

## INTRODUCTION

New sanitation concepts offer solutions to different but interconnected problems of today's and tomorrow's world. Providing save water, while not wasting or polluting water resources, and providing sustainable nutrition, especially in highly dense populated areas, by nutrient redirection to agricultural areas.

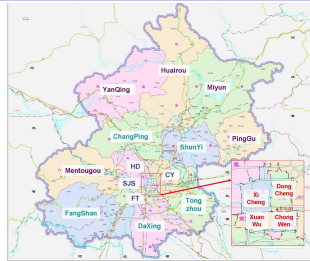


Figure 1: Map of region of Beijing, modified from [BJGHW, 2007]

In the presented work the agricultural demand for products from new sanitation concepts is evaluated for the region of Beijing, China, as well as the required transport for distribution, based on data from population statistics, agriculture and water infrastructure.

## Distribution of nutrient demand & potential of products from new sanitation concepts

Quantities of nutrients from potential new sanitation concepts are nearly balanced with the nutrient demand in Beijing's agriculture. However the locations of potential and demand are diverse.

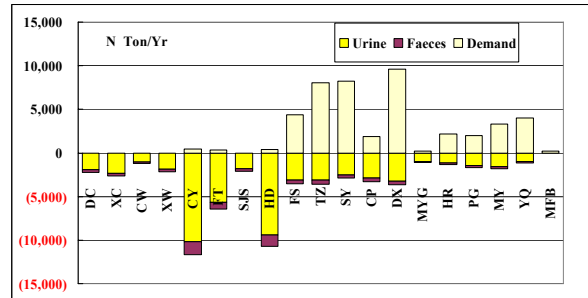


Figure 4: Nitrogen demand in agriculture and potential of nitrogen contained in urine and faeces

## Agriculture in Beijing

The total area of Beijing is about 16.4 thousand km<sup>2</sup>. While the importance of agriculture has decreased in the last years, due to the development of the urban city of Beijing, in 2006 still 67% of the total land of Beijing was used for farming in general (11,000 km<sup>2</sup>), 2,320 km<sup>2</sup> of that was arable land (21%).

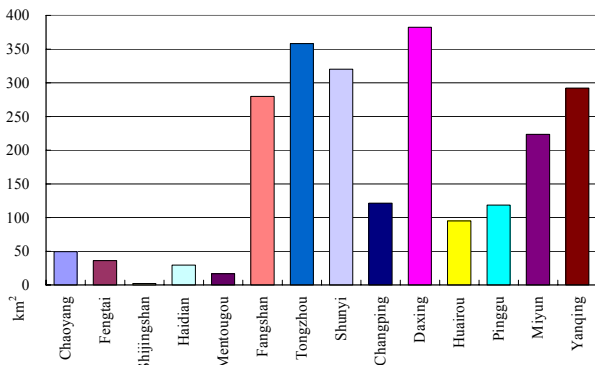


Figure 2: Distribution of arable land in Beijing, 2006 [Beijing statistic year book 2007]

The nutrient demand in agriculture is depending on the types of crops planted.

For this study more than 20 types were evaluated. Grain, vegetables, and forage were the most relevant ones.

2003/2004	Grain	Vegetables	...	N	P	K
Chaoyang	2.798	92.922		455	105	362
Fengtai	1.815	52.044		323	82	268
...						
Fangshan	89.845	265.083		4.353	1.537	4.494
Tongzhou	133.016	896.691		8.066	2.545	7.788
Shunyi	92.229	1.122.617		8.234	2.341	7.391
Daxing	122.795	1.310.324		9.572	2.692	8.459
...						
<b>Total</b>	<b>641.033</b>	<b>5.082.471</b>		<b>45.120</b>	<b>13.664</b>	<b>41.935</b>

Table 1: Distribution of crop yield & nutrient consumption [t/yr]

## Potential of products from new sanitation systems

The nutrient potential of source separated wastewater streams is presented in Table 2 for the whole Beijing Area.

Losses were incorporated at a later point of this study.

[mil kg/yr]	Urine	Faeces	Total	Agriculture Demand
N	55	8	63	45
P	6	3	9	14
K	21	8	28	42

Table 2: Nutrient potential from EcoSan products in Beijing [mil kg/yr]

Average Annual Fertilizer consumption (2000-2005):  
N: 80 mil kg  
P: 12 mil kg

## Transport for distribution of products from new sanitation concepts

Assuming that nutrients from urine could be recovered by new sanitation concepts in whole Beijing area, about 84 % of the total Nitrogen demand in agriculture could be covered.

Losses during treatment and transport were considered.

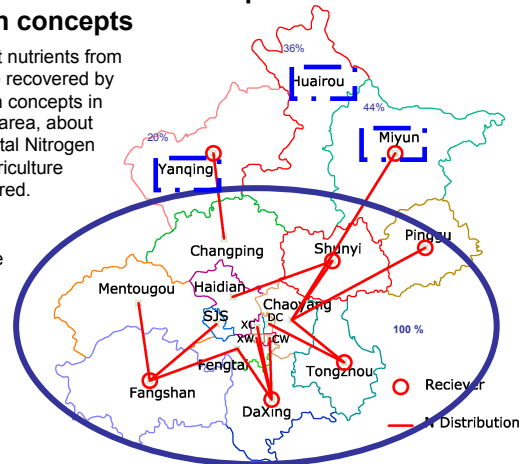


Figure 5: Distribution model for fertilizing products from new sanitation concepts in respect to nitrogen

## Summary

Models for different treatment, transport, and distribution systems were set up. In case of nutrient recovery by steam stripping and MAP precipitation from source separated urine about 84% N and 64% P of the demand in agriculture could be covered.

Considering energy demand for nutrient elimination in convention treatment plants and for fertilizer production about 57% of energy could be saved compared to the conventional system.

The energy for a truck based transport of the fertilizing products were less than 5% of total energy consumption of treatment & distribution within the new sanitation concepts.

For more details, please contact the authors.

## ACKNOWLEDGEMENT

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