

**Supplementary Table 1: Reference list of final studies reviewed**

No	Reference	Author (s)	Title of publication
1.	Angula and Kaundjua, 2016)	Angula, M.N. and Kaundjua, M.B.	The changing climate and human vulnerability in north-central Namibia
2.	Antwi-Agyei <i>et al.</i> , 2013	Antwi-Agyei, P., Dougill, A.J., Fraser, E.D.G. and Stringer, L.C.	Characterising the nature of household vulnerability to climate variability: Empirical evidence from two regions of Ghana
3.	Asare-Kyei <i>et al.</i> , 2017	Asare-Kyei, D., Renaud, F.G., Kloos, J., Walz, Y. and Rhyner, J.	Development and validation of risk profiles of West African rural communities facing multiple natural hazards
4.	Bele, Sonwa and Tiani, 2014	Bele, M.Y., Sonwa, D.J. and Tiani, A.M.	Local Communities Vulnerability to Climate Change and Adaptation Strategies in Bukavu in DR Congo
5.	Cooper and Wheeler, 2017	Cooper, S.J. and Wheeler, T.	Rural household vulnerability to climate risk in Uganda
6.	Choptiany <i>et al.</i> , 2017	Choptiany, J.M.H., Phillips, S., Graeub, B.E., Colozza, D., Settle, W., Herren, B., and Batello, C.	SHARP: integrating a traditional survey with participatory self-evaluation and learning for climate change resilience assessment
7.	Dasgupta and Baschieri, 2010	Dasgupta, A. and Baschieri, A.	Vulnerability to climate change in Rural Ghana: Mainstreaming climate change in poverty-refuction strategies
8.	Derbile and File, 2016)	Derbile, E.K., File and D.J.M	Community risk assessment of rainfall variability under rain-fed agriculture: the potential role of local knowledge in Ghana
9.	Derbile, File and Dongzagla, 2016	Derbile, E.K., File, D.J.M. and Dongzagla, A.	The double tragedy of agriculture vulnerability to climate variability in Africa: How vulnerable is smallholder agriculture to rainfall variability in Ghana?
10.	Deressa, Hassan and Ringler, 2009	Deressa, T.T., Hassan, R.M. and Ringler, C	Assessing household vulnerability to climate change
11.	Dumenu and Obeng, 2016	Dumenu, W.K. and Obeng, E.A.	Climate change and rural communities in Ghana: Social vulnerability, impacts, adaptations and policy implications
12.	Effah, 2014	Effah, E.	Assessment of vulnerability of assets and livelihoods to climate variability for adaptation planning in a coastal community in Ghana
13.	Etwire <i>et al.</i> , 2013	Etwire, P.M., Al-Hassan, R.M., Kuwornu, J.K.M. and Osei-Owusu, Y.	Application of Livelihood Vulnerability Index in Assessing Vulnerability to Climate Change and Variability in Northern Ghana
14.	Hahn, Riederer and	Hahn, M.B., Riederer, A.M. and Foster,	The Livelihood Vulnerability Index: A pragmatic approach to assessing risks

