Article

Aligning Resilience and Wellbeing Outcomes for Locally-Led Adaptation in Tanzania

Emilie Beauchamp [1,*], Nigel C. Sainsbury [2], Sam Greene [1] and Tomas Chaigneau [2]

[1] International Institute for Environment and Development, London WC1V 7DN, UK; sam.greene@iied.org
[2] Environment and Sustainability Institute, University of Exeter, Penryn TR10 9FE, UK; nigel_sainsbury@sfu.ca (N.C.S.); t.w.b.chaigneau@exeter.ac.uk (T.C.)
[*] Correspondence: emilie.beauchamp@iied.org

Abstract: Interventions to address climate adaptation have been on the rise over the past decade. Intervention programmes aim to build the resilience of local communities to climate shocks, and ultimately their wellbeing by helping them to better prepare, adapt and recover. Resilience, similar to human wellbeing, is a multidimensional construct grounded in local realities and lived experiences. Yet current evaluation frameworks used in resilience programming rarely consider what resilience means in local contexts prior to implementation. This means policy designs risk failing to improve resilience of communities and creating unintended negative consequences for communities' wellbeing. Better processes and indicators for assessing resilience are needed. This paper explores the interplay between local predictors of resilience and wellbeing to assess the validity of self-assessed indicators as part of frameworks to measure resilience. We draw from research on the Devolved Climate Finance (DCF) mechanism implemented between 2014 and 2018 in Tanzania. We find that different factors explain resilience when compared to wellbeing; while resilience is primarily influenced by relationships, wellbeing is correlated with livelihoods. This shows that incentives to improve resilience differ from those of wellbeing. Climate and development practitioners must adopt locally grounded framings for resilience and wellbeing to ensure interventions track appropriate indicators, towards positive outcomes.

Keywords: climate adaptation; social resilience; human wellbeing; Devolved Climate Finance; resilient development; Tanzania; monitoring and evaluation

1. Introduction

An increasing awareness of the negative impacts of climate change on communities, including from the rising frequency of climate shocks and stressors, is spurring organisations to support adaption to these changes to enhance human welfare and wellbeing. Climate change however brings challenges that are wide-reaching, with the only expectation for the future being that it will be nothing similar to the present or past [1]. It is critical that governments, funding agencies and interventions integrate climate risks into plans and policies to progress sustainable development in the face of the climate crisis [2]. The concept of resilience is now widely used in policy and practice yet its meaning and measurement remain contested [3–5].

Resilience is seen as a pivotal concept in helping communities deal with climate related stressors and shocks [6]. Several definitions of resilience co-exist, spanning disciplines from engineering, ecology, psychology and social sciences [7,8]. Given the socio-ecological context of climate adaptation interventions, we here refer to climate resilience as the capacity of individuals, communities or systems to adapt, reorganize and evolve into more desirable configurations in face of climate shocks, leaving them better prepared for future climate change impacts [9–11]. Several factors affect resilience of individuals and of systems: resilience varies across scales and contexts, depending on the local manifestations of climate change (exposure), the degree to which people depend on affected

resources (sensitivity) and on their capacity to adapt to or take advantage of the changes they experience (adaptive capacity) [12]. Global accords such as the United Nation's Paris Agreement and 2030 Agenda for Sustainable Development [13] see resilience to climate variability and change as a key development priority to improve wellbeing [14,15]. This rise in policy interest has inevitably led to calls for identifying robust ways of measuring resilience across scales, and validation of the linkages between resilience and wellbeing outcomes [16,17]. Yet, how well local conceptualizations of both concepts compare and align locally is rarely explored (Chaigneau et al. In Review). This positive and synergistic relationship between wellbeing and resilience indicators remains a powerful yet unevidenced conceptual assumption with important implications for the design of development and climate intervention programmes—and the wellbeing of communities across the globe.

Linking Resilience and Wellbeing

Since the rise of resilience as a key concept, the term has been taken up by different policy actors and communities and has been interpreted, presented and applied in different ways in the humanitarian and development sphere [18]. The uptake of the term is similar to the one observed for the concept of human wellbeing as an alternative to income indicators of development progress [19].

The adoption of resilience to understand community response to climate shocks is reflected in the multitude of frameworks which seek to measure multiple dimensions of resilience through practical assessments [4,20]. There is however, no emerging consensus on what metrics or methods to use—neither for resilience, nor wellbeing [17]. Further, many of these frameworks measure more tangible factors, such as assets, livelihood strategies, financial or social capitals. These factors do not capture everything that encompasses what resilience is, or what influences when and how resilience capacities help buffer the negative effects of shocks and stressors [18]. A similar pattern is found for wellbeing, for which emphasis is often placed on objective and easily quantifiable indicators such as wealth and income over relational or subjective domains of wellbeing [21,22]. Increasingly, there are calls to assess how resilience and wellbeing are lived and experienced rather than through observable variables [23]. Subjective measures of resilience [24] and wellbeing [25,26] can enable an investigation of the key issues that people highlight when explaining their vulnerability to, and capabilities to deal with, climate change (rather than their proxy [1]), and how this relates to their wellbeing.

The complexities inherent within multi-dimensional concepts such as a resilience and wellbeing, together with the need for collecting and communicating evidence on the climate resilience of communities, raises questions about how best to measure, monitor and assess resilience and its consequence for wellbeing. Numerous measurement frameworks for climate and development programmes have emerged over the past decade to operationalise the concepts, and aggregate results within and between intervention programmes [17]. However, as resilience and wellbeing are not directly observable, they must be inferred from the measurement of items that can be observed [27]. As such, both are latent variables and, with a broad range of definitions in existence, quantitative measurement of resilience and its relationship to wellbeing therefore poses a significant challenge [28].

Complex sets of quantitative indicators are often used for monitoring and evaluating projects that seek to build resilience as a means to improve long-term wellbeing. The guidance to measure the number of people whose resilience has been improved as a result of intervention programmes often necessitates multiple time consuming and expensive steps. These steps often entail resilience metrics based on measured resilience at a household or individual scale, using a set of externally generated project-specific indicators (e.g., DFID 2014 in Brown [1]. There are a number of well-documented drawbacks of such an approach. Firstly, resilience capacities that experts choose to measure may not relate to lived experiences of resilience across different contexts. Secondly, variables identified often prove difficult to measure objectively. Finally, resilience indicators often require variables

to be combined into a single value that can cause difficulties with relative weighting and addressing interactions between different resilience domains [28].

