Local level climate justice? Adaptation finance and vulnerability reduction

Sam Barrett *
Trinity College Dublin, Ireland

Abstract
Climate change creates a double inequality through the inverse distribution of risk and responsibility. Developed states are responsible, but are forecast to confront only moderate adverse effects; least developed states are not culpable and yet experience significant threats to livelihoods, assets and security. Adaptation finance addresses inequality by developed states facilitating/funding behaviour adjustments necessary for exposed communities to lessen climate risk. This article investigates the ground-level effectiveness of adaptation finance in climate vulnerable villages across Malawi, while controlling for disparities in vulnerability. Malawi and selected districts are both climate vulnerable and significant recipients of adaptation finance. This concludes a larger top–down multi-scalar analysis of climate justice, which applies the distribution and effectiveness of adaptation finance as a proxy. The study avails of participatory assessments to compare actions of villages receiving adaptation finance with those engaging in autonomous and informal adaptations. Adaptation finance villages: (a) address more climate related risks; and (b) enhance agency, security and sustainably lessen climate vulnerability. Conversely, informal practice villages attend to a lower proportion of climate risks and often develop short-term strategies with less enduring vulnerability reduction. Vulnerable communities receiving adaptation finance do change behaviours to reduce climate risk and thus secure local level climate justice.

1. Introduction
Climate change research identifies climate change as the source of a double inequality with an inverse distribution of risk and responsibility (Adger et al., 2006; Füssel, 2010; Roberts and Parks, 2007). The majority of least-developed states have accumulated less than 115 tonnes of carbon dioxide emissions per capita since 1960, relative to 1.6–2.7 k tonnes in many developed states (World Bank, 2013). Conversely, least-developed states experience disproportionate adverse consequences (Maplecroft, 2011; Bushy et al., 2013a, 2013b). Marginal environments contend with climate variability and are prone to physical hazards, such as flooding (Lopez-Marrero, 2010; Mustafa, 1998), drought (Eriksen and Lind, 2009; Stringer et al., 2009) and storms (Fazlul and Nobuo, 2008). Exposure and sensitivity to physical events is driven by manifestations of poverty and underdevelopment (Wisner et al., 2004), whereby poor education, health infrastructure and governance structures magnify adverse consequences (Mearns and Norton, 2010).

Climate justice research is often located on the international scale, focusing on justice principles (Albin, 2001; Paterson, 2001), allocation criteria (Ferrmann, 1997; Baer et al., 2009), carbon markets (Caney, 2010; Page, 2012) and funding architectures (Grasso, 2010a, 2010b). A limited scholarship reaches below to observe subnational justice implications of domestic policy (Thomas and Twyman, 2005) and planning for adaptation (Hug and Khan, 2006; Paavola, 2006). International and subnational research is appropriate for questions of policy processes, framing and design, but these are not the scales where vulnerability is experienced. Rather, climate variability and change is encountered at the local level by communities and requires analysis and response at lower scales (Cash and Moser, 2000) through practices such as Community-Based Adaptation (Ayers and Forsyth, 2009; Ayers and Huq, 2013). Research needs to reach down further and assess climate risk reduction strategies of poor, marginalized and vulnerable communities as the primary and defining actors in climate justice analysis (Barrett, 2013). Further, adaptation finance provides a means to analyze how actions of developed states address climate inequality, through lessening impacts for local level actors (Paavola and Adger, 2006).

Yet recent justice and equity debates do not focus on vulnerable communities at the local level. For example, empirical research...
investigates the international distribution of the Adaptation Fund (Stadelmann et al., 2013) and the justice implications of specific climate policies (Beyer-Farris and Bassett, 2012; Mercer et al., 2012). This article is thus the final stage in a multi-scale climate justice analysis, following adaptation finance from inter-state distribution to local level implementation, and focusing on select at risk communities in Africa. Two prior quantitative analyses investigate the international and subnational distribution of adaptation finance: the international stage tests whether the most climate vulnerable states are receiving a disproportionate share of funds (Barrett, 2013a); the subnational stage finds whether the most climate vulnerable districts in Malawi are receiving most intra-state allocations (Barrett, 2013b). These answer questions of whether policy is putting the most vulnerable first (Adger and Paavola, 2006, p. 604), allocating to the most vulnerable urban stakeholders (Ayers, 2009) and adhering to equity principles regarding financial assistance of the Convention (United Nations Framework Convention on Climate Change, 1992, 2010). This study improves understanding of adaptation finance once it reaches vulnerable communities and determines its effectiveness, offering a substantive justice approach based on just outcomes of funding efforts to accompany distributive and procedural aspects (Heywood, 2004, p. 176).