- Foster, 2009 S.O.
15. Grothmann *et al.*, 2017 Grothmann, T., Petzold, M., Ndaki, P., Kakembo, V., Siebenhüner, B., Kleyer, M., Yanda, P. and Ndou, N. from climate variability and change-A case study in Mozambique  
Vulnerability assessment in African villages under conditions of land use and climate change: Case studies from Mkomazi and Keiskamma
16. Hotz, 2010 Hotz, H. Local-scale Vulnerability and Adaptive Capacity to Climate Variability and Change: a Case Study from Northern Central Namibia  
Smallholder famers' vulnerability to floods in the Tolon District, Ghana  
Participatory action research (PAR) as an entry point for supporting climate change adaptation by smallholder farmers in Africa
17. Jakpa, 2015 Jakpa, J.T.
18. Mapfumo *et al.*, 2013) Mapfumo, P., Adjei-Nsiah, S., Mtambanengwe, F., Chikowo, R. and Giller, K.E. Participatory action research (PAR) as an entry point for supporting climate change adaptation by smallholder farmers in Africa
19. Molefe and Masundire, 2016 Molefe, C. and Masundire, H. Climate change vulnerability and risk analysis in the Bobiriwa Sub-District, Botswana: Towards improving livelihood adaptation to climate
20. Kienberger, 2012 Kienberger, S. Spatial modelling of social and economic vulnerability to floods at the district level in Búzi, Mozambique
21. Ng'ang'a *et al.*, 2012 Ng'ang'a SK, Maute F, Notenbaert A, Herrero M, Moyo S. Coping strategies and vulnerability to climate change of households in Mozambique
22. Nkondze, Masuku and Manyatsi, 2013 Nkondze, M.S., Masuku, M.B. and Manyatsi, A. Factors Affecting Households Vulnerability to Climate Change in Swaziland: A Case of Mpolonjeni Area Development Programme (ADP)
23. Notenbaert *et al.*, 2013 Notenbaert, A, Karanja, S.N., Herrero, M., Felisberto, M. and Moyo, S. Derivation of a household-level vulnerability index for empirically testing measures of adaptive capacity and vulnerability
24. Okpara, Stringer and Dougill, 2017 Okpara, U.T., Stringer, L.C. and Dougill, A.J. Using a novel climate–water conflict vulnerability index to capture double exposures in Lake Chad
25. Oluoko-odingo, 2011 Oluoko-odingo, A.A. Vulnerability and Adaptation to Food Insecurity and Poverty in Kenya
26. Pavageau, Butterfield and Tiani, 2013 Pavageau, C., Butterfield, R. and Tiani, A.M. Current vulnerability in the Virunga landscape, Rwanda
27. Raemaekers and Sowman, 2015 Raemaekers, M. and Sowman, S. Community-level socio-ecological vulnerability assessments in the Benguela Current Large Marine Ecosystem
28. Rurinda *et al.*, 2014 Rurinda, J., Mapfumo, P., van Wijk, M. T., Mtambanengwe, F., Rufino, M. C., Chikowo, R. and Giller, K. E. Sources of vulnerability to a variable and changing climate among smallholder households in Zimbabwe: A participatory analysis
29. Sallu, Twyman and Sallu, S.M., Twyman, C. and Stringer, Resilient or vulnerable livelihoods? Assessing livelihood dynamics and

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| 30. | Stringer, 2010<br>Sorey, 2011 | L.C.<br>Sorey, G.  | trajectories in rural Botswana<br>Climate change and vulnerability Impact assessment study of the agricultural adaptability in Tanzania                 |
| 31. | Tesso, Emanu and Ketema, 2012 | Tesso, G., Emanu, B., and Ketema, M.   | Analysis of vulnerability and resilience to climate change induced shocks in North Shewa, Ethiopia  |
| 32. | Tiani <i>et al.</i> , 2015    | Tiani, A. M., Besa, M.C., Devisscher, T., Pavageau, C., Butterfield, R., Bharwani, S. and Bele, M.Y.       | Assessing current social vulnerability to climate change: A participatory methodology   |
| 33. | Umoh <i>et al.</i> , 2014     | Umoh, G.S., Udoh, E.J., Solomon, V.A., Edet, G. E., Okoro, G. I., Uwem, C.A., Basse, N. E. and Akpan, O.D. | Analysis of upland farm households' vulnerability to climate variability in the Niger Delta, Nigeria  |
| 34. | van Vliet, 2010               | van Vliet, N.  | Participatory Vulnerability Assessment in the Context of Conservation and Development Projects: A Case Study of Local Communities in Southwest Cameroon |
| 35. | Vilissa, 2016                 | Vilissa, D.J.  | Vulnerability of horticulture producers to climate variability  |
| 36. | Westerhoff and Smit, 2009     | Westerhoff, L. and Smit, B.  | The rains are disappointing us: Dynamic vulnerability and adaptation to multiple stressors in the Afram Plains, Ghana                                   |
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**Supplementary Table 2: Summary of conceptual definitions of vulnerability, hazards and variables for characterizing vulnerability of reviewed studies**

