Landeshauptstadt
München
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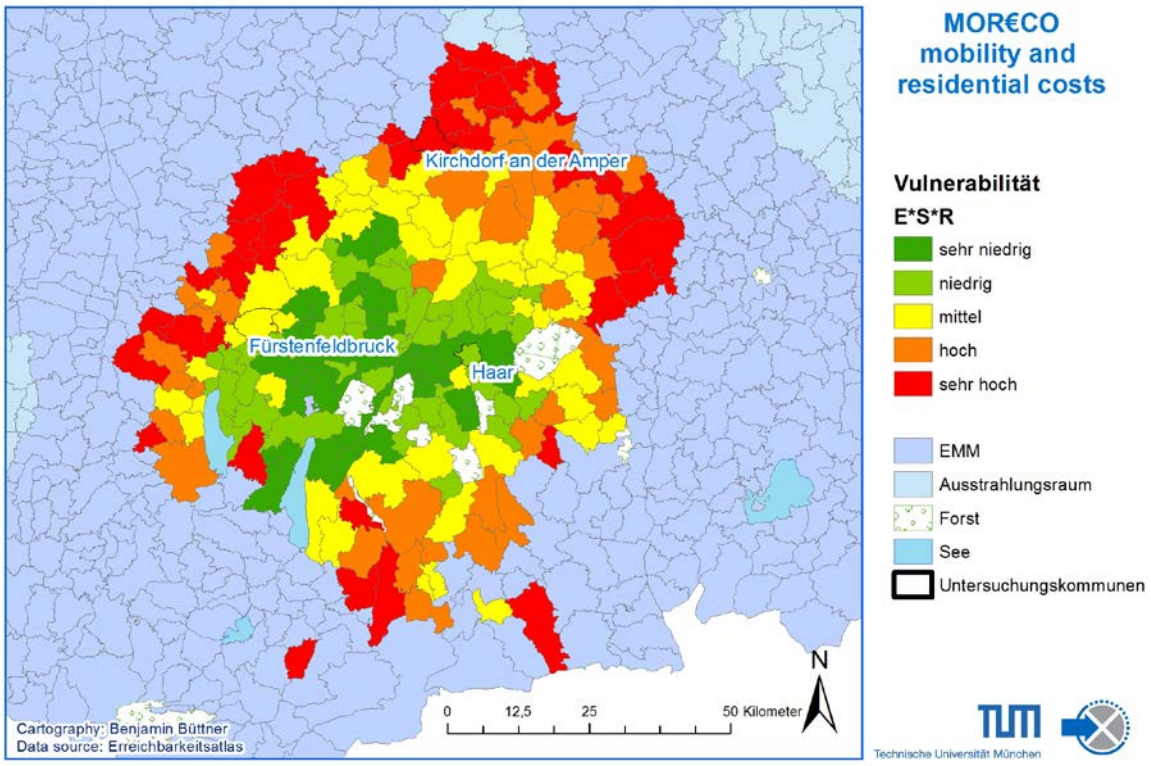
MOR€CO

Analysis of future residential and mobility costs for private households in Munich Region

The amount of the household budget spent on mobility is rising dramatically. While residential costs can be estimated quite easily and accurately, mobility costs and travel times are often underestimated or even ignored in household location decisions. When taken in aggregate, this disconnect between residential locations and transport costs can have serious impacts on a region in the face of rising gas prices.

To see which regions are in danger of increasing mobility costs the Vulnerability Assessment has been performed with a combination of indicators for the dimensions exposure (e.g. fossil fuel consumption), sensitivity (income) and resilience (accessibility to jobs by public transport) within the Munich region.



The feasibility of transferring the Vulnerability Assessment to different regions and households based on the socio-demographic and transport data is crucial to test the future viability. Displaying and visualizing the vulnerable regions through mapping can assist in the development of sustainable spatial and transport policies to cope with issues arising from increased mobility costs (e.g. social exclusion…).

