
1 CHAPTER 13: ADAPTATION TO CLIMATE CHANGE

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34 **Table of Contents**

35	Chapter Overview	3
36	13.1 Adaptation to Climate Change	7
37	13.1.1 Adaptation to climate change in the HKH is a complex challenge compounded by social	
38	differentiation and poor development	7
39	13.1.2 National governments in the HKH are responding to the adaptation challenge, strongly	
40	influenced by the evolving global regime	8
41	13.2 LOCAL AUTONOMOUS RESPONSES TO CLIMATE VARIABILITY AND EXTREME EVENTS IN HKH	14
42	13.2.1 Many autonomous adaptation practices continue to be highly relevant in the local context	
43	and need policy support	14
44	13.2.2 Autonomous adaptation may prove to be inadequate in cases of new risks and ‘surprises’	
45	arising from climate change	17
46	13.2.3 Local-level knowledge systems on adaptation deserve greater attention from both science	
47	and policy	17
48	13.3 STATE-LED PLANNED ADAPTATION IN THE HKH	18
49	13.3.1 Commonalities among policy responses of national governments	20
50	13.3.2 HKH countries have established high-level political bodies to coordinate climate change	
51	responses	22
52	13.3.3 Paucity of tailored responses for gender and social inclusion	24
53	13.3.4 Implementation of adaptation programmes is challenged due to institutional inertia and	
54	inadequate institutional capacity.....	25
55	13.4 ADAPTATION INITIATIVES BY NON-STATE ACTORS SHAPING PRACTICE IN THE HKH	26
56	13.4.1 There is multiplicity of actors and approaches, but little synergy	26
57	13.4.2 Scaling up and sustainability challenges are common to projects implemented by NGOs....	28
58	13.5 FINANCING ADAPTATION IN THE HKH	29
59	13.5.1 Estimates of climate change adaptation finance need and availability are lacking for the	
60	HKH	29
61	13.5.2 Business potential in adaptation is high, but investment is limited	31
62	13.5.3 Labour migration and migrant remittances provide an opportunity for building adaptive	
63	capacity	33
64	13.6 THE WAY FORWARD – SOME KEY AREAS FOR PRIORITY ACTION BY COUNTRY GOVERNMENTS IN THE HKH	33
65	13.6.1 Regional cooperation on adaptation is a necessity	34
66	13.6.2 Stronger integration of adaptation in development plans and programmes	34
67	13.6.3 Convergence of adaptation, DRR, SDGs, and resilience-building priorities	34
68	13.6.4 Investing to enhance the synergies between CBA and EBA approaches	35
69	13.6.5 Generating new knowledge and strengthening the evidence base.....	35
70	13.6.6 A policy environment for social learning	35
71	13.6.7 Building institutions and capabilities.....	36
72	13.6.8 Engaging with private business	36
73	13.6.9 Engaging with the emerging policy regime on loss and damage.....	37
74	REFERENCES	37
75		

76 CHAPTER OVERVIEW

KEY FINDINGS

1. Adaptation to climate change is increasingly urgent for the HKH – yet for policy makers it is a complex challenge (well established). Four principal constraints are:

- *A lack of adequate data (both in quantity and quality terms, and especially at localized scale) about climate change impacts*
- *Weak institutional capacity at various governance levels*
- *Social and economic barriers to intervention uptake*
- *Poor infrastructure for development and adaptation purposes*

2. Adaptation responses by governments in the HKH are mostly incremental; they are driven by international commitments; they are yet to be well integrated with development plans and programmes; and their implementation lags behind official targets and goals (established but incomplete). Governance, especially at the subnational level, suffers from low information, knowledge, and resources. To be sure, national climate policies and short-run interventions may aim to build strategic knowledge, public awareness, and institutional capacity. Yet the policies do not envision transformative adaptation, and very little regional collaboration takes place.

3. Funding is the main challenge to climate change adaptation in HKH countries (established but incomplete). According to estimates, the region will need far more funding for adaptation than HKH countries have so far accessed from international sources. With appropriate incentive mechanisms, private financing might support adaptation.

