LEIBNIZ UNIVERSITY HANNOVER, GERMANY

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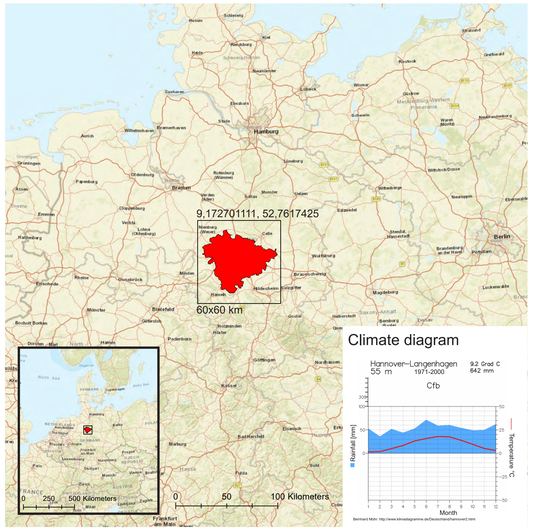


Hannover Region

The Hannover Region has a high level of biodiversity in its landscape, with fertile soils in the south and old forests in the north. The city of Hannover is also called „green city“, because it is one of the greenest cities in Germany and the proportion of green areas accounts for 11% of the total urban area. This is a positive starting point for the development of a sustainable region up to the year 2050. However, the agricultural use of the peatlands in the north poses challenges, as they generate large greenhouse gas emissions. In addition, the groundwater is also polluted with high nitrate levels due to intensive agriculture. Hannover was planned as a „car-friendly city“ during reconstruction after the Second World War and the region‘s transport infrastructure is one of the most important traffic junctions in Germany for rail and road traffic. This has led to problems of fragmentation, greenhouse gas emissions and exhaust and noise pollution for the region‘s inhabitants. The last conversion measures to a „bicycle-friendly“ city were carried out 20 years ago. The basis for the scenario development in the early adapter scenario are the 17 globals sustainable development goals (SDGs) from the „2030 Agenda for Sustainable Development“ To reach these goals an immediate change of regional policies will be necessary for adaptation.[1 2]

Method

We developed two extreme scenarios for the area until the year 2050:

1. The early adopter scenario assumes that any actions for a sustainable development of the region will be implemented.

2. The non adopter scenario assumes that current socio-political trends continue and new political impulses for change are missing.

Each land use determined a reachable goal for the year 2050 and identified the areas of activity, necessary measures and innovations to reach the particular goal. Subsequently each land use was overlaid to show and analyze resulting conflicts or synergies. You find detailed information to our approach in poster #2 “Steps”.

Major issues

If the major trends continue as assumed until 2050, there will be many problems for the Hannover Region. The main problems are:

1. Fragmentation
2. Land Consumption
3. Emission
4. Soil degradation
5. Loss in biodiversity
6. Exploitation of resources

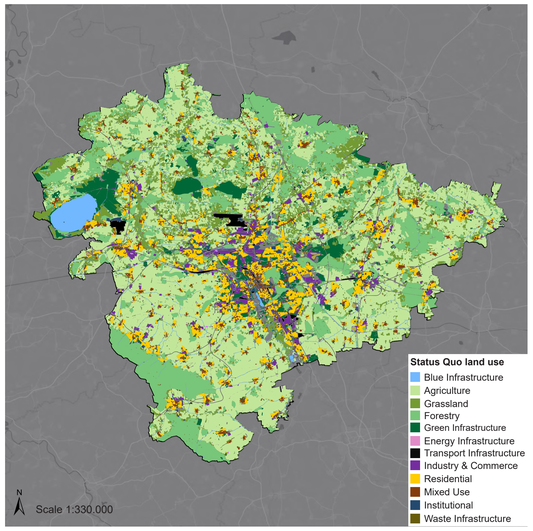
Major assumptions

- Population decline by 8 % by 2050 [3]
- Growth of 1.3 % until 2030
- Increase in older people by 2030 [4]
- City shrinks less than rural area (-2.6 % compared to -14.8 %)[4]
- Rearranging to electric power [6]
- Number of employees decreases by 6 % [3]
- Gross value increase by +35 %
- Expansion of digital network
- Safer, more efficient and more sustainable network
- Average temperature 2050 > 11 ° C
- Less frost, ice days and cold spells
- More tropical nights, hot days
- Slight decrease in rainfall [5]
- Abdication of fossil fuels
- increasing electricity production [6]

