

# Summary of the Bachelor's Thesis: *Can Freiburg Feed Itself* by Dominique Bednarek

## Introduction

### *The playing field for sustainability*

Humanity strives for sustainable development, yet it is not clear what this should look like. A logical starting point for this consideration is to examine the fundamental system – where this development has to take place – and its boundaries. In a simplification this system is the globe in its totality – the Earth system, consisting of the subsystems “Human” and “its environment”. These subsystems have natural boundaries described through their specific properties.

The limits of the Earth System should not be trespassed in order to avoid a critical change of conditions, because humans are highly dependent on their environment<sup>1</sup>. Examples of these boundaries are biodiversity loss, interference with the nitrogen cycle or climate change (Rockström et al. 2009). Moreover a lot of natural resources are limited (Peak Oil being the most famous representative) (Korowicz, 2010).

However, the restrictions on humans are not less important, although they are often neglected:

- Limited physical and psychological ability to handle stress,
- Their basic needs
- And cognitive abilities (Hanke 2012).

Through the adaptation to their ecological niche, humans developed their very own combination of abilities. These are characterized by their mediocrity:

- Perception of small to intermediate dimensions (small velocities and forces, intermediate distances and times)
- Perception and comprehensibility of low complexity
- The manageable size of a social environment, where stable and emotional relations are still possible, is a group of about 150 persons (Hanke 2012).

Within this playing field for sustainability it is possible to approach feasible solutions for sustainable development – any paradigms that ignore this playing field can be questioned. Localization (or Regionalization) is well compatible with the human abilities: social, ecological and economical interdependencies come within the reach of the individual and are perceptible through spatial, temporal and emotional proximity. In addition, localization shows higher resilience through decentralized structures and consequently counteracts critical changes to the system.

### *The practical approach*

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<sup>1</sup> Actually the human species became meanwhile a driving factor for the change of the Earth System, as a result the actual age is also called Anthropocene (Crutzen 2002).

Agriculture is jointly responsible for environmental problems (e.g. methane emissions, land use change, impact on the nitrogen cycle and fresh water) and crucial for the survival of humans (J. A. Foley et al. 2006, p.570; IPCC 2007, p.36f.; MEA 2005, p.341ff.; WWDR 2012, p.45f.) As a practical approach localization of agriculture and urban gardening was therefore examined on the example of the Region Freiburg and the city itself. To what extent can the region supply the city with food?

**Methods**

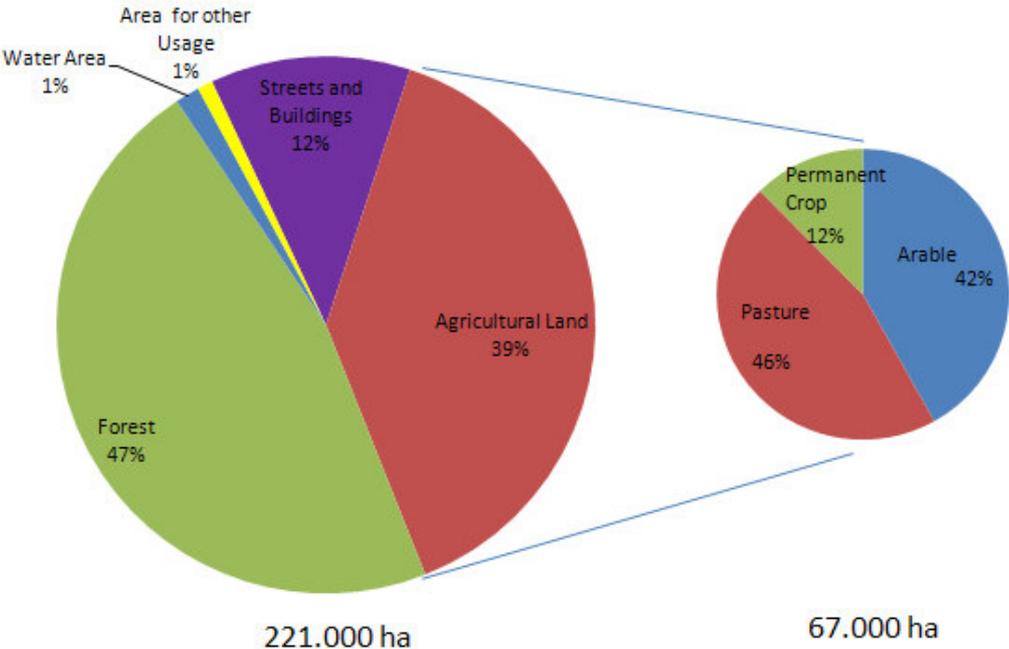
In a first step, the Region of Freiburg was defined. Then, on the basis of statistical data, the existing and potentially usable agricultural land was identified for this region. The results of this analysis were compared with the demand of agricultural land for the inhabitants with the current diet on one hand and with a diet recommended by nutritional science on the other hand (using data from Wakamiya 2010).

