EUROPEAN IMMIGRATION FOOD INSECURITY:

Lessons from Localized Food System Pathway Modeling and Agroforestry

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Introduction

- More than 1M migrants & refugees entered Europe in 2015 and hundreds of thousands more immigrated within Europe (16).
- Rapid urbanization creates potential for "Food Deserts:" *poor access to healthy and affordable food which may contribute to social and spatial disparities in diet and diet-related health outcomes* (17); likely in low-income, predominately minority areas (18).
- To create a framework for identifying and treating food desserts in the European migration context we combined tools used in:
  - GIS Food System Pathways (FSP) mapping
  - Agroforestry adoption institutional analysis
- GIS is now being applied to model food insecurity in developing regions (19).
- Agroforestry has developed measures of sustainability for components of agroforestry systems but these cannot be realized without some level of adoption; a primarily sociological decision shaped by Institutional Environment (Fig. 1), the survey-based measurement of which can be used as a proxy for sustainability potential (Table>>>)
- Combined this information can guide limited funding to areas with both greatest need and potential for success (20).

Objectives

- Prioritize targets of rural sustainability and peri-urban production efforts
- Strengthen logistical connections between these areas and urban centers
- Examine further relief through homegardens*

Materials & Methods

HYPOTHETICAL STUDY AREA

- Nairobi's pop. grew 260% from 1980 – 2010; representative of immigration issue (*21*)
- Nairobi has near largest percentage of high-net-worth individuals in Africa (*22*), while 60% reside in slums (18); this disparity creates food deserts

METHODS – FSP Mapping

- Use available GIS map for land-use, roads, transportation, and building density (*23*) (Fig. 2A)
- Develop new layers for segments of local food system (Fig. 2B) to predict insecurity hotspots
- Collect new FSP data for layers using primary sources (e.g. direct observation via GPS) or secondary sources (e.g. remote sensing, aerial photography) *(24)* (Fig 2C)
- Import data into GIS system as a GPS eXchange Format file, auto-transform into a shapefile layer using ArcGIS explorer tool
- Create x,y map coordinates for features and associated attribute tables to graphically map evidence of location-specific food insecurity

METHODS – Sustainability Prioritization

- A sense of potential for sustainability can be gained by surmising primary factors identified through agroforestry adoption studies (Table).
- Survey of the policy, cultural, and socioeconomic elements (institutional environment) provide understanding of how drivers of sustainable agriculture are perceived by a community.
- Results can be calibrated against biophysical-sustainability measurements to refine the process and produce acceptable parameters.

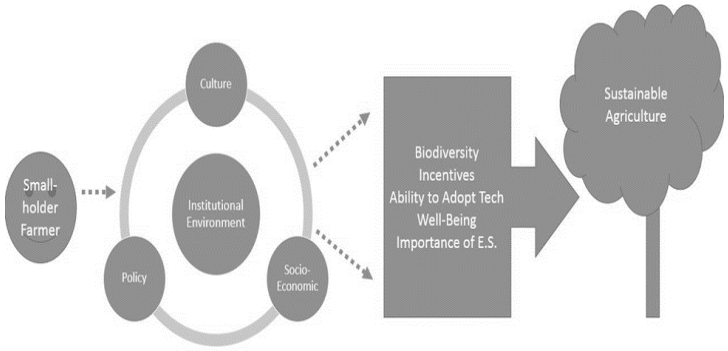


Figure 1. Schematic presentation of how institutional environment affects smallholder farmer perceptions. Institutional environment, which is the nexus of policy, culture, and socio-economic conditions, affects farmers' perception (dotted arrows) of factors influencing adoption of sustainable agriculture (solid arrow) such as financial ability and incentives, benefits of biodiversity and ecosystem services, and their relationships to well-being (20).