4. Autonomous adaptation, widespread in the HKH, deserves more study though it may prove inadequate (established but incomplete). Generally, local knowledge systems are recognized as repositories of traditions and management practices that could usefully inform adaptation responses. Yet the systematic documentation of local, autonomous responses to climate change in the HKH is limited, and few attempts have been made to validate these responses scientifically.

5. Opportunities exist for a scaled up, inclusive, and more comprehensive climate change adaptation response in the HKH (established but incomplete). Such a response should include:

- Greater regional cooperation among HKH countries in information and knowledge sharing, particularly in areas such as disaster risk reduction, and food and water security.
- Stronger integration of adaptation with national development plans and programmes.
- Convergence of adaptation, disaster risk reduction, the Sustainable Development Goals (SDGs), and resilience-building priorities.
- Investments for generating science-based climate information and knowledge services.
- Incentives to promote policy experimentation through adaptation pilots.
- Institutional capacity building on adaptive governance.
- Creation of knowledge networks.
- Mobilization of funds for greater social protection and risk insurance.

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POLICY MESSAGES

1. Climate change adaptation policies and practices must intensify in the HKH – and must become transformative. Institutional capacity on adaptation urgently needs to increase until it fits to purpose at each level of governance. Lessons learned from successful policy instruments, such as the Local Adaptation Plans for Action (LAPAs), should widely inform efforts elsewhere. Governments should mainstream these instruments in their planning and budgeting processes.

2. Local-level autonomous responses to climate variability and extreme events must be studied systematically and documented. Such responses need to generate critical, practice-based feedback for adaptation planning at higher governance levels.

3. Alleviating poverty must be the first step in building HKH communities' adaptive capacity. Policy and practice should address the links among climate change adaptation, disaster risk reduction, and the Sustainable Development Goals (SDGs), and should look beyond SDG target 11b to other goals and targets (see SDG box below). Various stakeholders – government, private business, and civil society – must work together to intensify and scale up adaptation efforts.

78
79 Climate change is likely to have serious effects in the mountains of the HKH (well established). By
80 2050, mountain temperatures across the region are projected to increase by about 1–2° C, more at
81 higher elevations. Although precipitation projections are less certain and spatial variability is high,
82 studies indicate that increased climate variability is already affecting water availability, ecosystem
83 services, and agricultural production (see Chapter 3). Further impacts will likely appear in the
84 frequency and magnitude of extreme weather events, such as high and intense rainfall, leading to flash
85 floods, landslides, and debris flow. A rise in extreme weather events and disasters due to climate
86 change, disproportionately affecting mountain communities, could further impede their development.

87 Mountain communities – especially remote ones – are more vulnerable to these climate change
88 impacts than non-mountain areas (established but incomplete). The high mountains are poorly served
89 by life-saving and livelihood-supporting infrastructure. Access to climate information and support
90 services is more limited in the mountains, as is the presence of government extension agencies. Weak
91 institutional links hinder farmers from adopting technology that can contribute to adaptive capacity.
92 For poor and marginalized groups, deep and pervasive structural inequalities make climate change
93 adaptation even more difficult.

94 A special challenge is our uncertainty about climate change impacts in the HKH, a result of the complex
95 interactions among various drivers. Although adaptation to climate change is an urgent priority for
96 the region, we also know less than we need to about how climate change will affect mountain people
97 and ecosystems, and about the range of mountain-specific adaptation needs and interventions
98 (established but incomplete).

99 So, how will people living in the mountains adapt, and what is being done to help them? This chapter
100 seeks to identify common patterns of adaptation response across the eight countries with territory in
101 the HKH: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. The chapter
102 distinguishes between adaptation responses that are planned by governments or by non-state actors,

103 and those that are local and autonomous. Further, it asks whether the planned responses are taking
104 notice of local/autonomous practices, and it considers the extent of policy support for these practices.

