Boverket 2014). Supplementation and relationship management as well as investments in the labor market and education measures are done in cooperation with the residents of the rural area. With the restructuring and completion of the missing function, the suburbs are becoming attractive and integrated parts of the urban areas (Boverket 2014).

Thanks to these improvements, the population increases in many Swedish rural areas, especially for the ones close to the cities. Therefore, new buildings are constructed, housing and job opportunities are increased, and service activities are provided in these locations (Boverket 2014).

Digitalization

Digitalization is one of the other megatrends that is effective all around the world. If technological arrangements are done with care and knowledge, they may oppose rising inequalities, create new job opportunities, shorten the educational/health gaps or fight against urban/rural divide (Zhongming et al. 2020).

Zhongming et al. (2020) mention that, policymakers can use mapping and geospatial technologies to understand the population changes and how they can develop the links between rural and urban areas. Technologies can be used for improving waste management and renewable energy systems. These would have a positive impact on the environment by reducing greenhouse gas emissions and supporting the circular economy of the rural area. Telecommuting can lessen rural to urban migration and boost labor productivity by decreasing commuting.

According to Eurostat (2019), employed people who work sometimes or usually from home in Europe slowly increased from 2006 to the middle of 2019, from 10% to 14.5%. After that date, a rapid increase in rate was observed with the Covid-19 pandemic. The rate was more than 20% in the middle of 2020.

Owl labs (2021) highlights that remote work is clearly an increasing trend. Many feel less stressed and more productive while working from home. Another working model is the hybrid model. This model gets popular since remote workers also want to have time together with their colleagues and miss the physical environment of the office. Many companies lean toward this working model to create a better working environment for their employees. A survey was done by Owl labs (2021) in September of 2021 and 2,050 full-time workers responded it. 20% of responders moved at least one time during the pandemic time and 4% moved permanently. 78% of them moved out from an urban area to a suburb (58%) or a rural area (20%), and 24% moved from a suburb to a rural area.

Kull (2020) mentions another trend: jobs follow people. With the increase in knowledge of digitalization and the economy, the link between the location of living place and the workplace got weakened. Talented and highly skilled people (creative class) can choose the place they want to live first and they can start a business or attract companies later.

International immigration

Lagercrantz and Hildestrand (2017) emphasize in their article, Immigration is the future for rural regions, that Nordic rural areas are welcoming immigrants who are searching for a job and would like to be a part of a small community. Municipalities offer language course since communication skills is highly important to have a job.

According to Lagercrantz and Hildestrand (2017), between 2011 and 2016, the population was decreasing in 40% of Nordic municipalities. The rural areas were facing many challenges during this time. With the declining population, municipalities were struggling economically, and it was difficult to find qualified people who could work in schools and health centers. The solution could be getting immigrants; therefore, immigration and the successful integration of newcomers were important topics for Nordic policymakers. During the same years, 26% of the municipalities experienced population growth thanks to international immigration. Lagercrantz and Hildestrand (2017) add that more people are needed, especially in rural areas.

FUTURE VISION FOR RURAL DEVELOPMENT

Today, rural areas are generally unequal to urban areas. Therefore, there is a need for more balanced development (UN 2020). As mentioned earlier, sustainable rural development is a highly important subject for Nordic Cooperation and Sweden. There are many ongoing investments and development plans to empower rural areas.

European Commission published the report, “A long-term vision for the EU’s rural areas - Towards stronger, connected, resilient and prosperous rural areas by 2040” in 2021. Information from this paper is shared to give an idea about the development plans for European rural areas.

Vision for European rural areas

Rural areas are an essential part of Europe. %30 of the population lives in rural areas, and, including agricultural land, forest, and natural areas, rural areas account for almost 80% of the EU’s area. (LUISA Base Map 2018)

European Commission (2021) emphasizes rural areas are highly valuable for food production, management, and protection of natural resources and also for tourism and recreation. In the last decades, rural areas are changing faster because of many reasons. Urbanization and globalization are the main reasons behind these changes. Many European find rural areas insufficient because of the lack of services such as healthcare, education, infrastructure, or digital connectivity.

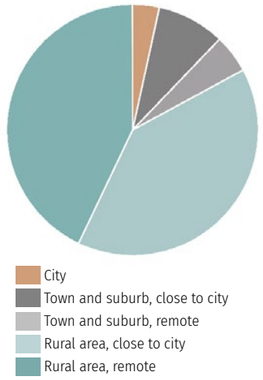


Figure 6: EU Land area, 2018 (LUISA Base Map 2018)

> “Europe would not be whole without its countryside.”
>
> European Commission’s President Ursula von der Leyen

Therefore, European Commission published a long-term Vision for the EU’s Rural Areas. The vision addresses issues and challenges those rural areas are facing today. The purpose of the vision is to make rural areas stronger, connected, more resilient, and more prosperous by 2040. (European Commission 2021)

Stronger rural areas

Local communities should be empowered. Since all rural areas have their own individual characteristics, their development should be in their own way as well. Locals are individuals who have good knowledge about their living space. Giving a voice to individuals in the decision-making process will promote more realistic and place-based investments.

The vision has the “leave no one and no place behind” principle. All living spaces must be attractive to live and work in. In this regard, everybody needs to have access to essential services, such as sanitation, water, transport, and digital communications.

Connected rural areas

It is essential to connect rural areas with each other and with closer urban areas. This is important to make rural areas easily accessible to be more recognizable and make access to urban areas easier for locals. This can be achieved by improving road/railway infrastructure, cycling paths or public transformation for the area.

Another important development is digital transition. With the transition energy need of buildings and systems will be decreased, resource use and waste management will be optimized.

Improving road and broadband infrastructure will create new opportunities epically for more remote and depopulating rural areas.

Resilient rural areas

Rural areas have the power to decrease the effects of climate change and promote circular and bio-economy. Therefore, it is necessary to make rural areas more resilient against potential threats. Reviving green areas, protecting natural resources, and restoring landscapes will make these areas more resilient against natural hazards and climate change. Promoting economics by shortening the supply chain will make these areas more resilient against economic crises.

In addition, rural areas should be areas where social equality prevails. Rural areas should offer quality job opportunities based on upskills and should ensure the right to equal representation. Gender, lgbt+, or age discrimination should not be made.

Prosperous rural areas

Existing economic activities in rural areas should be developed. Increasing the recognition of agriculture, forestry or fishery in these areas with various advertisements will contribute to local economies. In addition, new sustainable economic activities that will contribute to the rural area should be supported to increase their recognition. Better networking of small businesses can keep them away from consolidation and stay in the rural area. This economic diversification also requires the education that the locals need to be provided in a digital or hybrid way.

With these improvements and investments, the gap between urban and rural areas will lessen. Meanwhile, we as architects should discuss how we can design more attractive, suitable and sustainable rural dwelling. These can make it easier for many people to decide to move to a suburb or a rural area.

HOUSING IN SWEDEN

There were 5 096 007 dwellings in Sweden by the end of 2021. Among these, 2 115 329 dwellings were in one or two-dwelling buildings, 2 626 837 were in multi-dwelling buildings (SCB 2021).

	multi-dwelling building	*one or two-dwelling building*
pct of dwellings (SCB 2021)	51,6%	41,5%
average size of an unit (SCB 2019)	68 m²	122 m²

Even though the percentage of dwellings in multi-dwelling buildings is 51%, as seen in figure 7, the percentage of multi-dwelling buildings is not higher than 10%. And the great majority of the dwellings consist of one or two-dwelling buildings.

Figure 7 shows that there is a strong link between housing typology and the number of inhabitants of the locality. As the size of the locality decreases, the percentage of one or two-dwelling buildings increases. In the localities with up to 500 inhabitants, the percentage makes up 93% of all residential buildings (SCB 2022).

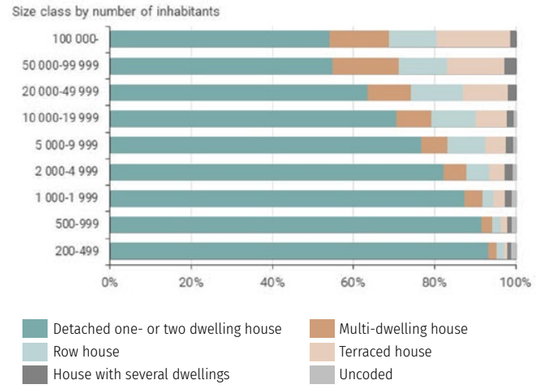


Figure 7 : Residential building types by the size of the localities (SCB 2020)

Due to the increase in interest in moving to suburbs and rural areas, there are many detached house projects in these areas. Two of them shared to discuss their architectural qualities.

*sourse of the ongoing projects and the images: hemnet.se, May 2022

Norberg
4 minutes to Norberg (city) by car

Units : 6 detached houses
Lot area : approximately 1 100 sqm
Size : 3 rooms (100 sqm)

\+ view, larger floor plan, material, visibility

\- options, density

The project is located on the outskirts of Norberg city. There are many detached houses with large plot sizes. The locality is expanding in many directions with this kind of houses.

The floor area is larger than in the previous examples. Here the connection with greenery is strong. Besides the trees and bushes in the project plot, there is a forest in front of the project area.

Sämjesta, Lindbacken
21 minutes to Uppsala (city) by car

Units : 5 detached houses
Lot area : 1 300 - 2 140 sqm
Size : 3 rooms (90 sqm) or 7 rooms (157 sqm)

\+ view, flexibility, material

\- privacy, density

Sämjesta is a small locality that is difficult to access without a car. Except for the three houses that appear in the site plan, there are no buildings in the immediate surroundings.

Users can use the house with or without the first floor. On the entrance floor, there are three rooms. All of them face the backyard. On the first floor, there are 4 rooms. 1/7 of the floor area can't be used due to the low height of the gable roof. The windows of these rooms are small. There are only 2 bathrooms, even though there are 7 rooms.

Size of dwellings

Until this point, many house projects have been shared and examined. These projects are located away from the city centers and close to nature. Among these projects, the most popular size is 3 rooms and an open kitchen.

To have a wider perspective, the number of dwellings in newly constructed one or two-dwelling buildings in 2020 in Sweden is examined and shared on the right side (Statistics Sweden 2020). Clearly, a dwelling with 1 room is less preferable in one or two-dwelling buildings. And dwellings with 4,5 or 6 rooms are more popular than others.

Due to these numbers, dwellings with 2,3 and 5 rooms are design for the design proposals. The dwelling with 2 and 3 rooms have flexibilty of having an additional room and turning into 3 or 4 rooms houses.

No. of dwellings in newly constructed one or two-dwelling buildings in 2020

1 room and kitchenette	11
1 room and kitchen	22
2 rooms and kitchen	298
3 rooms and kitchen	**1 434**
4 rooms and kitchen	**2 153**
5 rooms and kitchen	**3 842**
6 rooms and kitchen	2 207
7 or more rooms and kitchen	1 596

Rural Housing Challenges

There are many housing challenges for low-populated areas in Sweden. These need to be researched and discussed in the design process. Some of them are shared in this subchapter.