Major innovations

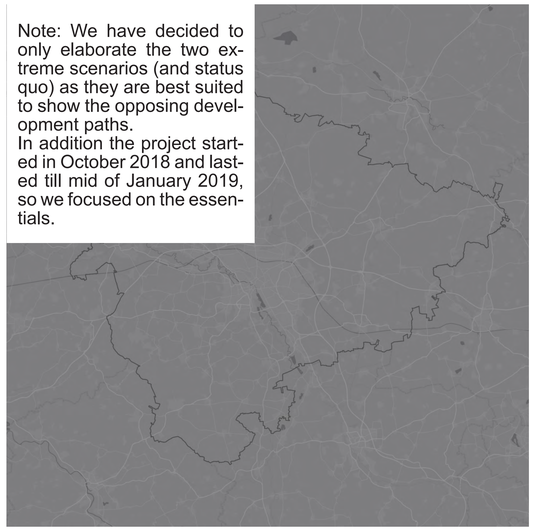
Mix 2035 3 People-oriented smart cities
Mix 2035 7 Sharing economy
Agr 2035/2050 1 Organic agriculture
Agr 2035/2050 15 Drones in agriculture
Grn 2035/2050 9 Connectivity and elements
Grn 2035 12 Green roofs
Ene 2035 3 Solar roads
Ene 2050 15 Windrail
Tra 2035/2050 1 The autonomous revolution

Aggregated results

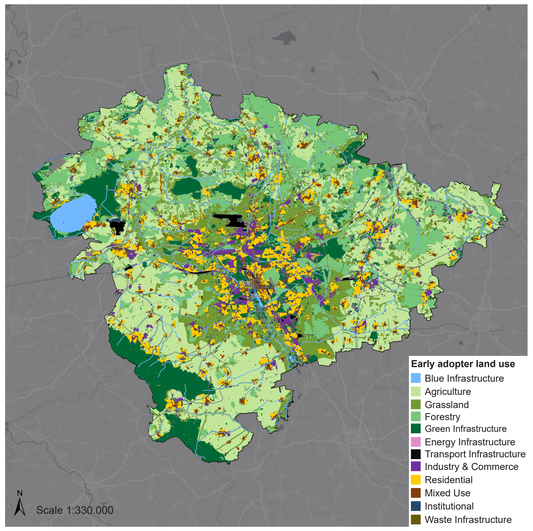


Status Quo: 2020

Note: We have decided to only elaborate the two extreme scenarios (and status quo) as they are best suited to show the opposing development paths.
In addition the project started in October 2018 and lasted till mid of January 2019, so we focused on the essentials.



Early adopter: 2035

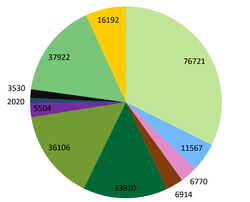


Early adopter: 2050

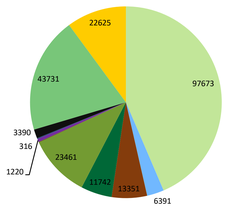
Early adopter scenario (E.a.)

As a result of the changes described below, significantly more CO_2 can be stored and land use driven emissions can be reduced so that the Hannover Region becomes carbon-neutral. Urban and industrial areas (72K ha) have only increased by 2 % while the green areas (34K ha) increased by 176 % as well as the rivers and meadows (12K ha) increased by 81 % but also areas for energy production (7K ha) emerge victorious. Because of its protective qualities for climate and groundwater energy infrastructure has increased but is also located on green areas. Agriculture decreases by 24 % but still accounts for the largest amount of land (113K ha), whereby the relation of farmland to grassland has shifted significantly towards grassland. In all, the Hanover Region has become greener, especially the green belt around the capital is very conspicuous. The future natural forest “Deister” occupies most of the green infrastructure. The strong increase in the blue infrastructure area is due to a naturalization of river patterns and the broadening of riparian zones. The region is crossed by meandering rivers. Biodiversity can greatly benefit from this development. Green areas provide corridors for animals and plants. Humans also benefit from the development of the region regarding recreation: The reduction of emissions leads to a lower temperature increase, the forests also cool pleasantly. More gentle farming methods allow the soil to recover and provide the basis for sustainable nutrition. In the urban area mesoclimate has improved due to green roofs and solar systems. Overall, the landscape is characterized by forests and meadows and locally with energy infrastructure elements such as wind turbines and solar panels.

Spatial proportion of land uses



Early adopter in ha



Non adopter in ha

Green Infrastructure includes all future natural forests. In some areas, two uses occur simultaneously. Therefore the sum of land use area is > 100%.

