The impact of water-related pollution on food systems in transition: the case of northern Vietnam

Vincent Linderhof (WUR), Vasco Diogo (WUR/Swiss Federal Institute for Forest, Snow and Landscape Research WSL), and Marieke Meeske (WUR/Oxfam Novib), Anne Sonneveld (WUR)

Background

In Vietnam, production choices on crop cultivation, fertilizer, pesticide and water use affect the landscape as well as the availability and safety of food. For instance, earlier studies in Vietnam showed that pesticides end up in surface water, which is used for drinking water, crop irrigation and in fish tanks. In addition, choices on fertilizer and pesticide use affect crop production. In particular, quality of food crops might be affected due to high levels of residues in food commodities. In this study, we consider two main pathways of exposure to toxic chemicals through i) food commodities (e.g. irrigated crops, fish and seafood) and ii) use of polluted surface water. Since polluted surface water data is unavailable, we use spatial proxies. Hence, we explore the interactions between food production and landscape on food consumption.

Objective

How do landscape elements, reflecting environmental pressures affecting affect food consumption choice. This is the first step towards relating the environmental pressures from production and landscape to consumer food choices. If the results are positive and significant, there is an urgency to look at the relationship in more detail.
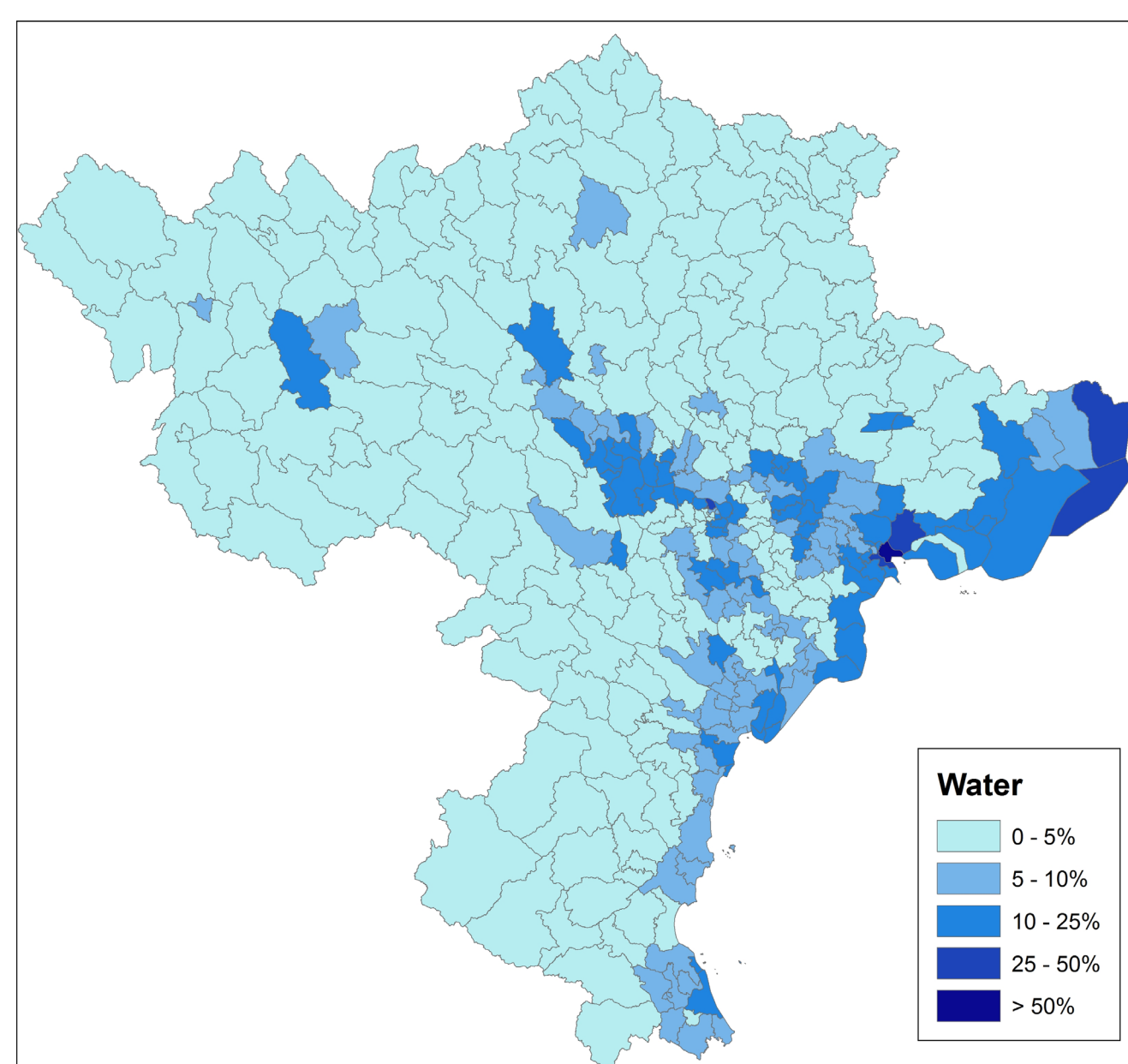
Approach and data