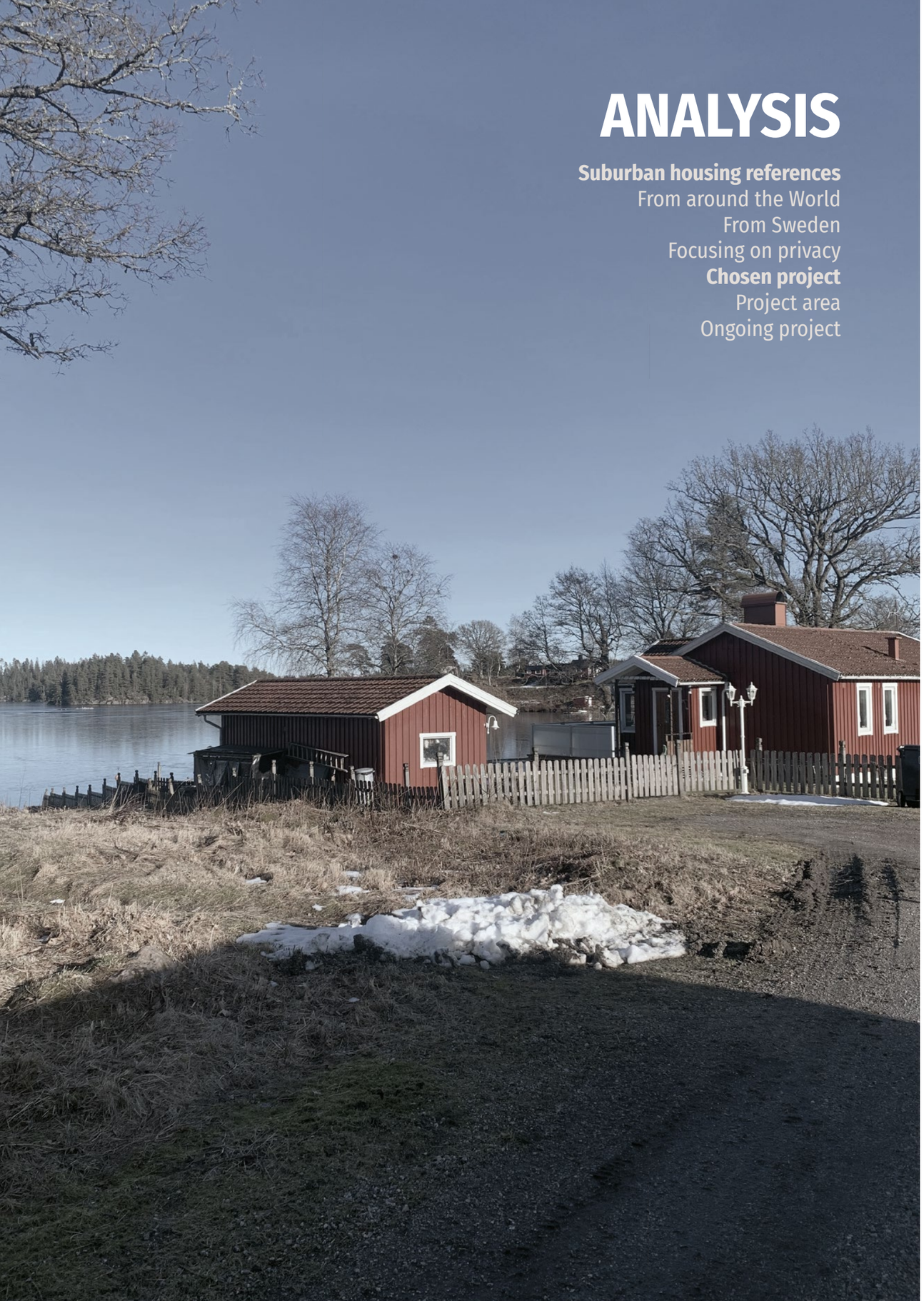
Karlsdottir et al. (2017) mention that one of the problems is there is an increase in houses that need to be renovated in many low-populated areas. For young couples who want to move to a rural area, there is a shortage of suitable houses due to the size or the cost of the houses. On the other hand, it is risky for them to renovate an existing house since it can be hard to sell it for a worthy cost.

This information is supported by Eliasen et al. (2020). According to them, there are two main housing challenges for Swedish rural areas. There is a lack of suitable houses especially for the young and elderly and existing houses are disposed to be used as second homes or for leisure.

According to Snell (2017), in 1980 33% of the households in Sweden were single-person and now the number is over 47%. We can assume that they are living in 1 or 2 rooms units. As mentioned earlier, houses of this size are the least built among houses with one or two-dwelling buildings. It would be hard for the single-person to find suitable and affordable housing unit in a one or two-dwelling building.

Baudin and Stelter (2019) determined possible scenarios by examining and formulating the trends in migration, mortality, and agriculture in western Europe for both rural and urban areas. They mention that higher migration costs would widen the inequalities between urban and rural areas, and this would delay the modern growth of both areas. Therefore, our aim must be to make moving to rural areas as easy as possible for those who want to do that. Facilitating the population growth of less-populated rural areas will also provide services to these areas. This population growth may lead to the opening of a small market, a kindergarten, or a health center in these areas.

Another important subject to discuss in this context is the usage of natural land. The housing plot sizes for rural areas are traditionally around 800-1800 sqm in Sweden. Since there will be an increase in population in many Swedish suburbs and rural areas, new houses will be built and the built area may quickly expand in the natural area. Boverket (2014) mentions that the need for the protection of natural and cultural areas is increasing due to the increase in population and buildings in rural areas. The density of new construction should be carefully decided to minimize land use as much as possible.



ANALYSIS

Suburban housing references
From around the World
From Sweden
Focusing on privacy
Chosen project
Project area
Ongoing project

ANALYSIS

Two of three main goals are defined with the knowledge from the research chapter.

Factors

The population is increasing in many Swedish suburbs and rural areas, especially the ones close to the cities.
There are many ongoing housing projects due to the projected population growth for these areas.
The great majority of the new construction in low-populated areas are detached houses.
The housing plot sizes for rural areas are traditionally around 800-1800 sqm in Sweden.
In the low-populated area that receives migration, the built area can expand fast in the natural area.

Main goal

density

Plot sizes of the detached houses should be smaller to save nature.

Factors

There is a lack of small size housse in low-populated areas for single-person, youth and elderly.
Temporary rooms can be useful for a crisis such as the Covid-19 pandemic (as home office).
Low-populated areas need to welcome more people to promote modern growth.

Main goal

flexibility

There will be also smaller options (2 and 3 rooms houses) with the flexibility of having an additional room.
Flexibility will give the opportunity to make the house unique for the user.

SUBURBAN HOUSING REFERENCES

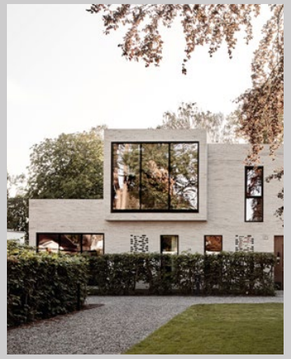
To be clear in discussions about the density, focused on the housing projects which include many housing units. Aimed to choose an ongoing housing project to work on during the design process. The number of houses will be increased for the same project plot area. The challenge is improving the architectural qualities of suburban houses even though the houses are closer to each other. To define these architectural qualities that should be protected or improved, reference projects are examined. The defined architectural qualities and the goals are explained afterward in p.36.

Suburban housing references from around the world

Bygdøynesveien 15 Residential Complex
OSLO, NORWAY
Architects : Reiulf Ramstad Arkitekter
Lot area : 6820 sqm
Year : 2019
Units : 12 semi-detached houses

\+ view, larger floor plan

\- density, flexibility, privacy, options

The project is located on the coast of the semi-island, Bygdøy. From there, the center of Oslo can be reached in 15 minutes by car. The common typology of surrounding houses is detached houses.

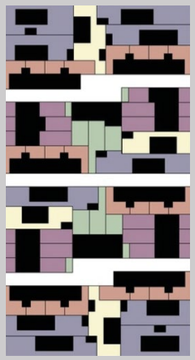
There are historical buildings on the project site. The harmony of these buildings with the new buildings was important. All entrances of housing units are from the central garden. The orientations are organized according to light. The day rooms are towards the southwest and the bedrooms mainly are towards the northwest. Housing units have large living areas, and offer attractive indoor and outdoor areas. There are large terrace areas on the roof where neighbors communicate, and have a great view of the semi-island.

Source : archdaily.com, Apple Maps (web), Google Maps (web)

Bloembollenhof Housing Complex
VIJFHUIZEN, THE NETHERLANDS
Architects : Studio Woodroffe Papa
Lot area : 4600 sqm
Year : 2003
Units : 56 houses

\+ density, options, material, view

\- privacy, flexibility




The project was designed as the first phase of the extension to the village of Vijfhuizen. This project includes 56 houses and the plan was to construct 700 new dwellings over 5 years. From there, the center of Amsterdam can be reached in 30 minutes by car and the center of Haarlem can be reached in 20 minutes by car.

The density of housing is increased by using different sizes of plots and different types of units are provided with different cost categories. Newcomers can choose a house from two-bed terraced homes or three-bed villas. The depths and height of the units are different which creates a dynamic view. Unfortunately, there is a lack of privacy. Garden areas or easily visible from neighbors' plots.

Source : archdaily.com, Google Maps (web)

Suburban housing references from Sweden

Pumpkällehagen
VISKAFORS, BORÅS
Architects : Nylander arkitektur,
Karlsson Wachenfeldt Arkitekter
Floor area : 109 sqm
Year : 2008
Units : 18 detached houses

\+ density, privacy, lower energy demand, view

\- flexibility, options


Viskafors is located in Borås (Figure 3 in p.14). This project includes 18 passive houses. From the location of the project, the center of Borås can be reached in 18 minutes by car. This project is designed to invite more people to Viskafors.

The rentable houses have a modern style of suburban housing. Natural material, stone, and wood insulated with rock wool. Houses are close to the roadside. Garden areas and the terraces in the backyards are not visible from the roadside. There is only one type of house. The living rooms have high ceilings. There are also three rooms of the same size.

Source : svenskbyggplat.se, gp.se

Prästgårdsgatan Örgryte
GOTHENBURG, SWEDEN
Lot area per unit : approximately 360 sqm
Year : 1965

\+ density, privacy, options, larger floor plan

\- flexibility, view


The project is located in western Gothenburg. Although the area is close to the city center (8 mins by car), it is surrounded by greenery and the major housing typology is detached houses.

Since the plot dimensions are approximately 360 square meters, we can say that it is a small size for a detached house. Individual plots are surrounded by walls. Therefore the visibility from the outside is completely blocked. However, this also prevented relations with the outside and neighbors. Newcomers can choose from one or two-storey houses. In each unit, the rooms are toward to house's private garden.

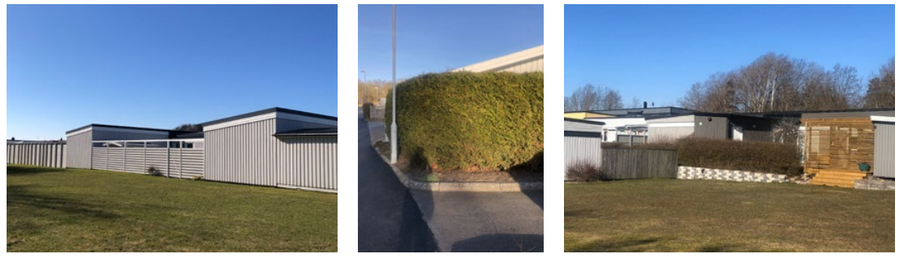
Source : facebook.com, eniro.se, hemnet.se

Focusing on privacy

As is discussed, there is a strong connection between the population of the locality and the common size of the plots of houses. Here are a few examples from the outskirts of Gothenburg city. This is the housing density that is aimed for the design proposals. In these places, many different elements are used to block the visibility of the garden.

Bushes and wooden fences

It is common to use bushes and wooden fences that do not completely restrict visibility. The densities of the leaves and bushes may change between summer to winter, and the visibility of the gardens may increase in winter.



elements that semi-block visibility of gardens in Fiskebäck, Gothenburg

Wooden walls

Another common method is to completely block the visibility with wooden walls. However, this also blocks the street view from the house.

elements that block visibility of gardens in Tynnered, Gothenburg

Atrium houses

This typology has been used in Nordic countries for a long time. This typology ensures that the private area is not visible from the outside, even if the houses occupy a smaller land area and are adjacent to each other.

Atrium house in northern Sköndal
built in 1970
(Holger Ellgaard 2012)

Atrium house in Vinderen, Oslo
built in 1971 - 4 bedrooms (198 sqm)
(krogsveen.no)

RESULTS

After these examinations, the third and the last main goal is defined.