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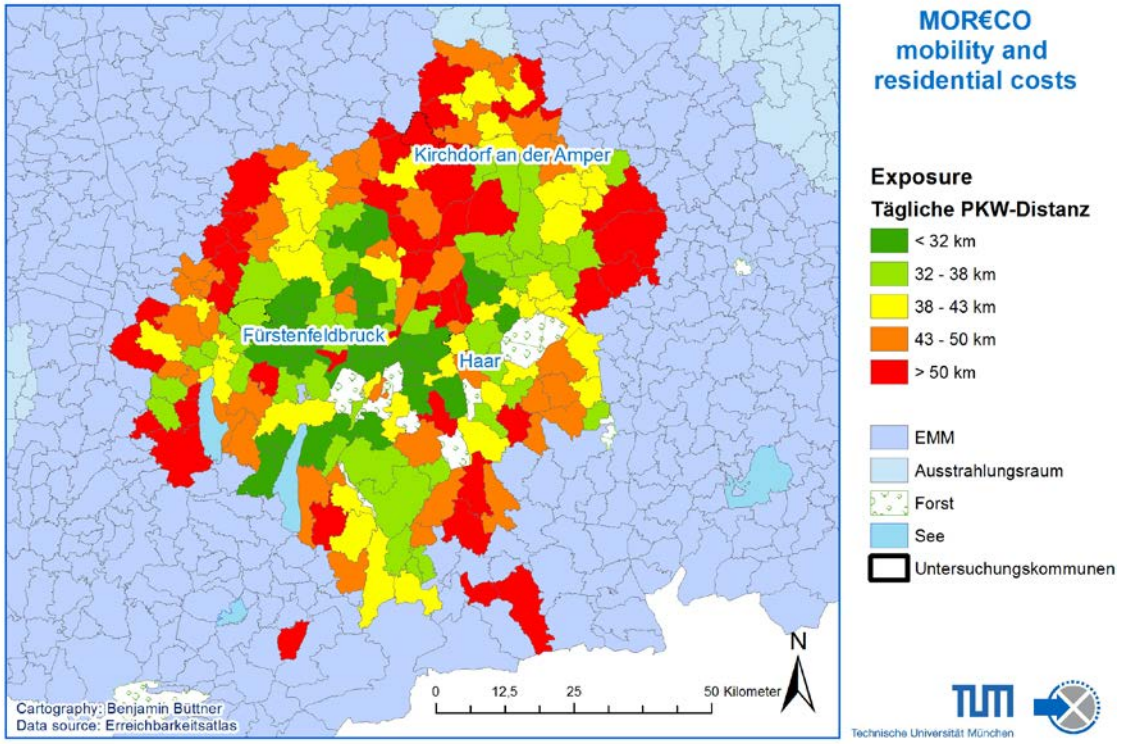
Vulnerability Assessment

In order to determine which regions or communities will be most vulnerable to increasing fuel prices, appropriate indicators have to be chosen to model exposure, sensitivity, and resilience:

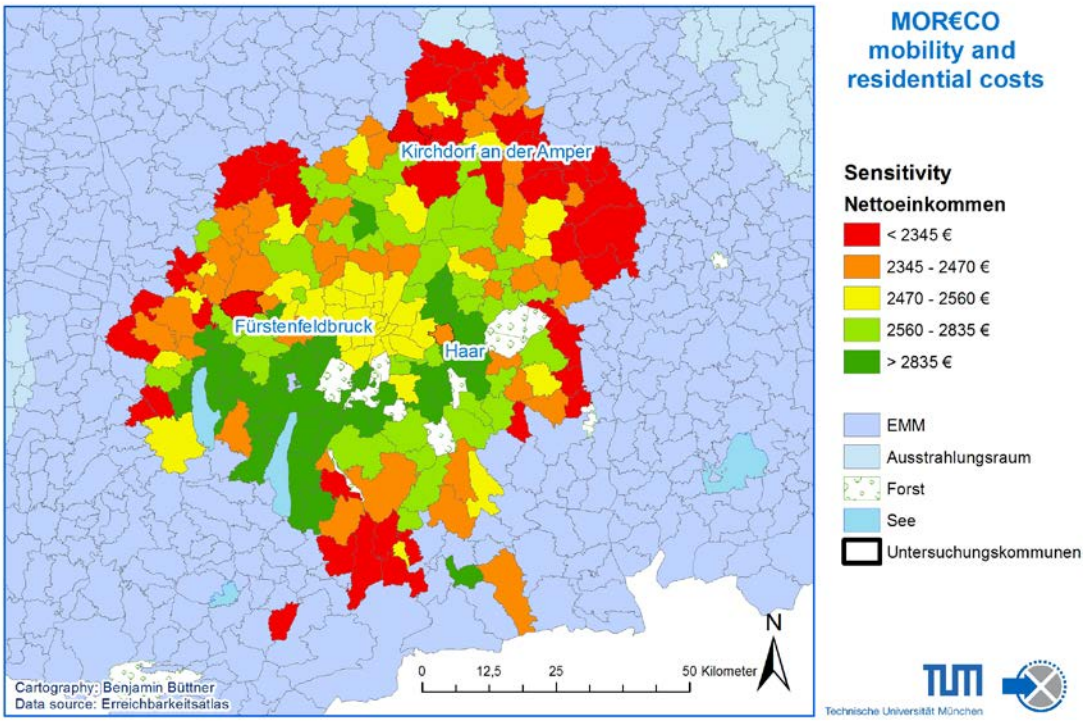
- For measuring **exposure**, two sources to obtain data are used. The first is a national database of regional statistics that provides population data. The second source is the regional transport data model which is run jointly by the city of Munich, the regional public transport authority (MVV) and the public transport operating company of the city of Munich (MVG). This model allows the calculation of vehicle-kilometers travelled by inhabitants of each municipality within the MVV coverage network.

  This key indicator for measuring exposure was chosen because vehicle-kilometers travelled are directly related to fuel consumption.



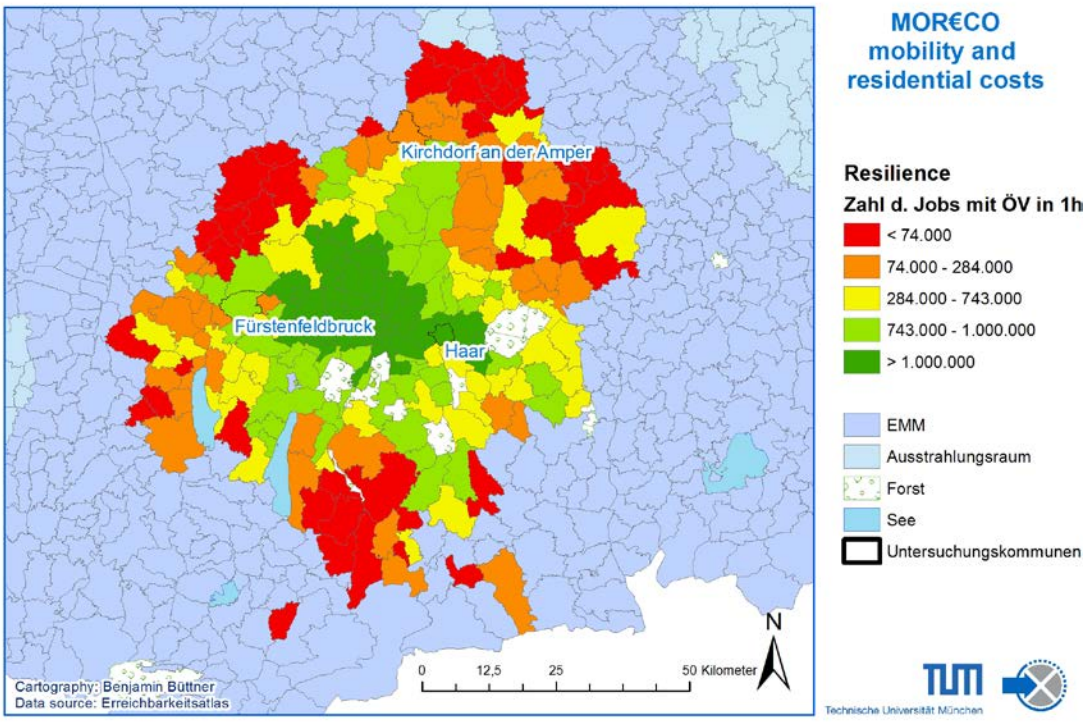
- The measurement of **sensitivity** relies on the the indicator ‘average monthly income’. This dataset is drawn from the GENESIS online database provided by the Bavaria department of data and statistics (2010) and is available on the municipal level.