<b>Representative studies</b>	<b>Conceptual definition of vulnerability indicated in studies</b>	<b>Nature of main climate hazard/threat considered</b>	<b>Variables used in characterizing vulnerability</b>
Grothmann et al. 2017	Amount of Agricultural Production (AP) and availability of different Alternative Income Source (AIS)	Drought	Amount of AP (ratio of agricultural outputs to inputs) and availability of AIS. Potential vulnerability determinants are found in the resource system, resource units, the governance system within the village, the users of the resources in the village, the social, economic and political setting, the related ecosystems, and the interactions between these factors
Cooper & Wheeler 2017	Was divided into internal and external aspects. The internal aspects comprised innate features of an exposure unit which was a household and the external aspect was the magnitude of exposure and the externalities which affect sensitivity	Drought, inter/intra seasonal dry spells, rainfall variability	Proxies for demographic and socio-economic characteristics (such as age, gender, education, household size, agricultural extension contacts, livestock ownership) were selected to represent intrinsic attributes of sensitivity. Selected external attributes were represented by land ownership, employment in a non-farm livelihood (any income-generating activity which was not crop or livestock production), participation in agricultural extension (extension farmers) and livestock ownership, all hypothesized to influence adaptive capacity
Asare-Kyei et al. 2017	Vulnerability was characterized by exposure, susceptibility and the capacity of coupled Socio-Ecological System to cope and adapt to the impacts of either a single hazard or the combined effects of multiple hazards.	Drought, floods	Hydro-climatic hazards and stressors such as floods and/or heavy rainfall events, slow onset events such as droughts, late onset of the rainy season but also more gradual changes such as changes in variability or averages of rainfall were variables for characterizing exposure. Socio-economic drivers and stressors included population affected by floods, population affected by droughts, average area of affected cropland, average number of affected livestock, number of people killed by floods, economic value of properties (houses, personal effects etc.) destroyed by floods or fires and/or occasioned by prolonged drought
Okpara, Stringer & Dougill 2017	Theoretical non-observable phenomenon relating propensity of a system, subsystem or component to experience harm	Climate-water conflict	Seven indicating baskets were considered relevant to operationalising vulnerability. That is, exposure to (1) climate variability and (2) water conflict; sensitivity to (3) lake water variability and (4) physical/natural assets; and adaptive capacity captured by (5) socio-demographic profile, (6) livelihood income

			strategies and (7) social/political networks. Some indicators were water accessibility, conflict sensitivity, lake water variability, physical and natural assets
Derbile, File & Dongzagla 2016	Vulnerability was conceptualised in the context of susceptibility of agriculture to climate change and climate variability.	Drought, heavy precipitation	Key variables considered were state of defenselessness arising from a low capacity to cope and/or adapt without damaging loss, households experiences and perceptions of exposure to risks, shocks and stress. It was described as comprising two sides; the external side that comprise the exposure to risks, shocks and stress which an individual or household experiences and the internal side showing a state of defenselessness.
Dumenu & Obeng 2016	The degree to which a system is susceptible to the effects of climate change owing to interplay of social, economic and demographic factors, describing the existing state (capacity) of rural communities that predispose them to climate change impacts.	Not specific	Indicators contributing to the high vulnerability level of the study zones were used and included demographic, social and economic factors such as household size, literacy level, diversified sources of income, climate sensitive occupation, access to climate information, dependence on forest resources
Westerhoff & Smit 2009	Vulnerability reflect the dynamic interaction of biophysical conditions (including climate change) and socioeconomic conditions with manifestations at scales from global to local.	Not specific (indicated future climatic changes)	People's exposures and sensitivities to external conditions were influenced by their occupancy and livelihood characteristics consisting of households' social, economic, cultural and political conditions (physical capital, social capital, water scarcity, migration, credit) and the nature and degree to which these were affected by external stresses (climate)
Raemaekers & Sowman 2015	Not explicitly defined for study	Not specific (indicated climate)	Relevant changes that affect the fishery system and local livelihoods' threats or stressors related to the environment; socio-economic circumstances and the management/governance arrangements such as historical overview of events, changes and impacts of environmental stressors, geographical location, post-harvest activities were considered.
Choptiany et al. 2017	Capacity of social, economic and environmental systems to cope with a hazardous event, trend or disturbance.	Not specific (Climate change and variability)	Farming resources/practices/knowledge, sources of water, non-farm income generating activities, exposure to hazards were resilience indicators, resources, practices and knowledge used in characterizing vulnerability.
van Vliet 2010	Not explicitly defined for study	Not specific (Climate)	Multiple stimuli such as political, cultural, economic, institutional