Factors

From the cities to less populated areas, the plot sizes of houses get larger.
In low-populated areas, the gardens of the houses are usually surrounded by bushes, fences or walls.
Atrium houses are popular in Nordic countries.

Main goal

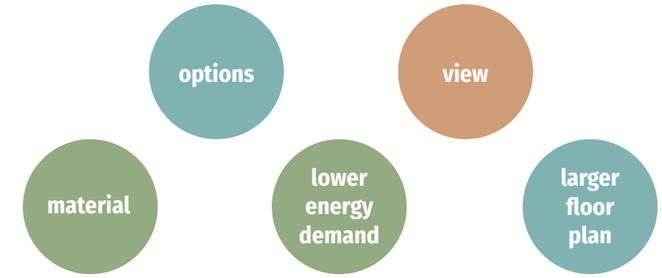
privacy

The interior, terrace area and a part of the garden of each house can be designed in such a way that they cannot be seen from other houses.
The visibility should be limited regardless of the use of bushes, fences or walls.

The architectural qualities and the goals are defined to discuss during the design process.
These goals are explained in the beginning of the design process chapter.

Main goals

Sub-goals



to save environment
regarding the size of the units
to improve social life

CHOSEN PROJECT

The satellite map (Google Maps) of the municipality of Borås is shared on the previous page. This municipality was also mentioned on pp. 14-15 and 3 ongoing housing projects from there were discussed. The housing project which is located in a rural area is chosen for the next step.

Project area

The ongoing project in Mjöshult is chosen because of its location and its size. Here is just 18 km (22 mins by car) away from the city center of Borås, 9.2 km (12 mins by car) away from Fristad, and 54 km (1 hour by car) away from Gothenburg.

While around 80-100 inhabitants live here full-time, in the summer population more than doubles. During my conversations with inhabitants, they were defining the south part of the settlement as the old Mjöshult and the north part as the new Mjöshult. They said nearly half of the inhabitants are elderly and many houses are empty during the winter times. But in summer people are often outside.

Mjöshult has a strong community. During my visit on Saturday, I saw two different groups with 6-7 people gathered outside. They invited me and my friend to their table. Also, people mentioned they know everybody who lives in the area. The newcomers are mostly relatives or friends of an inhabitant. People move here to be closer to nature, for its atmosphere, woods and lake, and for the community.

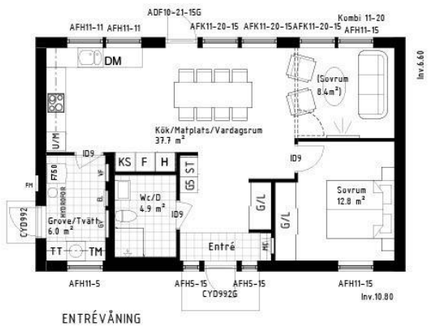
Last year a young couple moved here from Gothenburg and this year another couple with a 19-year-old daughter will move. Besides these, there is an ongoing housing project and 14 new houses will be constructed.

Figure 8 : Photographs of the rural area

Ongoing Project

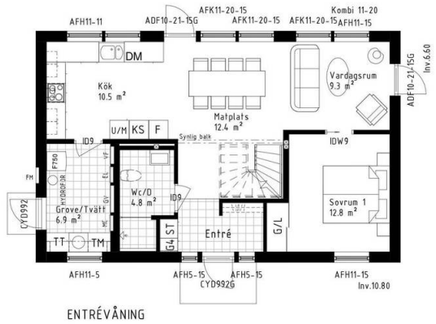
Total land area	19 200 sqm
Area per parcel	1 100 - 1 200 sqm
Options	2 rooms house (77 sqm)
	4 rooms house (154 sqm)
No. of units	14

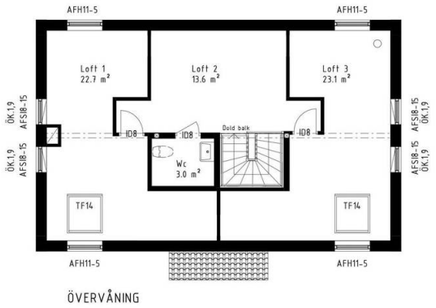
The project area is divided into 14 parcels. The plot sizes of each unit are shared in p. 39. There is an opportunity for the new owners. They can choose if they want 1 storey house (2 rooms house) or 2 storey house (4 rooms house).



2 rooms house

One of the options has one bedroom area and has the flexibility to create an extra bedroom (8.4 sqm). But with that possibility rest of the living space is unfunctional to have dining, living, and kitchen functions inside.





4 rooms house

The other option is 4 rooms (3 bedrooms and 1 living space) house. While it has similar entrance floor plan with 2 rooms house, this option has a highly unfunctional first floor plan. The height of to ceiling is lower than 1.70 in 30% of the floor area. There can be a lack of daylight, due to small window openings. The division of the rooms is unfunctional and it is hard to use them as bedrooms.

*sourse of the floor plans and the facade drawings: hemnet.se, February 2022

Figure 9 : Satellite map of Mjöshult (eniro.se)

Site plan

Aerial view

Figure 10 & 11 : Site plan and the aerial view of the ongoing project (hemnet.se, February 2022)

DESIGN PROCESS

There are 3 main goals for the design proposals.

density

The built area is expanding in the natural area. Plot sizes of detached houses should be carefully decided to save nature.

flexibility

Low-populated areas should welcome more people. There must be suitable houses for everybody, not only for families but also for single-person, youth and the elderly. There should be opportunity for the users to reorganize the interiors and have an additional room when they need it.

privacy

People are seeking privacy when they are moving to low-populated areas. Therefore, the interior, terrace area, and a part of the garden of each house can be designed in such a way that they cannot be seen from other houses.

The research question is,

What are the potentials to build dense dwelling areas and at the same time improve privacy and flexible space for residents?

By increasing the number of dwellings for the same plot, the natural area can be saved and even the dwellings will be closer to each other, the architectural qualities of the dwelling can be improved. To be clear on this discussion, an ongoing project is chosen. Aimed to increase the number of houses for the same project plot. Two projects are proposed for this area.

Proposal A - 50% increase
- designed as a housing project for the chosen rural area

Proposal B - 100% increase
- designed as a suburban housing project
- also would be implemented in this rural area due to many reasons

The architectural qualities and goals

The defined architectural qualities are shared and summarized. On the next page, the importance level of different architectural qualities for the design proposals is shared. And then the qualities are discussed one by one.

density

Smaller plot sizes are used to fit more houses in the same plot area. The main aim of this is saving from the natural area and make the expansion of the built area slower.

flexibility

All houses have large living spaces with an open kitchen. In the options of 2 and 3 rooms houses, the user can have an additional room in this space.

privacy

To provide privacy, the terrace areas and inside of the houses are not visible from other houses. Higher or lower windows are used on one side of the houses to limit visibility.

options

4 different options are provided to welcome more people to low-populated areas. One option has only 2 rooms. This option will be a suitable option for the single-person and youth.

view

All rooms of each house have large windows and most of them have a glass door to the private garden. The pathways are visible to feel the social life. Sunset is watchable from each house.

larger floor plan

The floor areas are slightly larger than the common sizes of units in urban areas. Taken for granted that users would like slightly bigger rooms when they are moving out of cities.

material

To do sure that the materials will be accessible for this location, similar materials to the materials of the ongoing project and surrounding houses are chosen.

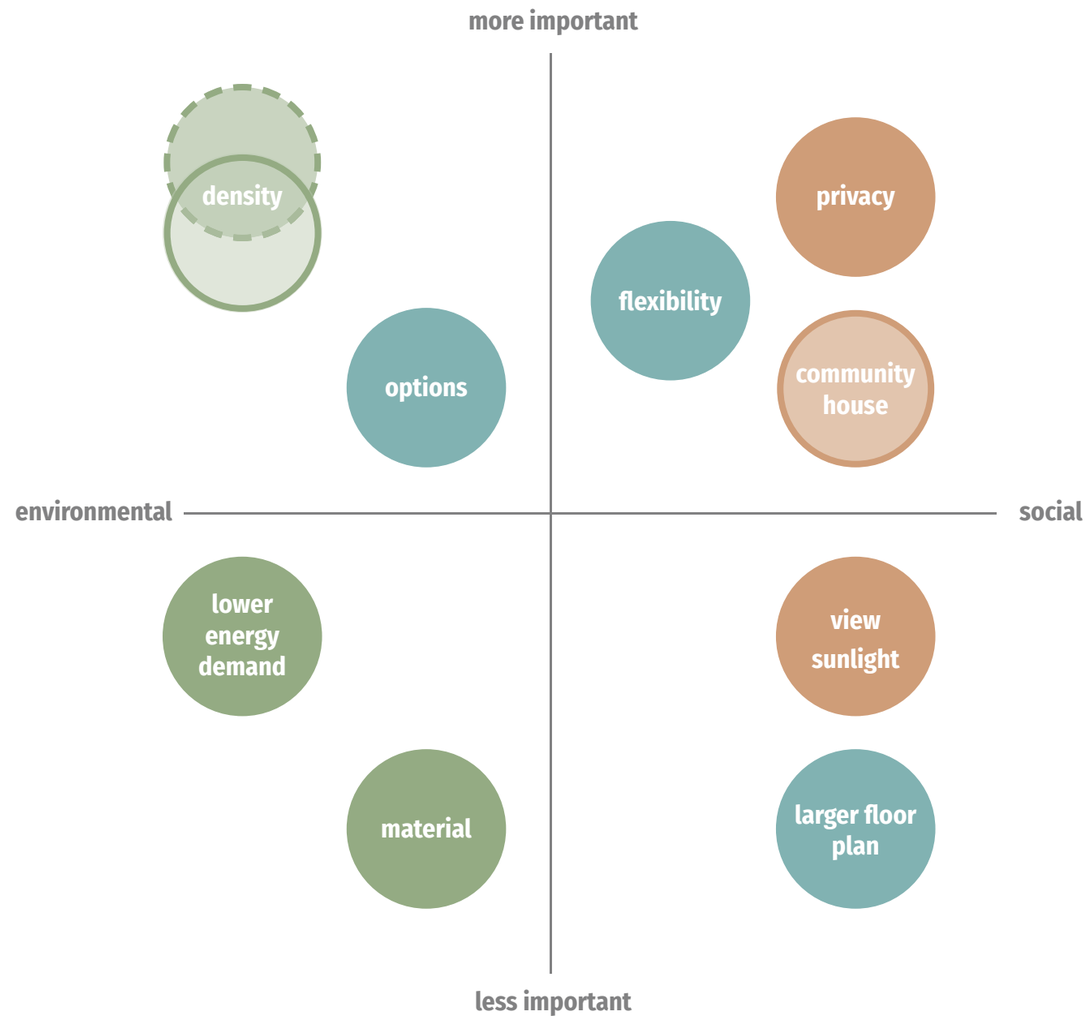
lower energy demand

Energy calculations are done with the CAALA software. Proposed houses have lower primary energy, electricity and heating demand than the original houses.

to save environment regarding the size of the units to improve social life

The importance of the architectural qualities

Some of the architectural qualities are more important than others for the design proposals. Which quality is given priority is shown on this chart. Also, the design has proceeded in order of the importance of the architectural qualities.



for both proposals only for proposal A only for proposal B

to save environment regarding the size of the units to improve social life

Density

The project area is around 19,200 sqm and 14 detached houses will be constructed in this plot. Defined plot areas per house are between 1100-1940 sqm. The aim of this thesis is to show that the lot area of rural-house can be smaller but still provide the architectural qualities that people expect from the rural area. Therefore, two alternative projects are designed for the same area. The first project has 21 houses which would use 28,800 sqm of land. The second project has 28 houses which would use 38,400 sqm of land. In this way, the natural area will be protected and at the same time, the expansion of the built area will be slower.