Rather than investing greater effort and more resources in developing definitive measurements of resilience and wellbeing, Levine [3] argues that organisations should focus on becoming better at quantifying things that really matter to communities. Importantly, it is the understanding of the determinants of resilience and wellbeing in different contexts that is more important than attempting to quantify the outputs of resilience-focused interventions [29].

Within resilience frameworks proposed by development actors, resilience is often framed normatively as an intermediate outcome that is conceptually linked to the long-term impact of improved wellbeing variables, such as food security or poverty reduction [30–32]. From a programming perspective, there is a hypothesized link between increasing resilience—or having better adaptive capacities—and improving wellbeing. For example, this was the case of the 3As framework of the global climate programme Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED), which was funded from 2015 to 2019 by the UK Department for International Development [33,34]. Indeed, the preferred way to assess the value of a resilience measure is its ability to predict a proxy outcome of interest, usually relating to food security, nutrition status or other objective measures of wellbeing [35].

Wellbeing and resilience are often assumed to be related, reinforcing or synergistic [36,37]. However, very little of the policy literature refers to the possibility of trade-offs inherent in advancing resilience as a means to improve wellbeing [38]. When multiple domains of resilience are considered, tensions between these—and with the multidimensional nature of wellbeing—may reveal each other [39]. For example, in the context of acute poverty, trade-off between provision of basic needs and fundamental rights such as food security with system resilience have been found in small-scale fisheries in West Africa [40]. Greenpeace have also highlighted that projects focused on achieving wider wellbeing goals through increased food production have left farmers less resilient as they are increasingly dependent on external inputs and resources that are too costly for farmers [41]. More generally, Medecins Sans Frontieres have also stated that building resilience can be at odds with approaches to crises that seek to enhance wellbeing [42]. They state that building resilience can become an excuse for inaction and consequently can ignore wellbeing impacts from resilience interventions.

Despite the popularity of development interventions and academic research involving resilience and wellbeing separately, there has been limited research to date exploring the linkages between the two concepts. The interplay resilience and wellbeing has only recently started to be explored conceptually in social-ecology and development [23]. Yet empirical evidence of how resilience and wellbeing outcomes pan out in reality remains scant, due in part to lack of reliable local data from either local government and development projects [17,43].

This paper addresses this gap by exploring the alignment and trade-offs between two local indicators of resilience and wellbeing, as part of a devolved climate and development project in Tanzania. We expect that predictors of local resilience and wellbeing will broadly align together, as per the normative development frameworks seeking increasing wellbeing from increased resilience. We use this analysis to assess the implications for framing and designing climate resilience programmes for sustainable development outcomes. This research draws on secondary data from monitoring and evaluation (M&E) exercises applied during the pilot of the Devolved Climate Finance (DCF) mechanism in Tanzania—more specifically its 2017 household baseline survey—by the International Institute for Environment and Development. DCF is a research action and advocacy project supporting local people to access to locally controlled adaptation funds in three districts in Northern Tanzania.

2. Materials and Methods

2.1. Study Site

The DCF mechanism aims to support locally led adaptation to climate change by enabling communities to access funding for locally prioritised public good investments [44]. To date, it has been piloted across four countries: Kenya, Tanzania, Mali and Senegal [45–48]. The DCF mechanism consists of four dimensions: (1) the creation of local adaptation committees that identify and implement resilience investments based on inclusive community consultations and pre-defined fund criteria; (2) the use of participatory resilience assessments and climate information-informed local decision-making tools, through which communities identify climate stresses, opportunities and resilience-building priorities; (3) the development of local climate adaptation funds managed by local governments to finance locally-prioritised public good investments in resilience; and (4) local monitoring to assess effectiveness of resilience investments, support iterative learning and inform future planning [44].

This article focuses on the implementation of the DCF mechanism in three northern districts in the Arusha Region of Tanzania (Figure 1) between 2014 and 2018. The project was funded by the UK government's Department for International Development's UK Aid (now the Foreign, Commonwealth and Development Office), which provided a US$4.8 million (£3.8 million) grant under its 'Assisting public institutions and markets to become resilient to effects of climate change in Tanzania' (AIM 4 Resilience) programme. The project aimed to strengthen the government of Tanzania's capacity to channel climate finance to the local level, at scale, for adaptation, by piloting the DCF mechanism in the three districts of Monduli, Longido and Ngorongoro. The mechanism was overseen by a consortium led by the President's Office—Regional Administration and Local Government and provided a system for accessing climate finance and channeling it, through existing government systems, towards a sub-national planning process that enables locally planned and delivered local investments for resilience. The DCF mechanism upholds the principle that local communities have existing strategies for managing climate variability and are best placed to identify investments that will support their adaptive strategies. In practice, most local investments aim to reinforce livelihood systems and productive assets, as part of a range of climate adaptation strategies. Through the mechanism, £1 million was directed towards 35 public good investments identified by community-led committees.

The three districts of Monduli, Longido and Ngorongoro comprise varied agro-ecological systems and a great variety of access to public services or transport infrastructures. Longido, Ngorongoro and parts of Monduli are dryland ecosystems characterised by variability and unpredictability of rainfall across time and space and high levels of biodiversity. Other parts of Monduli include the East African Rift Valley with milder temperatures and a bi-modal rainfall pattern.

As in many dryland regions, communities rely on flexible and varied livelihood strategies and associated cultures. Economies are dominated by produce from agro-pastoral activities that use flexibility, negotiated seasonal migration and customary resource management systems to maximise productivity during periods of rainfall and minimise loss during dry spells. Most pastoralists in the region identify as Maasai. Non-Maasai, and particularly those living in the valley regions of Monduli, engage in cultivation of crops including Maize, Millet and other vegetables, often for export—although Maasai farmers, particularly wealthy ones, also often cultivate crops. In normal times the local economy is bolstered by tourism generated by the rich biodiversity and famed wildlife, as well as artisanal mining and growing urban centres.