			and technical forces; socio-economic situation, access to roads, markets, education, and health facilities, household members, primary sources of income, current farming activities, recent changes affecting livelihood strategies, perceptions of local environment, and strategies for meeting short-term development aspirations were variables considered in vulnerability characterization.
Oluoko-odingo 2011	Not explicitly defined for study	Drought, floods	Information on climate and food security was the main vulnerability variables considered. These include months of drought, socioeconomic variables such as households' total production, farm size, land cultivated, years of farm operation, distance to the nearest market and proximity of households to various infrastructural sources like schools, banks, markets, fuel, and water.
Bele, Sonwa & Tiani 2014	The interplay between social capital and nature	Not specific (changing climate)	Factors such as poverty and number of conflicts were the top two factors that were identified listed as the most important factors amplifying vulnerability. Additional variables were lack of climate information, lack of access to credit, lack of infrastructure, lack of access to sufficient farm input and limited access to markets.
Pavageau, Butterfield & Tiani 2013	Not explicitly defined for study	Not specific (mentioned climate)	Changes in conflicts, political and social factors, exploitation of natural resources and livelihoods were highlighted and used by the study for vulnerability characterization. Climate impacts on famine, overexploitation of natural resources and livelihoods and the high number of refugees were also noted to have a toll on the environment, historical climate and hazards
Mapfumo et al. 2013	Not explicitly defined for study	Not specific (changing climate)	Major variables considered were declining soil fertility, land tenure system, crop nutrient deficiencies and yield changes.
Tesso, Emana & Ketema 2012	Difference between adaptive capacity of a household and its sensitivity and exposure to climate induced hazards	Not specific (indicated climate)	Climate data, responses to indicators for socioeconomic and natural factors such as household characteristics, landholding, crops and livestock production, disaster occurrence, perception level (on precipitation, temperature, soil moisture, air moisture and wind direction), adaptation strategies pursued, level of resilience were considered.
Deressa, Hassan & Ringler 2009	Probability of a household falling below a consumption level due to	Drought, floods, hailstorm	Variables considered were incidence of climate and other shocks in the past years, access to food aid, social capital, access to credit,

	climate shocks and as expected poverty		land tenure system, machinery ownership, livestock production, rain fed and irrigated agriculture and perceptions of changing climate
Angula & Kaundjua 2016	Not explicitly defined for study	Drought, flood	Vulnerability was characterized mainly by the occurrence and intensity of natural disasters, impact of climate related natural disasters on livelihoods, population displacement and movements as well as human health.
Derbile & File 2016	Exposure to risks and hazards and capacity for adaptation.	Rainfall variability	Variables considered were mainly climate related and included decreasing and irregular rainfall, level of local climate knowledge and individuals' experiences with changing climate
Kienberger 2012	Expected probability of harmful consequences and losses resulting from interaction between natural and anthropogenic hazards	Floods	Set of spatial indicators constituting vulnerability units and characterizing an area considered were land cover/land use, road network, location of schools, hospitals in addition to individuals' perception and experiences with changing climate.
Molefe & Masundire 2016	Not explicitly defined	Rainfall variability, drought, flood	Vulnerability variables considered were mostly socioeconomic indicators such as education, quality of products, market accessibility, changes in plant and animal diseases, knowledge of climatic changes.
Sorey 2011	Impacts of climate change on humans and their livelihoods	Not specific (indicated climate)	Indices on past climate parameters to show hydrologic events such as Monthly Average Precipitation, Yearly Average Precipitation, Absolute Deviation from Average Precipitation Estimated Monthly Average Temperature and its impacts on humans and livelihoods were variables considered.
Effah 2014	Function of both magnitude and scope of perturbation and the system it influences	Floods	Vulnerability of Community Assets and livelihood to flood were illustrated in the washing away of top soil making soil infertile, destruction of crops by flood, animals killed and carried away by water during flood, exposure of livelihoods to water and community's perception about changes and causes of climate variability
Umoh et al. 2014	Risk of present and future climatic variations and responses to improve resilience to future risks.	Not specific (climate variability)	Factors considered to predispose households to being vulnerable were irrigation water availability, drought, changes in agricultural productivity and production, labour availability, land tenure, food storage and processing, income and conflicts.
Tiani et al. 2015	A function of exposure,	Drought, flood, strong	How identified hazards (drought, flood, winds) in relation to past

