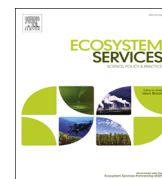




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# Provisioning ecosystem services-sharing as a coping and adaptation strategy among rural communities in Ghana's semi-arid ecosystem



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## ABSTRACT

As complex challenges linked to changing socio-economic, environmental, political, and cultural conditions continually hamper the delivery of ecosystem services to natural resource dependent communities, local level adaptation needs attention. This paper presents the findings of an empirical survey in rural semi-arid Ghana investigating how households are employing communal sharing as a strategy to enhance access and management of nine provisioning ecosystem services (provisioning ES) namely crops and vegetables, livestock and poultry, bushmeat, freshwater, wildplants, fodder and forage, traditional medicine, fuelwood, and building materials. The results indicate that the variations in the sharing patterns of the nine provisioning ES can be linked to a mix of closely-linked socioeconomic, cultural, and environmental factors. Traditional medicine is the most commonly shared, whilst building materials are the least commonly shared. Sharing intensifies during the long dry season for majority of the provisioning ES. Logistic regression modeling indicates annual household income to be the most significant socio-demographic variable influencing participation in sharing. A greater proportion of interviewed household heads (64%) perceive sharing to be on the decline. These findings provide important baseline data for further quantitative and qualitative research exploring sharing's potential contribution to rural households' livelihoods sustenance and ecosystem sustainability under changing conditions.

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## 1. Introduction

Historically, communities in semi-arid dryland ecosystems have adapted to chronic environmental stresses, such as drought and floods (Smit et al., 1999, 2000; Hammill, 2007). However, well-established evidence has shown that the increasing adverse effects of climate variability and change, coupled with socio-economic, cultural, and political changes over the last few decades, have heightened community vulnerabilities and undermined the supply, utilization, and management of ecosystem services. This implies the weakening of local adaptive capacities (Fisher et al., 2005; Thornton et al., 2006).

The situation is highly precarious in Sub-Saharan Africa because of its geographical location (IPCC, 2007), widespread poverty, and the extensive dependence of individuals and communities on ecosystem services (Cavendish, 2000; Shackleton and Shackleton, 2006; Boko et al., 2007; Paumgarten and Shackleton,

2011; Fagerholm et al., 2012; Egoh et al., 2012). By ecosystem services, we reference the Millennium Ecosystem Assessment (MA) definition, which refers to ecosystem services as “benefits people obtain from ecosystems” (MA, 2005: 5). These benefits are further classified into four categories: provisioning, regulating, cultural, and supporting services. Of these four categories, this study emphasizes on provisioning ecosystem services (hereafter provisioning ES) which are the material goods or benefits that can be harvested and easily quantified and are derived from the ecosystems to be directly used by local people. Examples of such provisioning ES include food, fuelwood, water, timber, and fiber (Maass et al., 2005).

Climate change and unsustainable human actions are exacerbating the pressure on various ecosystems to supply critical provisioning ES, thus posing a major challenge for ecosystem sustainability and human livelihood sustenance. Across global ecological regions, semi-arid ecosystems have been found to be among the most vulnerable to these challenges (MA, 2005; Thomas, 2008). In order to face this challenge, researchers and development agencies recommend community-based, natural resource utilization and management strategies underpinned by reciprocal

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relationships and social capital. Ayers and Hug (2006) argued that community-based adaptation strategies offer at least a more sustainable and participatory avenue to strengthening the adaptive capacity of vulnerable communities in the face of current and future stresses associated with climate change although it is often difficult to measure. In the case of rural natural resource-dependent semi-arid communities of Sub-Saharan Africa, the existence of strong communal relationships means that households with limited income may be able to cope with food shortages caused by droughts by actively participating in the non-market “gift economy”. This is made possible through social relationships and networks that value reciprocity (Bugra, 2002). Common-pool resource management suggests that resources are managed through community-based rules (Agrawal and Gibson, 1999; Agrawal, 2002; Gibson and Koontz, 1998; Armitage, 2005; Conrad and Hilchey, 2011) and through the use of social capital (Ostrom, 1990, 2000; Ostrom and Ahn, 2003; Ostrom et al., 1994; Pretty, 2003; Adger, 2003; Poteete and Ostrom, 2004). These authors contend that, because vulnerability and adaptive capacities are location-specific, it can be more effective to employ community-level adaptation strategies with an emphasis on place-based knowledge, technology, social structures, and institutions.

In semi-arid developing tropics, community-based coping and adaptive strategies, including the sale of productive and non-productive assets, out-migration, petty trading, wage labour, and changes in diet, among others are well acknowledged (Chirwa et al., 2008; Kalaba et al., 2010; Paumgarten and Shackleton, 2011). However, little is known about the practice of communal sharing in the context of provisioning ES, especially in places where biodiversity decline and ecosystem degradation is evident. This collective action has been overlooked in the conventional ecosystem assessment discourses and is yet to be documented.

