

# Rural Livelihood Climate Vulnerability

Subjects: Sociology

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Rural livelihood vulnerability to climate change impacts is one of the major policy challenges for sustainable development. Rural socio-economic systems are different from urban and peri-urban systems because of high dependence on climate sensitive natural resources for livelihood practices, access to which is significantly influenced by context-specific socio-cultural and political properties. Rural livelihood vulnerability, therefore, needs to be understood considering both climatic and non-climatic factors. By articulating the Vulnerability Assessment (VA) Framework and the Sustainable Rural Livelihoods (SRL) Framework into a shared conceptual framing, this entry defines the rural livelihood vulnerability and outlines its assessment process. In so doing, the framing borrows three vulnerability components (i.e., exposure, sensitivity and adaptive capacity) for its structural outline and derives analytical variables from the SRL framework.

Keywords: Sustainability ; Socio-economy ; Socio-ecological system ; Exposure ; Sensitivity ; Adaptive capacity ; Poverty ; Assessment ; Capital assets ; Developing countries

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## 1. Definition

According to the Intergovernmental Panel on Climate Change (IPCC), climate vulnerability is defined as "... the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change"<sup>[1]</sup>. Climate vulnerability is a complex and dynamic policy challenge, interacting with social, political, economic and ecological factors at global, regional, national and local scales<sup>[2][3]</sup>. The interpretation of climate vulnerability therefore differs across sectors and contexts<sup>[4]</sup>.

According to the IPCC, livelihood is (p. 798): "... the ensemble or opportunity set of capabilities, assets, and activities that are required to make a living"<sup>[5]</sup>. Livelihoods in the rural areas of developing countries are often characterized by extreme poverty, social discrimination and a heavy dependence on natural resources<sup>[6]</sup>. In the presence of climate change-related stresses, natural resource-dependent and climate-sensitive livelihood activities can become particularly threatened<sup>[7]</sup>. This situation raises two key policy challenges: First, local resource use and distribution practices<sup>[8]</sup>; and, second, the degree of livelihood uncertainty due to climate variability<sup>[9]</sup>. Both of these broad challenges can be better understood when the influences of climate on locally-specific socio-economic and social-ecological conditions are studied together<sup>[10]</sup>.

## 2. Introduction

Despite the global agreement and active involvement and interventions of global leadership on climate change, sufficient advancements have not been made to meaningfully regulate the human drivers of climate change<sup>[11]</sup>. Many climate stresses are known to result in persistent poverty, socio-economic disparity and continued loss of lives, livelihoods and resources, particularly among the rural smallholders of developing countries<sup>[12][13]</sup>. While international efforts generally struggle to bring meaningful change, more locally-based adaptation measures, often emerging from the joint interventions of governments, non-government organizations and affected communities, are making significant contributions to adaptation in response to climate stresses<sup>[14]</sup>. There is, however, a need to further understand the potential for public policy institutions to deliver more localized approaches to avoiding livelihood vulnerability to climate change impacts<sup>[15]</sup>. Such understanding can be facilitated by more precise identification of context-specific knowledge gaps and livelihood vulnerability assessment<sup>[10]</sup>. However, some of the most widely adopted approaches to vulnerability assessment, including those undertaken by the IPCC, have taken a 'top-down' approach<sup>[16]</sup>. Under this framing, vulnerability is conceptualized as an outcome of climate change that can be offset by different adaptation measures. This outcome-based framing often uses different greenhouse gas emission scenarios to project changes to the climate system and then identify potential impacts on communities. A limitation of this is that it excludes context-specific socio-economic, political, cultural, behavioral and ecological variables that are relevant for adaptation policy<sup>[16]</sup>.

Livelihood vulnerability reduction strategies need to be pragmatic, problem-oriented and participatory<sup>[17]</sup>. Previous studies have suggested that policy making based on rigorous scientific evidence (e.g., climate modeling) is not sufficient for guiding vulnerability reduction strategies because of the multidimensionality of climate impacts<sup>[18]</sup>. Furthermore, most studies that attempt to predict future climate challenges are limited in order to obtain precision, and are often not appropriate for the vulnerability reduction strategies 'on the ground'<sup>[19]</sup>. This is particularly the case in developing areas, where people are largely dependent on climate-sensitive natural resources for their livelihoods<sup>[20][21]</sup>. Although different conceptual and analytical views have been developed and adopted to characterize and assess vulnerability, more effort is needed to compare and combine these views<sup>[22]</sup>.