In a second step, potentially usable agricultural areas within the city of Freiburg were determined by analyzing geodata and field studies. These results were compared with the demand for land of the mentioned diets.

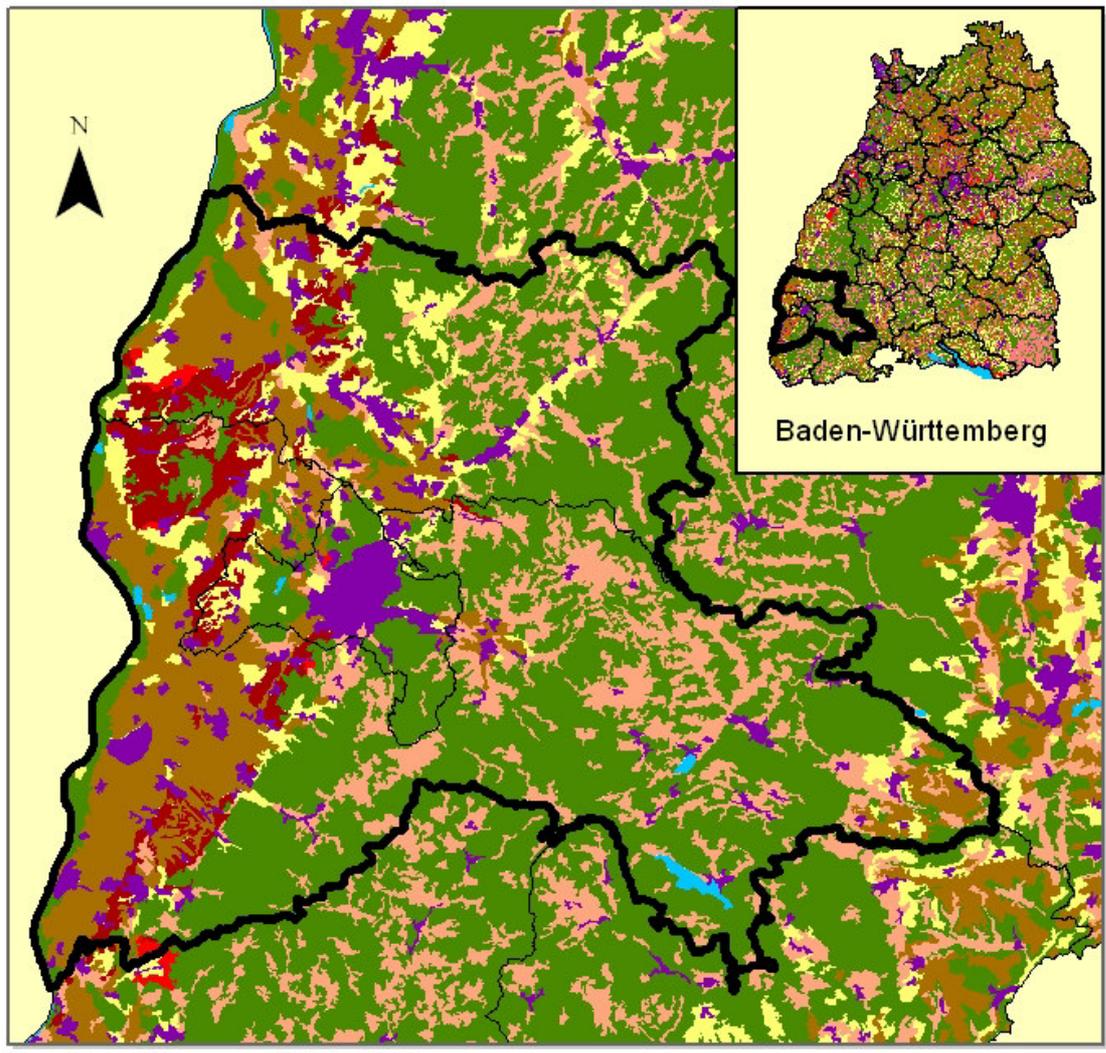
**Results**

*Areas in the Region of Freiburg*

The Region of Freiburg was defined as the three administrative districts Stadtkreis Freiburg, Landkreis Emmendingen and Landkreis Breisgau-Hochschwarzwald (see Fig. 2, small map). The total area of this region extends over about 221,000 ha, of which 39 % are agricultural land (see Fig. 1, left). The agricultural land itself consists of about 67,000 ha. It is used to 46 % as pasture, to 42 % as arable land and to 12 % as permanent crops (see Fig. 1).



**Fig. 1:** Land use according to the actual use (left) and land use of the agricultural land (right) both of the Region Freiburg in the year 2011 and with the actual size (StLABW 2011; StLABW 2012)



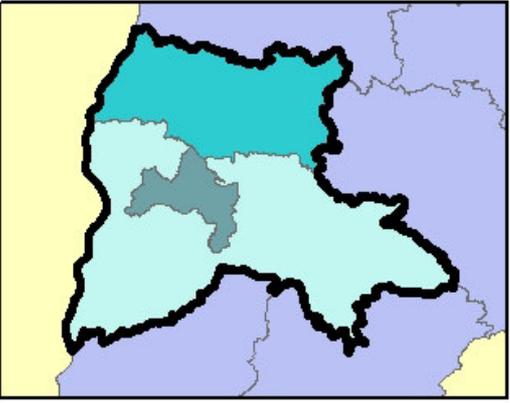
0 5 10 20 Kilometer

**Legend**

- Boarder Region
- District Boarder

**Usage**

- Arable Land
- Pasture
- Fruits and Berries
- Vineyards
- Area Other Usage
- Streets and Buildings