  The more a household or individual earns, the less sensitive she or he will be in the case of a sharp increase in mobility costs.



- Those people who have alternatives to private cars for travel to work will be more resilient in the case of increasing fuel prices. Therefore, the level of **resilience** is determined by the number of jobs that are accessible by public transportation.

  The number of accessible jobs by public transport within one hour was calculated by the TUM Accessibility Atlas.



Following this, high exposure and high sensitivity combined with a low resilience will result in a high vulnerability. The following assumptions are adopted when assigning the ranks: the more one drives (highly exposed), the more vulnerable she or he is; the less one earns (highly sensible), the more vulnerable; the better public transport accessibility one has (highly resilient), the less vulnerable.

The city of Fürstenfeldbruck offers excellent social and transportation facilities. Work places are available in the city itself, as well as in other nearby central places. Due to the rather low average income, the sensitivity is very high. Therefore, Fürstenfeldbruck's vulnerability is moderate.

The suburban community of Haar benefits from its proximity to the city of Munich and from its attractive public transportation services. Even though the settlement structure is quite urban and dense, many people rely on their car to be mobile. As such, the vulnerability of the community Haar is low.

Due to its peripheral location and a high car dependency, the rural municipality of Kirchdorf an der Amper is the most exposed of the three communities. In addition, the inhabitants are very sensitive to increases in fuel prices, as their average income is very low. Since there are no attractive alternatives to the car, Kirchdorf an der Amper has a high vulnerability.

Simply analyzing the current situation will not solve upcoming problems. Therefore, long-term planning needs to include future scenarios to better understand consequences of vulnerability. To investigate this aspect, synthetic households were exposed to shock scenarios.

Generation of synthetic households and their mobility behavior

The synthetic households and their mobility behavior were derived from analyzing regional databases. Spatial patterns of movement and the corresponding causes were considered based on the Wanderungsmotivuntersuchung II (WMU). The Study "Mobility in Germany on the level of the region of Munich" (MiDMUC) yielded socio-demographic characteristics of the population, trip chains and the corresponding mode of transport. Numerous data from the Bavaria department of data and statistics completed the population data on the municipality level. Also, the GIS-based accessibility atlas (TUM) helped with a first estimation of the community structures and was subsequently used for the implementation of the data and households. The communities reviewed the generated households including the individual mobility patterns in advance and judged whether they were relevant and reasonable.

Calculation of costs

The current costs for the synthetic households based on their individual trip chains and spatially referenced activities were calculated using the WoMo calculator of the MVV. The residential costs were also considered in the case of relocation.