### **3. Rural Livelihoods and Climate Change Policy Challenges**

#### **3.1. How Do We understand Livelihood Vulnerability to Climate Change Impacts?**

Livelihood vulnerability assessment generally views human and ecological systems as two inter-connected systems <sup>[21]</sup>, and considers vulnerability to be the outcome of not only changing climate properties, but also of social, economic, institutional, political and technological processes<sup>[22]</sup>. Focusing on the capacity of a household to anticipate and adapt with climate change impacts, this approach assumes that insufficient asset accumulation (in the present) limits the capacity of a household to respond to future climate impacts<sup>[23][24][25]</sup>.

Climate change often brings uncertain and irreversible changes to both social and natural resource systems, and its impacts are adversely felt when it limits a household's capacity to develop<sup>[22]</sup>. Sen<sup>[26]</sup> and Devereux <sup>[27]</sup> posit that household vulnerability depends on the availability of assets to which a household has 'full rights'. Assets buffer risk, enhance recovery and, based on the level of possession, generate disproportionate outcomes for the households in a community<sup>[28]</sup>. Hence, questions related to climate vulnerability are strongly connected to locally-embedded poverty, economic inequality and institutional structures<sup>[29]</sup>. Poorer sections of a community are more prone to falling into poverty traps due to repeated climate stress events that limit their capacity to sustain livelihoods, thus making them the worst victims of climate change<sup>[30][31]</sup>. Notably, access and entitlement to assets are governed by institutional processes that extend beyond those of the national government and its legal frameworks; indeed, the distribution of assets is highly connected to social norms and locally-embedded political systems<sup>[32]</sup>. In a socially and economically unequal society, poorer people tend to have limited participation levels in both local and national institutional processes<sup>[33][34][35]</sup> because of their insufficient social networks and low political power<sup>[36]</sup>. Therefore, it is often argued that vulnerability reduction can be enhanced by securing social justice for, and the economic inclusion of, marginalized groups<sup>[8]</sup>.

#### **3.2. How Do We Understand Livelihood Sustainability in the Face of Climate Change Impacts?**

Livelihood sustainability is essential for adequate stocks and flows of food, income, shelter and other necessities <sup>[37]</sup>. Chambers and Conway<sup>[38]</sup> and Ellis<sup>[9]</sup> have posited that rural livelihoods are environmentally sustainable when they maintain the assets on which they depend, and socially sustainable when they can cope with, and recover from, shocks. Livelihood sustainability can be better understood by characterizing livelihood assets, which include social, financial, human, manufactured and natural capitals—jointly known as the “capital assets”<sup>[9][37][39][40]</sup>.

Putnam<sup>[41]</sup> (p. 35) defines social capital as “the features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions.” Social capital engenders collective actions that organize people in order to provide them access to, and use of, institutional resources <sup>[42][43][44]</sup>. Bebbington<sup>[40]</sup> and Pretty<sup>[45]</sup> posit that different forms of social capital play a supportive role in gaining access to other assets and services (e.g., property rights, credit access, development incentives). For example, bonding (connecting community members with “strong ties”), bridging (connecting neighboring community members with dissimilar situations through “weak ties”), and linking (connecting community members with power and financial resources through “vertical ties”) social capitals can promote self-governance with regards to common resources, knowledge and information sharing, and cross-scalar institutional, political and economic interactions<sup>[46][47][48][49]</sup>.

Human capital refers to the qualitative and quantitative availability of labor, skills, knowledge and experiences <sup>[44][50][51]</sup>. Sen<sup>[52]</sup> suggests that this capital widens opportunities for individuals to participate in institutional and market mechanisms and enhances their capability to choose favorable livelihood options. Since investing in generating human capital helps individuals diversify their livelihood opportunities in non-natural and wage-earning activities, it can also help enhance their production possibilities and their capacity to cope with risks and uncertainties<sup>[53][54]</sup>.

Saving and credit opportunities (or their substitutes) that can be directly invested into production activities are regarded as financial capital. This asset can also be invested for the purpose of securing other assets like natural and manufactured capitals<sup>[9][40][50]</sup>. For example, fishing communities in Bangladesh pay rental fees to the government in order to obtain wetland fishing rights<sup>[44]</sup>. In addition, buying water from community-based irrigation systems during the drought season is a common practice in Tanzanian indigenous peasant communities<sup>[55]</sup>. Rakodi<sup>[50]</sup> posits that, when invested in production inputs (e.g., buying improved seeds, fertilizers and pesticides for increasing agricultural productivity), financial capital can increase the productivity of other assets such as natural capital.