The DCF project operated across 10 administrative divisions in the district authorities of Monduli, Longido and Ngorongoro. Divisions consist of 3–5 wards, with wards in the three districts having an average population of 12,000. A history of inappropriate development interventions, marginalisation and policies that undermine local livelihood strategies including seasonal mobility, combined with climate shocks (droughts, flooding) and slow-onset threats (temperature change, changing rainfall patterns, windstorms)

have culminated in widespread poverty and vulnerability to climate change. Longido is particularly drought prone and 55% of its population falls below the Tanzanian basic needs poverty line [49].
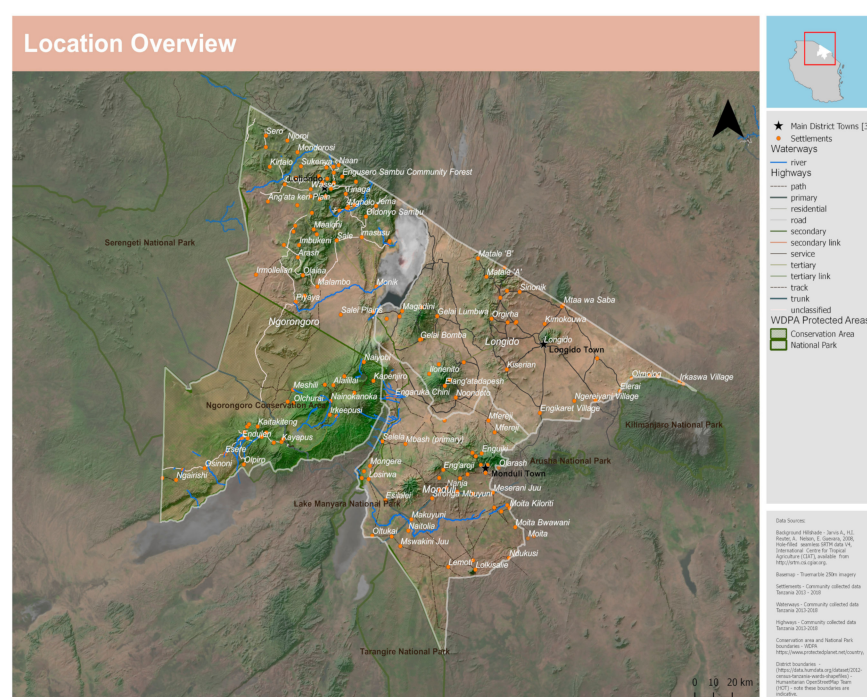

Figure 1. A project map Monduli, Longido and Ngorongoro in Northern Tanzania [50].

2.2. Methods

This analysis uses secondary data collected in the frame of its project M&E exercises. The Tanzania DCF project team developed a household survey to measure resilience and identify changes over time in household resilience guided by the TAMD framework, and other M&E exercises in Mali and Senegal [17]. The survey design aimed at recording changes in core outcomes of household wellbeing and resilience, along with influencing factors in villages across years. This article is based on the baseline data collected for a longitudinal analysis. However, due to cuts in the programme funding, there was no possibility to collect data later or after the intervention. Given this programmatic M&E purpose and the desire to test simple indicators that local actors could use, the DCF team framed resilience in the context of climatic shocks and tested indicators of subjective resilience and community wellbeing ranking. The household survey was designed and administered by LTS International, an M&E consulting firm working with DCF project partners to track indicators identified by communities as valuable for increased resilience in planning meetings for DCF investments. The survey was reviewed and edited by a community expert from Northern Tanzania for context relevance. This article uses anonymized secondary data for this analysis.

Data collection took place across 19 villages in April and May 2017, six in Longido, six in Monduli and seven Ngorongoro. Villages for data collection were selected by grouping those likely to benefit from DCF interventions by thematic areas including water access, livestock health, agriculture or market access. An equal number of villages were selected across Monduli, Longido and Ngorongoro. Villages were relevant, a selection was made to ensure villages with characteristics representative of the overall community, reflecting dominant livelihoods in the region.

Data collection for community wellbeing rankings were developed using participatory discussions with mixed and women-only groups of 8–12 people from sampled villages. Participants described characteristics of four or five categories of wellbeing, which differed for men and women. They then ranked a representative group of 150 households in their

villages against each category. Through the process, they further refined the categories. Defining characteristics included size of family, ability to obtain food for the household, number of livestock and land ownership for households cultivating crops. Data was collected from 572 households across 17 villages in in April and May 2017. Enumerators were identified by project partners as well by local government officers from sampled villages. Local language enumerators able to speak Ma, the Maasai language, were necessary to ensure participants could offer meaningful responses, which were translated during the interview into KiSwahili and English for recording. Training was carried out with enumerators by the M&E consultant one week before data collection. Stratified random sampling was used to identify households for interviews. Households were selected using the wellbeing categories from wellbeing ranking exercises to ensure proportional representation of households from each category.

2.3. Variables and Statistical Analysis

This analysis is concerned with two primary response variables: community ranking of household wellbeing, and household subjective resilience. Subjective indicators were included as part of other proxy variables to better understand determinants of perceived resilience and wellbeing. Subjective approaches to measurement are argued to add value to more traditional, objective measures for three reasons. Firstly, they suggest that they can improve our understanding of the drivers of latent concepts such as resilience and wellbeing. It offers a valuable opportunity to capture the perspectives of those who know most about their own resilience and wellbeing, and the factors that contribute to it: the people themselves [49]. Secondly, they can reduce the questionnaire burden on respondents. This is especially relevant where the main goal of a questionnaire is to investigate the level, rather than the drivers, of resilience and wellbeing [28]. Finally, they can offer more valid cross-cultural comparisons, as they measure an individual's perception of whether their overall resilience capacities are sufficient to maintain and/or improve wellbeing within the context of shocks and stressors that they currently experience and are likely to experience in future.