105 The chapter finds that the government-led planned adaptation responses in the HKH are strongly
106 influenced by the evolving global regime under the United Nations Framework Convention on Climate
107 Change (UNFCCC). Notably, the National Adaptation Programme (NAP) process — established in 2010
108 — emphasizes that to reduce vulnerability and build resilience, countries should integrate climate
109 change adaptation into development planning. Most HKH countries have initiated efforts towards such
110 integration, and established high-level coordinating bodies under political leadership. The
111 government-led responses are at both national and subnational levels through multiple plans,
112 programmes, and projects. In all the countries there is clear identification of priority sectors for
113 adaptation interventions; however, attention to mountain specificities is not common (well
114 established).

115 What is clear is that planned responses to climate change by HKH governments and non-state actors
116 are hindered by large constraints on institutional capacity (well established) leading to major gaps
117 between policy goals and actual implementation of adaptation programmes. This chapter seeks to
118 identify the most urgent of these constraints — the ones that require immediate action. It also
119 describes many adaptation initiatives undertaken by non-state actors. How can the most successful of
120 these be replicated, scaled up, and learned from, to inform and create synergies with other coordinated
121 actions? The chapter identifies solutions that could work to better connect adaptation science, policy,
122 and practice.

123 Given climate change impacts that will likely be large — but that may be non-linear, and that are
124 subject to high uncertainty — HKH countries must now go beyond incremental strategies (established
125 but incomplete) and need to initiate transformative adaptation. Gaps in a country's adaptive capacity
126 cannot be addressed until political leadership pushes for an intensified adaptation response within the
127 larger development regime.

CLIMATE CHANGE AND THE SUSTAINABLE DEVELOPMENT GOALS (SDGs)

In the Sustainable Development Goals (SDGs) and their accompanying targets, SDG 11 — *Make cities and human settlements inclusive, safe, resilient and sustainable* — includes climate change adaptation explicitly as part of target 11.B:

By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, [and] resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels

This target under SDG 11 is critically relevant for the HKH, especially in hill and mountain areas with rural-urban migration. Yet several other SDGs are no less important for addressing climate change and anticipating its effects.

In our view, the first priority must be that of SDG 1: *End poverty in all its forms everywhere*. For climate change adaptation to be transformative, pro-poor, and socially inclusive in the HKH, a policy

approach is needed that includes poverty alleviation measures well-integrated with disaster risk reduction (DRR) and resilience-building interventions.

In addition, SDG 13 — *Take urgent action to combat climate change and its impacts* — includes target 13.2: *Integrate climate change measures into national policies, strategies and planning*. The National Adaptation Plan (NAP) process will likely be instrumental for this purpose in the HKH.

Further, under SDG 16 — *Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels* — is target 16.7: *Ensure responsive, inclusive, participatory and representative decision-making at all levels*. Inclusive institutions are essential in the HKH for adaptation measures to be consistent with social justice.

Finally, SDG 17 — *Strengthen the means of implementation and revitalize the global partnership for sustainable development* — includes target 17.6, stressing the need for enhanced regional and international cooperation. Adaptation to climate change in the HKH will depend on meeting this target, for practical reasons related to financing, technology transfer, and capacity building.

Beyond these SDGs and targets, we propose an SDG-consistent priority for adaptation to climate change in the HKH:

- *Ensure sustainable adaptation to climate change and disaster risk reduction through evidence-based decision making*

We also propose ten indicators of climate change adaptation for the HKH, consistent with SDG priorities and targets:

1. Number of deaths, missing persons, and persons affected by climate hazards per 100,000 people (disaggregated by sex)
2. Economic loss (as a percentage of national GDP) that is averted by climate-proofing critical infrastructure and basic services
3. Percentage of population with access to improved climate information and services
4. Percentage of population with improved access to successful adaptation technologies
5. Proportion of local governments that formulate and implement local adaptation plans aimed at disaster risk reduction and resilience building for vulnerable population groups
6. Number of cities or urban settlements with access to safe, climate-resilient infrastructure and service delivery systems
7. % of rural population drawing major part of their household income from climate resilient livelihood systems
8. Amount of climate financing flowing locally for climate change adaptation (for example, the percentage of the national budget allocated to mountain districts)
9. Access to international funding (for example, from the Green Climate Fund)
10. Number of knowledge institutions actively engaged in adaptation knowledge generation, communication, pilots, and scale-up relevant to the mountain context.