19,200 sqm	14 units	50% increase→21 units	100% increase→28 units
equal	1,371 sqm	914 sqm	571 sqm
different options	1 100 – 1 940 sqm	620 - 1 100 sqm	420 – 700 sqm

Options

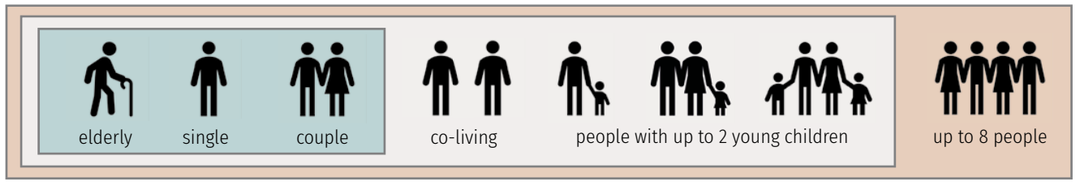
Today, there is a lack of suitable houses especially for single-person, youth and elderly. Since the houses are generally designed for people with children, existing houses are expensive or unnecessarily huge for these users. For the modern growth of the rural area, place needs to welcome everybody.

For both proposals, there are 4 houses which have only 2(or 3) rooms. We can assume that this kind of housing will be suitable also for single-person, young couples who don't need a huge space. These houses have the smallest plot areas than other houses.

Majority of the houses has 3 (or 4) rooms. And a quarter of the units have 5 rooms.

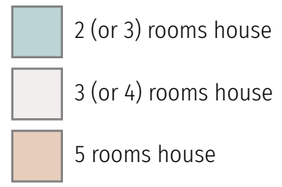
House	14 units	50% increase→21 units	100% increase→28 units
2(3) room house	**x** (77 sqm)	**4** (82 sqm)	**4** (89 sqm)
3(4) rooms house	**x** (154 sqm)	**10** (96 or 110 sqm)	**16** (100 or 110 sqm)
5 rooms house		**6** (171 sqm)	**7** (160 sqm)
		(+1 -separated plot)	(+1 -separated plot)

Potention users of the houses in relations to numbers of bedrooms



Plot division

ORIGINAL - 14 units

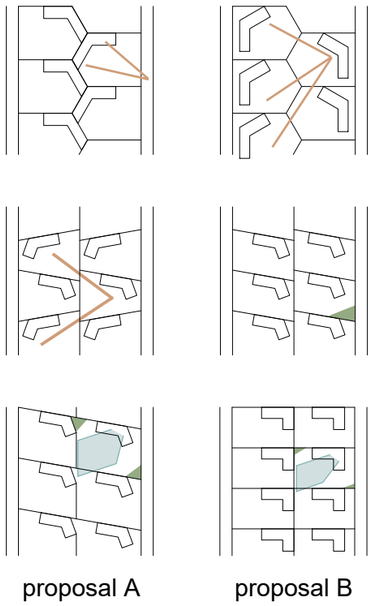


PROPOSAL A - 21 units

PROPOSAL B - 28 units

Privacy and View

Visibility is one of the biggest threats to privacy at home. Therefore, aimed to limit the visibility from other houses, and make the terrace area, a part of the private garden and inside of the houses not visible from the other houses. This was the design decision which has a great impact on the orientation and the settlement of the houses.



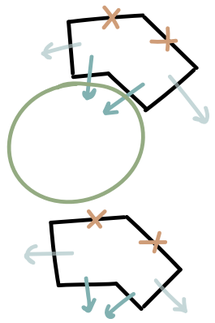
Many combinations and orientations are examined. Visibility from the roadside or from other houses was higher when the houses had opposite orientations. Therefore, decided to face a similar direction to make sure that the inside of the house will not be visible from others.

Angled buildings have a larger perspective of view but angled plot division created areas that will not be used. The uneven plot area was causing fewer houses to fit in the total area. The most efficient way due to plot use is working with 90°. But it narrowed the view from the inside.

In conclusion, the buildings in proposal A angled at 60° to have a better view and the buildings in proposal B are angled at 90° to fit more houses in the project plot.

In the design proposals, while 3 sides of the houses have a view, one side will be blind. The living rooms and the bedrooms will have the garden view and these areas will not be visible from other units. There will be windows on the “blind wall” too but these windows will be higher or lower to limit view and visibility from outside.

Blind wall	Good view	Best view (also sun)
Bathroom Closet Store/cleaning room	Working room Entertainment room Kitchen	Living room Bedroom



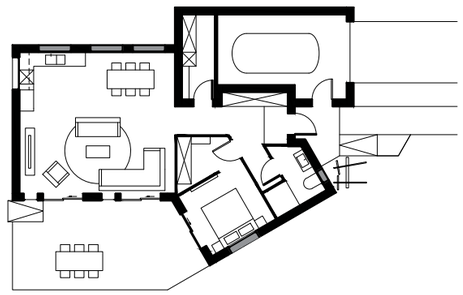
low level windows (dezeen.com)

high level windows (acarchitects.com)

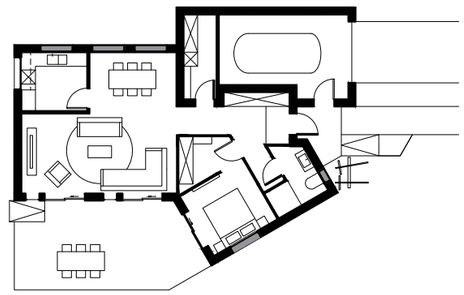
Flexibility and Larger floor plan

As mentioned, the average size of a unit in a one or two-dwelling building is larger than a unit in a multi-dwelling building. With this information assumed that people would like to have larger spaces, when they live outside the city and closer to nature. Therefore, minimizing the room sizes was not one of the goals.

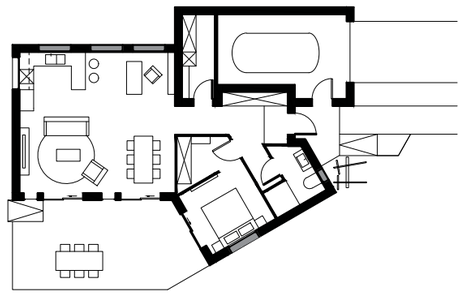
Flexibility is one of the three main goals. It is not possible to design exactly what the future owner wants. But we can provide a space for them to personalize their home. A space that can be used as a temporary or permanent room, would be useful for many people. All proposed units have large living spaces with an open kitchen. With the wish of users, the kitchen space and the dining space can be surrounded by walls and can be separated from the living room. Also, in the options of 2 and 3 rooms houses, the user can have an additional room in this space. For instance, the covid-19 pandemic was one of the most important things that triggered the rise in remote work. In such a case, extra space in the house could turn into a home office for times of pandemic and then back into part of the living room.



Living space with an open kitchen

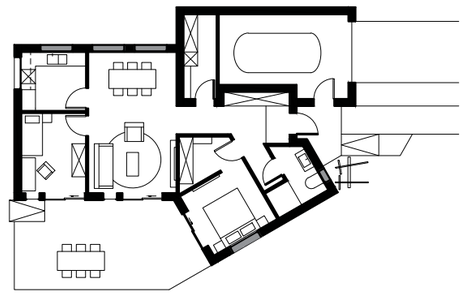


Living space with a separated kitchen



Living space with a hobby corner

area for desk, sports equipment or arts supplies



Living space with an additional room

separated room which has a good view

Materials and Building systems

To do sure that the materials will be accessible for this location, similar materials to the materials of the ongoing project and surrounding houses are chosen. Different options are compared in CAALA software. The final choices are shared below.

Materials

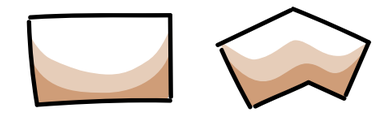
column		Wooden column (12 cm × 12 cm)
exterior wall		Timber frame (22 cm), Cellulose insulation, Plaster fiber
	outside	Battens with Wooden board
	inside	Gypsum plaster, Paint (1 cm)
roof		Timber rafter roof, Wood fiber insulation
	outside	Brick covering
	inside	Counter battens, OSB Plates
floor		Parquet on heated screed, Mineral wool insulation
	foundation	Reinforced concrete floor slab (40 cm), Foam glass, Bitumen sealing
ceiling		Timber frame ceiling without filling (22 cm), Mineral wool (10 cm)
	flooring	Parquet on heated screed, Mineral wool impact sound insulation (3 cm)
	finishing	Gypsum plaster, Paint
window		Double glazing, Wooden frame, U=0.9, g=0.65
exterior door		Wood-Aluminium, U=0.64
interior wall		Timber frame wall (10 cm), Wood fiber insulation
	outside	Gypsum plaster, Paint (1 cm)
	inside	Gypsum plaster, Paint (1 cm)
interior door		Wood
roof of garage		Timber rafter roof (20 cm) without insulation
	outside	Brick covering
	inside	Gypsum plaster, Paint (1 cm)
floor of garage		Mineral wool (1.5 cm), Bitumen cardboard, Cement based screed, Tiles
	foundation	Reinforced concrete floor slab (40 cm), Foam glass, Bitumen sealing

Building Systems

Heat generation equipment	Electric heat pump, water-water
Ventilation systems	Mechanical ventilation with heat recovery

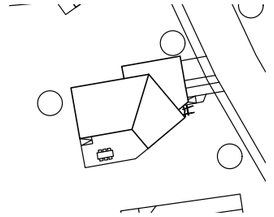
Sunlight and View

It was aimed to take advantage of sunlight as much as possible. Having angled volume was useful for this subject too. Since the living room and bedrooms with large windows are designed in this facade, it is sure that these rooms will receive direct sunlight and be able to see the sunset in the evenings.

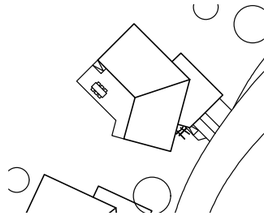


The roof is angled on one side in the proposed design. With this design decision, solar gain is increased and solar losses are reduced. The calculations (CAALA software) are shared on pages 40-41.

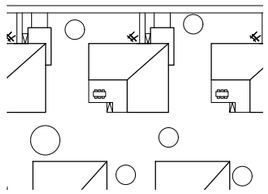
Orientation and settlement are important decisions. Aimed to have similar orientations to avoid inequality between units.



Proposal A - best orientation



Proposal A - worst orientation



Proposal B - orientation

Lower energy demands

Enery demands of houses in ongoing project are compared with the energy demand of proposed houses. Calculations are done with the CAALA software. The materials and the building systems are chosen as mentioned in previous subchapter in p. 42. The calculations of primary energy demand, global warming potential, heating and electricity demand are compared and shared in next pages. (Vaules are yearly)

> Definition of "Global Warming Potential (GWP) " according to EPA (epa.gov) :
> "The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO2)."

The aim of these calculations is to compare different volumes rather then giving realistic energy demands.

Additionally, 10 sqm solar panels can harvest 1,457 kWh/a electricity per year. Users can have them on the roof or garden area.

Results

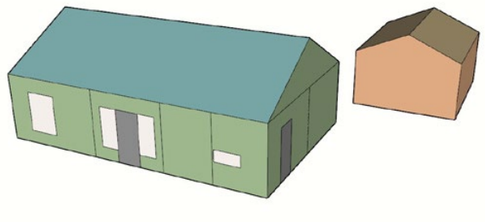
For 2 rooms house : Even though the net floor areas are higher for proposed houses, and the proposed houses have the opportunity to have an additional room, all shared values are lower. There is a clear increase in "solar gains transparent" thanks to the decisions to gain more sunlight.

For 4 rooms house : As discussed in p. 32, the first floor plan in the original design is highly unefficient due to it's low ceiling and separation of the rooms. This make the house unnecessarly big for only 4 rooms house. This must be why, electricity and heating demands are higher in the original design. There is also a clear increase in "solar gains transparent". On the other hand primary energy demand and global warming potentials are lower. This must be due to the number of storeys. Original design has 2 storeys and the proposed ones have 1 storey.

