Agricultural Systems 154 (2017) 133–144

Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

Homegardens and the future of food and nutrition security in southwest Uganda

Cory W. Whitney[a,b,c,*], John R.S. Tabuti[d], Oliver Hensel[e], Ching-Hua Yeh[f], Jens Gebauer[a], Eike Luedeling[b,c]

[a] Faculty of Life Sciences, Rhine-Waal University of Applied Sciences, Marie-Curie-Straße 1, Kleve 47533, Germany
[b] World Agroforestry Center (ICRAF), United Nations Avenue, Gigiri, Nairobi, Kenya
[c] Center for Development Research (ZEF), University of Bonn, Walter-Flex-Straße 3, Bonn 53113, Germany
[d] Makerere University, College of Agricultural and Environmental Sciences, P.O. Box 7062, Kampala, Uganda
[e] Department of Agricultural Engineering, Faculty of Organic Agricultural Sciences, University of Kassel, Nordbahnhofstr. 1a, Witzenhausen 37213, Germany
[f] Department of Agricultural and Food Market Research, University of Bonn, Nussallee 21, Building 2, Bonn 53115, Germany

ARTICLE INFO

Keywords:
Monte Carlo
Decision support
Probabilistic simulations
Cropping systems
Uncertainty
EVPI

ABSTRACT

Governments around the world seek to create programs that will support sustainable agriculture and achieve food security, yet they are faced with uncertainty, system complexity and data scarcity when making such choices. We propose decision modeling as an innovative approach to help meet these challenges and offer a case study to show the effectiveness of the tool. We use decision analysis tools to model the possible nutrition-related outcomes of the Ugandan government's long term agricultural development plan termed 'Vision 2040'. The analysis indicates potential shifts in household nutritional contributions through the comparison of the current small-scale diverse systems and the envisioned industrial agricultural systems that may replace them. A Monte Carlo simulation revealed that Vision 2040 plans outperform homegardens in terms of energy and some macronutrients, yet homegardens are likely to be better at producing key vitamins and micronutrients, such as Vitamin A. Value of information calculations applied to Monte Carlo outputs further revealed that gathering more data on the annual yields and nutrient contents of staples, pulses, vegetables, and fruits could improve certainty about the nutrition contribution of both scenarios. We conclude that the development of Uganda's agricultural sector should consider the role that agrobiodiversity in the current small-scale agricultural systems plays in national food and nutrition security. Any changes according to Vision 2040 should also include farmers' voices and current crop management systems as guides for a sustainable food supply in the region. This modeling approach may be a tool for governments to consider agricultural policy implications, especially given the data scarcity and agricultural variability in regions such as East Africa.

1. Introduction

1.1. Political decision making

When deciding about the design of programs that will best meet their goals, governments are faced with a lot of uncertainty; they often have little exact knowledge to guide their decisions. As a consequence of this complexity, political decisions are rarely perfect (Beratan, 2007). Instead, they are often different from, and commonly in direct opposition to, what was expected or desired (Max-Neef, 1992; Shepherd et al., 2015) particularly regarding agricultural systems (Luedeling and Shepherd, 2016).

Development decisions should consider impacts on the wider natural and social environment (Luedeling et al., 2015), yet these are often not taken into account. Instead, political decisions are frequently based almost entirely on perceived technical and economic feasibility. Decision-makers often lack the tools necessary for integrating information into a forecast about possible outcomes (Peterman and Anderson, 1999), particularly given the uncertainty about many of the variables that should be considered (Luedeling et al., 2015). This often proves consequential, because failure to assess the effects of important factors could jeopardize the intended impacts, with the risk that outcomes will not meet stakeholder expectations (Luedeling et al., 2015; Rosenstock et al., 2014). This is particularly problematic given the complexity and strong social aspects of agricultural systems (Luedeling and Shepherd, 2016; Rivera-Ferre et al., 2013) and given the data-scarcity of environ-

* Corresponding author at: Center for Development Research (ZEF), University of Bonn, Walter-Flex-Straße 3, Bonn 53113, Germany
E-mail address: cory.whitney@uni-bonn.de (C.W. Whitney).

http://dx.doi.org/10.1016/j.agsy.2017.03.009
Received 30 June 2016; Received in revised form 10 March 2017; Accepted 11 March 2017
0308-521X/ © 2017 Elsevier Ltd. All rights reserved.

ments such as Sub-Saharan Africa (Luedeling et al., 2015).

1.2. Nutrition

Adequate nutrition is a prerequisite for human development and socioeconomic well-being (Müller and Krawinkel, 2005). Therefore, governments around the world have agreed to end hunger and support sustainable agriculture to achieve food security (United Nations, 2015). Hunger, or acute malnutrition, is defined as not having enough to eat to meet energy requirements, referring specifically to lack of energy, carbohydrates, and fats. Micronutrient deficiency (hidden hunger) is caused by a lack of essential vitamins and minerals in the diet (Biesalski, 2013). Hidden hunger can lead to illness, blindness, impaired development, and premature death. As the name implies, clinical symptoms are not readily apparent with hidden hunger. Those suffering from hidden hunger may be stunted (too short for their age), have poor night vision, and suffer frequently from illness (Biesalski, 2013). Both are major public health problems in Uganda, especially among women and children (UBOS and ICF, 2012). Most of those suffering from hidden hunger in Uganda eat an unbalanced diet with large amounts of foods high in calories but lacking sufficient micronutrients, e.g. staple food crops, and small amounts of micronutrient-rich foods, such as fruits, vegetables, and animal products (Ssewakiryanga, 2015; Whitney et al., under review).

