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Environmental Analyses to Inform Transitions to Sustainable Diets in Developing Countries: a Component of the EATS Project

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Abstract
Sustainable diets are an environmental, economic and public health imperative, but identifying clear intervention points is challenging. The Entry points to Advance Transitions towards Sustainable diets (EATS) project seeks to re-package existing data, combined with an interview-informed awareness of current national and sub-national policy processes, to inform food system-level decision making. Here we view historic trends in food supply in Vietnam and Kenya as a proxy for national average diets, and consider them in terms of the greenhouse gas emissions and cumulative energy demand associated with producing that food. Economic prosperity in Vietnam in recent decades has led to increases in meat consumption and, in turn, amplified increases in diet level environmental impacts. Mild levels of beef consumption in Vietnam have now overcome the most popular meat, pork, as the dominant source of greenhouse gas emissions. Meanwhile, historically consistent levels of dairy and beef in Kenya dominate diet-level environmental impacts. This preliminary work will be integrated into later stages of the EATS project to promote systemic approaches to sustainable development.

Keywords: *decision making, Vietnam, Kenya, SDG, GHGE, diet*

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1. Introduction

Human diets are among the principal drivers of both human health and environmental change. There is an urgent environmental, economic, and public health imperative to reshape human diets to safeguard human health, mitigate climate change, and sustainably use the planet's natural resources, goals that are integral to the concept of "sustainable diets". Despite a growing number of ecologically-oriented dietary guidelines and initiatives, a major barrier is defining clear intervention points that will provide a net-positive systemic influence across sectors (Mason and Lang, 2017). This challenge is exemplified by the ambiguous objectives and lack of clear policy guidance among the numerous diet-related Sustainable Development Goals. Further, data informative to decision makers are commonly accessible only in disparate sources, limiting their effectiveness. Moreover, the segregation of data collection, analysis and related decision making within sectoral silos often prevents dissemination and application of information across sectors (Abson et al., 2017; MacRae et al., 2012) . The Entry points to Advance Transitions towards Sustainable diets (EATS) Project aims to address these challenges by considering the research question: how can existing data be leveraged to effectively shift multiple axes of food systems toward enhancing the sustainability of diets? Focusing on two case study countries – Vietnam and Kenya – the EATS project aims to: 1) identify and aggregate existing relevant data; 2) conduct interviews with national and sub-national stakeholders to better understand the policy process; 3) perform analyses with aggregated data to generate unique information packages aimed at informing decision-making related to sustainable diets; and 4) re-engage with stakeholders to solicit feedback on information packages. This paper focuses on analyses aimed at providing the often-overlooked perspective of how consumer food choices – diet – affect environmental impact from food production. These analyses are contextualized with insights from other aspects of the EATS project.

2. Material and methods

Food Balance Sheet (FBS) data from FAOSTAT, composed of 72 food commodities, were used as proxy for national average diets in Vietnam and Kenya (FAO, 2018). To smooth inter-annual variability, data from 3 consecutive years were averaged to provide decadal time steps (1963-2013). These were then combined with a data set of greenhouse gas emissions (GHGE) and cumulative energy demand (CED) associated with production of food commodities,

which was collected and aggregated from life cycle assessment (LCA) literature as described in (Heller et al., 2018). These LCA data comprise case studies from diverse geographies, predominantly Europe and North America. As such, they do not explicitly represent the production practices in Vietnam and Kenya, but in the absence of specific data, they serve as a proxy to provide coarse guidance on diet-level impacts. As a check on the influence of this data choice, region-specific emission factors from (Porter et al., 2016) were used. These regionally-specific emission factors are drawn from extremely limited cases from the literature and are far more granular in food commodity specificity.

3. Results

3.1. Diet-level environmental impacts for Vietnam

Figure 1a shows the changes in food supply – used here as a proxy for national average diets – over the six decades from 1963 – 2013. On a mass basis, cereals and grains (primarily rice) and vegetables dominate the Vietnamese food supply, with an increasing supply of meats in the most recent three decades. Fish and seafood is the stand-out contributor to CED (Figure 1b). Energy usage in fish harvest or farming is highly variable and depends on specific fisheries, seasons, production methods, etc., and the generic values used here may be misrepresenting the Vietnamese case. The growing trend in meat supply is amplified in terms of GHGE from food production (Figure 1c), warranting detailed exploration.