Climate finance, and adaptation finance more specifically, has developed into one of the main outputs of international climate negotiations. Recent promises (Conference of the Parties 15 and 16) related to new and additional climate finance, balanced between adaptation and mitigation, and democratically from existing funding flows (United Nations Framework Convention on Climate Change, 2009, 2010). Nevertheless, accounting is ambiguous without universal definitions to determine new and additional funds (Stadelmann et al., 2011) and complicated by inadequate transparency across donors (Ciplet et al., 2012; Stadelmann et al., 2012). Further, bilateral and multilateral donors are widely recognized as integrating adaptation measures into development assistance (Fankhauser and Burton, 2011). This study provides a solution by availing of information from key players in local level implementation. Adaptation finance interventions are categorized based on data provided by District Council Representatives on aims and objectives and evaluated in terms of effectiveness in climate risk reduction.

Adaptation finance effectiveness is understood relative to, and in terms of, informal actions. This study refers to adaptation finance villages as those in receipt of formalized adaptation interventions, and compares these with villages that receive no monies, but engage in autonomous adaptations and coping strategies. Informal adaptations are on-going processes of human adaptation, occurring independently of external assistance, ranging from small adjustments in daily routines to significant changes in circumstance through particular disaster events (Birkmann et al., 2010). Informal actions are shown to facilitate coping and adaptation to climate change (Nelson et al., 2007), but the focus here is to compare their effectiveness with formal and externally funded efforts to adapt. The following questions direct the analysis:

1. Does adaptation finance address what climate vulnerable communities perceive as their climate risk?
2. Does adaptation finance enable communities to attend to more climate risks than informal measures alone?
3. Does adaptation finance secure greater agency, security and more sustainable vulnerability reduction than informal measures?

This article provides answers using data collected across 18 villages in southern and eastern Malawi. Malawi has a history of flooding, drought, land degradation, poverty and food insecurity (Devereux, 2007; Davies et al., 2010; Mijoni and Izadkhah, 2009; Phiri and Saka, 2008). Malawi is highly climate vulnerable and a significant recipient of adaptation finance transfers (Barrett, 2013a); likewise, within Malawi, Nsanje, Chikwawa and Salima districts are highly climate vulnerable and significant recipients of intra-state adaptation finance distribution (Barrett, 2013b); villages in these districts are selected based on a matching technique that maximizes parity in socio-economic drivers of climate vulnerability. Finally, survey data is collected across villages using the participatory vulnerability assessment as an appropriate method for climate justice analysis.

Adaptation finance does improve adaptive actions relative to informal practices alone: (a) enabling villages to address a greater number of climate risks; and (b) enhancing agency and security of villagers, and sustainably lessening climate vulnerability. Informal practice villages adopt more short-term coping behaviours that often compromise future security and agency and show little enduring vulnerability reduction. Evidence of effectiveness suggests climate justice as a multi-scale process is being done across select villages of Nsanje, Chikwawa and Salima districts.

Four sections as follows: Section 2 situates the study within the prior literature and develops a framework to analyze adaptation finance effectiveness; Section 3 outlines the village matching and data collection methodology; Section 4 presents the results of group discussions; Section 5 discusses implications of the research.

2. Assessing adaptation finance effectiveness

This section outlines the literatures used to construct a framework to study local level adaptation finance effectiveness. The effectiveness literature indicates the need for a framework to empirically assess local level adaptation interventions, due to research being hitherto international and national level. The framework is guided by the vulnerability literature, which has the conceptual tools to analyze community level climate risk as a justice issue.

2.1. Climate finance effectiveness, formal and informal adaptation

The climate finance effectiveness literature is primarily a policy-based discussion concerning how international and national funding architectures shape outcomes. Effectiveness is understood in terms of adherence to principles and characteristics, described as meeting societal needs (Calland and Reddy, 2013); ease of implementation, legitimacy, coherence, transparency (Bird et al., 2013); and climate returns (Cham et al., 2012). For example, the Adaptation Fund (Canales Trujillo and Nakhooda, 2013), Amazon Fund (Forster et al., 2013), and generic flows (Nakhooda, 2013) are evaluated for multi-scale support, strengthening procedures, innovative design and national ownership. This leaves community level implementation largely absent. Local level assessments of adaptation finance provide insight into localities where vulnerability is experienced and offer the effectiveness literature a means to empirically evaluate the outcome of vulnerability reduction. A growing literature documents funded adaptation and broadly separates formal/funded as planned longer-term adaptation and informal/unfunded actions more as on-going short-term coping strategies. For instance, Ayers and Forsyth (2009) investigate community level actions designed to protect assets and livelihoods in flood prone Bangladesh. Sovacool (2012) describes local adaptation intervention objectives across Asia. In Malawi, research shows strategies of Shire Valley farmers adapting to extreme weather conditions (Phiri and Saka, 2008), and efforts relating to the United Nations environmental conventions as facilitating the management of climate change, drought and desertification
(Stringer et al., 2009). This literature generally reports the positive effects of financed interventions, such as livelihood protection/diversification, disaster mitigation and community resilience. By contrast, informal adaptations are regarded more as on-going responses of short-term coping in marginal environments. The literature explores autonomous behavioural changes induced by disasters (Birkmann et al., 2010), the types of responses (Jabeen et al., 2010), the role of forests as a facilitator (Fisher et al., 2010), as well as institutions for managing climate risks (Rodima-Taylor, 2012) and their cross-scale dynamics (Osborn et al., 2008).