Figure 1. Share of surface water (%) in area of the district in northern Vietnam
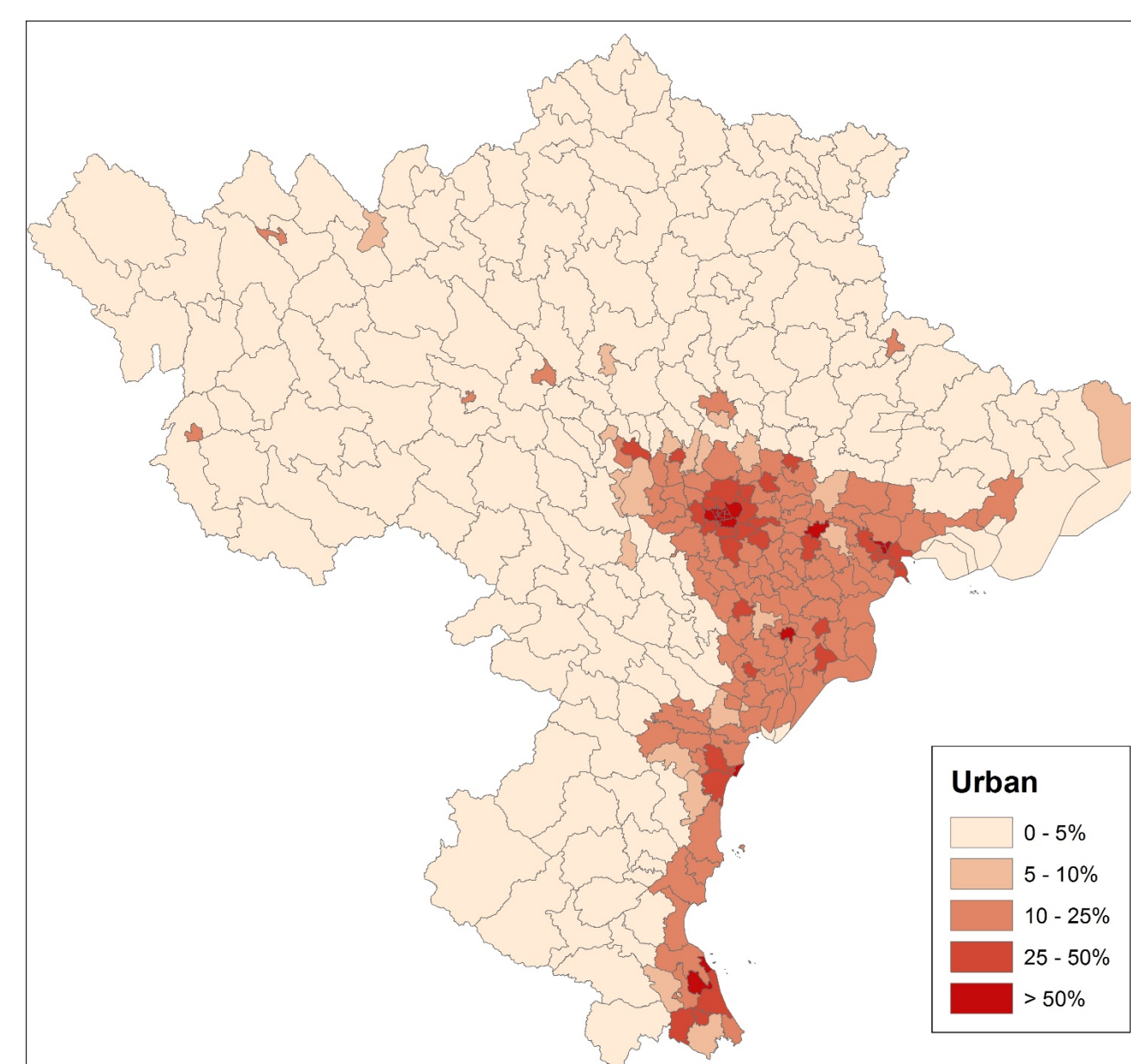