	sensitivity and adaptive capacity of a system	winds	trends and current conditions affects various actors, livelihood activities and resources in the study areas indicated different dimensions of vulnerability in the study.
Hotz 2010	Not explicitly defined for study	Not specific (climate change and variability)	Variables for vulnerability included social factors such as household's living conditions, perceptions of weather and climate, land and water management for example land allocation or conflicts over water (water point committee).
Jakpa 2015	It is a function of exposure, sensitivity and adaptive capacity of a system to create total household's vulnerability (IPCC 2007)	Flood	Location of farms was the principal determinant of flood vulnerability in the study. Other socioeconomic and climate factors considered were connected to livelihood asset indicators such as access to information, credit, number of farms owned, dependency ratio and membership of Farmer Based Organisations (FBO) as well as standard deviation of change in average monthly temperature and precipitation, flood occurrence in the past decade, injuries incurred by household members as a result of floods, farm land degraded by flood events in the past ten years and crops damaged due to floods
Sallu, Twyman & Stringer 2010	Not explicitly defined for study	Drought	Variables such as Landsat images and aerial count data records on diurnal and seasonal temperature variations, low average annual rainfall as well as social and political factors such as access to diversity of assets and support from formal and informal institutions were considered.
Notenbaert et al. 2013	Exposure to climate change impacts and variability of households in the same village to be equal, sensitivity to the impacts and capacity to cope with those impacts.	Not specific (climate variability)	Social factors were employed and these were livelihood strategies, livelihood ownership, livestock feeding techniques and management, welfare outcomes (income, food consumption and health), market, household composition, herd dynamics and species.
Nkondze, Masuku & Manyatsi 2013	Impact of diseases (HIV and AIDS) and shocks (erratic weather patterns and poverty) and a household's ability to withstand	Not specific (climate change)	Livelihood capital assets: natural assets such as land, soil and water; physical assets such as livestock and equipment; financial assets such as savings, salaries, remittances or pensions; human capital assets such as farm labour, gender composition and dependants and social assets such as information, community support, extended families and formal or informal social welfare support characterized vulnerability.



Ng'ang'a et al. 2012	Not explicitly defined for study	Not specific (climate variability)	Socioeconomic variables were used in characterizing vulnerability. These were livestock holdings and management, off-farm income activities and earning, household characteristics, households' demographic, households' livelihood, livestock ownership and other standard cattle-related activities, household composition, livelihood strategies, and livestock assets; herd dynamics and species and vulnerability context as main concerns facing the households.
Dasgupta & Baschieri 2010	Not explicitly defined for study	Drought	Assets such as labour, non-labour productive assets (like land, radio, vehicles) human capital, household relations demographic characteristics of household members, their reported health status, education, employment, housing and income from wages, agricultural production and presence of infrastructure, schools among others were seen as important productive assets for rural Households and could either be used or sold in order to buffer short-term climatic shocks so their specific changes characterized vulnerability. The more assets people have, the less vulnerable they are, and the greater the erosion of people's assets, the greater their insecurity'
Etwire et al. 2013	Not explicitly defined for study	Flood, drought	Local context subcomponents under socio demographic profile, livelihood strategies, social network, health, access to food, water and natural disasters constituted estimation of vulnerability of area studied.
Hahn, Riederer & Foster 2009	Capacity of social, economic and environmental systems to cope with a hazardous event, trend or disturbance	Flood, drought, (also climate variability)	Multiple indicators constituting natural disasters, social and economic characteristics to assess exposure to natural disasters and climate variability, social and economic characteristics of households that affect their adaptive capacity, and current health, food, and water resource characteristics that determine their sensitivity to climate change impacts.
Antwi-Agyei et al. 2013a	Capacity of a system to cope with environmental disturbance	Drought	Vulnerability was characterized by identification of multiple indicators that highlight household livelihood vulnerability and links to different assets such as human, financial, natural, physical and social capitals.
Rurinda et al. 2014	Not explicitly defined for study	Not specific (climate variability)	Vulnerability was characterised by perceptions about changing climate parameters, perceptions of climate variability, onset of

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			rains, temperature changes, drought occurrence and seasonal dry spells as well as components of farming systems affected by a hazard, cropping patterns, types and amounts of fertilizer use, crop yields.
Vilissa 2016	Not explicitly defined for study	Not specific (climate variability)	Households socioeconomic consequences to changing climate, timing, frequency and intensity of weather variability, livelihood impact of climatic stresses and agricultural production challenges at each stage of production (during sowing, transplanting, flowering and harvesting) characterized vulnerability.