- Forest
- Water Area



**Districts**

- Lkr. Breisgau-Hochschwarzwald
- Lkr. Emmendingen
- Stkr. Freiburg im Breisgau

Quelle: Wasser- und Bodenatlas Baden-Württemberg

Fig. 2: Map of the Region Freiburg

Fig. 2 (big map) gives a spatial impression of how the different land use types are spread over the region. It shows that the different land use types are concentrated in certain areas: The pasture is mainly located in the mountainous region of the Black Forest, the arable land in the Rhine valley and the permanent crops at the Kaiserstuhl (former volcano in the Rhine valley) and the foothills of the Black Forest.

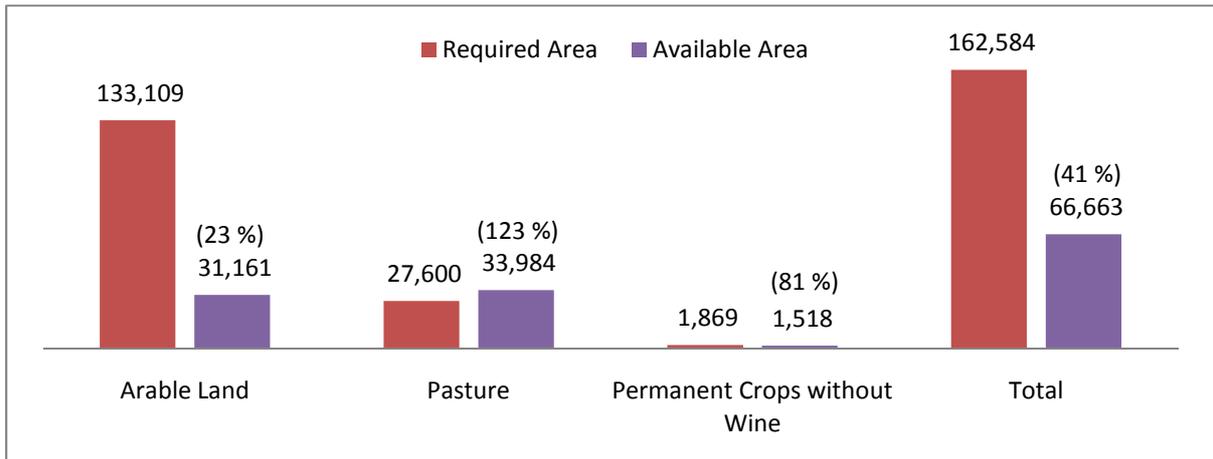
### Land requirements

Wakamiya determined the annual consumption amount of the average German and with this calculated the agricultural land needed by using organic agriculture (see Table 1). According to this data, the production of plant-based foods for the actual diet requires about 380 m<sup>2</sup> and the one of animal-based foods about 2,143 m<sup>2</sup>. If the people stick to a scientifically recommended nutrition the required area would drop by about 1,000 m<sup>2</sup> due to reduced animal-based products.