The equipment and infrastructure (e.g., roads, irrigation systems, embankments, etc.) used to maintain livelihood productivity are referred to as manufactured or physical capital<sup>[54]</sup>. This type of asset can be owned and developed both socially and privately. The IPCC<sup>[56]</sup> suggests that the poorest people in a society usually occupy marginal areas, which do not have adequate physical protection from climate change impacts. Hence, Rakodi<sup>[50]</sup> suggests that investments in manufactured capital (e.g., transportation network building, irrigation channel development, etc.) should be aimed at protecting the poor from marginalization and external stresses. However, such investments need to be adjusted with local biophysical and ecological properties<sup>[57]</sup>. In addition, the level of privately-owned manufactured capital may significantly contribute to economic inequality and social marginalization. For example, Heltberg and Tarp<sup>[58]</sup> have found that farming households in Mozambique who possess privately-owned manufactured capital (e.g., a motorcycle, radio, television, mobile phone) have wider market participation opportunities for selling their products, which in turn affords them an economically advantageous position in the community. In addition, Heltberg et al. <sup>[30]</sup> note that the loss of this capital due to climate change impacts (e.g., destruction of houses from floods or cyclones) may exacerbate asset inequality and lead to a “poverty trap”, as the poorer sections of society usually lose more than the richer sections, and recovering lost assets tends to be more difficult for them due to their generally high cost of repair and replacement.

According to Rakodi<sup>[50]</sup> (p. 316), natural capital is “made up of the natural resource stocks from which resource flows useful to livelihoods are derived, including land, water and other environmental resources.” Access to and ownership of natural resources is central to rural livelihood sustainability<sup>[51]</sup>. Babbington<sup>[40]</sup> suggests that households possessing high levels of natural capital have a marked advantage in terms of obtaining support from and influencing external agents (e.g., government institutions). Poorer households that do not own private natural resources (e.g., land, forest, fisheries) may rely on common or open access resources<sup>[50][59]</sup>. However, locally-embedded political processes, conflicts over resource use, and government policy may limit the ability of poorer households to access such resources<sup>[60]</sup>. Consequently, their insufficient capacity to cope with climate stresses, and the resultant loss of natural capital, may lead to recurrent vulnerability<sup>[61]</sup>.

Chambers<sup>[62]</sup> and Rakodi<sup>[50]</sup> suggest that capital assets are connected to each other. However, rural households tend not to invest all their capital assets towards a single activity; instead, they often opt to distribute their assets in order to diversify their livelihood strategies through agricultural intensification (obtaining more output from a unit of land by investing more in production inputs), extensification (increasing land for cultivation) and migration to seek non-farming activities<sup>[39]</sup>. Rakodi<sup>[50]</sup> and Mphande<sup>[63]</sup> suggest that the selection of strategies depends on three conditions: (i) the internal structure of a household (e.g., the ratio of employed to unemployed household members, timely availability of usable workforce, inheritance of parental livelihood activities, etc.); (ii) the geographic locations of the households (e.g., households located in urban areas are more privileged than those in rural areas due to a greater availability of opportunities); and (iii) the household’s connectivity to the wider market, as well as social and political systems (e.g., national political instability or agricultural market failures may reduce the availability of opportunities).

### **3.3. How Can We Assess Livelihood Vulnerability to Climate Change Impacts?**

The Vulnerability Assessment (VA) Framework developed by Turner et al.<sup>[64]</sup> considers vulnerability as being a function of context-specific exposure (intensity of climate stresses<sup>[5]</sup>), sensitivity (propensity of a system to be affected by the stresses<sup>[5]</sup>) and adaptive capacity (capacity to respond to the stresses and derive positive outcomes<sup>[5]</sup>). This framework can be applied across sectors following contextual modifications to ensure appropriate assessment variables (see, for example, Ford and Smit<sup>[65]</sup>; Ebi et al.<sup>[66]</sup>; Johnston and Williamson,<sup>[67]</sup>; Wilhelmi and Hayden<sup>[68]</sup>; Hughes et al.<sup>[69]</sup>; Prosperi et al. <sup>[70]</sup>). The Sustainable Rural Livelihoods (SRL) framework conceptualizes vulnerability as the external stresses that can affect livelihood assets, while assets can also generate feedback responses to the stresses<sup>[39]</sup>. Asset responses can be aided by external institutional and policy support (e.g., government, donor, non-government organizational supports) when needed for deriving favorable livelihood outcomes (e.g., increased income, agricultural productivity, health care system, food security, etc.)<sup>[9]</sup>. The following sections combines the VA and the SRL frameworks to present an analytic approach for assessing livelihood vulnerability. In so doing, the approach borrows three components (i.e., exposure, sensitivity and adaptive capacity) from the VA framework its structural outline, while the analytical variables are derived from the SRL framework.