The trend suggests external assistance facilitates, secures and improves the process of climate risk reduction. This is to be systematically tested by comparing the effectiveness of formal adaptations relative to informal coping strategies in reducing of climate vulnerability and risk. Local vulnerability assessments between the two groups of villages are the primary means to make this determination.

2.2. Vulnerability assessment

Vulnerability assessments can compare climate risk between formal and informal actions. The vulnerability assessment discussion offers various methods to measure local level vulnerability. Therefore, this immediately connects vulnerability and climate justice discussions as both are searching for empirical evidence.

Indicator approaches to vulnerability assessment take socio-economic and physical parameters as values to compare exposure, sensitivity and adaptive capacity to climate change (Adger, 1999; Hahn et al., 2009; Sullivan and Meigh, 2005; Deressa et al., 2008). However, Vincent (2007) emphasises uncertainty when linking specific indicators and climate vulnerability: Füssel and Klein (2006) judge indicators as static in the sense of providing little means to identify feedback mechanisms between impacts and exacerbated climate sensitivity.

Multiple stressor vulnerability assessments identify how stressors, with climate change being just one, shape long-term vulnerability (Casale et al., 2010; O’Brien et al., 2004; Patt, 2009). This approach recognizes multiple stressors threatening a system, instead of focusing on the multiple effects of a single stress factor (Füssel and Klein, 2006), accommodating a more dynamic and evolving reality through incorporation of internal and external aspects of vulnerability (Casale et al., 2010). In short, stressors create outcomes that conceive/fortify new stressors. This research is empirically underdeveloped for several reasons: (a) stressors differ across environments; (b) the weighting of stressors is ambiguous and stressors will not interact similarly across environments; and (c) case study research requires understanding how single and compounded stressors affect individuals and systems.

Participatory approaches to vulnerability assessment include communities in determining their own sensitivities and exposures (Chiwaka and Yates, 2012; Care, 2009; Pelling, 2007; Van Aalst et al., 2008; Fazey et al., 2010; Red Cross and Red Crescent Societies, 2010). In this approach, researchers do not presume to know the pertinent exposure and sensitivities within the community (Smit and Wandel, 2006) and reflexive engagement with local knowledge is the methodological strength. This creates practical bottom-up assessments with communities as active participants (Chambers, 1990, 1994; Van Aalst et al., 2008). This has been applied to compare vulnerability in locations such as the United States, Mexico (Vasquez-Leon et al., 2003) and Samoa (Sutherland et al., 2005).

2.3. Integrating indicator and participatory approaches

Indicator and participatory approaches serve as complements by dividing analysis for case selection and vulnerability assessment. To analyze the effectiveness of adaptation finance at the local level requires: (a) minimizing disparities in climate vulnerability between adaptation finance and informal practice villages for unbiased assessments of adaptation finance effectiveness; and (b) locating the impact of adaptation finance on a village’s climate risk, relative to informal practices, but in a way conducive to climate justice as a subject. Indicators are utilized when matching adaptation finance and informal practice villages to maximize parity between villages on the main drivers of vulnerability. These include poverty, education, medical access, water access, electricity access and livestock ownership for optimal village matches. Conversely, indicator vulnerability assessments display academic transcendence not appropriate for climate justice research, as indicator increases may not transfer into a meaningful lessening of climate risk. Rather, participatory approaches incorporate communities as primary actors in shaping and evaluating their assessment. The extent to which those exposed identify lessening climate risk determines the degree of climate justice.

3. Methods and data

Selecting cases and assessing climate risk reduction involves three stages: first, country and district selections are made according to high climate vulnerability and adaptation finance; second, parity in climate vulnerability drivers is maximized across paired cases of adaptation finance and informal practice villages; third, village surveys identify effectiveness of adaptation finance relative to informal practices in reducing climate risk.

3.1. Country and district selection

Malawi is chosen based on framework requirements of high climate vulnerability and inter-state adaptation finance transfers (Barrett, 2013). Malawi is the most climate vulnerable mainland country in Africa (6.89 mean composite localized score, relative to the African continental mean of 5.11) (Maplecroft, 2011). Second, adaptation finance transfers are extracted from AidData 2.0, which defines development finance as loans or grants from governments, official government aid agencies, and inter-governmental organizations intended to promote economic development and welfare of developing countries (Tierney et al., 2011, p. 1892). Malawi received per-capita adaptation funding (2000–2010) of $39.82 and $0.92 for broad (addressing vulnerability reduction) and narrow (explicitly climate adaptation related) classifications respectively, relative to the African mean of $6.38 and $0.46 (see Appendix A for definitions).