Figure 2. Share of urban areas (%) in total area of the district in northern Vietnam

We regressed the share of food groups in the consumption values on household characteristics, as well as spatial features of the locations where these households reside. The food groups are: cereals (including rice), fruit and vegetables, meat, fish and seafood, eggs and milk, and food away from home. With a sample from the Vietnam Household Living Standard Survey (VHLSS) for 2014, we analyzed the diets for different groups of consumers.

Spatial indicators at district level were computed using the High-Resolution Land Use and Land Cover Map of the Northern Region of Vietnam from the Japan Aerospace Exploration Agency (JAXA). The share of surface water reflects the environmental pressure of water contamination, and the share of urban areas reflects the potential additional pressures of point sources from industrial activities.

Results

Figure 3 shows a high share of cereals in consumer value (middle bar) which reflects more than 50% of the caloric intake (left bar). Fruits & vegetables have a minor share. Both cereals (particularly rice) and fruits and vegetables are often irrigated and thus prone to contamination.
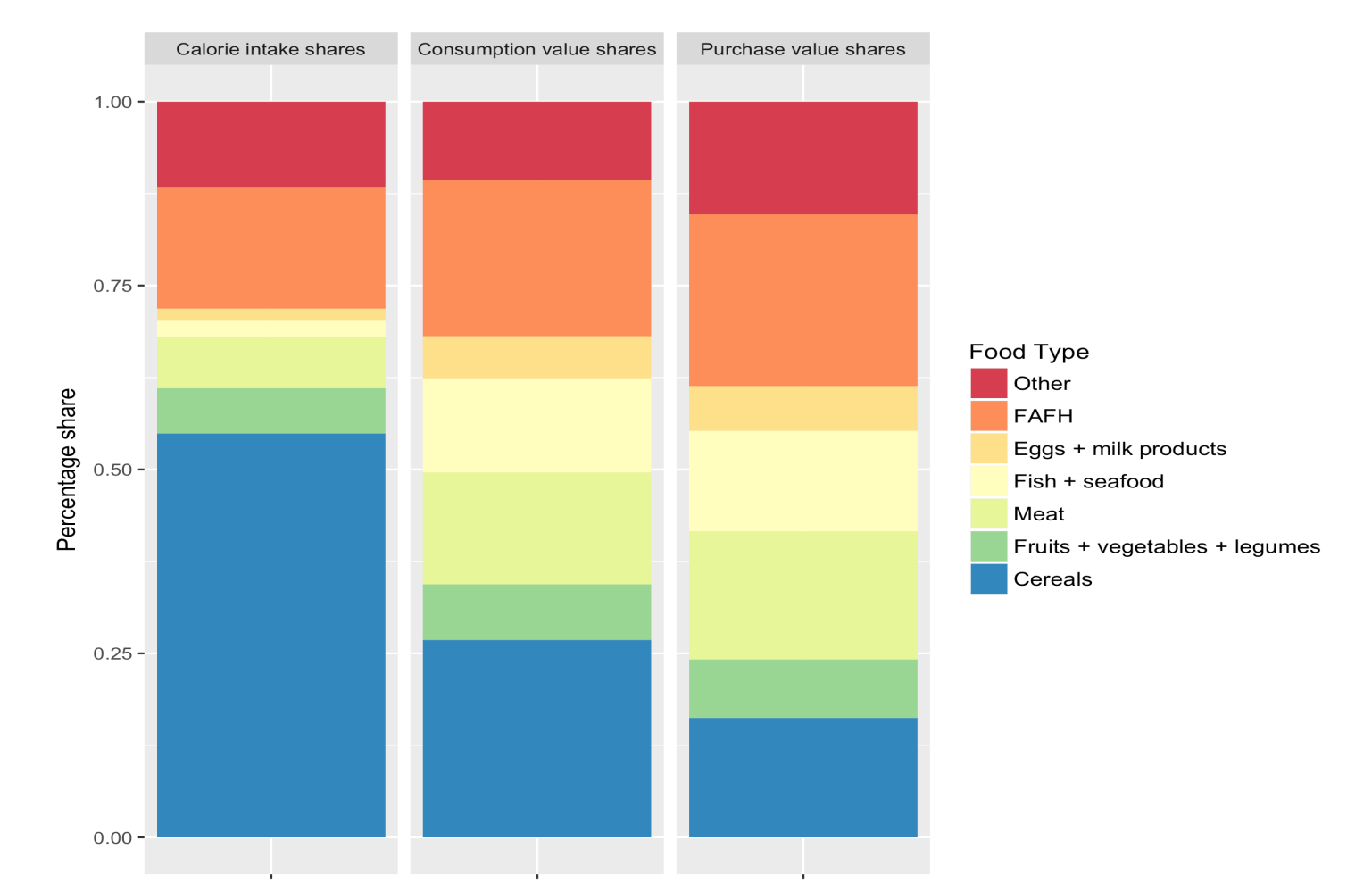