### 3.3.1 Exposure

IPCC defines exposure as the frequency, extent and nature of climatic extremes in a local setting<sup>[5]</sup>. Ribot<sup>[71]</sup> and Ford et al.<sup>[72][73]</sup> have posited that social phenomena along with climatic variability are responsible for exposure, which suggests that both social and ecological components are important. However, exposure is most frequently studied using climate variables (e.g., temperature trend, precipitation pattern, frequency of extreme events like drought, flood, cyclone etc.) that are used to observe potential present and future risks—identified as the ‘outcome-based approach’ of exposure assessment<sup>[22][74][75]</sup>. Engaging community perception-based assessment of stresses is also important<sup>[76]</sup> with experiential interpretation being key to ‘context-specific’ rural livelihood vulnerability assessment<sup>[22][77][78]</sup>. Such assessments can be influenced by local ecological properties, nature and use patterns of resources, observational and tacit knowledge of communities and the availability and seasonality of resources<sup>[79][80]</sup>. Further, many regional climate models based on long-term climate data fail to adequately account for local climate properties, and thus, insufficiently inform understandings of more locally-observed impacts<sup>[81][82]</sup>. Moreover, rural livelihood adaptation decisions are made based on the experiential and subjective interpretation of climate change impacts<sup>[83]</sup>. Importantly, exposure does not sufficiently indicate a system’s vulnerability to climate stresses. More specifically, a system, community, household or individual may be exposed but not vulnerable. A system can be said to be vulnerable only when it is exposed to stresses and reacts to them<sup>[5]</sup>.

### 3.3.2 Sensitivity

Sensitivity is defined as the degree to which a system is affected, either positively or negatively, by climate stresses<sup>[84]</sup>, and along with exposure, determines the extent of vulnerability. Thus, Smit and Wandel<sup>[85]</sup> and Ford et al. <sup>[72][90]</sup> identify exposure and sensitivity as two inextricably associated components of vulnerability; with this association explained as having “dose-response” interactions<sup>[2][64][86][87]</sup>. Smit and Wandel <sup>[85]</sup> characterize this dose-response association stating that it depends on interactions between system characteristics and climate stimuli. Further, Füssel and Klein<sup>[86]</sup> distribute climate stimuli and system characteristics (i.e., non-climatic factors) between exposure and sensitivity respectively. Characterizing access to, and use of, capital assets is considered key to understanding livelihood interactions with climate sensitivity<sup>[88]</sup>. The underlying notion of such analysis is that the assets generate livelihood opportunities and diversities<sup>[62][89][90]</sup>. However, the SRL framework also suggests that capital assets are organized, transformed and substituted in order to strategize livelihood portfolios<sup>[39][50]</sup>, although this remains understudied in the livelihood vulnerability literature. Better understanding this property of capital assets is likely to be particularly important because asset organization ultimately determines feedback relationships with vulnerability, and may help with reducing negative livelihood sensitivity to climate impacts<sup>[51]</sup>.

### 3.3.3. Adaptive Capacity

Adaptive capacity is the impetus that influences the ability of an individual, a household or a community to maintain their livelihoods in the face of climate stresses<sup>[85]</sup>. Engle<sup>[91]</sup> suggests that adaptive capacity modulates livelihood exposure and sensitivity to climate stress to help maintain and improve livelihood practices. Institutional and governance mechanisms that determine access to different capital assets are considered to be some of the most important determinants of adaptive capacity<sup>[92]</sup>. Institutions are the mutually agreed upon rules that specify who gets access to a resource system (e.g., fisheries, irrigation, forest, agricultural resources etc.) and what actions are permitted or not<sup>[93]</sup>. Institutions are developed both formally (as a coded form) and informally (as social norms and values) <sup>[93]</sup>. Both forms of institutions play pivotal roles in determining adaptive capacity. For example, formal institutions provide the rational and legitimate mean of transaction, and therefore, articulate the process of market integration within and across communities and scales (e.g., from a local level market to broader scale markets operating at regional, national and international levels). Thus, formal institutions have considerable influence on livelihood portfolios. Informal institutions, on the other hand, are locally embedded and often based on ‘thick bonding’ social networks. Informal institutions determine and reflect local level resource use politics, and emerge from local power structures, social systems, historical resource use practices, local knowledge systems, and the biophysical properties and resource stocks of a system. They therefore influence the distribution of resources and access to higher levels of market.

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## References

1. IPCC. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press: Cambridge, UK, 2007.
2. Adger, W.N.; Arnell, N.W.; Tompkins, E.L. Successful adaptation to climate change across scales. *Glob. Environ. Chang.* 2005, 15, 77–86.