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**Supplementary Table 3: Summary of outcomes and implications of vulnerability assessments from reviewed studies**

Reference(s)	Key outcome of assessment	Recommendations given for future vulnerability research	Challenges mentioned as constraining response to vulnerability	Mention of adaptation/coping measures after assessment
Angula and Kaundjua, 2016)	Examined factors contributing to farmers vulnerability to impacts of climate change discussing various aspects of human vulnerability	Further research to develop scenario based on past historical climate variability and future projection to climate change as well as use a comprehensive approach to contextualize vulnerability assessment at local and household levels.	Unemployment, high adult and elderly population as well as high dependency on agricultural livelihood systems.	Existing coping strategies identified included reduction of agricultural activities, supplementary agricultural based livelihood, migration, and use of crop variety that is resistant to drought .
Antwi-Agyei <i>et al.</i> , 2013	Developed and applied Livelihood Vulnerability Index (LVI) at community and household levels to explore the nature of climate vulnerability	Recommendation for future vulnerability research was not given	Not mentioned	Not mentioned
Asare-Kyei <i>et al.</i> , 2017	Conducted risk assessment for multiple hazards and assessed risk perspective of Socio-Ecological Systems by quantifying indicators of vulnerability	Recommendation for future vulnerability research was not given	Not mentioned	Not mentioned
Bele, Sonwa and Tiani, 2014	Mainly developed appropriate responses to climate change vulnerability	Recommendation given for strengthening assessment of social and economic vulnerability to involve process identifying priorities for adaptation	Capacity to respond affected by poverty, armed conflicts, weak economies, low literacy rate, weak institutional support, lack of technology and information, limited marketing, farm input and low management capacities	Range of adaptation measures specified included diversification of crops and income sources, planting different crop varieties, changing planting and harvesting dates to correspond to the changing pattern of precipitation, crop irrigation and strengthening nonfarm income activities.
Cooper and Wheeler, 2017	Evaluated the vulnerability of farmers to climate risk	Need for future research capture dynamism of vulnerability	Inequality between wealthier and poorer farmers	Mentioned general adaptation measures practiced such as Employment in a non-farm livelihood (any income-generating activity which

				was not crop or livestock production), planting earlier, planting short-maturing varieties and/or strategic planning, directly through purchasing food, asking neighbours for food, subsisting on stored food, or indirectly by generating income and/or the liquidation of asset
Choptiany <i>et al.</i> , 2017	Measured resilience of a farm system to climate variability and change	Tool for vulnerability called 'SHARP' developed was commended for more application in vulnerability assessments	Geographical differences across communities limiting capacity to adapt	Not mentioned
Dasgupta and Baschieri, 2010	Evaluated the extent to which standard money metric measure of poverty contributes to climate change vulnerability and mainstreaming it to poverty reduction strategies.	More research needed for development of measures of vulnerability to climate change. Also, assessment for vulnerability was suggested too be integral part of poverty assessment and development of poverty reduction strategies	Not mentioned	Not mentioned
Derbile and File, 2016)	Explored potential of Community Risk Assessment (CRA) using perspectives of climate related risks among local population.	Recommendation for future vulnerability research was not given	Not mentioned	Not mentioned
Derbile, File and Dongzagla, 2016	Explored how vulnerability of smallholders can be differentiated, risk factors farmers encounter and how they affect production	Recommendation for future vulnerability research was not given	Not mentioned	Not mentioned
Deressa, Hassan and Ringler, 2009	Analyzed probability of farmers falling below a given consumption level due to climate shock	Recommendation for future vulnerability research was not given	Not mentioned	Identified coping strategies used by households such as use of drought tolerant varieties, crop and livestock diversification, mixing crop and livestock production and membership of credit groups
Dumenu and	Assessed social vulnerability to	Recommendation for future	Not mentioned	Provided adaptation strategies practiced