Within Malawi, Nsanje, Chikwawa and Salima districts are chosen based on framework requirements of high climate vulnerability and adaptation finance activities (Barrett, 2013). Adaptation finance data is provided by the Climate Change and African Political Stability Program who partner with AidData and the Ministry of Finance in Malawi to locate the destinations of all aid activities from 2000 to 2010 (Peratsakis et al., 2012; Weaver et al., 2012). Nsanje, Chikwawa and Salima receive high adaptation finance activities (36, 26 and 26 respectively, compared to the national mean of 17.5), which represent the geo-coded subnational components of larger national level projects (Strandow et al., 2011). Further, these districts are highly climate vulnerable with mean composite vulnerability scores of 7.9 (Nsanje), 7.9 (Chikwawa) and 7.27 (Salima), compared to the national mean of 6.89 (Maplecroft, 2011; Government of Malawi, 2006).

Climate models and observational data show communities within Nsanje, Chikwawa and Salima are experiencing, and projected to experience further, climate change (see Fig. 1). This is illustrated through a simulation of climate change for the period 1981–2000 compared to mid 21st century projections for Malawi.
(2041–2060). The latter is based on Intergovernmental Panel on Climate Change mid-line carbon dioxide emissions scenario of 536 parts per million by volume.

Climate observations and projections are sourced from a regional climate model maintained at the National Center for Atmospheric Research/National Oceanic and Atmospheric Administration, and developed for applications over Africa by researchers from the Climate Change and African Political Stability Program (Vizy and Cook, 2012; Cook and Vizy, 2012). In the maps above, four indicators – dry days, wet days, heat waves and low elevation coastal zones – were normalized into quintiles and aggregated to represent climate hazard exposure for Malawi between 1980–2000 and 2041–2060 (Busby et al., 2013a, 2013b). The original model has continent wide coverage for Africa, and shows central and southern Malawi confronting increasing physical exposure. For the purposes of this study, data are reclassified and spatially analyzed into quintiles to compare variation in physical exposure within Malawi (from the least exposed 20% to the most exposed 20%). Fig. 1 shows 20th century (top-left) versus 21st century (bottom-left) projected climate conditions and illustrates the change (right). Northern Malawi is witnessing lower orunchanging physical exposure, but central and southern districts are forecast to endure greater climate change. In particular, the districts of Nsanje and Chikwawa are some of the worst affected. The physical hazards these communities are forced to address are related to climate change. Therefore, any observed adaptive actions in central and southern Malawi are responding to long-term increases in climate risk, as well as short-term variability.

3.2. Village matching

Villages are the units of analysis, categorized and matched as either treatments that receive adaptation finance, or controls, that do not receive finance but conduct informal actions. Matching maximizes probabilistic equivalence (Rubin, 1973), and minimizes imbalance and thus bias between covariates (Blackwell et al., 2012; Burnham, 2008; Nielsen, 2011), allowing for a comparative estimation of climate risk reduction. Creating matches between controls and treatments requires maximizing parity on several village characteristics (Stuart, 2011) and selecting villages with similar covariate distributions and values on climate vulnerability indicators (Busby et al., 2013a, 2013b; Maplecroft, 2011). Additional vulnerability indicators from Malawi’s Demographic and Health Survey (2010) provide measures of poverty, education, livestock ownership, medical, water, and electricity access. External assistance is measured through Official Development Assistance activity point data from the Climate Change and African Political Stability program (Peratsakis et al., 2012; Weaver et al., 2012).

Data are aggregated to Enumerations Areas, which are the smallest administrative boundaries within the Malawian state. A shapefile of Enumeration Areas is created by the National Statistical Office of Malawi. Mean vulnerability indicator aggregations are created for each Area and village vulnerability means are derived from these scores.

Fixed effects control for further heterogeneity across matched villages. Issues of municipal administration, livelihoods, ethnicity, language, electoral constituency and government affiliation are
Table 1