3. Adger, W.N. Vulnerability. *Glob. Environ. Chang.* 2006, 16, 268–281.
4. Jurgilevich, A.; Räsänen, A.; Groundstroem, F.; Juhola, S. A systematic review of dynamics in climate risk and vulnerability assessments. *Environ. Res. Lett.* 2017, 12, 013002, doi:10.1088/1748-9326/aa5508.
5. IPCC. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*; Cambridge University Press: Cambridge, UK.; New York, NY, USA, 2012.
6. Barnett, B.J.; Barrett, C.B.; Skees, J.R. Poverty trap and index-based risk transfer products. *World Dev.* 2008, 36, 1766–1785.
7. Hahn, M.B.; Riederer, A.M.; Foster, S.O. The Livelihood Vulnerability Index: A pragmatic approach to assessing risks from climate variability and change-A case study in Mozambique. *Glob. Environ. Chang.* 2009, 19, 74–88.
8. Adger, W.N.; Paavola, J.; Huq, S.; Mace, M.J. Toward justice in adaptation to climate change. In *Fairness in Adaptation to Climate Change*; Adger, W.N., Paavola, J., Huq, S., Mace, M.J., Eds.; MIT Press: London, UK, 2006; pp. 1–19.
9. Ellis, F. *Rural Livelihoods and Diversity in Developing Countries*; Oxford University Press: New York, NY, USA, 2000.
10. Ford, J.D.; Pearce, T. What we know, do not know, and need to know about climate change vulnerability in the western Canadian Arctic: A systematic literature review. *Environ. Res. Lett.* 2010, 5, 14008–14009.
11. Fussler, H.M. Adaptation planning for climate change: Concepts, assessment approaches, and key lessons. *Sustain. Sci.* 2007, 2, 265–275.
12. Adger, W.N.; Kelly, P.M. Social vulnerability to climate change and the architecture of entitlements. *Mitig. Adapt. Strateg. Glob. Chang.* 1999, 4, 253–266.
13. O'Brien, K.; Leichenko, R.; Kelkar, U.; Venema, H.; Aandahl, G.; Tompkins, H.; Javed, A.; Bhadwal, S.; Barg, S.; Nygaard, L.; et al. Mapping vulnerability to multiple stressors: Climate change and globalization in India. *Glob. Environ. Chang.* 2004, 14, 303.
14. Baker, I.; Peterson, A.; Brown, G.; McAlpine, C. Local government response to the impacts of climate change: An evaluation of local climate adaptation plans. *Landsc. Urban. Plan.* 2012, 107, 127–136.
15. Urwin, K.; Jordan, A. Does public policy support or undermine climate change adaptation, Exploring policy interplay across different scales of governance. *Glob. Environ. Chang.* 2008, 18, 180–19.
16. Hossain, F. Preface–Vulnerability of Water Resources to Climate. In *Climate Vulnerability*, Pielke, R.A., Ed.; Academic Press: Oxford, UK, 2013; pp. 1–2, doi:10.1016/B978-0-12-384703-4.00541-4.
17. Dovers, S.R.; Hezri, A.A. Institutions and policy processes: The means to the ends of adaptation. *Wiley Interdiscip. Rev. Clim. Chang.* 2010, 1, 212–231, doi:10.1002/wcc.29.
18. Laukkonen, J.; Blanco, P.K.; Lenhart, J.; Keiner, M.; Cavric, B.; Kinuthia-Njenga, C. Combining climate change adaptation and mitigation measures at the local level. *Habitat Int.* 2009, 33, 287–292.
19. Dessai, S.; Hulme, M.; Lempert, R.; Pielke, R. Jr. Do We Need Better Predictions to Adapt to a Changing Climate; Eos, Trans. Am. Geophys. Union 2009, 90, 111–112, doi:10.1029/2009eo130003.
20. Karim, M.; Mimura, N. Impacts of climate change and sea-level rise on cyclonic storm surge floods in Bangladesh. *Glob. Environ. Chang.* 2008, 18, 490–500.
21. Islam, M.; Sallu, S.; Hubacek, K.; Paavola, J. Migrating to tackle climate variability and change? Insights from coastal fishing communities in Bangladesh. *Clim. Chang.* 2014, 124, 733–746.
22. O'Brien, K.; Eriksen, S.; Nygaard, L.P.; Schjolden, N.E. Why different interpretations of vulnerability matter in climate change discourses. *Clim. Policy* 2007, 7, 73–88.
23. Kelly, P.M.; Adger, W.N. Theory and practice in assessing vulnerability to climate change and facilitating adaptation. *Clim. Chang.* 2000, 47, 325–352.
24. Grasso, M.; Moneo, M.; Arena, M. Assessing social vulnerability to climate change in Samoa. *Reg. Environ. Chang.* 2014, 14, 1329–1341.
25. Dumenu, W.K.; Obeng, E.A. Climate change and rural communities in Ghana: Social vulnerability, impacts, adaptations and policy implications. *Environ. Sci. Policy* 2016, 55, 208–217.
26. Sen, A. *Poverty and Famines: An Essay on Entitlement and Deprivation*; Oxford University Press: Oxford, UK, 1981.
27. Devereux, S. Livelihood insecurity and social protection: A re-emerging issue in rural development. *Dev. Policy Rev.* 2001, 19, 507–519.
28. Ribot, J.C. The causal structure of vulnerability: Its application to climate impact analysis. *GeoJournal* 1995, 35, 119–122.