Food selection and preparation is also a critical component of household nutrition (Müller and Krawinkel, 2005) along with poor cooking and preservation methods (Hotz et al., 2012) that may lead to nutritive or anti-nutritive impacts.

1.3. Homegardens

Homegardens are diverse agroforestry systems managed by poor and marginalized smallholder farmers throughout the humid tropics (Galluzzi et al., 2010; Kumar and Nair, 2004). Homegardens in Uganda are important for household nutrition and health (Whitney et al., in preparation). They contain a variety of useful crops and traditional knowledge and supply a crucial diverse and year-round supply of food (Whitney et al., in preparation).

1.4. Industrializing agricultural systems

Agriculture is central to improving food security and reducing poverty in Africa. Recently there has been a renewed focus on policies and programs designed to support domestic agricultural production (Demeke et al., 2014). Uganda has followed this trend by promoting the Vision 2040 policy plan, which includes agricultural industrialization through extension education, greater involvement of the private sector (NPA, 2011), credit schemes, subsidies for land and export promotion (Demeke et al., 2014). The country has a growing and food insecure population (IFPRI, 2016; NPA, 2011; UBOS and ICF, 2012) together with a strong potential for agricultural production (FAO, 2014; UBOS and ICF, 2012; UBOS, 2014b; Weidmann et al., 2010). The long-term planning of Vision 2040 calls for the total transformation of the agriculture sector from the current mode of subsistence farming to commercial production. The policy aims to address food insecurity and malnutrition, largely by targeting agricultural production systems (MAAIF, 2010; NPA, 2007, 2011). The policies of Uganda's Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) outlined in the National Agriculture Policy (MAAIF, 2013) and the Agriculture Sector Development Strategy and Investment Plan (MAAIF, 2010) follow Vision 2040 with a strong focus on agricultural industrialization.

The impetus for the proposed changes relies largely on the experiences of recent economic development in East Asia (NPA, 2007) and outsiders' views of the best path to economic growth. The common narrative holds that economic development requires rapid increases in agricultural productivity (Conceição et al., 2016) and increased food production (Godfray and Garnett, 2014). According to this logic, smallholder farmers do not have the capacity to be agents of economic growth. Therefore, development requires moving populations away from agriculture and away from rural areas (Collier and Dercon, 2014). However, in following this development path, Uganda may experience lower availability and access to diverse food sources, a potentially undesirable phenomenon observed in many countries across the globe (Khoury et al., 2014). One important impact of industrializing farming systems is the loss of many traditional fruits and vegetables throughout Africa (Shackleton et al., 2009), particularly in Uganda (Dweba and Mearns, 2011). Markets may also be risky as the sole source of food security since they do not function, legally or morally, to meet subsistence needs (Sen, 1981). Limited access to food can be a major hindrance to food security (Devereux, 2001; Nyariki and Wiggins, 1997; Webb et al., 2006).

It is important to note that increasing food supply per capita does not necessarily result in less hunger. Policy decisions aimed at increasing agricultural production may be shortsighted in believing that agricultural systems can meet the demand for food solely based on their productive capacity, because food security depends as much on people's ability to access food as on the food's existence. There is, therefore, a need to define yields in terms of nourishment to populations (Cassidy et al., 2013) and for strategies to assist policy decision makers in considering the implications that changes to agricultural systems may have for household nutrition. Analyses and tools are needed that can support decisions by modeling agricultural systems, determining system dynamics, and projecting future implications of system changes (Luedeling and Shepherd, 2016).

Critiques of Vision 2040 also point out possible negative consequences for local communities and the environment (Hansen et al., 2015). Current nutrition efforts are thwarted by high population growth and poor access to land (FAPDA, 2015), and lack of transparency in the planning and budgeting add further difficulty to tracking and sharing progress. Consequently, nutrition-related funding is often spent on activities that are not relevant to nutrition (Adero et al., 2015). Furthermore, robust science-based information to support decisions about the future of farming, and the potential impact on food and nutrition, is lacking. Government decision making is therefore in need of robust scientific support, since many pending agricultural policy decisions stand to affect millions of rural people, millions of hectares of farmland, and they will cost billions of dollars.

1.5. Decision modeling

Decision modeling can help to meet the challenges of system complexity and data scarcity in agricultural development (Luedeling and Göhring, 2016) by offering decision-makers robust models capturing a range of ecological, socioeconomic, cultural and political factors relevant for agricultural systems. Probabilistic simulations of the full range of plausible outcomes of particular interventions can be made by identifying important variables and quantifying the uncertainty around them. Though outcomes projected in this way are often highly uncertain, such modeled outcome distributions often suffice for deciding on a rational course of action for the decision (Peterman and Anderson, 1999). In cases where the remaining uncertainty is too high to immediately decide on the most desirable decision option, decision analysis can provide guidance for what pieces or information decision-makers are lacking (Luedeling et al., 2015). Calculating the value of information (Milner-Gulland and Shea, 2017) for variables within such models allows for prioritization of knowledge gaps that should most urgently be narrowed in order to improve certainty about the decision (Hubbard, 2014; Luedeling et al., 2015).

We use decision analysis tools to model the possible nutrition-related outcomes of the Ugandan government's ‘Vision 2040’ agricultural development. The work presented here seeks to demonstrate the use of decision analysis tools to model the possible nutrition-related

Download English Version:

https://daneshyari.com/en/article/5759668

Download Persian Version:

https://daneshyari.com/article/5759668

Daneshyari.com