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty</td>
<td>Malawi Demo. and Health Survey</td>
<td>Proportion of households in poverty</td>
</tr>
<tr>
<td>Education</td>
<td>Malawi Demo. and Health Survey</td>
<td>Proportion of adult men with no education</td>
</tr>
<tr>
<td>Medical Access</td>
<td>Malawi Demo. and Health Survey</td>
<td>Proportion of household heads receiving free healthcare</td>
</tr>
<tr>
<td>Water Access</td>
<td>Malawi Demo. and Health Survey</td>
<td>Proportion of households with water access</td>
</tr>
<tr>
<td>Electricity Access</td>
<td>Malawi Demo. and Health Survey</td>
<td>Proportion of households that have electricity</td>
</tr>
<tr>
<td>Livestock Ownership</td>
<td>Malawi Demo. and Health Survey</td>
<td>Whether Livestock Ownership is required</td>
</tr>
<tr>
<td>Official Development Assistance</td>
<td>Climate Change and African Political Stability Program</td>
<td>Whether Official Development Assistance is required</td>
</tr>
<tr>
<td>Climate Vulnerability</td>
<td>Maplecroft Climate Vulnerability Index</td>
<td>Average composite vulnerability score within Enumeration Areas</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Adaptation finance</th>
<th>Poverty</th>
<th>Education</th>
<th>Medical</th>
<th>Water</th>
<th>Electricity</th>
<th>Livestock</th>
<th>Vulnerability</th>
<th>Assistance</th>
<th>Informal practice</th>
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<tbody>
<tr>
<td>Mbenje</td>
<td>X</td>
<td></td>
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<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Kanyakanya</td>
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<tr>
<td>Mpisamanja</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Sabola</td>
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<tr>
<td>Chapinga</td>
<td>X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
<td></td>
<td>Kalonga</td>
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<td>Kan dodo</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
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<td>X</td>
<td></td>
<td>Chatica</td>
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<tr>
<td>Moses Chimphepo</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Timbenawa</td>
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<tr>
<td>Nyamphota</td>
<td>X</td>
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<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Mafale</td>
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<tr>
<td>M’Manga</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Mikute</td>
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<tr>
<td>Chizuwu</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Bushiri</td>
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<tr>
<td>Mtika</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>Saidi</td>
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</table>
Narrow adaptation finance is adaptation in direct association with climate change; broad adaptation finance aims at vulnerability reduction in terms of the direct and indirect effects of climate change as understood by the Intergovernmental Panel on Climate Change (2001). Those effects include drought, desertification, land degradation, floods, hurricanes and temperature increases.

Subnational tracking of adaptation finance, especially to the point of ground level interventions, is a complex process. Examples of programs designed to track the distribution of monies include The Nepal Climate Public Expenditure and Institutional Review that tracks ministry level adaptation spending (Jones et al., 2012) and the Climate Change and African Political Stability Program, through the development of a replicable methodology first applied to project activities in Malawi (Weaver et al., 2012). Using various forms of information on finance distribution, fieldwork across the Great Lakes region has shown how governments and bilateral donors lose control over the type of interventions taking place once the funds drop below the district level. In Malawi, a complex local administrative system receives funds and dictates final distribution: the committee system, implementing agencies, traditional leaders and District Development Officers determine the destinations and exact character of community-level interventions. Hence, information provided by the local District Development Officers is the best means available by which to categorize evaluate assistance as adaptation finance.

3.4. Survey data collection

Survey data are collected through discussion groups using participatory vulnerability assessments. District Council representatives, the village head, senior figures within the village, and both male and female adult members were present. Groups ranged between ten to forty participants with a tendency for more men than women. All discussions were held in Chichewa and translated into English by at least two translators. Questions related to specific vulnerabilities, type and frequency of biophysical hazards, adaptation finance projects and on-going informal practices and fell into the following categories: identification of general vulnerabilities, climate vulnerability, biophysical hazards, informal adaptive practices and adaptation finance projects/interventions.

Village heads and senior figures answered the majority of questions, either on their own, or based on input from villagers. One possible methodological shortcoming was the consistent presence of Village Development Committee representatives. These individuals have an incentive to speak positively about adaptation finance interventions, especially in the presence of District Council representatives who arranged our meetings. The allocation of adaptation finance and other assistance monies are made through District Executive Committees, where District Council representatives are influential in providing information to other deciding members. Nevertheless, despite their presence, Village Development Committee representatives were rarely prominent in the discussion groups, as these individuals were not village heads and often not senior village members.

4. Results

This section analyzes village group discussions in Nsanje, Chikwawa and Salima. Part one investigates village exposure to climate risk factors and biophysical hazards; part two investigates whether villages address these factors and hazards and compares across adaptation finance and informal practice villages; and part
three determines the quality of adaptations through the framework of positive and negative adaptation based on which villages secure sustainable and agency enhancing adaptations.

4.1. Climate risk and biophysical hazards

All village respondents express hunger and poverty as a primary concern that is becoming more severe in recent years. Reliance on increasingly lower-yielding subsistence agriculture results in a multi-faceted deterioration in their economic and social situation. Villagers consistently indicate links between climate and their worsening predicament by recognizing that numerous and compounded climate risks are exacerbating pre-existing adverse social and livelihood consequences.

Villagers across Nsanje, Chikwawa and Salima identify themselves as highly climate vulnerable, regardless of whether funded interventions are present or not. Biophysical hazards and their social consequences are evenly distributed across the two categories. Villagers are exposed to five hazards: flooding, erratic rainfall, drought, strong winds and temperature extremes.