29. Eisenack, K.; Moser, S.C.; Hoffmann, E.; Klein, R.J.T.; Oberlack, C.; Pechan, A.; Rotter, M.; Termeer, C.J.A.M. Explaining and overcoming barriers to climate change adaptation. *Nat. Clim. Chang.* 2014, 4, 867–872, doi:10.1038/nclimate2350.
30. Heltberg, R.; Siegel, P.B.; Jorgensen, S.L. Addressing human vulnerability to climate change: Toward a 'no-regrets' approach. *Glob. Environ. Chang.* 2009, 19, 89–99.
31. Paavola, J. Livelihoods, vulnerability and adaptation to climate change in Morogoro, Tanzania. *Environ. Sci. Policy* 2008, 11, 642–654.
32. Ostrom, E. *Governing the Commons: The Evolution of Institutions for Collective Action*; Cambridge University Press: New York, NY, USA, 1990.
33. Adger, W. Social capital, collective action, and adaptation to climate change. *Econ. Geogr.* 2003, 79, 387–340.
34. O'Brien, K.; Leichenko, R.M. Double exposure: Assessing the impacts of climate change within the context of economic globalization. *Glob. Environ. Chang.* 2000, 10, 221–232.
35. Eakin, H. Institutional change, climate risk, and rural vulnerability: Cases from Central Mexico. *World Dev.* 2005, 33, 1923–1938.
36. Gentle, P.; Maraseni, T. Climate change, poverty and livelihoods: Adaptation practices by rural mountain communities in Nepal. *Environ. Sci. Policy* 2012, 21, 24–34.
37. Chambers, R. *Whose Reality Counts; Putting the First Last*; ITDG Publishing: London, UK, 1997.
38. Chambers, R.; Conway, G.R. *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*; Institute of Development Studies DP 296: Brighton, UK, 1991.
39. Scoones, I. *Sustainable Rural Livelihoods: A Framework for Analysis*; IDS Work Paper 72; IDS: Brighton, UK, 1998.
40. Bebbington, A. Capitals and Capabilities: A Framework for Analyzing and rural livelihoods. *World Dev.* 1999, 27, 2021–2044.
41. Putnam, R.D. The prosperous community: Social capital and public life. *Am. Prospect* 1993, 13, 35–42.
42. Ostrom, E. New horizons in institutional analysis. *Am. Political Sci. Rev.* 1995, 89, 174–178.
43. Brondizio, E.S.; Ostrom, E.; Young, O.R. Connectivity and the governance of multilevel social-ecological systems: The role of social capital. *Annu. Rev. Environ. Resour.* 2009, 34, 253–278.
44. Rahman, H.M.T.; Hickey, G.M.; Sarker, S.K. An institutional framework for evaluating collective action and informal institutional dynamics under a resource management policy of decentralization. *Ecol. Econ.* 2012, 83, 32–42.
45. Pretty, J. Social capital and the collective management of resources. *Science* 2003, 302, 1912–1914.
46. Dale, A.; Sparkes, J. Protecting ecosystems: Network structure and social capital mobilization. *Community Dev. J.* 2007, 2, 143–156.
47. Dale, A.; Newman, L. Social capital: A necessary and sufficient condition for sustainable community development. *Community Dev. J.* 2010, 45, 5–21.
48. Rahman, H.M.T.; Hickey, G.M.; Sarker, S.K. Examining the role of social capital in community collective action for sustainable wetland fisheries in Bangladesh. *Wetlands* 2015, 35, 487–499.
49. Saint Ville, A.S.; Hickey, G.M.; Locher, U.; Phillip, L.E. Exploring the role of social capital in influencing knowledge flows and innovation in smallholder farming communities in the Caribbean. *Food Secur.* 2016, 8, 535–549.
50. Rakodi, C. A capital assets framework for analysing household livelihood strategies: Implications for policy. *Dev. Policy Rev.* 1999, 17, 315–342.
51. Morse, S.; McNamara, N. *Sustainable Livelihood Approach: A Critical Theory and Practice*; Springer: Berlin/Heidelberg, Germany, 2013.
52. Sen, A. *Development as Freedom*; Oxford University Press: New Delhi, India, 2000.
53. Ellis, F. The determinants of rural livelihood diversification in developing countries. *J. Agric. Econ.* 2000, 51, 289–302.
54. Rickards, L.; Howden, S. Transformational adaptation: Agriculture and climate change. *Crop. Pasture Sci.* 2012, 63, 240–250.
55. Gillingham, M.E. Gaining access to water: Formal and working rules of indigenous irrigation management on Mount Kilimanjaro, Tanzania. *Nat. Resour. J.* 1999, 39, 419–541.
56. IPCC. *Climate Change 2011: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Inter.—Governmental Panel on Climate Change*; Cambridge University Press: Cambridge, UK, 20