Subjective wellbeing was first locally defined before being assessed through a local ranking exercise. Wellbeing—or "Maisha Bora" in KiSwahili, "Ingishu Sidai" in Maa, is broadly understood as having a "good life" and doing well economically. For some, it is closely linked to available wealth. The ranking exercises used the locally defined concept of wellbeing to identify categories of wellbeing within a village through a series of focus groups (see Table 1). Enumerators asked participants to state whether a household had higher or lower wellbeing when compared to the average in the village. They then asked why the household ranked so, through which locally assessed definitions of wellbeing were developed.

Depending on the village, the wellbeing ranking process identified four or five categories of wellbeing, with women picking out different characteristics to mixed groups. The precise nature of the categories differs from village to village, and the variable cycles of drought and rainfall necessarily introduce fluidity between them: several years of good rains can see some households gain greater wellbeing and move upwards through categories—but drought, disease or other factors can have significant negative impacts.

Subjective resilience was assessed in the household survey on a scale of 1 to 10, as per the respondent's perceptions. We asked, "On a scale of 1–10, 1 being the lowest, 10 being the highest, please rate how resilient you feel to the impacts of climate change?".

Explanatory variables were selected using theoretical justification, an assessment of key factors of resilience, and mixed factor analysis to check for multi-collinearity. Table 2 shows the justification, format and transformation for variables used in the statistical analysis.

Table 1. Overview of typical characteristics identified under different levels of wellbeing through the wellbeing ranking exercise. Mixed and women focus groups are shown, aggregated across villages.

Category	Women's Groups	Mixed Group
High *(Irkasis)*	Married to a man with livestock 3 meals a day Can buy food when needed Access to health services Own medium sized businesses Able to dress well Farm ownership (non-Maasai households) Children educated to college level Small poultry farms Access to credit Water storage and rainwater harvesting	Ownership of cattle (150+) Ownership of sheep and goats (400+) Children educated to college level Access to health services Able to hire labour and vehicles to support livelihood Land ownership (for cultivating households) −10 acres + Rainwater storage facilities Able to support others in the community Stone houses with iron roofs
Upper Middle *(Irkasis Lepolos)*	Own small businesses Children go to school with support from small businesses Some access to credit	Ownership of cattle, <150 cattle Ownership of sheep and goats <400 Children educated to form 4 level Access to health services Some vehicle access Own secondary businesses Access to tractors (farming only) Land ownership 5–7 acres Donkey access
Lower Middle *(Irmentati)*	Dependant on others, particularly Irkarsis Participate in women's self-help groups Dependent on family/clan for support Work as casual labourers or petty traders Often widowed or without husbands Children educated up to form 6 Some credit access through village communitybanks Often single parents or absentee husbands	Work as casual labourers Ownership of cattle − <10 cattle Ownership of sheep and goats <30 Dependent on state support for health services Reduced food access
Low *(Ilaisanik)*	Reduced nutrition intake Unreliable businesses—*"pata potea"* selling firewood, vegetables, eggs <2 cattle <2acre of land	Work as casual labourers Reliant on others in the community for support No cattle ownership Sheep/Goat ownership <10 Reduced Food Access
Lowest *(Ndorobo)*	Often elderly Few possessions or income generating activities Dependent on others for support: permitted to grow beans in between Maize	Destitute No livestock owned Dependent on others in the community for survival

Separate statistical models were estimated to test the effect of livelihood explanatory variables on subjective resilience and wellbeing. A proportional odds cumulative logit generalised linear mixed effects (POCL) model analytical framework was selected, reflecting the ordinal categorical nature of the response variables. The proportional odds cumulative logit model is suitable in this case as it reflects the appropriate amount of information contained within the ordinal response variable, in that the variable represents an underlying continuous interval/ratio variable and so neither loses the ordinal information nor assumes a ratio or interval value that is not present. Further, the use of the POCL model is also appropriate because we assume that the coefficients across levels of the dependent variable are constant (proportional odds). The POCL models were fitted using the Ordinal package [51] in R Programming with the village treated as a random effect to account for spatial differences in the response variables. A detailed description of the POCL model can be found in Supplementary Materials (Tables S1 and S2). Model validation tests (optimization convergence, parameter accuracy and likelihood function

performance), as required by for ordinal logistic regression, were performed using the Ordinal package [51] and were satisfied.

An Information Theoretic (IT) approach to model selection [52,53] was adopted to reflect the absence of a single truth for relationships between resilience, wellbeing and the predictor variables we have selected. The IT approach recognises that the data was not collected in an experimental setting and that an average of possible models will provide the best insight into the workings of the system. The 'MuMIn' package [54] was used to create a selection of candidate models from the global model up to two points lower than the best model AIC. The global model consisted of the variables summarised in Table 2.

Table 2. Hypothesis and table of variables used for the statistical analysis.

Variable	Direction of Effect	Justification	Format and Transformation
Response Variables			
Subjective resilience	N/A	Response variable	10 level response scale consolidated to 1–4 scale to homogenise distribution (1–2 = 1, 3–4 = 2, 5–6 = 3, 7–10 = 4)
Wellbeing	N/A	Response variable	Six level response scale consolidated to 1–4 scale to homogenise distribution (5–6 = 4)
Explanatory Variables			
Gender of head of household (HHH)	Negative for female HHH	Reduces adaptive capacity for women through agency and assets domains	None
Major livelihood	Negative for pastoralists	Affects adaptive capacity through assets, flexibility and agency domains	None
Livelihood diversity	Positive	Enhances adaptive capacity through flexibility domain	Converted to total count of number of major livelihood and complementary incomes sources for each respondent.
Livelihood group membership	Positive	Enhances adaptive capacity through organization and learning domain	None
Receipt of climate information	Positive	Enhances adaptive capacity through learning domain	None
Water access for domestic use in dry season	Positive	Enhances capacity through assets domain	None
Livestock ease of pasture access all season score	Positive	Enhances capacity through assets and flexibility domain	None
Livestock market access	Positive	Enhances capacity through assets and flexibility domain	None
Storage of harvest	Positive	Enhances capacity through assets and flexibility domain	4 level categorical responses consolidate to two ("No" = "no", "yes" = "yes", "Yes, in my house" = "yes", "Yes, in a communal storage facility" = "yes")
Access to agricultural extension services	Positive	Enhances capacity through learning domain	None
Use of irrigation	Positive	Enhances capacity through assets domain	None

3. Results

After respondents were removed due to data absence, 392 (resilience) and 410 (wellbeing) responses were used in the models. Of the sample used in the wellbeing model, 48% heads of household were female and 52% male. Major livelihoods of the household were 45% agro-pastoralist, 40% pastoralist, 10% farmer, 2% pastoralist-business, 2% business and 1% agro-pastoralist-business. Below we report the results from the regressions on self-assessed resilience (Table 3) and wellbeing ranking (Table 4).

