Agricultural Biodiversity and Adaptation

Mary C. Thompson

The Basque Center for Climate Change *mary.thompson@bc3research.org

Justification of the proposal

This paper addresses key issues relating to farmers and rural agricultural systems and how agricultural biodiversity is being utilized for climate change adaptation. Agrobiodiversity (ABD) can be broadly defined as all planned biodiversity (i.e. domesticated crops and livestock) within agricultural systems as well as the planned and unplanned non-domesticated biodiversity included inside or outside agricultural systems that interplay in various ways with the health and functioning those systems (i.e. crop wild relatives, pollinators, and soil invertebrates and microorganisms) (Pascual et al., 2011; Lenné and Wood, 2011). Encompassed within ABD are the plant genetic resources for food and agriculture (PGRFA) and animal genetic resources (AnGRFA) that form the foundation of modern food systems (together referred to as GRFA). GRFA provide options in the form of a range of different traits and attributes that can be utilized by farmers to cope with stressors such as changing temperatures, changing availability of water, changing soil conditions, pests, parasites, and diseases. These features are the result of a combination of active maintenance by farmers and evolutionary processes that have converged in specific locations over thousands of years. Today, GRFA is being threatened by multiple combinations of stressors, including global climate change. In order for farmers and food systems to adjust to these new contexts, it is essential that we better understand how GRFA can be conserved and utilized for adaptation. In this paper we discuss these activities, highlight remaining research gaps, and look toward new framings for optimizing the use of GRFA as a part of broad processes of adaptation. This paper will be of interest for farmers, researchers, and policy/decision makers.

Opportunities and challenges faced by the rural world with regard to climate change in the Basque Country

Global trends toward prioritizing a limited number of marketable cash crops and breeds that are often heavily reliant on synthetic agrochemical inputs, intensive breeding programs, unsustainable irrigation schemes, and conversion of forests and fields into mono-cropped operations and feed lots (Jackson, 2012 have come at the expense of traditional breeds and varieties that have been developed and adapted over time to suit the unique needs of local people and conditions of particular places and contexts (Louise E. Jackson, Pascual, and Hodgkin 2007; Jackson 2012).

Today, increased understandings have emerged regarding the ways in which global climate change is further exacerbating the existing challenges for GRFA through the initiation of a diverse range of stressors including rising temperatures, rising sea levels, changing rainfall patterns, extended droughts, increasing extreme events such as severe storms and flooding, unseasonal frosts, and widening ranges for disease vectors and invasive species among others (IPCC, 2014). These stressors portend numerous effects on GRFA, for example increasing temperatures can negatively impact cattle resulting in decreased meat and milk production (Nardone et al., 2010). Further, increasing temperatures and changes in precipitation patterns also have the potential to extend the ranges of harmful pests and pathogens that can negatively impact the health of livestock as well as the livelihoods of those that depend on them (Hoffmann, 2010). With regards to wild PGRFA or WCR, Lane and Jarvis (2008) estimate that 16%-22% of these resources are under threat of extinction due to climate change. Further, climate change is expected to cause shifts in the geographic zones of suitability for many crop species, with some areas becoming more favorable for increased productivity in agriculture and others becoming less favorable (Lane and Jarvis, 2007). These shifts will result in increased international interdependence regarding AnGRFA and PGRFA and therefore in an increased need for cooperation

amongst countries on a number of issues relating to GRFA including in the areas of economics, policy, and conservation (Fujisaka et al., 2011).

The combined effects of market stressors, globalized agriculture, and changing climates and the impacts they are expected to bring for GRFA in the form of losses and reductions are concerning because of their potential for increasing the vulnerability of food systems and livelihoods across a broad range of enmeshed scales.

What transformations are necessary?

Here we show how GRFA is situated within broader processes of adaptation and discuss what we know about the role of GRFA in both incremental and transformational adaptations. Highlighted are farmer-based adaptation activities such as participatory plant breeding and community seed banks as well as technology based activities including genetic engineering and non-GM technological advances in the are of genomics.

Understanding and managing the rural world in the face of climate change

Our current understandings of the role of genetic resources for food and agriculture in responding and adapting to climate change are broad but disjointed. Significant gaps still exist. Increased integration is needed within and across research communities and practitioners.

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