57. Brammer, H. After the Bangladesh Flood Action Plan: Looking to the future. *Environ. Hazards* 2010, 9, 118–130.
58. Heltberg, R.; Tarp, F. Agricultural supply response and poverty in Mozambique. *Food Policy* 2002, 27, 103–124.
59. Schlager, E.; Ostrom, E. Property rights regimes and natural resources: A conceptual analysis. *Land Econ.* 1992, 68, 249–262.
60. Agrawal, A. Small is beautiful, but is larger better; forest-management institutions in the Kumaon Himalaya, India. In *People and Forests: Communities, Institutions, and Governance*; Gibson, C.C., McKean, M.A., Ostrom, E., Eds.; MIT Press: Cambridge, UK, 2000; pp. 57–85.
61. Carter, M.R.; Barrett, C.B. The economics of poverty traps and persistent poverty: An asset-based approach. *J. Dev. Stud.* 2006, 42, 178–199.
62. Chambers, R. Vulnerability, coping and policy (editorial introduction). *IDS Bull.* 1989, 37, 33–40.
63. Mphande, F.A. *Infectious Diseases and Rural Livelihood in Developing Countries*; Springer: Singapore, 2016.
64. Turner, B.L.; Kasperson, R.E.; Matson, P.A.; McCarthy, J.J.; Corell, R.W.; Christensen, L.; Eckley, N.; Kasperson, J.X.; Luers, A.; Martello, M.L.; et al. A framework for vulnerability analysis in sustainability science. *Proc. Natl. Acad. Sci. USA* 2003, 100, doi:10.1073/pnas.1231335100.
65. Ford, J.D.; Smit, B. A Framework for Assessing the Vulnerability of Communities in the Canadian Arctic to Risks Associated with Climate Change. *Arctic* 2004, 57, 389–400.
66. Ebi, K.L.; Kovats, R.S.; Menne, B. An approach for assessing human health vulnerability and public health interventions to adapt to climate change. *Environ. Health Perspect.* 2006, 114, 1930–1934.
67. Johnston, M.; Williamson, T. A framework for assessing climate change vulnerability of the Canadian forest sector. *For. Chron.* 2007, 83, 358–361.
68. Wilhelmi, O.V.; Hayden, M.H. Connecting people and place: A new framework for reducing urban vulnerability to extreme heat. *Environ. Res. Lett.* 2010, 5, 14021–14027.
69. Hughes, S.; Yau, A.; Max, L.; Petrovic, N.; Davenport, F.; Marshall, M.; McClanahan, T.R.; Allison, E.H.; Cinner, J.E. A framework to assess national level vulnerability from the perspective of food security: The case of coral reef fisheries. *Environ. Sci. Policy* 2012, 23, 95–108.
70. Prosperi, P.; Allen, T.; Padilla, M.; Peri, I.; Cogill, B. Sustainability and Food & Nutrition Security: A Vulnerability Assessment Framework for the Mediterranean Region. *SAGE Open* 2014, 4, 2158244014539169, doi:10.1177/2158244014539169.
71. Ribot, J. Cause and response: Vulnerability and climate in the Anthropocene. *J. Peasant Stud.* 2014, 41, 667–705.
72. Ford, J.D.; Smit, B.; Wandel, J. Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada. *Glob. Environ. Chang.* 2006, 16, 145–160.
73. Ford, J.D.; Berrang-Ford, L.; Lesnikowski, A.; Barrera, M.; Heymann, S.J. How to track adaptation to climate change: A typology of approaches for national-level application. *Ecol. Soc.* 2013, 18, 40.
74. Ford, J.D.; Keskitalo, E.C.H.; Smith, T.; Pearce, T.; Berrang-Ford, L.; Duerden, F.; Smit, B. Case study and analogue methodologies in climate change vulnerability research. *Wiley Interdiscip. Rev. Clim. Chang.* 2010, 1, 374–392.
75. Antwi-Agyei, P.; Fraser, E.D.G.; Dougill, A.J.; Stringer, L.C.; Simelton, E. Mapping the vulnerability of crop production to drought in Ghana using rainfall, yield and socioeconomic data. *Appl. Geogr.* 2012, 32, 324–334.
76. DFID. Sustainable Livelihoods Guidelines Sheets. Available online: [http://www.livelihoods.org:80/info/guidance\\_sheets\\_pdfs/section1.pdf](http://www.livelihoods.org:80/info/guidance_sheets_pdfs/section1.pdf) (accessed on 20 May 2016).
77. Byg, A.; Salick, J. Local perspectives on a global phenomenon—Climate change in Eastern Tibetan villages. *Glob. Environ. Chang.* 2009, 19, 156–166.
78. Bele, M.Y.; Tiani, A.M.; Somorin, O.A.; Sonwa, D.J. Exploring vulnerability and adaptation to climate change of communities in the forest zone of Cameroon. *Clim. Chang.* 2013, 119, 875–889.
79. Marino, E.; Ribot, J. Special Issue Introduction: Adding insult to injury: Climate change and the inequities of climate intervention. *Glob. Environ. Chang.* 2012, 22, 323–328.
80. McCubbin, S.; Smit, B.; Pearce, T. Where does climate fit? Vulnerability to climate change in the context of multiple stressors in Funafuti, Tuvalu. *Glob. Environ. Chang.* 2015, 30, 43–55.
81. Campbell, D.; Barker, D.; McGregor, D. Dealing with drought: Small farmers and environmental hazards in southern St. Elizabeth, Jamaica. *Appl. Geogr.* 2011, 31, 146–158.