- Blue Infrastructure
- Agriculture
- Grassland
- Forestry
- Green Infrastructure
- Energy Infrastructure
- Transport Infrastructure
- Industry & Commerce
- Residential
- Mixed Use
- Institutional
- Waste Infrastructure

Late adopter: 2035

Late adopter: 2050

Late adopter scenario

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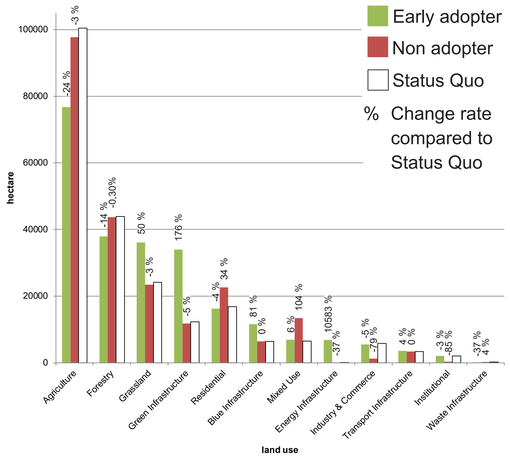
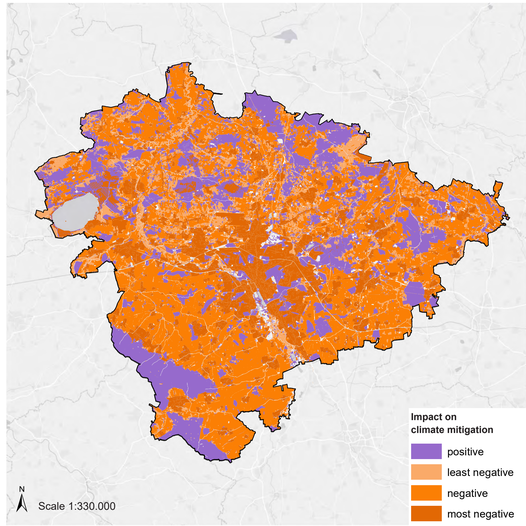
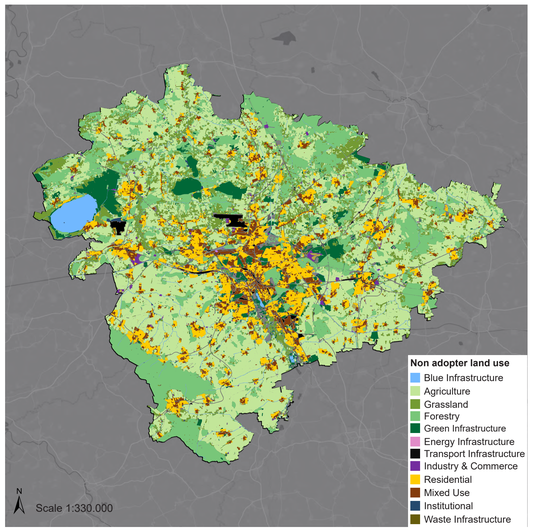
Spatial scenario comparison





Non adopter - Climate mitigation conflicts



Non adopter scenario (N.a.)

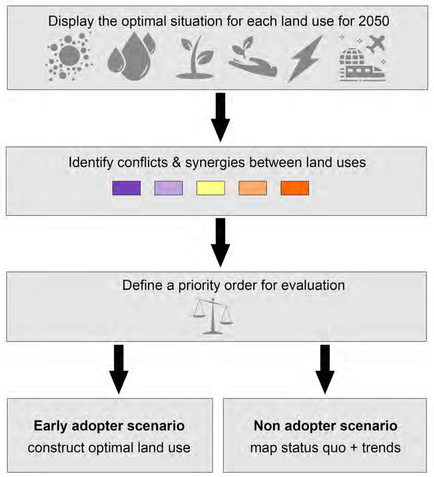
If the trend continues, land will be sealed for the construction of new housing (+34 %). Among other things, the expansion of the city contributes to the total loss of agricultural (-3 % to 98K ha) and recreational (-5 % to 12K ha) area. In the agricultural sector, there will be only small changes to organic agriculture and a degradation of soil and water quality can be expected.

The way of life is not resource- conserving, energy is not produced in an environmentally friendly way. The performance of the motorized individual traffic will remain high.

Increase of traffic infrastructure and conventional farming correlates with the decline in green areas, leading to a deterioration of the climate.
The air is getting worse; the quality of life in the city will continue to decrease, the health of the population is also impaired. The climate targets are missed, so that the region continues to heat up. For example, longer droughts are expected during the summer months.