129 13.1 ADAPTATION TO CLIMATE CHANGE

130 Temperature across the mountains of the Hindu Kush Himalaya is projected to increase by about 1–
131 2°C by 2050, and even more at higher elevations (Shrestha et al. 2015). Winters are expected to be
132 warmer than summers in most places. Precipitation projections are less certain and the spatial
133 variability is high. A number of research studies (as cited in earlier chapters of this assessment) show
134 that increased climate variability is already affecting water availability, ecosystem services, and
135 agricultural production in the region. The serious changes likely to occur in the HKH due to climate
136 change are related to frequency and magnitude of extreme weather events such as high intense rainfall
137 leading to flash floods, landslides, and debris flow (Shrestha et al. 2015). These events would most
138 likely affect various productive sectors in the HKH countries, particularly the natural resource systems
139 that provide the livelihoods for poor and marginal communities, and impede the development process
140 (Moors and Stoffel 2013; Su et al. 2013; Ahmed and Suphachalasai 2014). There is also the recognition
141 that climate-related population dislocation will be significant in Bangladesh, China, India, and
142 Pakistan (ADB 2012).

143 The current level of understanding of adaptation needs and interventions specific to mountain
144 situations continues to be highly limited because of inadequate knowledge of climate change impacts
145 on mountain people and ecosystems. At the same time, adaptation is becoming increasingly urgent for
146 the HKH. Five of the eight HKH countries – Afghanistan, Bhutan, Myanmar, Nepal, and Pakistan –
147 are predominantly mountain countries and, at the same time, four of these (excluding Pakistan) are
148 classified as Least Developed Countries (LDCs). Even in case of the remaining two South Asian
149 countries – Bangladesh and India – the mountain states/regions compare poorly with most of their
150 non-mountain counterparts in terms of GDP and HDI indicators. In China, most of the people living in
151 poverty reside in mountain regions which occupy nearly two-thirds of the land.¹ Thus for mountain
152 people in HKH countries, climate change impacts carry a significant risk of undermining the
153 achievement of fundamental human rights like rights to food, health, adequate housing, and access to
154 safe drinking water and sanitation (Cameron et al. 2013).

155 While climate change is acting as a natural driver of change, there are several other driving forces such
156 as urbanisation and globalisation causing rapid socioeconomic transformation in the HKH. This
157 process of change is often accompanied by conditions of high uncertainty due to complex interactions
158 among the driving forces. For adaptation planning and actions under circumstances of large-scale
159 changes (some of which may be nonlinear) and high uncertainty, the HKH countries are required to go
160 beyond incremental strategies and initiate transformative development and adaptation. There is
161 definitely a capacity need for policy makers in the HKH to plan and deliver both, but addressing this
162 need will be possible only when the political leadership pushes for an intensification of the adaptation
163 responses within the larger transformative development regime.

164 13.1.1 Adaptation to climate change in the HKH is a complex challenge compounded by social 165 differentiation and poor development

166 The mountain communities in HKH countries, particularly those located in remote areas, are most
167 vulnerable to climate change impacts (especially disasters caused by extreme weather events). The
168 adaptation needs of several subsets of highly vulnerable groups in the HKH, such as indigenous

¹ <http://www.fao.org/docrep/ARTICLE/WFC/XII/0510-A3.HTM>

169 peoples, women, migrants and migrant-sending households, urban slum dwellers, and minorities,
170 deserve special understanding and targeted action. Deep and pervasive structural inequalities in HKH
171 societies make adaptation even more difficult for the poor and marginalized people. Entitlements to
172 elements of adaptive capacity (for example, ownership of productive assets and access to services of
173 local government agencies) are typically socially differentiated which affects the uptake of coping
174 strategies. For instance, in studies conducted in the Central and Western mountains of Nepal, caste
175 hierarchy and patriarchy-led gender restrictions have been found to act as barriers for the socially
176 marginalized groups within a locality to access certain institutions and adopt the adaptation options
177 that are easily accessible for the so-called higher castes (Jones and Boyd 2011; Onta and Resurreccion
178 2011). For policy makers of the HKH, such social embeddedness makes adaptation a complex challenge.