3.1. Resilience

The most important predictor variables for self-reported resilience in the average model were the major livelihood of the household, membership of a livelihood group and gender of head of household. However, only the coefficient estimates for gender of head of household and livelihood group membership had confidence intervals that did not cross zero, providing high confidence in the direction of effect. Female head of households were found to have a lower subjective resilience than men. Respondents that were members of a livelihood group had higher subjective resilience than those who were not. In order of importance in the average model (from more to less), storage of harvest, use of irrigation, livelihood diversity, climate information and ease of access to livestock markets were also found to play a role in subjective resilience, although the confidence intervals for their coefficient estimates cross zero indicating low confidence in the direction of effect. Details of explanatory variable importance in the average model can be found in the Supplementary Materials.

Table 3. Results from average model (conditional average) for resilience. Conventional symmetric so-called Wald confidence intervals were run for the parameters and are presented alongside the estimate and standard error, all on the log odds scale. The importance of each variable to the average model, and the number of models in which the variables appear are shown in Table S1 in Supplementary Materials.

Parameter	Categorical Base Level	Estimate	Std Error	CI (2.5%)	CI (97.5%)
1|2	N/A	−0.81573	0.41317	−1.626	−0.006
2|3	N/A	0.72689	0.41197	−0.081	1.534
3|4	N/A	2.85900	0.43901	1.999	3.719
Major livelihood (Agro-pastoralist)		0.71067	0.38221	−0.038	1.460
Major livelihood (Agro-pastoralist-business)		0.99860	1.02518	−1.011	3.008
Major livelihood (Business)	Pastoralist	1.20880	0.80441	−0.368	2.785
Major livelihood (Farmer)		−0.57144	0.53840	−1.627	0.484
Major livelihood (Pastoralist-business)		−0.64994	0.79651	−2.211	0.911
Gender (Female)	Male	−0.58767	0.19740	−0.975	−0.201
Livelihood group membership (Yes)	No	0.46499	0.22861	0.017	0.913
Storage of harvest (Yes)	No	0.51670	0.32002	−0.111	1.144
Use of irrigation (Yes)	No	0.57968	0.45588	−0.314	1.473
Livelihood diversity (Number of livelihoods)	N/A	0.22720	0.18227	−0.130	0.584
Receipt of climate information (Yes)	No	0.19065	0.21595	−0.233	0.614
Livestock market access (Somewhat difficult)		0.56667	0.34236	−0.104	1.238
Livestock market access (A little difficult)	Always accessible	0.36569	0.35761	−0.335	1.067
Livestock market access (Very difficult)		0.03825	0.38372	−0.714	0.790

Table 4. Results from average model (conditional average) for wellbeing. Conventional symmetric so-called Wald confidence intervals were run for the parameters and are presented alongside the estimate and standard error, all on the log odds scale. The importance of each variable to average model, and the number of models in which the variables appear are also shown. See Table S2 in Supplementary Materials for additional details.

Parameter	Categorical Base Level	Estimate	Std Error	CI (2.5%)	CI (97.5%)
1|2	N/A	−1.51831	0.31805	−2.142	−0.895
2|3	N/A	−0.22500	0.30626	−0.825	0.375
3|4	N/A	1.49210	0.31336	0.878	2.106
Major livelihood (Agro-pastoralist)		−0.23339	0.29832	−0.818	0.351
Major livelihood (Agro-pastoralist-business)		−0.67400	0.86520	−2.370	1.022
Major livelihood (Business)	Pastoralist	−0.50057	0.77468	−2.019	1.018
Major livelihood (Farmer)		1.32243	0.44961	0.441	2.204
Major livelihood (Pastoralist-business)		−0.55534	0.63701	−1.804	0.693
Gender (Female)	Male	0.32378	0.18885	−0.046	0.694
Livelihood group membership (Yes)	No	−0.28282	0.21242	−0.699	0.134
Domestic water access (Somewhat difficult)	Very difficult	−0.33826	0.36932	−1.062	0.386
Domestic water access (Moderately easy)	Very difficult	−0.14374	0.32353	−0.778	0.490
Domestic water access (Very easy)	Very difficult	0.53277	0.42822	−0.307	1.372
Livelihood diversity (Number of livelihoods)	N/A	−0.10755	0.17719	−0.455	0.240
Use of irrigation (Yes)	No	−0.25168	0.40900	−1.05	0.550
Ease of access to pasture in dry season (Difficult)	Easy	−0.12472	0.23288	−0.581	0.332
Receipt of climate information (Yes)	No	−0.08802	0.20004	−0.480	0.304

3.2. Wellbeing

Major livelihood was found to be the most important predictor of household well-being, mirroring importance for explaining self-reported resilience. Farming households were shown to have higher wellbeing than pastoralist households (coefficient estimate confidence intervals did not cross zero). Gender was also important in predicting wellbeing, although the direction of effect had greater uncertainty (confidence intervals cross zero). The same uncertainty affects the remaining predictors of wellbeing, which in order of importance in the average model (high to low) were domestic water access, livelihood diversity, use of irrigation, ease of access to pasture in the dry season and receipt of climate information. Details of explanatory variable importance in the average model can be found in the Supplementary Materials.

3.3. Resilience-Wellbeing Equivalence

Of the nine explanatory variables in the average models for either resilience or wellbeing, six featured in both average models (major livelihood, gender of head of household, livelihood grop membership, livelihood diversity, crop irrigation and receit of climate information). Two predictor variables (resilience model) and one (wellbeing model) had confidence intervals that did not cross zero (high confidence in direction of effect) (Table 5): difference between agriculture and pastoralist major livelihood on wellbeing; gender of head of household on resilience; and livelihood group membership on resilience. As such, high confidence effects of explanatory variables on resilience or wellbeing were not equivalent, which prevented comparison of the direction of effect of variables on resilience and wellbeing. Three explanatory variables only appeared in one of the average models: domestic water access in dry season and ease of access to pasture in dry season only affected wellbeing; and ease of access to livestock market only affected wellbeing.