Flooding is a primary concern. Sixteen of 18 villages identify flooding, and increases in flooding frequency, as a hazard attributable to village proximity to rivers, tributaries, or Lake Malawi. Further, villages are typically situated on flat areas causing river flooding to spread significant distances during seasonal rains. Erratic rainfall is a perpetual challenge. Fifteen of 18 villages state that in years past rains enabled planting in November. More recently, later and shorter rains inhibit planting until late December to January. This depiction was consistent across affected villages. Further, drought is a significant hazard for many, affecting 13 of 18 villages with longer and ever-more consistent periods of little or no rain. Strong winds concerned 6 of 18 villages, and in particular, those in Salima district (5 out of the 6 villages). Salima is proximate to Lake Malawi, and therefore fewer surrounding trees offer protection. Finally, temperature increases are a hazard for two Salima villages.

The negative social consequences of physical effects are numerous and often occur simultaneously: flooding, drought, erratic rains and strong winds result in land degradation, temporary relocation, loss of assets, damage to houses, physical injury, lower crop yields, poverty exacerbation, hunger and disease outbreak. Exposure to one or more hazards in turn weakens the position of communities to withstand any that follow.

4.2. Actions addressing climate risk factors

Both formal and informal actions address climate risks, and practices vary between villages. Table 3 sets out the proportion of adaptation finance or informal actions attending to self-identified climate risk.

Table 3

<table>
<thead>
<tr>
<th>Climate risk factor</th>
<th>Adaptation villages</th>
<th>Informal practice villages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Risk</td>
<td>Action</td>
</tr>
<tr>
<td>Flood</td>
<td>9/9</td>
<td>7/9</td>
</tr>
<tr>
<td>Drought</td>
<td>8/9</td>
<td>8/9</td>
</tr>
<tr>
<td>Dry spells</td>
<td>4/9</td>
<td>2/9</td>
</tr>
<tr>
<td>Disease outbreak</td>
<td>3/9</td>
<td>0/9</td>
</tr>
<tr>
<td>Strong winds</td>
<td>3/9</td>
<td>1/9</td>
</tr>
<tr>
<td>Land degradation</td>
<td>4/9</td>
<td>4/9</td>
</tr>
<tr>
<td>Pest attack</td>
<td>1/9</td>
<td>0/9</td>
</tr>
<tr>
<td>Temperature rise</td>
<td>1/9</td>
<td>0/9</td>
</tr>
<tr>
<td>Storms</td>
<td>0/9</td>
<td>0/9</td>
</tr>
</tbody>
</table>

Adaptation finance villages address twice as many climate risks as villages without interventions: adaptation finance villages offer at least one action towards 26 of the 37 (0.70) identified risk factors; compared to 10 of 30 (0.33) for informal practice villages. This is a consistent trend across cases. Further, some informal practice villages fail to undertake any informal actions. Tiimbenawa, Mafale and Bushiri all either took no informal actions, or actions were not directed towards risk factors. Conversely, adaptation finance villages took at least one action. Flooding and drought are the most common adaptation finance interventions with 7 and 8 villages engaging in flood and drought mitigation respectively.

4.3. Qualitative differences between formal and informal actions

To evaluate village actions, the livelihood literature offers a conceptual framework to distinguish positive from negative adaptation. Davies and Hossain (1997) states:

Positive adaptation is of choice and can be reversed if fortunes change and usually leads to increased security and sometimes wealth. It is concerned with risk reduction and is likely to involve an intensification of existing livelihood strategies or diversification into neighbouring livelihood systems. Negative adaptation is of necessity, tends to be irreversible and frequently fails to contribute to a lasting reduction in vulnerability. It occurs when the poor are forced to adapt their livelihoods because they can no longer cope with short-term shocks and need to alter fundamentally the ways in which they subsist (p. 5).

What follows identifies, discusses and compares the qualities of adaptation finance and informal practice actions—classified as negative adaptation and positive adaptation (see Table 4). The optimal scenario is when actions increase agency and security for villagers, intensify existing livelihoods and offering an enduring and sustainable climate vulnerability reduction strategy.

Several examples underscore how adaptation finance interventions elicit positive adaptation over informal practices: adaptation finance provides 7 of the 8 flood defences in the form of riverbed excavation and riverbank reinforcement. These activities raise, or at least fortify, the threshold for when waters break to become floods, increasing security and facilitating lasting climate vulnerability reduction. Contrast these actions with informal practices of temporary relocation to higher ground as a flooding adaptation: immediate physical security is assured, but this endangers remaining and immobile assets. As such, relocation offers no medium to long term lessening of climate vulnerability. Further, slow withdrawing floodwater forces villagers to transform their lives and temporarily re-establish livelihoods elsewhere, further eroding assets and compromising future agency and security.

One financed intervention develops an early warning system, which applies the proliferation of mobile phone technology to organize highland villagers to alert lowlanders of impending floods. Such an intervention fails to stop flooding, but provides villagers with more time to organize family and moveable assets to a place of safety. This intervention increases the agency of villagers, relative to the more reactive informal relocation strategy, to better protect assets and contribute to future agency and security.