Figure 3. Share of food groups (%) in caloric intake , food consumption value, and food expenditures

The share of surface water is highest around Hanoi, the Red River Delta upstream of Hanoi, the city of Hanoi and the coastal area, see Figure 1. Urban areas are located in Hanoi city and surrounding areas and in the coastal area at the south of Hanoi, see Figure 2.

Table 1. Selection of SURE regression results for share of consumption value (%) per food group (significant coefficients at 0-5% level in bold)

	Cereals	Fruit& Vegetables	Meat	Fish	Eggs& Milk	Food away from home
Share of urban area (%)	**-0.1218**	**0.0212**	**-0.0667**	**0.0258**	0.0083	**0.1638**
Share of surface water (%)	-0.0572	-0.0106	**-0.0636**	**0.1144**	0.0128	-0.0125
Income Q2	**-0.0500**	-0.0012	**0.0216**	0.0029	0.0030	**0.0267**
Income Q3	**-0.1041**	-0.0077	**0.0280**	-0.0004	**0.0118**	**0.0800**
Income Q4	**-0.1360**	-0.0111	**0.0283**	-0.0018	**0.0132**	**0.1136**

Other control variables included household characteristics, type of tap water use, season dummies, and district dummies

Households in higher income quartiles had lower shares of cereals and fruit & vegetables, higher shares of meat and animal products, and higher share of food-away-from-home (FAFH), see Table 1. In districts with higher shares of surface water, households had a higher share of fish consumption and a lower share of meat consumption. From an environmental and health perspective, households in water-rich areas thus may have a higher probability of being exposed to toxic chemicals due to higher fish consumption. In districts with higher shares of urban areas, which are located in the coastal area and Red River delta, the share of meat was lower, and the share of fish higher. The share of fruit & vegetables was higher.

Conclusions

Based on the regressions results, we have indicated how pollution through the use of landscape characteristics as proxies might affect consumers through their consumption pattern. Households in urban areas have higher shares of fruit & vegetables consumption, which are often irrigated and more prone to industrial pollution. Household in water-rich areas are less affected by pollution through meat but more through fish consumption. The actual impact is more complex and should be analysed in more detail with more sophisticated data (water quality maps for multiple pollution indicators) and methods.