Table 5. Comparison between the effects of aspects of adaptive capacity on resilience and subjective wellbeing (* important in system but 95% confidence intervals of coefficient estimates cross zero; ** important in system and 95% confidence intervals of 95% confidence intervals do not cross zero; N/A means that variable does not feature in average model are not important in system).

Variable	Resilience	Wellbeing	Comparison
Major livelihood	*	**	=
Gender of head of household (female)	**	*	=
Livelihood group membership	**	*	=
Domestic water access in dry season	N/A	*	≠
Livelihood diversity	*	*	=
Crop irrigation	*	*	=
Ease of access to pasture in dry season	N/A	*	≠
Receipt of climate information	*	*	=
Ease of access to livestock market	*	N/A	≠

4. Discussion

We analyzed household survey data from the baseline of the climate and development project to assess if, and how, factors affecting local concepts of resilience and wellbeing aligned. We found that while six predictors featured in both average models, high confidence predictor variables were not shared between models. The results show that while both resilience and wellbeing can conceptually feature similar sets of proxy predictors, meaningful predictors that have high influencing effects are not aligned. This falls against our initial assumption that predictors of wellbeing would match those of resilience. The relative importance of some variables was high in both models; however, their lack of high confidence effect means this cannot be used as a basis for replicable and transferable results.

Only the difference between agriculture and pastoralist major livelihood influenced wellbeing outcomes with high confidence, whereas both gender of the household head and membership of a livelihood group did so for resilience outcomes. This falls in line with conceptualizations that livelihoods and wellbeing are closely related [55–57], not simply in terms of income but also identity. Resilience results also point to the importance of power, agency and relationships as key determining factors [12]. While predictors of resilience and wellbeing are not shared, they nonetheless point to strong links between both concepts and local power dynamics. The observed cleavages between farmers and pastoralists, and between men and women head of households mean climate and development interventions must sit on robust interpretation and navigation of local power dynamics and intersectionality. Strategies benefitting one or some social groups may be detrimental to others.

Understanding and respecting local social norms and power dynamics require taking appropriate time and resources at project inception, something current project life cycles rarely allow. This research encourages practitioners and donors to secure enough resources at the expense of making entire programmes miss expected yet misunderstood outcomes. Bottom-up work that puts local people and rules at the center of interventions are required not only to produce positive outcomes, but also to start addressing the decolonization of aid.

This means practitioners must explore carefully what are the hypothesized pathways of change between resilience outcomes and wellbeing impacts, at a disaggregated scale. This is essential to avoid unintended negative consequences to local wellbeing by programming activities that could lead to maladaptation and ill being in the long-term. Developing with local communities involved a shared understanding of the underlying mechanisms that underline correlations is critical to reach positive effects. Our analysis shows that resilience-seeking interventions may need to programme different sets of activities, such

as the creation of cooperative, and gender-focused work, whereas wellbeing-seeking interventions must ensure livelihood benefits are reached. These are far from incompatible, yet this shows how several completing strategies must be used to achieve both sustained resilience and wellbeing—rather than focusing on few select activities.

Our analysis shows that subjective indicators of wellbeing and resilience are a useful part of indicators used to understand impacts on these latent variables. Wellbeing and resilience are fluctuating states, and more importantly can be a state of mind. Ensuring that researchers and practitioners understand and monitor how different observable factors affect subjective perceptions and lived experiences are key in designing programmes that truly build resilient and sustainable capabilities in local communities, regardless of the nature of the shocks and changes occurring. Using subjective indicators can further inform whether building resilience to climate shocks should be considered separate to building resilience to other shocks and stressors for intervention programming. Ultimately, feeling resilient and well are key desirable outcomes that should drive sustainable development.

This research provides empirical evidence that go against hypothesized theories of change, resilience does not straightforwardly contribute to wellbeing [39]. We show that the misalignment between their predictors suggests the relationship between the multiple dimensions of resilience and wellbeing are not linear. However, this research has not allowed commenting on whether the conceptualizing resilience as a short or medium-term outcome and wellbeing as a long-term impact appropriately reflects local realities. While this research applies practically to Tanzania, other regional research has shown that localized resilience and wellbeing predictors do not align. Practitioners must therefore carefully monitor and track changes across several indicators for potential trade-offs.

Further empirical research on local conceptualisations of wellbeing and resilience, both qualitative or quantitative, is needed to verify how predictors change through time. Building collections of robust local case studies would promote building regional, and ultimately global, syntheses and meta-analyses that could provide a robust evidence base for practitioners and policy makers to understand and plan to improve resilience and wellbeing appropriately. This would also enable building conceptual framework that truly reflect local and lived realities. Similarly, power dynamics analysis should feature as an ongoing exercise throughout projects to ensure unequal dynamics are not reproduced or entrenched.

5. Conclusions

Both resilience and wellbeing are multidimensional concept, that cannot be tracked and assessed without a series of both qualitative and quantitative indicators that can reflect their latent dimensions. These indicators must be locally contextualized and interrogated prior to development interventions, at the risk of perpetuating incorrect assumptions about how resilience and wellbeing interact in the local communities involved. Community power dynamics, social identities must become integral parts of programming rather than quick inception assessments to ensure the trade-offs between—and within—resilience and well-being dimensions, do not lead to maladaptation and illbeing.