Figure 2 shows the trends in Vietnamese meat supply from 1963-2013. Pig meat is clearly the most popular choice and supply has increased steadily since the 1970s. More recent increases in poultry and bovine meat (beef) are notable. While still 4.6 times smaller than the pig meat supply, the nearly 200% increase in beef supply from 2003 to 2013 has led to beef becoming the greatest contributor to GHGE from meat in the Vietnamese diet, and second only to rice in the overall diet. This emphasizes the effect that otherwise unremarkable changes in diet can have on food system environmental impacts such as GHGE.

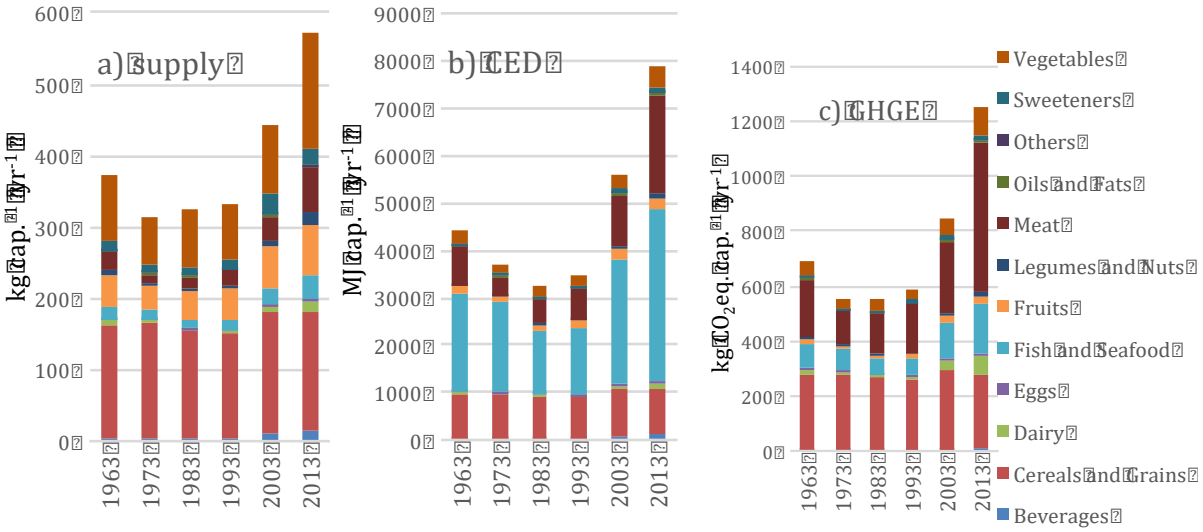

Figure 1. Decadal trend in annual per capita food supply for Vietnam (a) and associated environmental impacts: (b) non-renewable cumulative energy demand (CED), and (c) greenhouse gas emissions (GHGE).

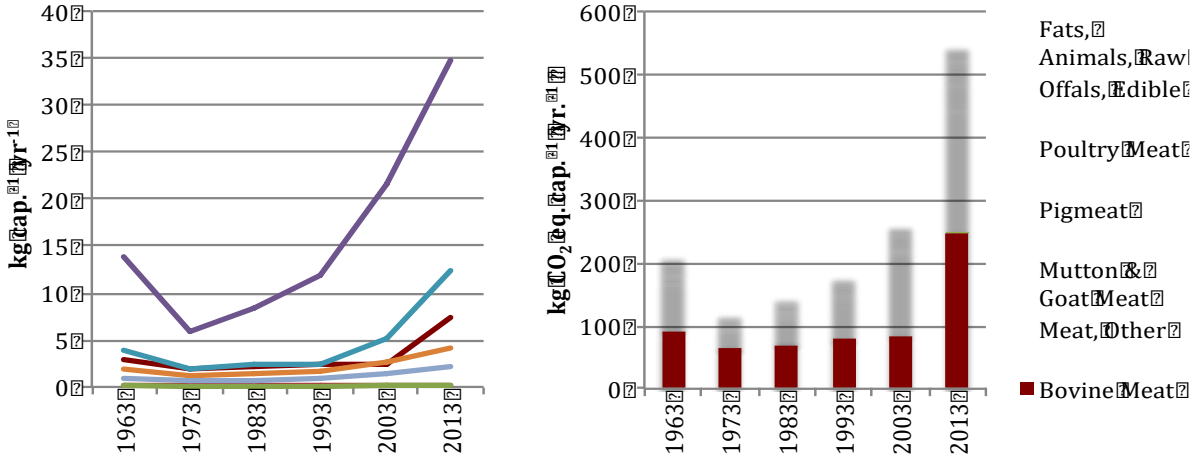

Figure 2. Trends in meat supply in Vietnam, alongside associated greenhouse gas emissions. While pig meat is dominant, small increases in bovine meat in the most recent decade outpace pig in terms of associated greenhouse gas emissions.