2 rooms house

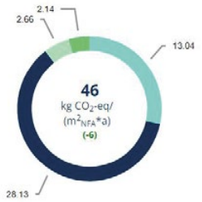
ORIGINAL DESIGN

Primary energy demand **79** kWh/(m2AN*a)



net floor area : 77 m²
net floor area of garage : 24,75 m²
volume : 231 m³

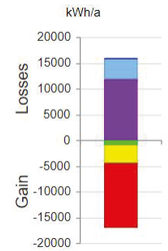
Global warming potential



Electricity demand

3,241 kWh/a

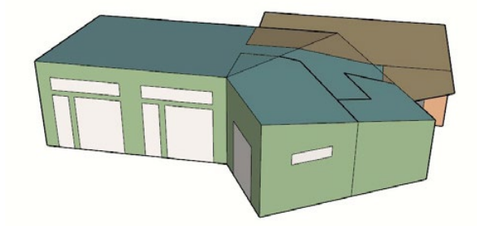
Heating demand



12,273 kWh/a

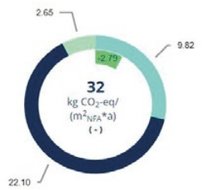
PROPOSAL A

Primary energy demand **62** kWh/(m2AN*a)



net floor area : 82 m²
net floor area of garage : 19 m²
volume : 232 m³

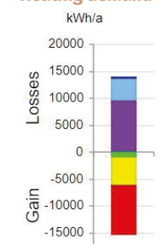
Global warming potential



Electricity demand

2,621 kWh/a

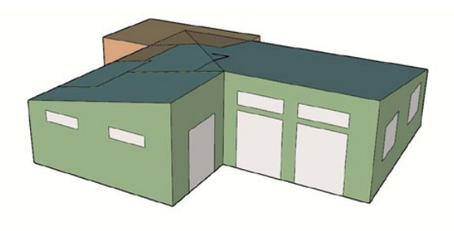
Heating demand



8,973 kWh/a

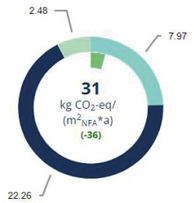
PROPOSAL B

Primary energy demand **62** kWh/(m2AN*a)



net floor area : 89 m²
net floor area of garage : 19 m²
volume : 251 m³

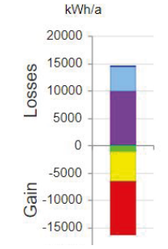
Global warming potential



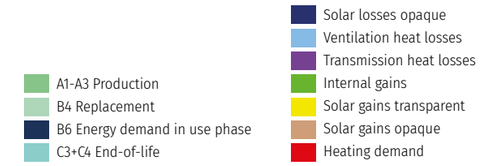
Electricity demand

2,827 kWh/a

Heating demand



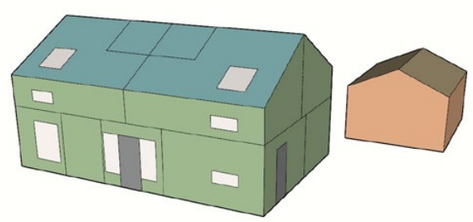
9,533 kWh/a



4 rooms house

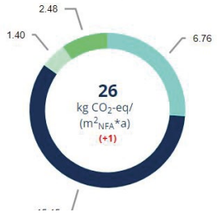
ORIGINAL DESIGN

Primary energy demand **43** kWh/(m2AN*a)



net floor area : 154 m²
net floor area of garage : 24,75 m²
volume : 462 m³

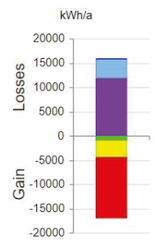
Global warming potential



Electricity demand

3,493 kWh/a

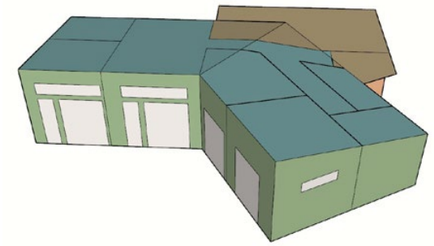
Heating demand



13,095 kWh/a

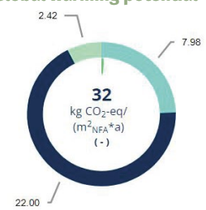
PROPOSAL A

Primary energy demand **63** kWh/(m2AN*a)



net floor area : 96 m²
net floor area of garage : 19 m²
volume : 275 m³

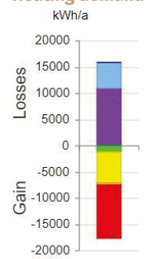
Global warming potential



Electricity demand

3,020 kWh/a

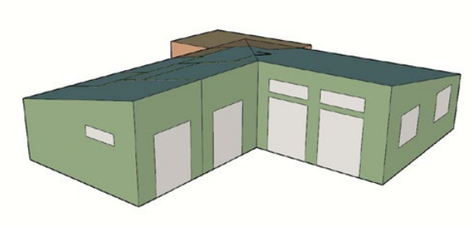
Heating demand



10,319 kWh/a

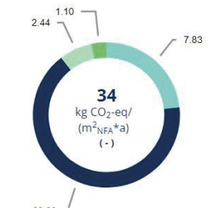
PROPOSAL B

Primary energy demand **62** kWh/(m2AN*a)



net floor area : 103 m²
net floor area of garage : 19 m²
volume : 305 m³

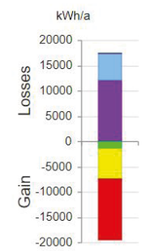
Global warming potential



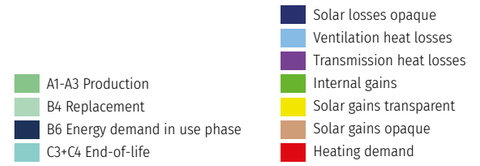
Electricity demand

3,383 kWh/a

Heating demand



11,807 kWh/a



DESIGN PROPOSALS

Proposal A
2 rooms house
3 rooms house (entrance from right)
3 rooms house (entrance from left)
5 rooms house
Community house
Proposal B
2 rooms house
3 rooms house (entrance from right)
3 rooms house (entrance from left)
5 rooms house

DESIGN PROPOSALS

One of the ongoing projects located in the municipality of Borås is chosen to discuss how more housing units for the same lot area can be proposed, and still provide privacy and flexibility in the house. Two projects are proposed for this area. In the first project, the housing density increases by 50% (14 units to 21 units), this project is proposed as a housing project for the rural area. For the second design proposal, the housing density increases by 100% (14 units to 28 units). This project is more experimental to show how it would be if the density is doubled and proposed as a suburban housing project. But also would be implemented in the chosen rural area due to many reasons.

Proposal A

Plot sizes 620 m² - 1100 m²

No. of Units 21

Units
2 rooms house
3 rooms house (entrance from right)
3 rooms house (entrance from left)
5 rooms house
Community house

Proposal B

Plot sizes 420 m² - 700 m²

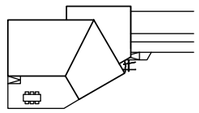
No. of Units 28

Units
2 rooms house
3 rooms house (entrance from back)
3 rooms house (entrance from front)
5 rooms house

PROPOSAL A

PROPOSAL A

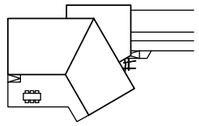
The number of housing units is increased by 50% than the ongoing housing project. This project is proposed as a housing project for this rural area and community. Aimed to propose a project that people can prefer over the original design. In addition to housing units, a community house is designed. Since Mjöshult has a strong community, this building can be useful for them. There, people can gather comfortably, have a large table inside or outside or play games.



2 rooms house × 4

GFA : 82 sqm

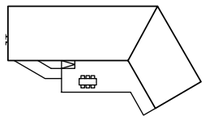
PS : 625 - 774 sqm



3 rooms house × 6

GFA : 96 sqm

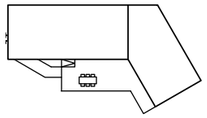
PS : 648 - 1034 sqm



3 rooms house × 4

GFA : 110 sqm

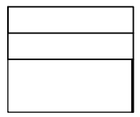
PS : 616 - 664 sqm



5 rooms house × 6

GFA : 171 sqm

PS : 819 - 1180 sqm



Community house

GFA : 85 sqm

PS : 541 sqm

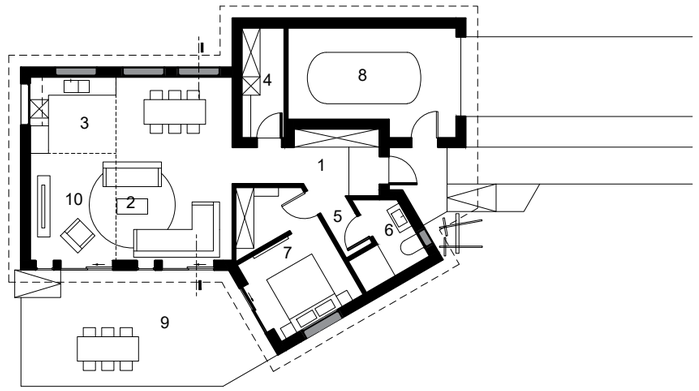
GFA = Gross floor area, PS = Plot size

2 rooms house

No. of rooms : 2 (or 3)
No. of units : 4
Gross floor area : 82 sqm
Plot size : 625 - 774 sqm

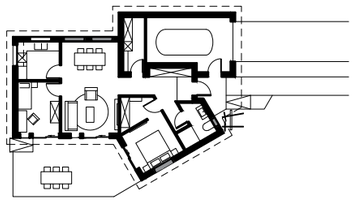
S: 1/200

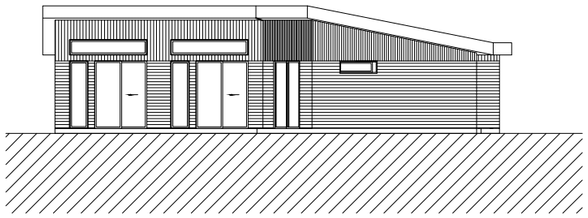
0 1 2 5m



with additional room (1/400)

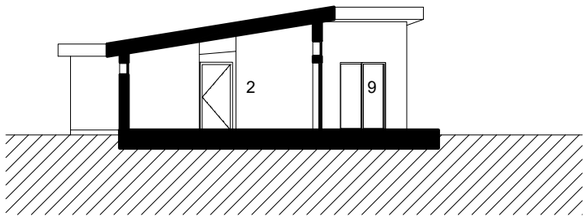
10 room	9,8 sqm
2 living room	23 sqm





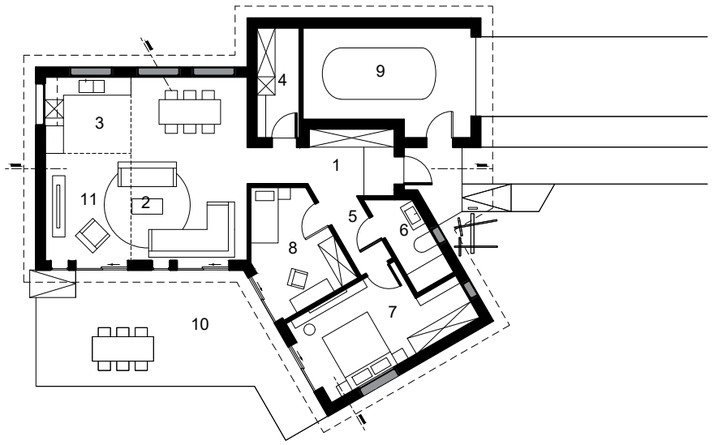
Legend

1 entrance hall	8,4 sqm
2 living room	33 sqm
3 open kitchen	7 sqm
4 closet-laundry	5 sqm
5 corridor	2,1 sqm
6 bathroom	4,6 sqm
7 bedroom	13 sqm
8 garage	19 sqm
9 terrace	29 sqm