References

1. Jones, L.; Tanner, T. 'Subjective resilience': Using perceptions to quantify household resilience to climate extremes and disasters. *Reg. Environ. Chang.* **2017**, *17*, 229–243. [CrossRef]
2. Brown, K. *Resilience, Development and Global Change*; Routledge: Abingdon, UK, 2016.
3. Brooks, N.; Anderson, S.; Aragon, I.; Smith, B.; Kajumba, T.; Beauchamp, E.; D'Errico, S.; Rai, N. *Framing and Tracking 21st Century Climate Adaptation*; IIED: London, UK, 2019.
4. Levine, S. *Assessing Resilience: Why Quantification Misses the Point*; Overseas Development Institute: London, UK, 2014; p. 26.
5. Schipper, E.L.F.; Langston, L. *A Comparative Overview of Resilience Measurement Frameworks Analysing Indicators and Approaches*; Working Paper 422; Overseas Development Institute: London, UK, 2015; p. 30. [CrossRef]
6. Sharifi, A. A critical review of selected tools for assessing community resilience. *Ecol. Indic.* **2016**, *69*, 629–647. [CrossRef]
7. Eakin, H.C.; Lemos, M.C.; Nelson, D.R. Differentiating capacities as a means to sustainable climate change adaptation. *Glob. Environ. Chang.* **2014**, *27*, 1–8. [CrossRef]
8. Alexander, D.E. Resilience and disaster risk reduction: An etymological journey. *Nat. Hazards Earth Syst. Sci.* **2013**, *13*, 2707–2716. [CrossRef]
9. Searle, B.A.; Pykett, J.; Alfaro-Simmonds, M.J. Introduction to wellbeing research. In *A Modern Guide to Wellbeing Research*; Edward Elgar Publishing: Cheltenham, UK, 2021.
10. Adger, W.N. Social and ecological resilience: Are they related? *Prog. Hum. Geogr.* **2000**, *24*, 347–364. [CrossRef]
11. Adger, W.N. Vulnerability. *Glob. Environ. Chang.* **2006**, *16*, 268–281. [CrossRef]
12. Folke, C. Resilience: The emergence of a perspective for social–ecological systems analyses. *Glob. Environ. Chang.* **2006**, *16*, 253–267. [CrossRef]
13. Cinner, J.E.; Adger, W.N.; Allison, E.H.; Barnes, M.L.; Brown, K.; Cohen, P.J.; Gelcich, S.; Hicks, C.C.; Hughes, T.P.; Lau, J.; et al. Building adaptive capacity to climate change in tropical coastal communities. *Nat. Clim. Chang.* **2018**, *8*, 117–123. [CrossRef]
14. United Nations United Nations Framework Convention on Climate Change, Paris, France. 2015. Available online: https://unfccc.int/sites/default/files/english_paris_agreement.pdf (accessed on 1 June 2021).
15. Béné, C.; Wood, R.G.; Newsham, A.; Davies, M. Resilience: New Utopia or New Tyranny? Reflection about the Potentials and Limits of the Concept of Resilience in Relation to Vulnerability Reduction Programmes. *IDS Work. Pap.* **2012**, *2012*, 1–61. [CrossRef]
16. Szaboova, L.; Brown, K.; Chaigneau, T.; Coulthard, S.; Daw, T.M.; James, T. Resilience and Wellbeing for Sustainability. In *Ecosystem Services and Poverty Alleviation*; Routledge: London, UK, 2018; pp. 273–287.
17. Jones, L.; Harvey, B.; Cochrane, L.; Cantin, B.; Conway, D.; Cornforth, R.J.; De Souza, K.; Kirbyshire, A. Designing the next generation of climate adaptation research for development. *Reg. Environ. Chang.* **2018**, *18*, 297–304. [CrossRef]
18. Beauchamp, E.; Abdella, J.; Fisher, S.; McPeak, J.; Patnaik, H.; Koulibaly, P.; Cissé, D.; Touré, M.; Bocoum, A.; Ndao, M.; et al. Resilience from the ground up: How are local resilience perceptions and global frameworks aligned? *Disasters* **2019**, *43*, S295–S317. [CrossRef]
19. Béné, C.; Frankenberger, T.; Griffin, T.; Langworthy, M.; Mueller, M.; Martin, S. 'Perception matters': New insights into the subjective dimension of resilience in the context of humanitarian and food security crises. *Prog. Dev. Stud.* **2019**, *19*, 186–210. [CrossRef]
20. Gough, I.; McGregor, J. *Wellbeing in Developing Countries: From Theory to Research*; Cambridge University Press: Cambridge, UK, 2007.

21. Ifejika Speranza, C.; Wiesmann, U.; Rist, S. An indicator framework for assessing livelihood resilience in the context of social-ecological dynamics. *Glob. Environ. Chang.* **2014**, *28*, 109–119. [CrossRef]

22. Reyes-García, V.; Babigumira, R.; Pyhälä, A.; Wunder, S.; Zorondo-Rodríguez, F.; Angelsen, A. Subjective Wellbeing and Income: Empirical Patterns in the Rural Developing World. *J. Happiness Stud.* **2015**, *17*, 773–791. [CrossRef]

23. White, S.C. Bringing Wellbeing into Development Practice. In *Wellbeing in Developing Countries Research Group Working Paper*; University of Bath/Wellbeing in Developing Countries Research Group: Bath, UK, 2009; p. 50.

24. Brown, K. Resilience, Development and Global Change. In *Resilience, Development and Global Change*, 1st ed.; Routledge: London, UK, 2015; pp. 1–208. [CrossRef]

25. Jones, L.; Samman, E.; Vinck, P. Subjective measures of household resilience to climate variability and change. *Ecol. Soc.* **2018**, *23*, 23. [CrossRef]

26. Clark, D. *Adaptation, Poverty and Development: The Dynamics of Subjective Well-Being*; Springer: Berlin, Germany, 2012.

27. White, S.C. Analysing wellbeing: A framework for development practice. *Dev. Pract.* **2010**, *20*, 158–172. [CrossRef]

28. Joseph, J.; McGregor, J. *Wellbeing, Resilience and Sustainability*; Springer: Cham, Switzerland, 2019.

29. Clare, A.; Graber, R.; Jones, L.; Conway, D. Subjective measures of climate resilience: What is the added value for policy and programming? *Glob. Environ. Chang.* **2017**, *46*, 17–22. [CrossRef]

30. Brown, K. Global environmental change: A social turn for resilience? *Prog. Hum. Geogr.* **2014**, *38*, 107–117. [CrossRef]

31. Marshall, N.; Marshall, P.; Tamelander, J.; Obura, D.; Malleret-King, D.; Cinner, J.E. *A Framework for Social Adaptation to Climate Change: Sustaining Tropical Coastal Communities and Industries*; IUCN: Gland, Switzerland, 2010.

