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Strategies of smallholder farmers for coping with the impacts of cyclones: A case study from Madagascar

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ABSTRACT

In many tropical countries, smallholder farmers are highly vulnerable to cyclones and experience significant crop losses, food insecurity and income loss when cyclones hit. Madagascar has one of the highest rates of cyclones globally and a population comprised primarily of smallholder farmers, yet there is little information on how Malagasy smallholder farmers prepare for and cope with the cyclones. We conducted interviews with 200 Malagasy smallholder farmers following the impacts of cyclone Giovanna (a category 4 cyclone that struck in February 2012) to understand how farmers prepared for the cyclone, how the cyclone impacted their livelihoods and what strategies farmers used to deal with these impacts. Most farmers prepared for the cyclone by storing clean water; some also secured their buildings and stored food and seeds. Cyclone Giovanna caused substantial damage to crops, stored grains and houses, and significantly reduced farmer food security. Farmers coped with the cyclone by replanting crop fields, rebuilding homes with local materials, reducing consumption of staple foods, harvesting wild foods and finding temporary work to buy food. Informal social networks were critical for providing food and rebuilding houses. There is an urgent need for governments, donors, and development organizations to reduce the vulnerability of Malagasy smallholder farmers to cyclones by improving early warning systems, increasing farmer preparedness for cyclones, creating formal safety nets to help farmers access food and essential supplies following cyclones, and promoting the use of adaptation measures to enhance the resiliency of smallholder farmers to future climate shocks.

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1. Introduction

Tropical cyclones are known to have significant global impacts on human health, livelihoods and economic activity. It is estimated that 35% of the world's population is affected by cyclones [22] and that cyclones affected 466 million people from 1980 to 2009 [14]. In addition to the immediate impacts on human health, livelihoods and local economies, severe cyclones often set back a country's development by several decades [22], as seen in Honduras after the impacts of hurricane Mitch [1].

Madagascar is one of the tropical countries that is most affected by cyclones globally and has one of the highest rates of cyclones in

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Africa [11,14,47]. Each year an average of 3–4 tropical cyclones originate in the Indian Ocean and the Mozambique Channel and hit Madagascar during the cyclone season from November to April [15,26,47,52]. The high winds, excessive rainfall and associated flooding from cyclones have devastating impacts on both the national economy and local livelihoods [19,22,33]. Cyclones damage infrastructure, flood agricultural areas, destroy crops, injure cattle, threaten food security, contaminate water supplies, increase the incidence of water-borne diseases, and cause human injuries and sometimes deaths [11.42]. The associated economic and humanitarian costs of natural disasters in Madagascar are enormous: it is estimated that floods, drought and cyclones have affected more than 11 million people in Madagascar in the last 35 years and resulted in roughly 1 billion US dollars of damage [47,51]. Across Madagascar, about five million people (or \sim 25% of the entire population) are estimated to be vulnerable to natural disasters such as cyclones, droughts and flooding [48]. The frequent occurrence of cyclones is also a major contributor to the country's extremely high levels of poverty and food insecurity [11,48]. Climate models project that Madagascar is likely to have fewer but more intense cyclones in the future due to climate change [26,45], which means that finding ways to reduce the vulnerability of the Malagasy population to these cyclones will become even more critical in the near future.

While cyclones affect all sectors of society, the most vulnerable communities are usually those that are poor, marginalized, and without access to formal safety nets [6,12,20,32]. Studies from other countries that are regularly affected by cyclones, such as Bangladesh (e.g., [2,49]), India [3,4], Mozambique [34] and Indonesia [10], among others, have highlighted that smallholder farmers are particularly vulnerable to cyclones. Smallholder farmers (generally defined as those having less than 2 ha of land; [46]) are vulnerable to climate shocks due to their dependence on rain-fed agriculture. limited areas of arable land, high poverty levels, food insecurity, lack of access to information and limited resources to prepare for and cope with the impacts of cyclones (e.g., [6,30,32]). The coping strategies of smallholder farmers to climate shocks and longer term adaptation plans are often place-specific and adapted to local circumstances [8]. Consequently, detailed information on how smallholder farmers in particular landscapes are already responding to climate shocks is needed to inform the development of strategies and policies to their vulnerability to climate shocks and to enhance their adaptive capacity [4].