**Table 1** Agricultural area required for two different diets using organic agriculture [m<sup>2</sup>] (Wakamiya 2010)

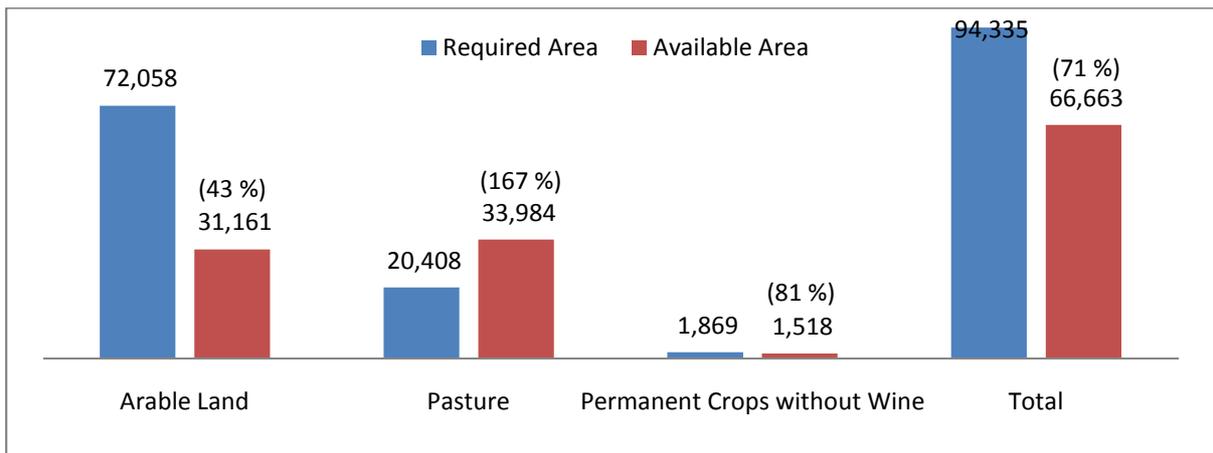
Food	Actual Diet	Scientifically recommended Diet
Cereals	295.0	297.7
Vegetables and Potatoes	51.5	51.5
Fruits	33.4	33.4
Pork	790.0	214.0
Beef	256.0	185.0
Chicken	189.0	49.1
Eggs	160.0	79.2
Milk Products	748.0	554.0
<b>Total</b>	<b>2,523.0</b>	<b>1,463.9</b>

Of the approximately 644,000 people that live in the Region Freiburg, about 230,000 are resident in the city of Freiburg. According to Wakamiya's numbers this amount of people requires an area of ca. 162,600 ha of agricultural land (see Fig. 3). Consequently 41 % of this required area is available in the region, although the numbers vary for the different types of land use. 23 % of the required arable land exists –the biggest lack in the agricultural land of the region is to be found here. There are 81 % of the required area for permanent crops and more than enough pasture.



**Fig. 3** With the scientifically recommended diet: Comparison of the area requirements for the food production of the Region Freiburg with the areas available in the region; in ha (calculated with data from Wakamiya 2010; StLABW 2011)

In the case of a conversion to a scientifically recommended diet the total area requirements would shrink to approximately 94,400 ha. This means that more than 70 % of the required land would be available within the region. This would increase the surplus of pasture up to 167 % and diminish the lack of arable land to 43 %<sup>2</sup>.