As a practice for redistributing essential resources among social groups, sharing has long been regarded as an important and effective mechanism for addressing the problem of scarcity (Polyani, 1958, Arrow, 1975; Becker, 1974; Lee, 1979; Gould, 1981; Kitahara-Frisch, 1982). It has been considered as essential attempt to meet or fulfill social, economic, political or cultural needs or obligations through a social interaction system (Sherry, 1983). In modern societies, evidence points to the use of sharing or resource gifting by communities and households in both rural and urban economies towards meeting the needs of vulnerable groups or to overcome resource stress (Polyani, 1944, Speth, 1990; Mingione, 1991; Chakraborty, 2007; Morton et al., 2008). Befu's (1968) study describes gift-giving in Japanese society as a minor institution guarded by complex rules of engagement. More recently, Kamiyama et al. (2016) found that the sharing of non-market food provisioning services was still prevalent in rural and semi-rural Japan. It is important to note that sharing as applied in this study is not limited to the reciprocal exchange of provisioning ES that occur at household or community levels. Sharing is used to encompass gifting or giving away provisioning ES over time and place in response to environmental stresses (drought, flood, and bushfires) or in fulfillment of socioeconomic and cultural obligations.

The literature has identified a number of factors and conditions that motivate people or communities to participate in resource exchange or gift-giving: in response to hazards or disasters (Dei 1988, Franzen, 2006), support for family members (Palmer, 1991), reciprocity (Gurven et al., 2000; Gurven, 2004), network or alliance building (Adger, 2003; Patton, 2005), and risk reduction (Franzen and Eaves, 2007). Compared to other community-based strategies for natural resource management, sharing may occur without any enforceable rules or regulations at the community level (Morton et al., 2008). In this sense, Morton et al. (2004) referred to sharing as voluntary “personal exchanges”, presumably

because sharing happens in communities that are naturally diverse owing to structural differences, including economic status, occupation, education, and religious affiliations. These factors are known to significantly influence community members' access to resources, knowledge, and perception of community-based practices, thus subsequently influencing their participation.

The objective of this study is to investigate how the communal practice of sharing is being used by poor rural communities as a coping and adaptation strategy in semi-arid landscape of Ghana in West Africa. We explore this through the lens of nine provisioning ES that are considered by community members to be critical for livelihood and ecosystem sustenance (Boafo et al., 2014). The provisioning ES include, crops and vegetables, livestock and poultry, bushmeat, fresh water, wild plants/food, fodder and forage traditional medicine, fuelwood, and building materials. Specifically, this paper investigates: (a) the sharing patterns and network structure of the nine provisioning ES; (b) the effect of seasonality, selected demographic variables and other factors influencing sharing of provisioning ES; and (c) household perceptions on the changing trends of the practice over the past 30 years. Our conclusion is based on examining the practical and theoretical implications of provisioning ES sharing under limited resources and competing needs.

## 2. Material and methods

### 2.1. Location and description of study area

Semi-arid Ghana consists of three autonomous administrative regions located in the northern-most extent of Ghana; namely, Northern, Upper East, and Upper West. Lying within the Guinea and Sudan Savanna agroecological zones of Ghana, they are known to be highly vulnerable to climate and ecosystem changes, owing mainly to their semi-arid climate and physical conditions (Dietz et al., 2004). The semi-arid region of Ghana is highly rural and inhabited by smallholder farmers (Ghana Statistical Service, 2008, 2013), whose poverty levels range between 68% and 88% (Canagaraah et al., 2001; Fig. 1). For many years, the cumulative effects of environmental and socioeconomic factors, such as climate change and variability, extreme disaster events like drought, floods, and bushfires, overexploitation of natural resources (Armah et al., 2011; Acheampong et al., 2014), disregard for traditional ecological knowledge (Boafo et al., 2015), and inter-tribal conflicts have been found to undermine the supply and management of ecosystem services especially provisioning ES needed to improve livelihood sustenance and security.

This study selected two rural communities, Yoggu (9°28' N, 1°5' W) and Kpalgun (9°30' N, 1°4' W) as case study sites for in-depth survey. The selected communities are located within the Tolon district, which is to the west of Tamale, the capital city of the Northern region of Ghana (Fig. 1). A district represents a second-level administrative sub-division below the level of region in Ghana (Institute of Local Government Studies, 2010). The sites were selected on the basis of: (i) the fact that they are part of six communities that have been purposely identified and used as focal areas for the international interdisciplinary project on climate and ecosystem changes, called ‘Enhancing Resilience to Climate and Ecosystem Changes in Semi-arid Africa: An Integrated Approach (CECAR Africa)’; and (ii) their proneness and high vulnerability to episodic drought conditions during the long dry season (Antwi et al., 2014). The Yoggu and Kpalgun communities are located approximately five kilometres apart and are accessible by gravel road from Tolon, the district capital. Based on a detail community survey in August 2013, Yoggu's population density can be estimated at 457 people per square kilometres whilst Kpalgun is

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