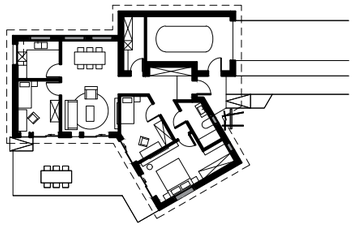
3 rooms house (entrance from right)

No. of rooms : 3 (or 4)
No. of units : 6
Gross floor area : 96 sqm
Plot size : 648 - 1034 sqm



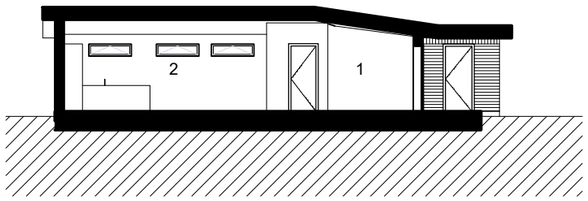
S: 1/200

0 1 2 5m



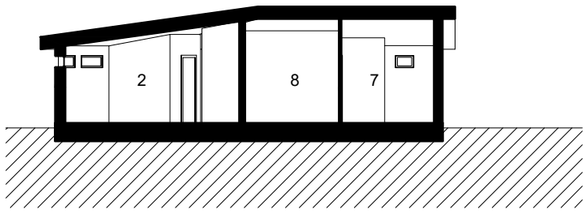
with additional room (1/400)

11 room	9,8 sqm
2 living room	23 sqm

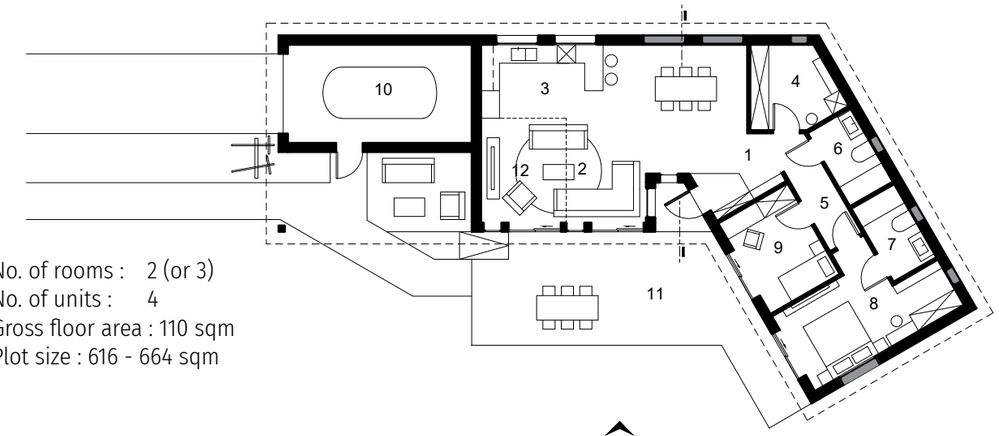


Legend

1 entrance hall	8,4 sqm
2 living room	33 sqm
3 open kitchen	7 sqm
4 closet-laundry	5 sqm
5 corridor	3,2 sqm
6 bathroom	4,4 sqm
7 master bedroom	13 sqm
8 bedroom	10 sqm
9 garage	19 sqm
10 terrace	32 sqm



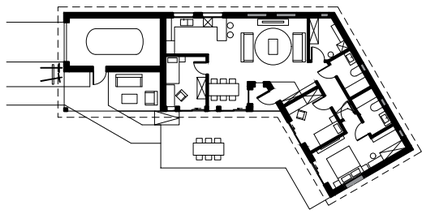
3 rooms house (entrance from left)



No. of rooms : 2 (or 3)
No. of units : 4
Gross floor area : 110 sqm
Plot size : 616 - 664 sqm

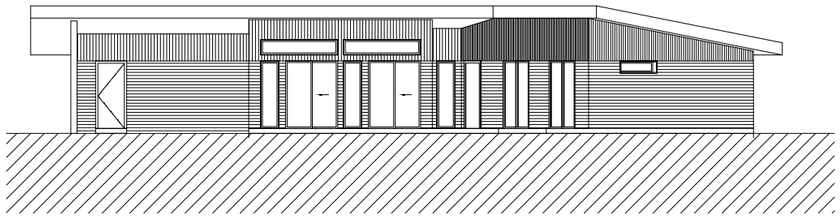
S: 1/200

0 1 2 5m



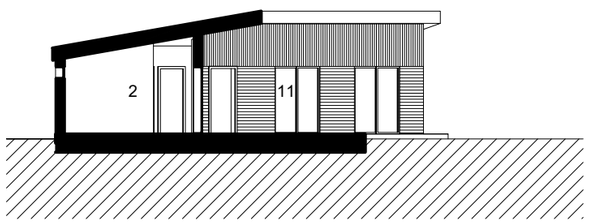
with additional room (1/400)

12 room	9 sqm
2 living room	27 sqm

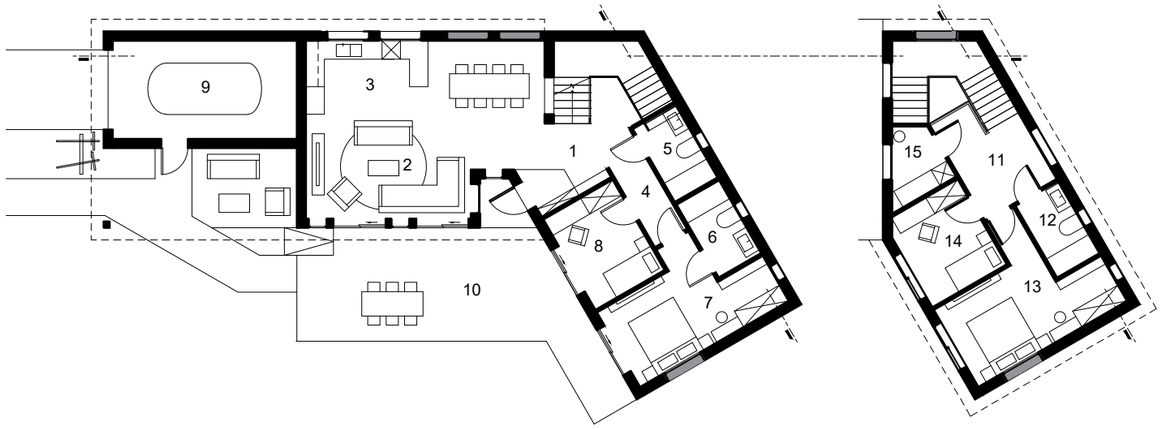


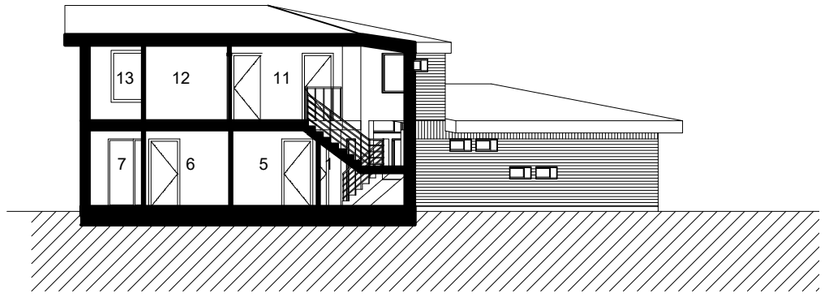
Legend

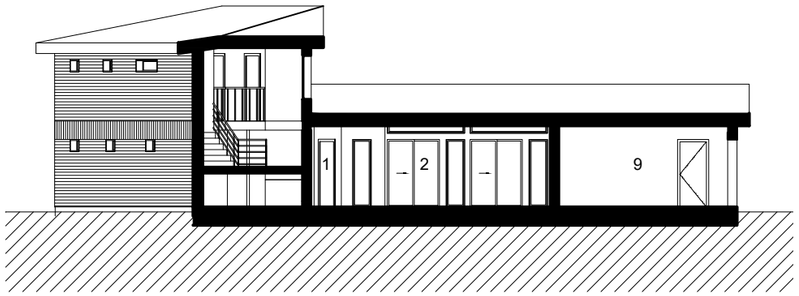
1 entrance hall	6.4 sqm
2 living room	36 sqm
3 open kitchen	9.6 sqm
4 closet - laundry	5.6 sqm
5 corridor	3.2 sqm
6 bathroom	4.4 sqm
7 bathroom	4.4 sqm
8 master bedroom	15 sqm
9 bedroom	9 sqm
10 garage	19 sqm
11 terrace	40 sqm



5 rooms house







No. of rooms : 5
No. of units : 6
Gross floor area : 171 sqm
Plot size : 819 - 1180 sqm

S: 1/200

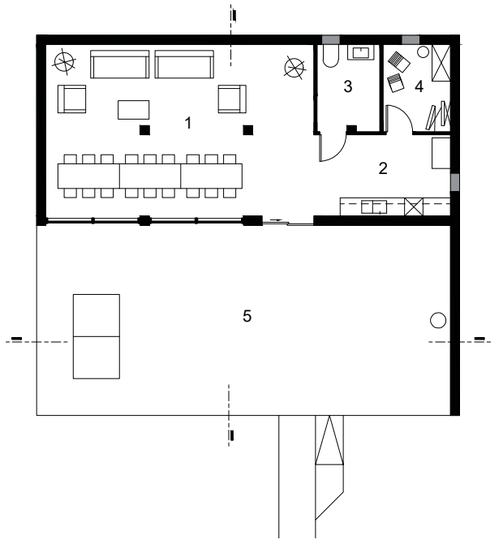
0 1 2 5m

Legend

1 entrance hall	16.3 sqm
2 living room	31 sqm
3 open kitchen	9.5 sqm
4 corridor	3.6 sqm
5 bathroom	4.4 sqm
6 bathroom	4.4 sqm
7 master bedroom	15 sqm
8 bedroom	9 sqm
9 garage	19 sqm
10 terrace	40 sqm
11 hall	7.8 sqm
12 bathroom	4.4 sqm
13 bedroom	16 sqm
14 bedroom	9 sqm
15 laundry	3.8 sqm

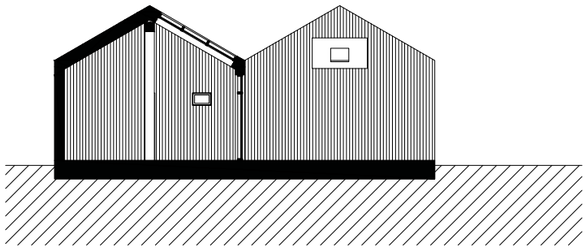
Community house

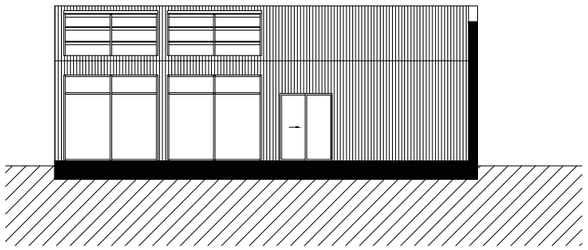
No. of units : 1
Gross floor area : 85 sqm
Plot size : 541 sqm



S: 1/200

0 1 2 5m





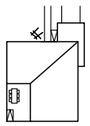
Legend

1 common room	50 sqm
2 open kitchen	12 sqm
3 WC	5.8 sqm
4 storage	6.3 sqm
5 open area	84 sqm

PROPOSAL B

PROPOSAL B

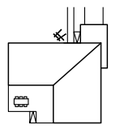
The number of housing units is increased by 100% than the ongoing housing project. This proposal is more experimental to show how it would be if the density is doubled and proposed as a suburban housing project. But also would be implemented in the chosen rural area due to many reasons. As mentioned, there is a lack of smaller houses for single-person, youth and elderly. These people and also many families would prefer to have smaller plot sizes and be closer to each other as a community. The proposed houses can be alternative options for these people. Another reason can be the projected expansion. If there is a huge increase in interest in moving to this rural area, plot sizes may be small like this to make the expansion slower.