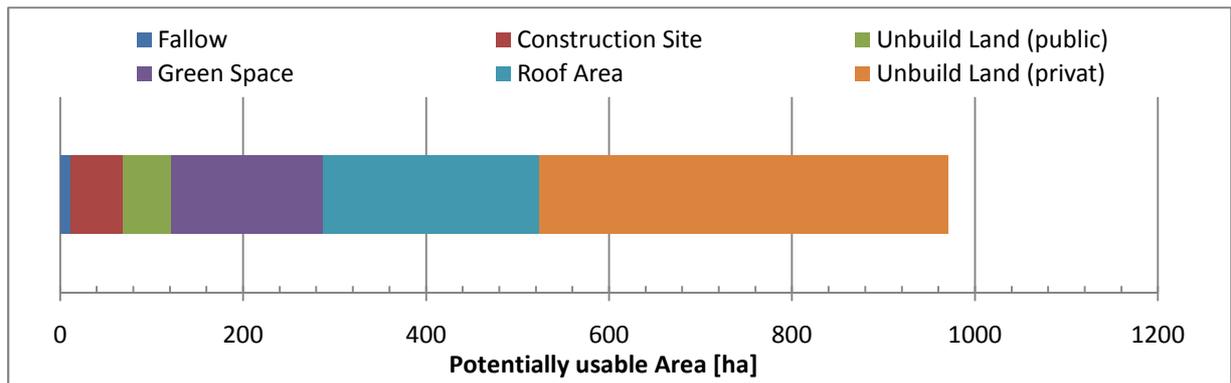


**Fig. 4** With the scientifically recommended diet: Comparison of the area requirements for the food production of the Region Freiburg with the areas available in the region; in ha (calculated with data from Wakamiya 2010; StLABW 2011)

### Urban Gardening

Like in every city, in Freiburg there is a lot of space which could be used for urban gardening. These areas are found in different types of use where they are temporarily or for indefinite time vacant (i.e. fallows, roof area, construction sites) or just partly used (i.e. unbuild land, green space). In total there are about 970 ha potentially available for urban gardening (see Fig. 5). This amount of usable space would increase the agricultural land in the region by 1.5 % - or you can say that it would be enough to supply half of the city's population with fresh vegetables, potatoes and fruits. Especially since most of those crops are highly perishable and the supply with fruits and vegetables shows one of the lowest self-sufficiency rates of foods in Germany, this would mean a significant improvement.

<sup>2</sup> In this study it was not investigated if the site conditions allowed a transformation from pasture to arable land.



**Fig. 5** Areas in the District of Freiburg that are potentially suitable for Urban Gardening, by type of use (own calculations)

## Conclusions

The study shows that a large portion of the foods consumed in the Region Freiburg could be produced regionally. There exists a possibility to raise this portion by changing the dietary habits. Within the City of Freiburg lie capacities for food production that are significant but still need further investigation. Not only could alimentation be improved but also ecological, social and economical potentials enhanced.

It is shown that the dependency on global markets could be reduced considerably. This would strengthen the regional economy, as the chain from production to consumption could be kept within the region. Another effect would be the reduction of the ecological impact of the food production due to shorter transport distances. Also, localization could facilitate changes to more sustainable practices. Finally, resilience could be increased through the small scale structure of the economy.

## Literature

- Crutzen, P.J., 2002. Geology of mankind. *Nature*, 415(6867), S.23. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/11780095>.
- Hanke, G., 2012. *Regionalisierung als Abkehr vom Fortschrittsdenken?* Albert-Ludwigs-Universität Freiburg i. Br.
- Foley, J. A., Defries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F. S., et al. (2006). Global Consequences of Land Use. *Science*, 309(5734), 570–574.
- IPCC. (2007). *Synthesis Report*. (R. K. Pachauri & A. Reisinger, Eds.) *Change* (Vol. 446, pp. 26–73). IPCC. doi:10.1256/004316502320517344
- Korowicz, D. (2010). *Tipping Point Near-Term Systemic Implications of a Peak in Global Oil Production An Outline Review*. Dublin.
- MEA. (2005). *Millenium Ecosystem Assessment Volume 1: Current State and Trends*. Washington.
- StLABW. (2011). *Bodennutzung in den Stadt- und Landkreisen Baden-Württembergs 2010* (Vol. 10, pp. 1–19). Stuttgart.

StLABW. (2012). *Flächenerhebung nach Art der tatsächlichen Nutzung 2011* (pp. 1–7). Stuttgart.

Wakamiya, A. (2010). *Flächenbedarf für den Nahrungsmittelkonsum in Deutschland. The Land* (Vol. 4 Winter 2, pp. 1–29).

WWDR. (2012). *The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk* (Vol. 1). Paris.