Steps

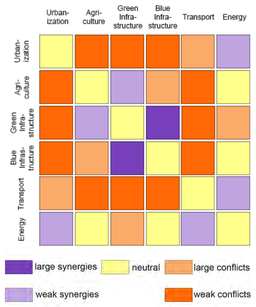
Our methodological approach



Conflicts & synergies

Conflicts and synergies between land uses are represented in the matrix below.

Assessment of conflicts & synergies



Note: Urbanization contains the land uses Industry & Commerce, Residential, Mixed use, Institutional and Waste Infrastructure.

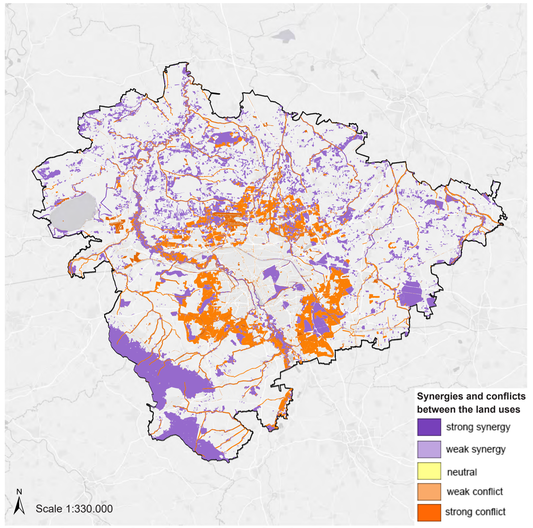
Examples for conflicts

- Transport routes cause fragmentation of green infrastrucure.
- Nitrate leaching into groundwater on agricultural land.
- No groundwater can be recharged on sealed surfaces.
- Wind turbines are a potential threat to birds and bats.

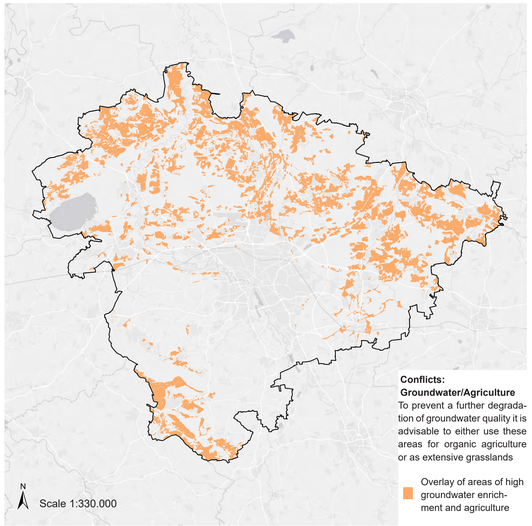
Examples for synergies

- Solar panels can be placed on roofs or along roads.
- Extensively managed grassland has a positive effect on biodiversity.
- To their rivers connected flood-plains have a positive effect on biodiversity as well as on groundwater recharge.

Non adopter: 2050



Spatial synergies & conflicts for both scenarios

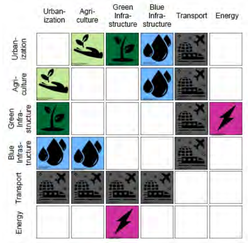


Groundwater enrichment conflict areas with agriculture

Priority order for evaluation

Conflicts were solved according to the priority given to the land uses as shown in the decision matrix. For each scenario, a different weighting of land uses was determined.

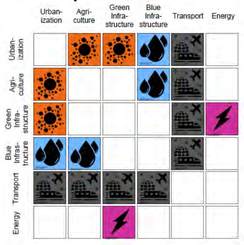
Early adopter scenario



Priority order

1. Transport Infrastr.
2. Blue Infrastructure
3. Energy Infrastr.
4. Green Infrastructure
5. Agriculture
6. Urbanization

Non adopter scenario

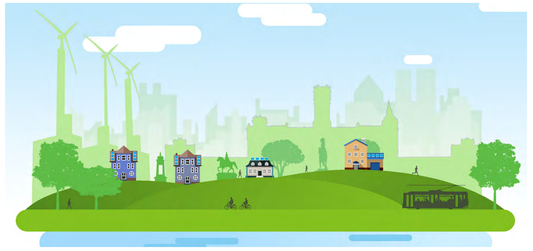


Priority order

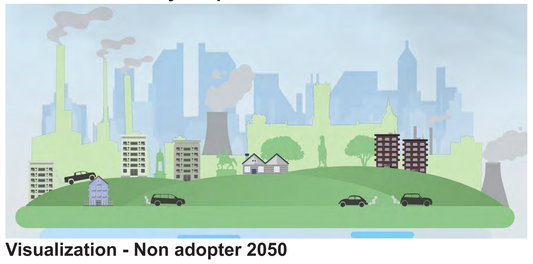
1. Transport Infrastr.
2. Blue Infrastructure
3. Energy Infrastr.
4. Urbanization
5. Agriculture
6. Green Infrastructure

