Ecological Economics 137 (2017) 99–109

Contents lists available at ScienceDirect

Ecological Economics

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

Analysis

Feeding the Household, Growing the Business, or Just Showing Off? Farmers' Motivations for Crop Diversity Choices in Papua New Guinea

Stella Nordhagen [a,*], Unai Pascual [b,c,d], Adam G. Drucker [e]

[a] University of Cambridge, CB39EP Cambridge, UK
[b] Basque Centre for Climate Change (BC3), Edificio Sede N° 1, Planta 1ª, Parque Científico de UPV/EHU, Barrio Sarriena s/n, 48940 Leioa, Bizkaia, Spain
[c] Ikerbasque, Basque Science Foundation, Maria Diaz de Haro 3, 48013 Bilbao, Bizkaia, Spain
[d] Department of Land Economy, University of Cambridge, CB39EP Cambridge, UK
[e] Bioversity International, Via dei Tre Denari 472/a, 00057 Maccarese, Rome, Italy

ARTICLE INFO

Article history:
Received 24 February 2016
Received in revised form 23 November 2016
Accepted 20 February 2017
Available online 16 March 2017

Keywords:
Papua New Guinea
Agrobiodiversity
Crop choice
Q methodology
Conservation

ABSTRACT

Understanding farmers' reasons for growing diverse crop portfolios is essential for supporting the conservation of agricultural biodiversity to foster social-ecological resilience and conserve crop genetic resources. In this paper, Q methodology is applied to examine the motivations for growing diverse crops among semi-subsistence rural farmers in Papua New Guinea. Various types of farmers are identified including so-called 'marketer-consumers,' who are highly motivated by crop sale, and 'exhibitionists,' who prioritize the 'show' values of crops. This approach can be applied to better target programs seeking to conserve crop diversity and promote new crop varieties in regions undergoing rapid transformation.

1. Introduction

Agricultural systems and the genetic resources associated with them are currently facing a number of overlapping stressors, including economic, climate, and demographic change (FAO, 2010). These forces are transforming agricultural practices, including fostering a trend towards prioritizing a limited number of marketable crops in systems often heavily reliant on synthetic agrochemical inputs, unsustainable irrigation schemes, and conversion of forests and fields into monocropped operations (Perrings et al., 2006; Jackson et al., 2012). Maintaining agricultural biodiversity (henceforth, agrobiodiversity) on farms is seen as fundamental for the social-ecological resilience of agricultural and cultural landscapes, within which smallholders pursue livelihoods amidst global agricultural intensification processes (Zimmerer, 2013). In more intensive agricultural systems agrobiodiversity also plays an important role, including hedging risks and potentially improving economic efficiency (Omer et al., 2007; Pascual et al., 2013).

Few countries boast a trove of agrobiodiversity richer than that of Papua New Guinea (PNG), where over 200 different crop species, native and introduced, are conserved almost entirely through de facto cultivation by farmers (Sem, 1996). This includes both traditional crops and many well-integrated crops (Bourke and Harwood, 2009). Diversity varies by farmer, however, with some growing as few as one or two crops, with just one variety of their main staple, and others growing over forty crops and numerous species and varieties. Variety loss could be particularly significant for this global biodiversity hotspot, with its rich plant-connected traditions, as well as for global crop conservation, making it crucial to understand the factors supporting crop choices that lead to diversity maintenance.

Analyses of crop choices in PNG are few and include mainly agronomic selection studies (Dehuku, 2001) and ethnobotanical studies of traditional plant uses (Sterly, 1997; Hays, 1974). Work in other regions has considered farmers' own perceptions, such as through surveys (e.g., Zawedde et al. 2014), valuation studies (e.g., Krishna et al., 2013), or in-depth interviews (e.g., Bardsley and Thomas, 2005). Though not universally done, work has increasingly sought to merge qualitative and quantitative insights (e.g., Bellon et al., 2003; Birol et al., 2006; Narloch et al., 2012; Zimmerer, 2013), such as through econometric modelling combined with informal interviews (e.g., Smale et al., 2001) or environmental analysis combined with ethnographic techniques (e.g., Zimmerer, 2003). Such work has rarely been undertaken in PNG, however; elsewhere, it has usually considered only one or two crops at a time, as opposed to the full farm portfolio of diversity. This leaves gaps in our understanding of which farmers grow diverse crop portfolios and why. Additionally, the methods that have previously been used to rigorously identify differences among farmers regarding diversity