In Madagascar, smallholder farmers are known to be at great risk from cyclones [19], but to date there have been no studies on the specific impacts they experience and how they cope with these impacts. An estimated 71% of Malagasy farmers are smallholders [23,29], with a national average upland rice area per farmer of only 1.28 ha [54]. Most Malagasy smallholder farmers practice subsistence farming, depending on agriculture both for food security and for household income, and are seasonally food insecure [5,13,14,19,37]. Most smallholder farmers are also extremely poor, with an estimated 87% of smallholder farmers falling below the national poverty line [23]. As a consequence, Malagasy smallholder farmers are extremely vulnerable to extreme weather events that reduce agricultural productivity or cause crop loss.

The overall objective of our study was to understand how Malagasy smallholder farmers prepare for and cope with the impacts of cyclones, using a case study of how smallholder farmers reacted to cyclone Giovanna that hit Madagascar in February 2012. Cyclone Giovanna was a category '4' cyclone (on the Saffir-Simpson Hurricane Intensity Scale of 1–5, where 1 is the weakest and 5 the strongest [27]; with winds of up to 269 km per hour and a total of 355.6 mm of rainfall occurring over three days [18]. The cyclone is known to have affected at least 246,000 people, destroyed > 44,000 houses, damaged > 27,000 houses and

damaged at least 12,517 ha of agricultural land across Madagascar, but the real impact was likely greater given that information on impacts was only reported by 250 of the 697 municipalities in Madagascar [7]. We conducted surveys of 200 farmers to: a) explore how farmers prepared for cyclone Giovanna and how effective their preparations were in reducing vulnerability; b) document the specific impacts of the Giovanna cyclone on agricultural production and farmer livelihoods (including impacts on income, health, housing and food security); and c) examine how farmers coped with the impacts of cyclones on their farming systems and livelihoods and how effective these coping strategies were in reducing their vulnerability.

While there are existing government assessments of the overall impacts of individual cyclones (including cyclone Giovanna) at the district, regional and national levels [7,17], to our knowledge, this is the first study in Madagascar to collect detailed household-level data on the specific impacts of cyclones on smallholder farmers and to examine the coping strategies used by farmers to deal with these impacts. Our study provides unique insights into how smallholder Malagasy farmers are affected by cyclones and highlights key measures which could be incorporated into Madagascar's National Action Program for Adaptation to Climate Change for Agriculture (PANA), the National Strategy for Risk Management (SNDRM; [50]), the National Action Plan for Food Security (PAN-SA), and the Poverty Reduction Strategy, among other national strategies. Our results also provide valuable information for donors and development agencies interested in improving food security, alleviating poverty, and reducing the overall vulnerability of Malagasy smallholder farmers to climate change. In addition, our study illustrates the complexity of addressing smallholder farmer vulnerability to extreme weather events, an issue which is relevant to other cyclone-prone developing countries (e.g., [3,10,32]).

2. Materials and methods

We examined how smallholder farmers prepared for and responded to cyclones in two agricultural landscapes located along the eastern escarpment of Madagascar - the Ankeniheny Zahamena Corridor (CAZ) and Nosivolo, both of which were significantly impacted by cyclone Giovanna (Fig. 1). The CAZ landscape is located adjacent to the Ankeniheny Zahamena forest, one of the largest remaining rainforests in Madagascar, while Nosivolo is a riverine protected area located further south in the District of Marolambo. Both landscapes are characterized by a mix of agricultural land, regenerating forests (from slash and burn) and remnant forests, and are inhabited by smallholder farmers who typically cultivate less than 2 ha of land ([19]; Table 1). The traditional and most common agricultural practice in both sites is the use of slash and burn ('tavy') for rice production for home consumption [39,43]. Other crops grown in tavy areas include cassava and corn. In the lowland areas of each site, farmers also grow irrigated rice and cash crops. Some farmers also raise poultry on a small scale or produce charcoal for sale to urban areas. Most farmers in the region live below the national poverty line, are food insecure for several months per year [19] and have large families. Their houses are constructed of local materials such as timber, mud bricks and the bark or leaves of Ravenala madagascariensis and Raphia ruffa [19]. Both areas are remote and have poor road infrastructure. Roads in Nosivolo are only accessible during the dry season. In CAZ, only the southern and western parts of the landscape are accessible by road year-round.

In order to assess the impacts of cyclone Giovanna on farmer livelihoods, we randomly selected a total of 10 selected communities (7 in CAZ and 3 in Nosivolo) from a list of areas which had been impacted by the cyclone. We surveyed more communities in the CAZ region than in Nosivolo because distinct regions of CAZ Download English Version:

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