Inst. Env.	Parameter	Influence on sustainability	Measure/applicable	R¶
Policy	Subsidies	Technology dependent, can be positive or negative	Typically not represented by stated policies but by perceptions (good b/c disconnect is common). Often quantified on a Likert scale using ordinal measures.	11
	Property rights	Direct positive relationship		1
	Markets	Policies increasing access create demand upturn		3
	Infrastructure	Schools, medical, roads, etc., increase adoption		2
	Extension	Teaching and supporting tech use has positive effect		9
	Tech available	Direct positive relationship		5
	Awareness	Direct positive relationship		2
Socio-economic factors	Access	Type of input can have positive/negative effect	Typically concrete, i.e., not perception. Often quantified through continuous measures denotable in intervals. This is good b/c it can highlight differences in population outcomes.	13
	Property size	Often tied to soil quality; positive relationship		13
	Land tenure	Direct positive relationship		7
	Income/wealth	Direction of relationship dependent on other factors		15
	Education	Mixed; predominately positive esp. w/ awareness		7
	Age	Inverse relationship		11
	Status	Mixes w/ factors like subsidy creating positive effect		2
Culture	Wealth meaning	If necessities met, value of gain often still positive	No "typical" method. Abstract so difficult to quantify but has real effects. Responses can be through ordinal or interval measurement, making comparison across studies difficult.	6
	Household roles	Stronger correlation with female household heads		12
	Communication	Direct positive relationship		8
	Marital residency	If manager / owner same influence is positive		12
	Family size	Often measure of available labor, positive relation		4
	Risk tolerance	Direct positive relationship		10
	Norm plasticity	Depends on other factors (e.g., policy)		14

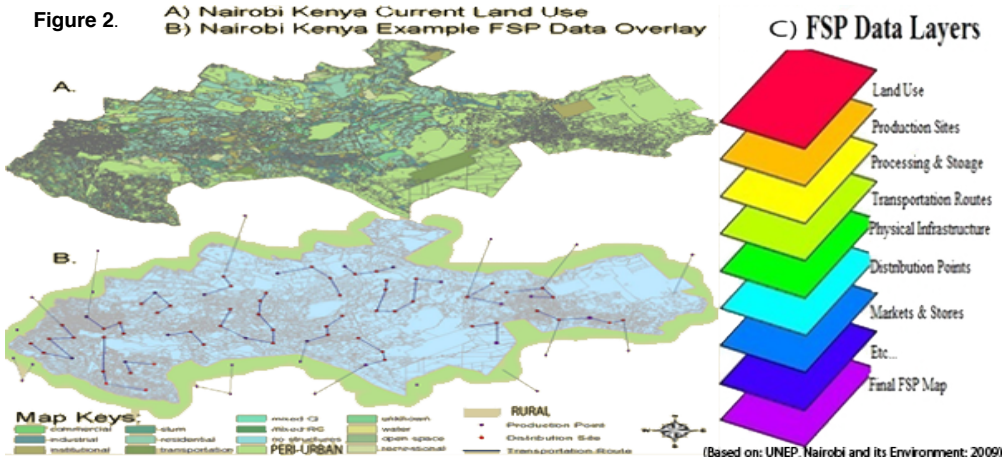
Sustainability Potential

- Target optimal FSP locations for enactment of urban/peri-urban agroforestry efforts (i.e. food desserts with high agroforestry adoption potential)
- Target Homegarden initiatives in FSP distant locations to optimize efficient resource use >
- Allows determination of actual (vs. theoretical) FSP impediments for long-term planning
- Allows for alleviation of demand on overburdened rural producers
- Increases nutrient variety and availability for urban residents
- Provides supplemental income potential
- Adds value of ecosystem services (e.g. water and air purification, microclimate amelioration, and biodiversity promotion)
- Provides a natural platform for monitoring and evaluating programmatic success

*Homegardens

Integrated tree – crop – animal production systems, often in small parcels of land surrounding homesteads, especially in highly populated areas dominated with smallholder farming systems. These systems evolved over time under the influence of resource constraints including population pressure and consequent reduction in available land and capital. Hailed as the epitome of sustainability, these integrated systems have the potential to mitigate environmental problems while providing economic gains, as well as food and nutritional security to owners. Food production is the primary function of homegardens; shade-tolerant food crops that can be grown with relatively less care and attention are the dominant species (25).

Figure 2.



Expectation: Model framework provides a timely inquiry into problem of urban food insecurity applicable to various urbanization scenarios.

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