32. Bennett, N.J.; Dearden, P. Why local people do not support conservation: Community perceptions of marine protected area livelihood impacts, governance and management in Thailand. *Mar. Policy* **2014**, *44*, 107–116. [CrossRef]

33. Béné, C.; Frankenberger, T.; Nelson, S. Design, Monitoring and Evaluation of Resilience Interventions: Conceptual and Empirical Considerations. *Inst. Dev. Stud.* **2015**, *2015*, 26.

34. DFID. *Methodology for Reporting Against KPI4—Number of People Whose Resilience Has Been Improved as a Result of Project Support*; DFID: London, UK, 2014.

35. Bahadur, A.; Peters, K.; Wilkinson, E.; Pichon, F.; Gray, K.; Tanner, T. *The 3As: Tracking Resilience across BRACED*; ODI: London, UK, 2015.

36. Constas, M.; Frankenberger, T.; Hoddinott, J. *Resilience Measurement Principles: Toward an Agenda for Measurement Design*; Food Security Information Network: Rome, Italy, 2014.

37. Frankenberger, T.R.; Constas, M.A.; Nelson, S.; Starr, L. *Nongovernmental Organizations Approaches to Resilience Programming*; International Food Policy Research Institute: Washington, DC, USA, 2014.

38. Smith, L.C.; Frankenberger, T.R. Does Resilience Capacity Reduce the Negative Impact of Shocks on Household Food Security? Evidence from the 2014 Floods in Northern Bangladesh. *World Dev.* **2018**, *102*, 358–376. [CrossRef]

39. Robards, M.D.; Schoon, M.L.; Meek, C.L.; Engle, N.L. The importance of social drivers in the resilient provision of ecosystem services. *Glob. Environ. Chang.* **2011**, *21*, 522–529. [CrossRef]

40. Chaigneau, T.; Camfield, L.; Coutlhard, S.; Jones, L.; Matthews, N.; Mcquistan, C.; Szaboova, L.; Daw, T.; James, T.; Reyers, B.; et al. Reconciling wellbeing and resilience for sustainable development. *Nat. Sustain..* in press.

41. Béné, C.; Evans, L.; Mills, D.; Ovie, S.; Raji, A.; Tafida, A.; Kodio, A.; Sinaba, F.; Morand, P.; Lemoalle, J.; et al. Testing resilience thinking in a poverty context: Experience from the Niger River basin. *Glob. Environ. Chang.* **2011**, *21*, 1173–1184. [CrossRef]

42. Thomson, K.F.; Kruszewska, I.; Tirado, R. *Building Environmental Resilience: A Snapshot of Farmers Adapting to Climate Change in Kenya*; Greenpeace Research Laboratories: Technical Report: 04-2015; University of Exeter: Exeter, UK, 2015.

43. Whittall, J.; Philipis, M.; Hofman, M. Opinion and Debate: Building Resilience by Deconstructing Humanitarian Aid. Available online: https://www.msf-me.org/article/opinion-and-debate-building-resilience-deconstructing-humanitarian-aid (accessed on 11 June 2021).

44. Beauchamp, E.; Hirons, M.; Brown, K.; Milner-Gulland, E.J. Twenty priorities for future social-ecological research on climate resilience. *Environ. Res. Lett.* **2020**, *15*, 105006. [CrossRef]

45. DCF Alliance. *The Devolved Climate Finance Mechanism: Principles, Implementation and Lessons from four Semi-Arid Countries*; Project Report; IIED: London, UK, 2019.

46. Crick, F.; Hesse, C.; Orindi, V.; Bonaya, M.; Kiiru, J. *Delivering Climate Finance at the Local Level to Support Adaptation: Experiences of County Climate Change Funds in Kenya*; Working Paper; IIED: London, UK, 2019.

47. Greene, S. *Lessons from Piloting the Decentralised Climate Finance Programme, Tanzania*; IIED: London, UK, 2019.

48. NEF; IIED; IED. Afrique Consortium Knowledge on Adaptation and the Reduction of Climate Risks and Disasters in Mali and Senegal; 2014. Available online: https://www.neareast.org/download/materials_center/Report_Reduction-of-Climate-Risks-Mali-and-Senegal.pdf (accessed on 11 June 2021).

49. World Bank Group. *Tanzania Mainland Poverty Assessment: Tanzania's Path to Poverty Reduction and Pro-Poor Growth Part 1*; World Bank: Washington, DC, USA, 2019.

50. DCF Alliance. Scaling up Devolved District Climate Finance in Tanzania: Community-Based Mapping of Pastoralist Resources and Their Attributes. Unpublished—Internal report.

51. Christensen, R.H. Ordinal—Regression Models for Ordinal Data. 2019, R Package Version 2019.12-10. Available online: https://CRAN.R-project.org/package=ordinal (accessed on 1 March 2021).

52. Anderson, D. *Model Based Inference in the Life Sciences: A Primer on Evidence*; Springer: New York, NY, USA, 2008.
53. Burnham, K.P.; Anderson, D.R. *Model Selection and Multimodelinference: A Practical Information-Theoretic Approach*, 2nd ed.; Springer: New York, NY, USA, 2002.
54. Barton, K. MuMIn: Multi-Model Inference 2020. Available online: https://cran.r-project.org/web/packages/MuMIn/index.html (accessed on 10 August 2021).
55. Deaton, A. Income, Aging, Health and Wellbeing around the World: Evidence from the Gallup World Poll. *J. Econ. Perspect.* **2008**, *22*, 53–72. [CrossRef]
56. Sina, D.; Chang-Richards, A.Y.; Wilkinson, S.; Potangaroa, R. A conceptual framework for measuring livelihood resilience: Relocation experience from Aceh, Indonesia. *World Dev.* **2019**, *117*, 253–265. [CrossRef]
57. DeJaeghere, J.; Morris, E.; Bamattre, R. Moving beyond employment and earnings: Reframing how youth livelihoods and wellbeing are evaluated in East Africa. *J. Youth Stud.* **2020**, *23*, 667–685. [CrossRef]