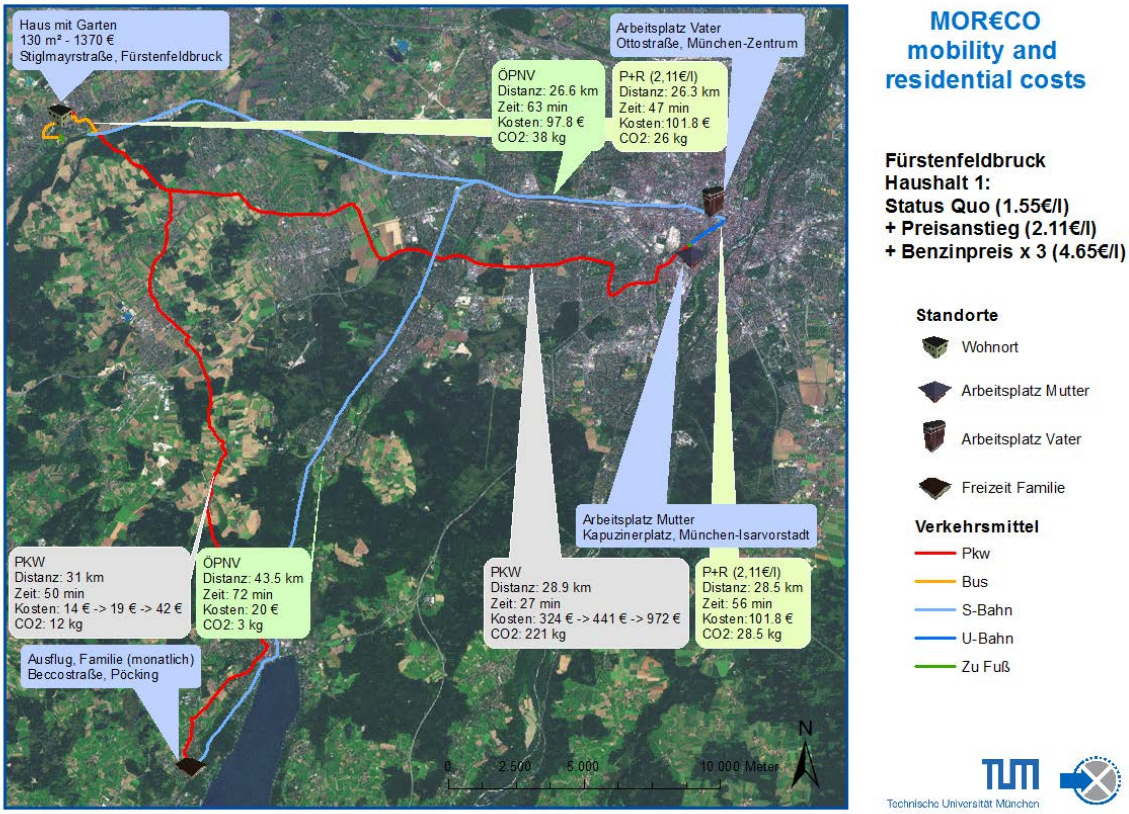
The future mobility costs were calculated using shock scenarios. Many studies predict a rise of the crude oil price to 200 $ per barrel, which would cause the prices at German gas stations to rise to 2,11 €/l. The jump from 1,55 €/l to 2,11 €/l is only a moderate shock. In order to avoid incorrect planning and wrong investments, drastic shock scenarios – assuming the gas price to triple – were implemented as well.

It can be assumed that the rise in gas prices will appear in leaps, which will have an immediate effect on the price consumers pay at the pump. However, since public transportation costs are based less on market forces and more on political forces, it is assumed that public transport costs will rise more moderately and allow people more time to adapt.

Implementation, visualization and GIS-based analysis by means of TUM Accessibility Atlas

As a first step, the individual mobility behavior and trip chains of the synthetic households were geo-referenced and visualized. This was done with the GIS-based accessibility atlas using real address data.

The MVV WoMo calculator was used to calculate the current costs for the respective trips individually. Price shocks were applied and their possible effects were outlined. In addition, all trips were attributed CO2 emissions and travel times. The accessibility atlas therefore administers the households and the precise addresses of the corresponding origin and destination relationships of the calculated activities (work and education, supply, leisure).



Final conclusions regarding individual mobility behavior

Although the price at the pump is going up, households can become less vulnerable to mobility price shocks by employing a number of different strategies:

Activities like working and shopping can be linked efficiently, while unnecessary trips can be avoided. Therefore intelligent location choices are required. However, this is not always possible, as some activity locations cannot be changed easily. Still, trip chains offer an enormous potential in saving time as well as money.

Choosing a different mode of transportation, when available, can save money and reduce a household's vulnerability to mobility price shocks. This requires attractive public transport services that are easily accessible. It is also possible to bring about a shift to non-motorized modes by implementing a dense and mixed settlement structure.

Daily private vehicle commutes can be made more sustainable through sharing a ride with other people. Car pooling is an effective strategy to save costs of commuting trips over driving alone and usually it enables faster travel times than public transport.

Park and Ride is another alternative, as it combines the advantages of two modes. It offers flexibility and comfort in sparsely settled regions without any PT services. At the same time congestion and time losses in densely populated urban centers can be avoided.

In some cases teleworking might be another possibility to save mobility costs.

In most cases, households are only able to change their mobility behavior if they are offered other options or alternatives. Recommendations to public stakeholders and decisions makers have to be based on detailed analyses on a regional level taking into account the development of future residential and mobility costs.

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