3.2. Diet-level environmental impacts for Kenya

Kenya offers an interesting contrast to the trends seen in Vietnam. While supply of dairy foods show a consistent increase in Kenya from 1963-2013 and vegetables increase notably since the 1990s, overall trends in the Kenyan food supply are not qualitatively apparent (Figure 3a).

Bovine meat dominates total meat supply, but both bovine and total meat supply show a slight decreasing trend. Ruminant animal-based foods (dairy and bovine meat) are consistently the largest contributions to both CED and GHGE, with dairy growing slightly and bovine meat declining slightly in fraction of total diet contribution over the six-decade span.

4. Discussion

The trends seen in the Vietnamese diet are consistent with economic development measures. Vietnam has experienced significant increases in both GDP and incomes per capita since the early 1990s (The World Bank, 2018; USDA Foreign Agricultural Service, 2017). On the other hand, Kenya's economic growth in recent decades has been more modest. The methods and results presented here may offer a fresh perspective in sustainable development policy deliberations. While FAO Food Balance Sheet data is known to inaccurately represent dietary intake thus presenting challenges for assessing nutritional adequacy (Del Gobbo et al., 2015), in cases where detailed diet intake data is unavailable, it may provide sufficient information to guide food system sustainability policy. Regionally appropriate data on the environmental impact of food production is a research priority. However, assessments using region-specific emission factors from Porter et al (2016) showed 14-22% *increases* in the absolute value of per capita GHGE but no observable changes in the trends discussed here.

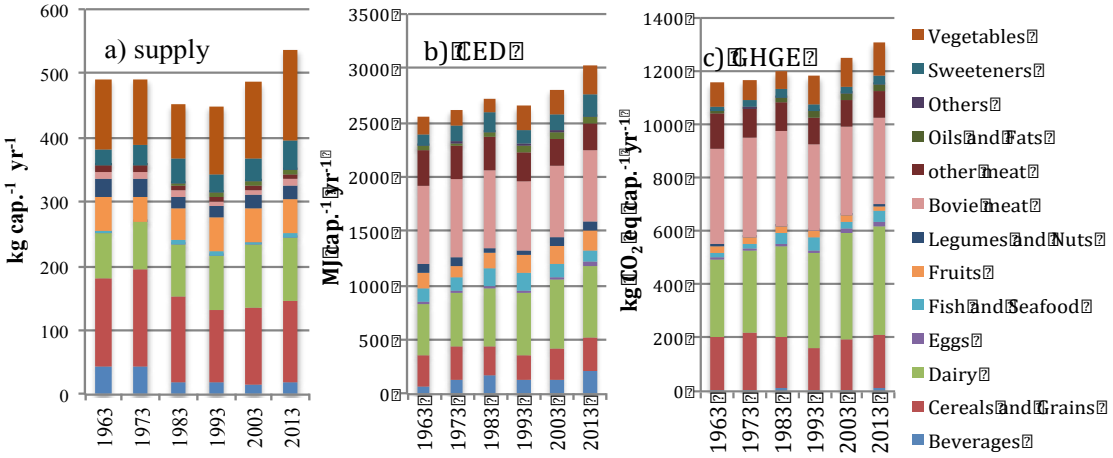

Figure 3. Decadal trend in annual per capita food supply for Kenya (a) and associated environmental impacts: (b) non-renewable cumulative energy demand (CED), and (c) greenhouse gas emissions (GHGE).

In future work, additional environmental impact indicators such as water and land use will be considered. In addition, the transformative role of refrigeration in dietary transitions will be explored from an environmental impact lens (Heard and Miller, 2016). Analyses of stakeholder interviews aim to better understand how they view food systems problems, what evidence they currently draw on, and what the perceived evidence needs are.

This preliminary work explores the potential for identifying important trends in diet-level environmental impact and will be integrated into later stages of the EATS project to promote systemic approaches to sustainable development.

5. Acknowledgement

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