Explanations for the priority order

- In the E.a. scenario transport routes especially for public transport, electric cars or bicycles are still necessary but are designed to be most environmentally friendly, e.g. with tunnels for transportation or connecting green bridges for animals.
- In the E.a. scenario Blue Infrastructure consisting the quality of water bodies and the availability of fresh water in combination with the protection of water-dependent ecosystems are of a high priority. Ensuring good or high ecological conditions for water bodies by extensive renaturation measures is a major goal.
- Energy has a high priority in both scenarios. In the E.a. scenario solar panels and wind turbines are operated in an environmentally friendly manner, e.g. site selection and operating time of wind turbines.
- In contrast to the N.a. scenario, urbanization is limited to existing expansion in the E.a., so it is of the least importance. Existing buildings are utilized more efficiently e.g. with smaller apartments. Instead of relying on expansion, additional actions for improvement of the urban areas are implemented, e.g. roof and facade greening.
- Agriculture is in both scenarios less prior because the ecological compatibility depends in particular on the management than on the size of the area. Environmentally friendly management can be achieved e.g. by organic farming, waiver of mineral fertilizer, use of fallow land or mowing dates for grassland.



Visualization - Early adopter 2050



Visualization - Non adopter 2050

Sources

1 https://www.hannover.de/Leben-in-der-Region-Hannover/Umwelt-Nachhaltigkeit/Nachhaltigkeit/Agenda-21-Nachhaltigkeit/Agenda-2030-f%C3%BCr-nachhaltige-Entwicklung/Agenda-2030-in-Hannover)

2 https://www.hannover.de/Service/Presse-Medien/Presseservice-Marke%C2%ADting,-Tourismus,-Wirtschaft/Allgemeine-Tex%C2%ADte-Hannover-im-Überblick/Der-Standort-Hannover-Daten-Fakten-im-Überblick

3 Region Hannover & Landeshauptstadt Hannover (Ed.) o.J.: Masterplan Stadt und Region Hannover. 100% für den Klimaschutz. Ein gemeinsames Projekt von Landeshauptstadt und Region Hannover. Phase 1. Berichtszeitraum Juni 2012 bis Dezember 2013. 136 S. Hannover.

4 Region Hannover & Landeshauptstadt Hannover (Ed.) 2014: Bevölkerungsprognose für die Region Hannover, die Landeshauptstadt Hannover und die Städte und Gemeinden des Umlands 2014 bis 2025/2030. 62 S. Schriften zur Stadtentwicklung 120. Hannover.

5 Büter, B. & Land, C. n.Y.: Grundlagen und Empfehlungen für eine Klimaanpassungsstrategie der Region Hannover

6 Walter, A., Wiehe, J., Schlömer, G., Hashemifarzad, A., Wenzel, T., Albert, I., Hofmann, L., zum Hingst, J. & von Haaren, C. 2018: Naturverträgliche Energieversorgung aus 100% erneuerbaren Energien 2050. 160 S. BfN-Skripten 501, Bonn: Bundesamt für Naturschutz.

7 Region Hannover & Landeshauptstadt Hannover (Ed.) n.Y.: Masterplan Stadt und Region Hannover. 100% für den Klimaschutz. Ein gemeinsames Projekt von Landeshauptstadt und Region Hannover. Phase 1. Berichtszeitraum Juni 2012 bis Dezember 2013. 136 S. Hannover.

Icons: decrease by Elliricon, demographic pyramid by b farias, Climate Change by Patrick Morrison, Electricity by Nimal Raj, Network by Rflor, renewable ehrgy by nauraicon, Economic Growth by Mosaic, icon, segmentation by Gregor Cresnar, Graph by Xinh Studio from the Noun Project, emission by anbileru adaleru, biodiversity by Angelo Troiano, fossil fuel by Becris from the noun project: https://thenounproject.com

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We thank our supervising professors Christina von Haaren and Julia Wiehe.
We would also like to thank our student tutor Anna-Lena Vollheyde. In our work we were able to constantly expand our knowledge of Geodesign. The Framework for Geodesign by Prof. Carl Steinitz provided us with the necessary basis. Thank you very much.