82. Shameem, M.I.M.; Momtaz, S.; Kiem, A.S. Local perceptions of and adaptation to climate variability and change: The case of shrimp farming communities in the coastal region of Bangladesh. *Clim. Chang.* 2015, 133, 253–266.
83. Soubry, B.; Sherren, K.; Thornton, T.F. Are we taking farmers seriously? A review of the literature on farmer perceptions and climate change, 2007–2018. *J. Rural Stud.* 2019, doi:10.1016/j.jrurstud.2019.09.005.
84. IPCC. Climate Change 2014: Impacts, Adaptation and Vulnerability. Part. A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Inter.—Governmental Panel on Climate Change; Cambridge University Press: Cambridge, UK, 2014.
85. Smit, B.; Wandel, J. Adaptation, adaptive capacity and vulnerability. *Glob. Environ. Chang.* 2006, 16, 282–292.
86. Füssel, H.M.; Klein, R.J.T. Climate change vulnerability assessments: An evolution of conceptual thinking. *Clim. Chang.* 2006, 75, 301–329.
87. Ribot, J. Vulnerability before adaptation: Toward transformative climate action. *Glob. Environ. Chang.* 2011, 21, 1160–1162.
88. Fang, Y.P.; Fan, J.; Shen, M.Y.; Song, M.Q. Sensitivity of livelihood strategy to livelihood capital in mountain areas: Empirical analysis based on different settlements in the upper reaches of the Minjiang River, China. *Ecol. Indic.* 2014, 38, 225–235.
89. Amekawa, Y. Agroecology and Sustainable Livelihoods: Towards an Integrated Approach to Rural Development. *J. Sustain. Agric.* 2011, 35, 118–162.
90. Cinner, J.E.; McClanahan, T.R.; Graham, N.A.J.; Daw, T.M.; Maina, J.; Stead, S.M.; Wamukota, A.; Brown, K.; Bodin, O. Vulnerability of coastal communities to key impacts of climate change on coral reef fisheries. *Glob. Environ. Chang.* 2012, 22, 12–20.
91. Engle, N.L. Adaptive capacity and its assessment. *Glob. Environ. Chang.* 2011, 21, 647–656, doi:10.1016/j.gloenvcha.2011.01.019.
92. Hill, M.; Engle, N.L. Adaptive capacity: Tensions across scales. *Environ. Policy Gov.* 2013, 23, 177–192 doi:10.1002/eet.1610
93. North, D.C. Institutions. *J. Econ. Perspect.* 1991, 5, 97–112, doi:10.1257/jep.5.1.97.

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