* Corresponding author.
E-mail address: stella.nordhagen@cantab.net (S. Nordhagen).

http://dx.doi.org/10.1016/j.ecolecon.2017.02.025
0921-8009/

preferences are limited; additional methodological diversity within this space would help to examine such issues in a more holistic manner.

Indeed, farmers are highly heterogeneous, not least in terms of preferences regarding agrobiodiversity. Brookfield et al. (2002) argue that a minority of 'expert' farmers have superior knowledge and/or appreciation of agrobiodiversity and hence conserve or create biodiversity without sacrificing production. The literature also makes reference to 'custodian' farmers or 'guardians' of biodiversity (e.g., Sthapit et al., 2015), suggesting that some farmers play a role in protecting diversity as a 'public good' (Smale et al., 2001). Other authors have delineated farming styles (of which crop diversity is one manifestation) such as managerial, stewardship-based, or conservative (Walter, 1997). Cognizance of such divergence is crucial for understanding agrobiodiversity's role in adaptation and conservation, as 'diversity on the land is better understood if diversity among individuals is recognized' (Brookfield, 2001, p.16). With adequate information on farmers' motivations and preferences, conservation interventions can be targeted to be most cost-effective (e.g., Narloch et al., 2012).

This paper examines what motivates semi-subsistence farmers' crop diversity choices and how/whether this varies systematically among them. This is done through a case study of PNG using Q methodology, an increasingly valued quantitative approach to typically qualitative topics (Brown, 1980) that focuses on farmers' *own* conceptions of crop choice/diversity. In Q methodology, the emphasis is placed on allowing subjects to define their own viewpoints; we thus examine farmers' opinions about crop selection and diversity choices and determine whether there are *typologies* of farmers with regards to their views, such as the 'expert famers' identified by Brookfield (2001).

This paper adds to the literature by deepening understanding of how crop diversity choices are motivated and specifically by revisiting historical research on crop diversity in Oceania (Howlett, 1962; Sillitoe, 1981; Brookfield, 1991; Bourke, 1988). Given the socio-economic transformation occurring in PNG and associated conservation pressures facing crop diversity, examination of this topic is sorely needed. Methodologically, the paper adds to work on Q methodology by using the methodology to consider crop choice. The results suggest that, in addition to academic research, the method could prove practically useful—e.g., for incentive mechanism design and targeting (e.g., Zabala et al., 2017), given the importance of individual preferences in effective agrobiodiversity conservation and crop outreach interventions. The paper also adds to a limited number of uses of Q in developing-country contexts (e.g., Brannstrom, 2011 in Brazil; Robbins, 2000 in India; Zabala et al., 2017 in Mexico).

The next section provides an overview of the PNG context, before considering the literature on crop choice. Section 3 details the methods, fieldwork sites, and data collection and analysis procedures. Section 4 presents the results, identifying five separate groups of viewpoints, with significant differences. In Section 5 we discuss the results and highlight some policy implications for agrobiodiversity conservation. Lastly, Section 6 concludes.

2. Background: Crop Diversity in Papua New Guinea

Papua New Guinea is a mountainous tropical half-island north of Australia and one of the world's culturally and geographically least explored yet most socially and biologically diverse regions (Fig. 1). A central spine of mountains divides the country into three regions: highlands, inland lowlands, and coastal lowlands and islands (Bourke and Harwood, 2009). Independent from Australia since 1975, PNG faces massive development challenges: the country is ranked 157 of 187 in terms of human development (UNDP, 2014), and 85% of the population (approximately six million) subsists on agriculture, using traditional cultivation methods (World Bank, 2004), in some areas including shifting cultivation, as in many parts of the tropics (van Vliet et al., 2012). Agriculture is the cultural and economic foundation of society and has been practiced for 10,000 years, with extensive cultivation beginning about 5000 years ago (Bulmer 1975 in Bayliss-Smith, 1996).