2 rooms house × 4

GFA : 89 sqm

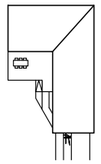
PS : 417 - 708 sqm



3 rooms house × 10

GFA : 100 sqm

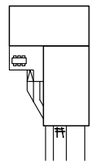
PS : 484 - 728 sqm



3 rooms house × 6

GFA : 110 sqm

PS : 434 - 456 sqm



5 rooms house × 7

GFA : 160 sqm

PS : 508 - 963 sqm

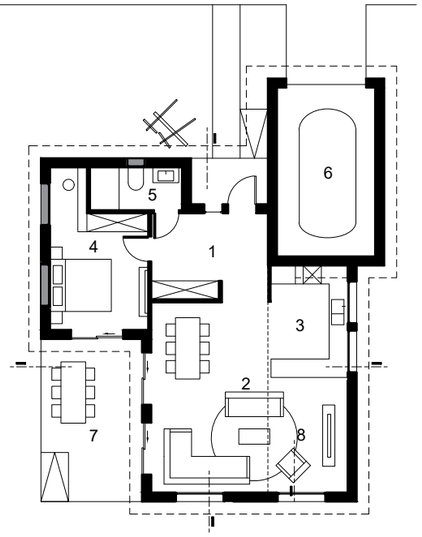
GFA = Gross floor area, PS = Plot size

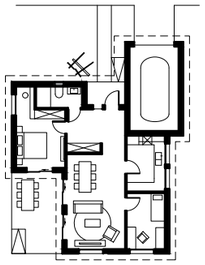
2 rooms house

No. of rooms : 2 (or 3)
No. of units : 4
Gross floor area : 89 sqm
Plot size : 417 - 708 sqm

S: 1/200

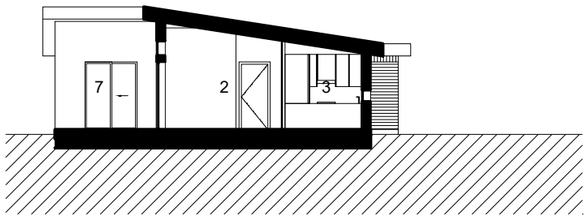
0 1 2 5m

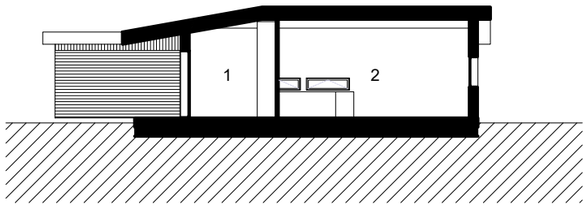




with additional room (1/400)

8 room	9.2 sqm
2 living room	25 sqm





Legend

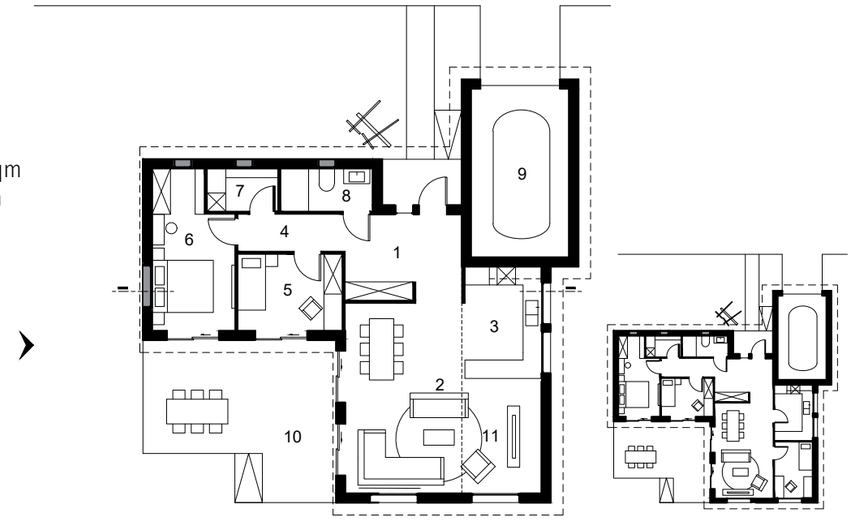
1 entrance hall	9 sqm
2 living room	33 sqm
3 open kitchen	9.2 sqm
4 bedroom	14 sqm
5 bathroom	4.2 sqm
6 garage	19 sqm
7 bathroom	4.2 sqm
8 terrace	18 sqm

3 rooms house (entrance from back)

No. of rooms : 3 (or 4)
No. of units : 10
Gross floor area : 100 sqm
Plot size : 484 - 728 sqm

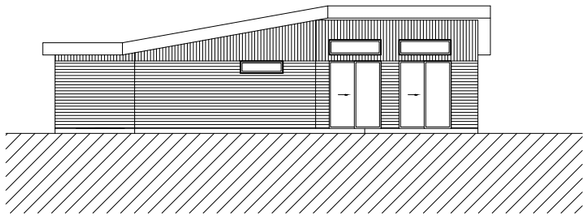
S: 1/200

0 1 2 5m



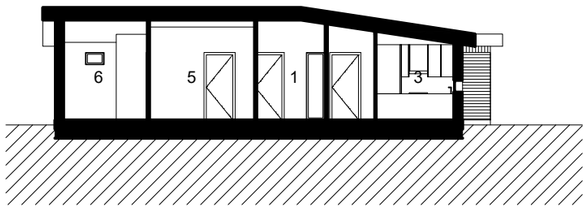
with additional room (1/400)

11 room	9.2 sqm
2 living room	25 sqm



Legend

1 entrance hall	9 sqm
2 living room	33 sqm
3 open kitchen	9.2 sqm
4 corridor	4.2 sqm
5 bedroom	9 sqm
6 master bedroom	13 sqm
7 laundry	3.2 sqm
8 bathroom	4.4 sqm
9 garage	19 sqm
10 terrace	23 sqm

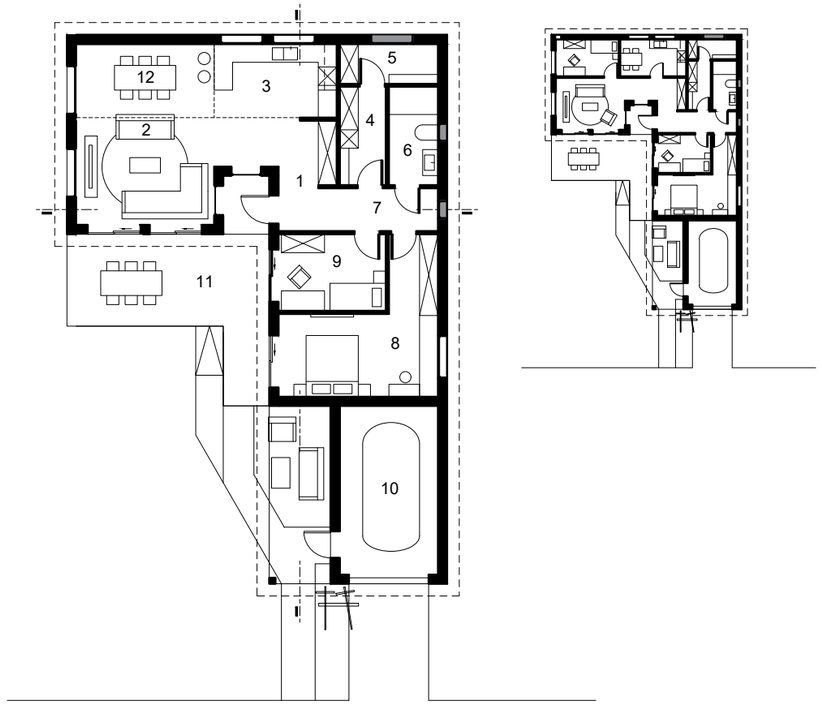


3 rooms house (entrance from front)

No. of rooms : 3 (or 4)
No. of units : 6
Gross floor area : 110 sqm
Plot size : 434 - 456 sqm

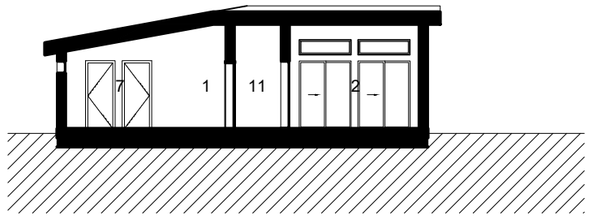
S: 1/200

0 1 2 5m



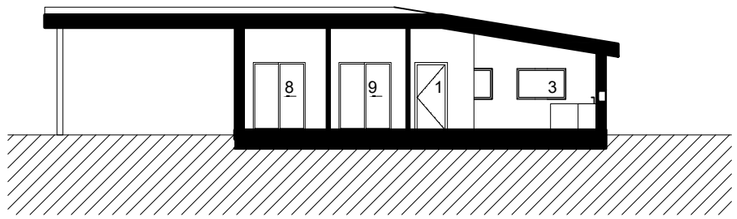
with additional room (1/400)

12 room	9 sqm
2 living room	19 sqm
3 kitchen	10.4 sqm

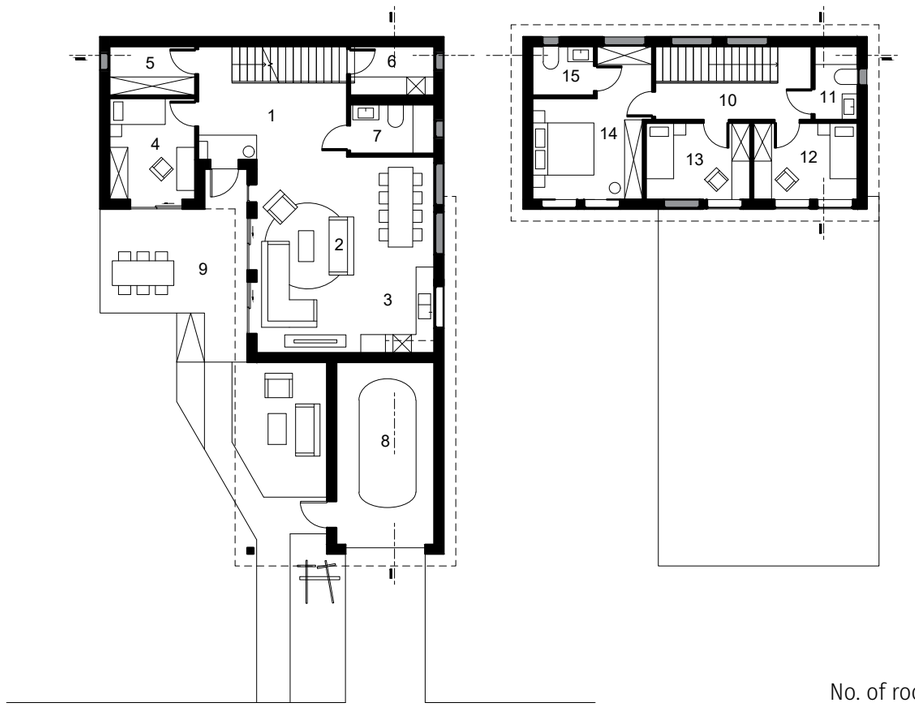


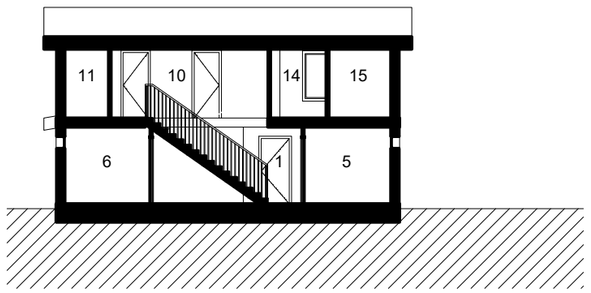
Legend

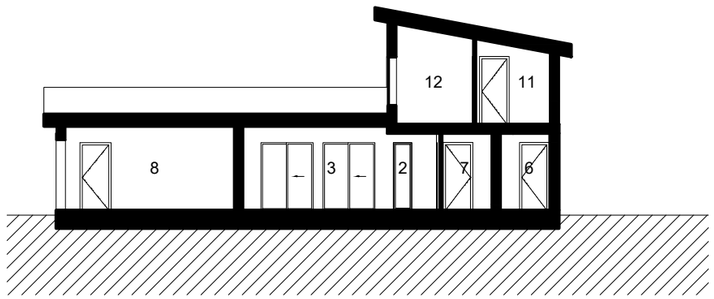
1 entrance hall	7 sqm
2 living room	27 sqm
3 open kitchen	10 sqm
4 laundry	4.8 sqm
5 storage	4.1 sqm
6 bathroom	5 sqm
7 corridor	4.6 sqm
8 master bedroom	18 sqm
9 bedroom	9 sqm
10 garage	20 sqm
11 terrace	25 sqm