Obeng, 2016	climate change, climate change impacts and identified locally evolved adaptation strategies	vulnerability research was not given		such as promoting non-farm economic activities alongside climate change resilient forms of agriculture, less expensive irrigation facilities, establishment of rural information hubs and use of mobile telecommunication services
Effah, 2014	Assessed vulnerability of studied community to drought and estimated adaptive capacity of community to drought	Recommendation for future vulnerability research was not given	Not mentioned	Study proposed some adaptation strategies to reduce vulnerability such as infrastructure provision (e.g. storage facilities, protecting harbors and landing sites) to improve fish market and quality, capacity building training programs, diversification and alternate sources of livelihoods
Etwire <i>et al.</i> , 2013	Assessed level of vulnerability of agricultural communities	Recommendation for future vulnerability research was not given	Lack of information about pending national disasters, fluctuations in rainfall, illiteracy, large family size, and inadequate access to food and water resources affect households response to vulnerability	Not mentioned
Hahn, Riederer and Foster, 2009	Developed LVI to estimate climate change vulnerability of some districts in Mozambique involved in agricultural livelihoods	Developed the LVI but suggested for pragmatic approach to be used to monitor vulnerability programme resources by introducing scenarios into the LVI model for baseline comparison while including refinement of social network subcomponent to move more accurately and evaluate social bonds.	Not mentioned	Not mentioned
Grothmann <i>et</i>	Described identifying which factors	Suggested for more comparative	Poor governance affecting	Not mentioned

<i>al.</i> , 2017	determine vulnerability and how it can be addressed using Socio-Ecological Systems (SES) Framework	research on local level and development of typologies similar in vulnerability assessments	conflicts between resource users as well as access to information and education constrains response to vulnerability	
Hotz, 2010	Analyzed how adaptive capacity is built by agrosilvopastoralists by analyzing vulnerability	Recommended for back up of assessments with adaptation projects as well as need for empirically downscaled climate change models to provide more clarity to local communities concerning future climate.	Not mentioned	Not mentioned
Jakpa, 2015	Assessed spatial-temporal variations of flood events by identifying triggering factors and adaptive capacity of smallholders	Recommended for a detailed assessment for flood vulnerability with wider understanding of physical elements.	High poverty level among smallholders limit their adaptive capacity	Not mentioned
Mapfumo <i>et al.</i> , 2013)	Explored state of resilience among smallholder farming	Recommendation for future vulnerability research was not given	Capacity to respond to vulnerability constrained by lack of access to information, improved technologies and poor support mechanisms to promote assimilation of new knowledge	Not mentioned
Molefe and Masundire, 2016	Developed common understanding among various stakeholders of main hazards and issues of vulnerability in a SESs landscape	Recommendation for future vulnerability research was not given	Shortcomings in governance as well as structural inequalities, livelihood options and employment opportunities, poverty, high levels of HIV/AIDS	Used the assessment to build on some adaptive measures such as irrigating using underground water, supplementary feeding, water harvesting and livelihood diversification
Kienberger, 2012	Provided integrated spatial modeling of different dimensions of vulnerability, exploring factors of vulnerability and integrated expert knowledge for adaptation strategies	Recommended for the integration of knowledge and experiences from the ground into spatial modeling of vulnerability at subnational levels and also	Not mentioned	Not mentioned

		provide useful tool for mapping approaches for identifying needs and constraints to reduce vulnerability.		
Ng'ang'a <i>et al.</i> , 2012	Identified factors that influence the nature and degree of peoples vulnerability to climate change at the household level by developing a vulnerability index with coping mechanisms identified	Recommended for more in-depth studies into the coping capacity of households using bottom-up assessment approaches employing primary data to enhance understanding of vulnerability and its underlying processes.	animal loss due to theft, insecurity/violence/fighting, lack of adequate food, crop failure and loss of access to land. lack of buyers for animals that households wished to sell; loss of house due to natural disaster, high input prices and conflict over water. Figure	Identified some local coping strategies such reducing the number of livestock, preventive health care for livestock, preventive health care for people, reduced mobility, reducing investments, saving, storing foods, introduction of irrigation and increasing water storage facilities. Increasing diversification by growing a variety of crops on the same plot or on different plots of land.
Nkondze, Masuku and Manyatsi, 2013	Investigated household vulnerability to climate change and factors affecting vulnerability of the households	Suggested need to conduct studies that will involve the use of panel data to reflect main impacts from due to climate change and in order to capture the impacts of climate change on households	Not mentioned	Not mentioned
Notenbaert <i>et al.</i> , 2013	Analysed vulnerability and coping strategies to climatic stress	Recommendation for future vulnerability research was not given	Not mentioned	Not mentioned
Okpara, Stringer and Dougill, 2017	Compared vulnerability of farming, fishing and pastoral livelihoods	Recommended for further refinement of vulnerability indicator frameworks	Not mentioned	Not mentioned
Oluoko-odingo, 2011	Showed linkages between food insecurity and poverty and how they relate to livelihoods and vulnerability discussing source of vulnerability	Recommended need for multidisciplinary approach to studying climate vulnerability to involve all livelihoods and land use.	Lack of land redistribution affecting access to land	Not mentioned
Pavageau, Butterfield and Tiani,	Provided information about various vulnerability dimensions	Recommendation for future vulnerability research was not given	Not mentioned	Not mentioned