Adaptation finance provides 8 of the 11 irrigation activities that offer the greatest protection from erratic rains and drought. This intensifies existing livelihoods, enhances food security and offers corresponding reductions in climate vulnerability. Naturally, variation exists in the scale and capacity of irrigation interventions. Treadle pumps that transfer water to planting areas are common. However, villagers’ complain about the low carrying capacity of pumps and the inability to replace broken parts. Conversely, an irrigation intervention in Chizuwi (Salima) best demonstrates the
capacity to secure all aspects of positive adaptation. The intervention involved raised water tanks fed through a solar pump, and waters a maize field where all village participants are allotted two rows. One villager estimated each participant receives more than 300 kilograms of maize each year from their allotment.

Informal actions include cultivating drought resistant crops such as sorghum, millet, cassava and drought resistant maize. Drought resistant cropping is a positive adaptation practice through increasing food security and wealth and with corresponding lessening of climate vulnerability. Nevertheless, drought resistant cropping has benefits in an absolute sense, but is inferior relative to financed irrigation interventions. Comprehensive water management circumvents drought as a biophysical hazard and leaves farmers with greater choice regarding which crops to grow and land management in general.

Three adaptation finance villages and four informal practice villages engage in tree planting. These actions offer lasting climate vulnerability reduction by directly mitigating the effects of high winds on the physical security of villagers and their property. However, considerable variation exists in the degree of protection offered between the two categories of village. In adaptation finance villages, tree planting occurred many years before; trees were, therefore, more established, greater in height and breadth, and thus offered greater protection. This was consistent across cases and suggested informal practice villages learn from intervention policy, but with a considerable time lag. Further, villagers in informal villages did not avail of technical advice from implementing agencies. For instance, informal tree planting in Mafale (Chikwawa) failed due to insufficient rainfall and poor ground fertility.

Adaptation finance villages had the capacity to combine negative and positive adaptations depending on circumstances and timelines. Conversely, informal action villages engage predominantly, and in some cases exclusively (Chatacha and Kanyakanya in Nsanje district), in negative adaptations that fail to reduce climate vulnerability. These involve winter cropping, riverbank cultivation, consuming inferior foodstuffs, receiving food aid and farm-labouring – termed ganyu. Winter cropping practices are reported as a cause of land degradation through overuse. Riverbank cultivation provides accessible water, but when seasonal rains arrive, crops are the first assets washed away. These practices constrain future agency by compromising productive capacity, wealth, and consequently, increases climate vulnerability. Harvesting less preferred foods (such as dried water-lily roots termed nyika) established new physical dangers in terms of frequent crocodile attacks. In addition, substituting nyika for cultivated foodstuffs compromises food security and represents an act of necessity. Finally, ganyu is recognized as a highly exploitative practice within Malawi (see Bryceon and Fonseca (2006) for a focus on this claim) that alters the way villagers subsist and offers no sustainable climate vulnerability reduction.

Food aid represents the only adaptation finance intervention with negative medium to long-term climate vulnerability implications. Food aid establishes dependency amongst recipients by failing to develop forward-looking and imminent solutions to hunger in times of low crop yields. Some researchers report adverse consequences due to the stifling of market mechanisms (Middleton and O’Keefe, 1998). Such interventions possibly weaken security and reduce long-term wealth.

Numerous informal livelihood diversification strategies - firewood collection and selling, banana selling, selling of livestock and brewing alcohol - intuitively contribute to intensifying existing livelihoods. Nevertheless, several issues question the agency-enhancing and sustainable character of actions. Collecting and selling firewood can result in deforestation and the establishment of new flood plains. Alcohol brewing has negative physical and social consequences that offset benefits associated with diversifying livelihoods. Livestock selling is inherently unsustainable and a positive action only when acting through choice. Only the sale of bananas can be considered positive adaptation, as it simultaneously intensifies and diversifies existing livelihood strategies; but this assumes the bananas sold are surplus foodstuffs and thus an action of choice rather than necessity.

In summation, relative to informal practices, adaptation finance actions consistently increase the agency of villagers, intensify existing livelihoods and offer sustainable vulnerability reduction strategies. This is clearest with regard to approaches addressing the primary hazards/risk factors of flooding and drought. The trend continues, but issues become more nuanced, when tree planting, livelihood diversification and the weakest negative adaptations are investigated. For instance, both adaptation finance and informal practice villages plant trees for physical protection, but the former have more success planting trees and secure a greater protection for villagers. Though many adaptation finance villages engage in negative adaptation, they combine negative and positive adaptation actions to develop an array of options to address climate risk factors. Conversely, informal practice villages are predominantly reliant on negative adaptation strategies that erode future agency, wealth and offer little sustainable climate vulnerability reduction.

5. Discussion

Findings indicate that adaptation finance is a relatively effective means to address climate risk. Results show a tangible impact of adaptation finance relative to informal practice across southern and eastern regions of Malawi. Further, adaptation finance villages address more climate risks and consistently elicit greater agency, security, and a more sustainable lessening of climate vulnerability. There are exceptions: some adaptation finance villages fail to address many climate risks identified by villagers and many still adapt in short-term and reactive ways. A small proportion of informal practice villages address all climate risks, and of these
actions, many are providing security and lasting vulnerability reduction. However, the trend signifies adaptation finance is assisting climate vulnerable communities.