5 rooms house







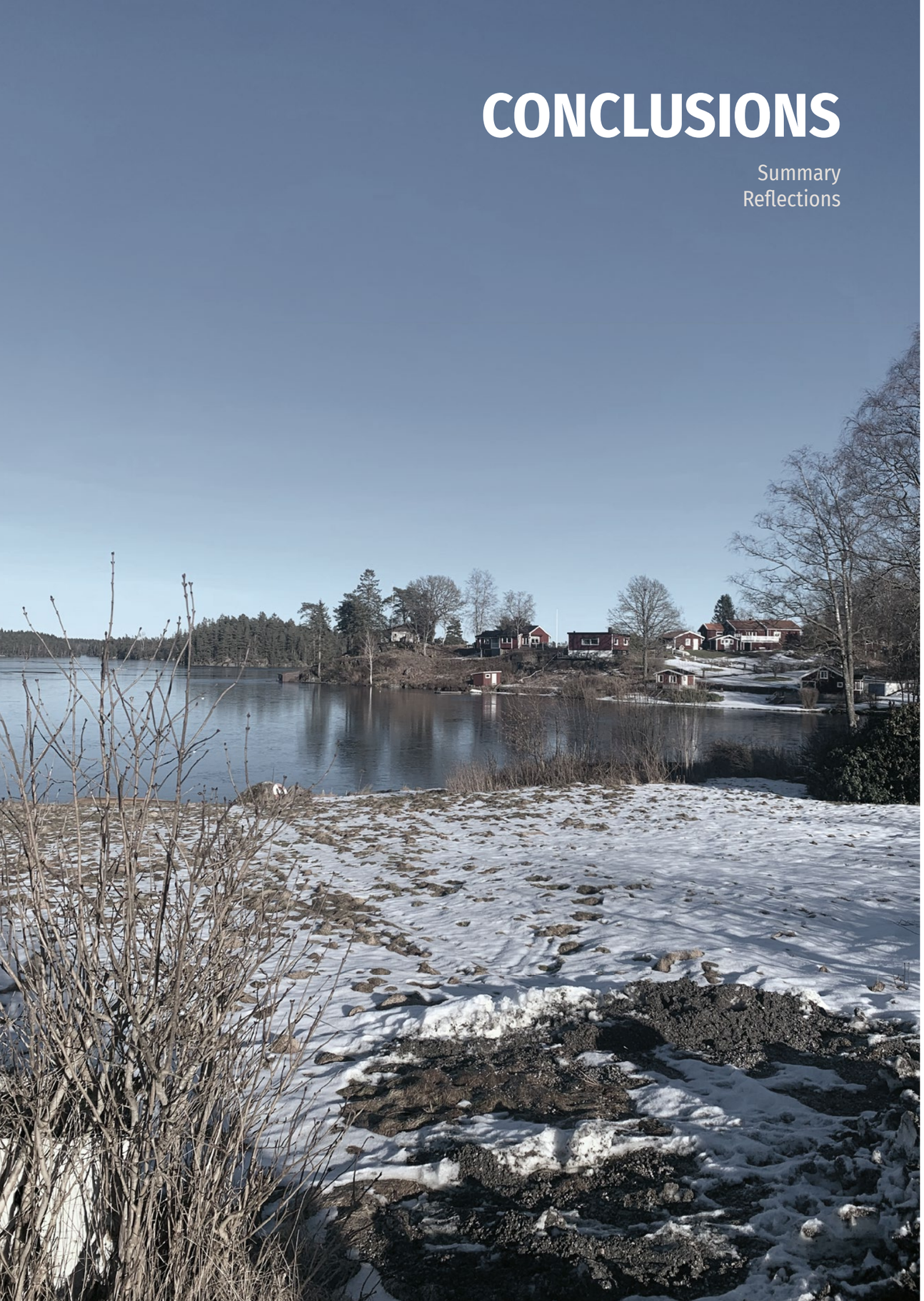
No. of rooms : 5
No. of units : 7
Gross floor area : 160 sqm
Plot size : 508 - 963 sqm

S: 1/200

0 1 2 5m

Legend

1 entrance hall	17 sqm
2 living room	30 sqm
3 open kitchen	7 sqm
4 bedroom	9.2 sqm
5 closet	4.5 sqm
6 laundry	4.4 sqm
7 bathroom	4.4 sqm
8 garage	19 sqm
9 terrace	20 sqm
10 hall	7.4 sqm
11 bathroom	3.4 sqm
12 bedroom	9 sqm
13 bedroom	9 sqm
14 master bedroom	15 sqm
15 bathroom	3.2 sqm



CONCLUSIONS

Summary
Reflections

CONCLUSIONS

In this chapter, the conclusions are done. A summary of findings and reflections are shared.

SUMMARY

Urban and rural areas are affected by ongoing trends at different levels. There are inequalities and a gap between the areas. 30% of the population of Europe, which is an important percentage, lives in rural areas. Narrowing the gap between urban and rural areas is an important subject for the European Commission and the governments. Therefore, many improvements and investments are planned to invite more people to low-populated areas. While many of the rural areas experiencing population decline, some of the Swedish suburbs and rural areas receiving population growth. The fact that there are many ongoing housing projects in these areas also supports this information. This thesis is focused on suburban housing projects and discussed how to make them more attractive, suitable and sustainable. Three main goals are defined and discussed.

1. Density : The population is increasing in many Swedish suburbs and rural areas, especially the ones close to the cities. There are many ongoing housing projects due to the projected population growth for these areas. The housing plot sizes for rural areas are traditionally around 800-1800 sqm in Sweden. The built area is expanding in the natural area. Plot sizes of detached houses should be carefully decided to save nature.

2. Flexibility : There is a lack of suitable house in low-populated areas for single-person, youth and elderly. Low-populated areas should welcome more people, not only families but also single-person, youth and the elderly. There must be suitable houses for everybody for the modern growth of the area. There should be opportunity for the users to reorganize the interiors and have an additional room when they need it.

3. Privacy : In the low-populated areas of Sweden, the gardens of the houses are usually surrounded by bushes, fences or walls. It is assumed that people are having these elements to protect their privacy. Therefore, privacy is an important subject to be discussed in the design process of suburban housing.

Besides these subjects, many other architectural qualities are defined and discussed. These qualities are view, options, larger floor plan, materials and lower energy demand. To be clear on the discussion about density, an ongoing project is chosen. Aimed to increase the number of houses for the same project plot and improve these architectural qualities at the same time. Two projects are proposed for this area. These proposals are compared with the ongoing project in terms of defined qualities.

Proposal A : In the first proposal the density of houses is increased by 50%. This project is proposed as a housing project especially for this rural location. A community house is added since there is a strong community in that area.

Proposal B : In the second proposal the density of houses is increased by 100%. This project is more experimental to show how it would be if density doubled. This proposal is designed as a suburban housing project. But also would be implemented in the chosen rural area due to many reasons.

REFLECTIONS

This thesis is focused on housing projects for low-populated areas which include many houses. There are these kinds of ongoing housing projects in Swedish suburbs and rural areas. And in many of these projects, the plot sizes of each detached house are around 800-1 800 sqm. It is defended that new housing projects in low-populated areas can have smaller plot sizes than the common plot size of the area. Dividing the total plot area into smaller parcels will bring the houses closer. The main challenges are protecting the users' privacy and providing flexible floor plans. Therefore, the research question is,

What are the potentials to build dense dwelling areas and at the same time improve privacy and flexible space for residents?

In this subchapter, explanations and conclusions are made by answering the questions.

Why should the housing *density* be increased for the low-populated areas?

Natural area can be saved. Suburbs and rural areas are expanding in natural areas. Due to this expansion many trees are being cut down. Many animals living in this area have to leave this area. By using smaller parcel sizes, less natural area will be destroyed.

Built area would expand slower. When large parcel areas are used, the projects that include many houses are built on a very large land area. If the projects that will be constructed in the future will have also large parcel sizes, we can assume that the built area will expand fastly. With this expansion, the relation of the buildings/functions would be weakened and the identity of the low-populated area can be lost. Using smaller plot sizes will cause the area to expand slower.

Why are *privacy* and *flexibility* important subjects for a suburban housing project?

Flexibility : To support immigration to low-populated areas, the houses must the suitable for many different kinds of people. Therefore, floor plans should be flexible, and the users should be able to change the interiors as their wish and make their house unique for themselves.

Privacy : From the cities and towards less populated areas, it is seen that the houses have their own garden areas and the garden areas get larger. These garden areas are usually surrounded by wooden walls, fences or bushes. It can be deduced from this that people seek more privacy as they move away from the city. Therefore, privacy is an important subject in the design process of suburban housing project.

What is the *end result*?

Choosing an ongoing project : In order to be more specific during the discussions, an ongoing project in a Swedish rural area is chosen. 14 new houses will be built according to this project. New owner can chose to have 2 rooms house or 4 rooms house in their project plot.

Increasing the housing density : Two design projects are proposed for the same project plot. In the first project, the housing density increases by 50% (14 units to 21 units), this project is proposed as a housing project especially for this rural location and community. For the second project, the housing density increased by 100% (14 units to 28 units). This project is more experimental to show how it would be if the density is doubled. This proposal is designed as a suburban housing project. But also would be implemented in the chosen rural area due to many reasons.

Design proposals : 4 different types of houses and a community house are designed for proposal A. In this proposal, the view from rooms is wider. 4 different types of houses are designed for proposal B. The architectural qualities of different proposals are compared with each others' and also with the original design.

What was the *biggest challenge* during the design process?

When the plot sizes get smaller, the houses get closer to each other. In this case, it was challenging to protect privacy. But the main challenge was providing privacy and flexibility at the same time. There are large windows on only 1 or 2 sides of the house to protect privacy. For this reason, all bedrooms and living space had to be on these sides. It was difficult to plan the space for the additional room, which could be added with flexibility, on these sides as well. This made houses narrower and longer. In some designs (for instance, proposal A - 3 rooms house (entrance from left)), there is a lack of sunlight in the living area when additional room is on use. For such cases, the chart of "the importance of the architectural qualities" is created (p. 37). Since, "privacy" and "flexibility" had higher importance than "sunlight", the design is proposed in this way.

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References of the figures are shared directly under them or on the same page.
The ones without resources are taken or drawn by me.

CHALMERS
UNIVERSITY OF TECHNOLOGY

Mine Erdem

Chalmers University of Technology
Department of Architecture and Civil Engineering
Master Programme Architecture and Planning Beyond Sustainability | MPDSD

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