2013				
Raemaekers and Sowman, 2015	Identified threats to livelihoods, exposure and assessed vulnerability in relation to climate change and identify vulnerability of groups and coping strategies	Recommendation for future vulnerability research was not given	Not mentioned	Summary of coping strategies were given after assessment such as better organization at local level (i.e. cooperatives) and improvement of infrastructure and facilities including post-harvest facilities
Rurinda <i>et al.</i> , 2014	Investigated nature and sources of vulnerability of smallholders to climate variability and change	Recommendation for future vulnerability research was not given	Households limited access to resources	Identified some local coping strategies such as staggering planting dates, diversifying cropping cultivar, managing soil fertility, strengthening social safety nets,
Sallu, Twyman and Stringer, 2010	Assessed resilience and vulnerability of livelihoods.	Recommendation for future vulnerability research was not given	Not mentioned	Not mentioned
Sorey, 2011	Investigated how hydrology and climate influences vulnerability and adaptation of livelihoods	Suggested future assessments to consider different methods to implement adaptation strategies as a prerequisite to ensure secure future.	Not mentioned	Mentioned current adaptation and resilience strategies such as livelihood diversification, increasing soil fertility and plant drought resistant crops
Tesso, Emanu and Ketema, 2012	Quantitatively determined the magnitudes and patterns of rural households vulnerability to climate change	Recommendation for future vulnerability research was not given	Social factors (low literacy level and lack of awareness on hazard related issues).	Not mentioned
Tiani <i>et al.</i> , 2015	Used participatory method to assess vulnerability of study communities	Suggested studies of future vulnerability to and impact to be based on scenario analysis to help identify possible adaptation options under different possible future conditions	Not mentioned	Not mentioned
Umoh <i>et al.</i> , 2014	Analysed household vulnerability to climate variability	Recommendation for future vulnerability research was not given	Non availability of irrigation facilities, insufficient labour, lack of food storage, low income and inadequate means	Not mentioned



van Vliet, 2010	Identified sources of social vulnerability as perceived by local communities	Recommendation for future vulnerability research was not given	of transportation uncertainty of prices and production, the absence of savings facilities, and a gender imbalance in access to income. From a conservation perspective, the major risk is the shift of pressure on natural resources from inside the protected area to the border, with increased deforestation and destruction of key habitats	Not mentioned
Vilissa, 2016	Estimated vulnerability of a system by describing exposure, sensitivity and adaptive capacity	Recommendation for future vulnerability research was not given	Lack of access to reliable information, insufficient technology, low extension services, inability to access credit services and market barriers prevents response to vulnerability	Various adaptation measures were mentioned such as cleaning secondary and tertiary canals, opening field drainages, use of seed varieties tolerant of higher temperatures, use of mulching, sowing either under shady trees or along river beds, increasing water supply building drip irrigation systems, breeding new varieties, conservation agriculture, introduction of Integrated Pest Management (IPM) and biological control and introduction of agroforestry techniques
Westerhoff and Smit, 2009	Contributed to understanding and conceptualization of vulnerability in climate change contributing to practical efforts of enhancing adaptive capacity	Recommendation for future vulnerability research was not given	Not mentioned	Related study to adaptation strategies practiced such as use of family networks (migration) alternative non-traditional livelihood activities (e.g., charcoal production, hairdressing, etc.), reduction in household expenditure, changes in household organization (to compensate for lost labour), rainwater collection, use of hand-dug reservoir and increased dependence on social food networks.