PNG is a major center of genetic diversity for roots/tubers and other crops, particularly under-utilized species (Kambuou 1996 in Ayalew and Kambuou, 2008). Sweet potato is dominant, particularly in the highlands; taro, banana, and yam are other key staples, cultivated in a mixed system with other vegetables, including traditional and novel introductions. In one Eastern Highlands area, Bourke (1988) recorded 71 food crops being grown over a three-year period, though only a handful predominated. Cash cropping is led by smallholders and growing in scale; most rural villagers earn some income from crop sales (Bourke and Harwood, 2009). Arabica coffee is widely grown as a cash crop in the highlands, making an important contribution to household incomes (Bourke and Harwood, 2009).

PNG's diverse cultures are founded on egalitarian Melanesian norms based on 'equality, diffused power and kin obligations' as opposed to contracts (Sillitoe, 2000, p.219). Kinship ties are of crucial importance, and reciprocity and exchange are central features, enshrined in the '*wantok*' system of mutual support. Traditional PNG cultures were largely male-dominated, with potential implications for crop choice. The country thus offers a context for examination that is unique both agro-ecologically and socio-culturally.

Crop diversity choices and agrobiodiversity conservation are motivated by a large range of context-dependent factors (Bellon, 1996; Brush, 1992; Zimmerer, 2010, 2013), but those most relevant to the PNG context (and generally applicable to semi-subsistence farmers in developing countries worldwide) can be grouped into four broad categories of concerns: marketing; culture, exchange, and status; environment and risk management; and culinary/consumption.

The need for income generation can encourage the adoption or expansion of market-preferred or lucrative crops and varieties (Bellon, 1996). Such concerns are of key relevance to the PNG highlands context (Moulik, 1973), where market expansion has been rapid in recent decades (Benediktsson, 2002; Bourke and Harwood, 2009), with potential realigning of opinions about crop choices. Nevertheless, even with good market access, farmers may be motivated to grow diverse crops and varieties by a desire to maintain self-sufficiency, particularly among women who may not be as involved in selling cash crops (Anderson, 2008; Chang and Be'soer, 2011).

In many traditional cultures, crops can play important symbolic roles (e.g., Brush, 1992); such factors are highly relevant in PNG (Sterly, 1997; Wiessner, 2005). Diversity may thus be motivated by a desire to supply traditional exchanges and ceremonial uses or for social status reasons (e.g., to demonstrate one's prowess as a farmer)—this entails both direct and indirect use values. Such ceremonial exchanges were traditionally essential to the maintenance of status and norms of exchange in PNG (Sexton, 1992; Sillitoe, 1981). They continue to be held, sometimes in connection with traditional events, such as marriages, and sometimes incorporated within Western religious practices, such as at Lutheran conferences. The need to supply such exchanges may foster a motivation for 'showy' crops, such as the large yams favored in traditional crop exchanges (Risimeri et al., 2001). On a simpler level, crop diversity may be chosen out of a sheer enjoyment of plants, shared by gardeners worldwide, or simply by following local traditions (Sterly, 1997).

Environmental factors can strongly influence crop portfolios. Marginal and varied land conditions encourage farmers to grow a more diverse portfolio, matching crops to conditions (Brush and Perales, 2007; Di Falco and Chavas, 2006); such trends have also been seen in PNG (Brookfield, 2001). In a dynamic context, crop diversity has been argued to increase resilience to climate shocks through spreading the risk of harvest failures and preserving 'option value'—i.e., increasing farmers' scope for changing crop portfolios in response to changing circumstances.[1] Thus agrobiodiversity may be maintained to offer resilience to variable weather/climate conditions (Pascual et al., 2011). PNG is no stranger to

[1] A parallel argument can be made for responding to cultural changes, such as new tastes, cooking methods, or livelihoods; indeed, resilience in general may gain greater value in such cultures where change is frequent (Buchmann, 2009).