Developing a method for measuring and analyzing adaptation finance effectiveness has implications for academic and development assistance communities. The method is transferable to other contexts and has several strengths: first, incorporating indicators to broadly assess and compare vulnerable locations based on local factors, develops Geographical Information Systems based matching village pairs for a quasi-experiment setting; second, participatory surveys assess how villagers understand and deal with localized climate risks and adaptation. Finally, the assessment is transferable to determine the strengths and weaknesses of different adaptation and coping practices in other contexts. All is made possible due to the considerable data and transparency efforts underway in Malawi and illustrates the benefit of similar endeavours for other developing states. All combined, this process delivers the means to measure effectiveness for adaptation finance and thus provides an empirical contribution to burgeoning academic and policy debates.

Second, this study speaks to academic debates following commodity flows across scales, and another concerning the local realities of global interventions. The former primarily focuses on North–South multi-scalar commodity flows, while the latter is investigated within the context of, for example, AIDS/HIV interventions. Yet few offer empirical evidence from data-driven multi-scalar investigations following material processes as they pass through and across scales. Following adaptation finance provides a means to understand funding distribution through multiple bureaucratic administrations and reveals the micro reality of international funding efforts for local level actors these actions are designed to assist: on the international scale, it reveals how funding flows are directed by donor-recipient trade and political linkages, governance factors and not by climate vulnerability; on the subnational scale, economically productive districts receive disproportionately large amounts of funding activities, while climate vulnerable districts collect the least; finally, local implementation has positive implications for vulnerable communities in terms of climate risk reduction. If the most eligible receive funds, there is a discernable impact.

Third, the findings are of consequence to those engaged in the prominent climate finance debate within the United Nations climate regime. Academic and policy research has long been concerned with problems of accounting for new and additional funds and the reclassification of development assistance as adaptation. An alternative solution is to access local level information on the aims and objectives of funds, identifying a sample as adaptation finance, and then evaluating their effectiveness in terms of climate risk reduction. To account for effectiveness, local level studies should be privileged, as well as local actors. Working with local level implementers’ of funds, such as District Council representatives, offer unparalleled primary sources about the precise characteristics of funds, the beneficiaries and outcomes. The study thus navigates around the stasis of accounting for climate finance and instead offers a solution concentrating on the outcome of funds. Implied within this perspective is that increased amounts spent by developed states is irrelevant if funds arrive in the least vulnerable locations, and once there, make little impact on the lives of poor and marginalized households and communities.

Fourth, the study offers local level empirical research to the climate justice discussion. Often debates focus on the higher scales of climate change governance, or deliberate on ideal principles. Tracking adaptation finance explores the social, political and economic reality of vulnerable communities and their interactions with climate related hazards. Further, the finding that adaptation finance reduces climate risk of these actors is encouraging for those campaigning for greater funding flows to least developed states. This suggests that individuals and groups lobbying to secure funds are positively influencing the predicament for the poor and marginalized in the developing world. Funding does change the lives of people exposed to climate change, and when directed towards the most vulnerable, provides a means of addressing climate variability and change impacts as a justice issue.

Nevertheless, several negative procedural justice dynamics uncovered across villages may directly impact the experience of adaptation finance implementation. These are primarily due to power relations at the community level and reveal further barriers to delivering funds for the most vulnerable. Household interviews within villages consistently found many families either not participating or excluded from availing of certain interventions. For instance, Village Headmen sometimes control cassava gardens themselves; many villagers’ never had the opportunity to avail of public works programs such as flood defences; in some villages it was clear that the most productive and functional households where the main recipients of funds. These incidences suggest that gender, household functionality, and affiliation with Traditional Leaders, determines access to adaptation funds.

The final implication resides with the long discussed present and historical responsibilities of developed states and their proclamations to address equity within the United Nations climate regime. The finding suggests some actions of developed states are working to ameliorate the double inequality of risk and responsibility. Within the context of adaptation, climate justice is being addressed through finance from those responsible, but only in the at risk communities where adaptation finance arrives.

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Appendix A

All adaptation finance transfers are selected through human coding of the available descriptions. Narrow adaptation finance refers to any financial transfers with the explicit objective of facilitating adaptation or strengthening adaptive capacity to climate change – the imperative is that funds have a stated reference to adaptation or resilience and that the purpose is to address climate change; broad adaptation finance transfers were located by whether these monies sought climate vulnerability reduction in terms of the Intergovernmental Panel on Climate Change’s understanding of the direct and indirect effects of climate change–chronic and sudden-onset disasters brought about by drought, desertification, land degradation, floods, hurricanes, temperature increases and sea-level rise. If descriptions claim to address any of these issues, then they were classified as broad adaptation finance and included in the sample.