179 The other key characteristic of the HKH mountain communities in the climate change context is
180 severely limited access to climate information and support services. Because of the mountainous
181 geography, government extension agencies have sparse presence. The weak institutional linkage
182 results in poor access among farmers to new and innovative adaptation measures.

183 Similar to the thin presence of agricultural extension services in mountain regions, the level of
184 penetration of life- and livelihood-supporting infrastructure is considerably low in high mountainous
185 terrains compared to other areas within HKH countries. This is perhaps even more evident in cases of
186 adaptive infrastructure. Lack of investments in this regard has long remained a challenge in the HKH.
187 The investment bottleneck must be addressed by the leadership of these countries in order to dent the
188 prevailing development injustice so that people in the HKH can use such infrastructure and accrue
189 adaptation benefits.

190 **13.1.2 National governments in the HKH are responding to the adaptation challenge, strongly** 191 **influenced by the evolving global regime**

192 The emergence of adaptation as a response option within the United Nations Framework Convention
193 on Climate Change (UNFCCC) is marked by several milestones. The first significant action towards
194 adaptation started in 2001 with the establishment of the Least Developed Countries Expert Group to
195 provide technical support to the LDCs for preparing their National Adaptation Programmes of Action
196 (NAPAs), and with the establishment of the Least Developed Countries Fund and the Special Climate
197 Change Fund (SCCF) to support LDCs and developing countries, respectively, with adaptation action.
198 This was followed by a knowledge and networking platform to support adaptation under the Nairobi
199 Work Plan in 2005. The Adaptation Fund was launched in 2007 under the Kyoto Protocol to fund
200 adaptation action in developing countries under a novel “direct-financing” modality. The Cancun
201 Adaptation Framework in 2010 further increased the focus on adaptation under the UNFCCC process
202 with the establishment of the Adaptation Committee and the launch of the process to formulate and
203 implement national adaptation plans (NAPs) for LDCs and other developing countries. Most recently
204 the Paris Agreement in 2015 cemented adaptation under Article 7 which defines an adaptation goal,
205 the approach towards adaptation at the national level, and also provides for “adaptation
206 communications” by parties to submit their priorities and needs for adaptation.

207 The NAP process established in 2010 emphasises that reducing vulnerability and building climate
208 resilience requires the integration of adaptation planning with overall development planning. This is
209 further carried into the Paris Agreement with the adaptation goal of “enhancing adaptive capacity,
210 strengthening resilience and reducing vulnerability to climate change, with a view to contributing to

211 sustainable development”. All the HKH countries have included adaptation actions in their Intended
212 Nationally Determined Contributions (INDCs), and the majority have explicitly identified the NAP
213 process as the approach for adaptation (Table 13.1).

214 Some of the recent INDCs submitted by the HKH countries emphasize building synergy between climate
215 action and achieving the SDGs. For instance, Myanmar’s climate change strategy and action plan
216 identifies adaptation indicators that are linked with the SDG targets in sectors such as health, climate
217 change, biodiversity, and food security. Similarly, Nepal’s INDC states that “it is, ..., imperative for Nepal
218 to tackle the impact of poverty and climate change simultaneously to achieve Sustainable Development
219 Goals”. The INDCs of India and Pakistan also make a strong reference to the SDG commitment. In its
220 INDC, China has committed to embark on a sustainable development path that leads to multiple wins in
221 terms of economic development, social progress, and combating climate change.

222 Adaptation priorities, based on a review of UNFCCC documents submitted by HKH countries (NAPA,
223 National Communications, INDCs), commonly identify agriculture, water, health, forests and
224 biodiversity, and disaster management as key sectors for intervention. Further, mountain-specific
225 adaptation issues are observed to have received varying degrees of emphasis in country priorities.
226 Thus, in the case of Bhutan, a wholly mountainous country, all its NAPA priorities relate to mountain-
227 specific climate risks and vulnerabilities. Strengthening early warning systems for floods and GLOF
228 risk reduction are identified to require significantly higher density of stations due to the micro
229 variation in the topography and climates in a mountain environment. Nepal’s NAPA and Local
230 Adaptation Plan of Action (LAPA) specifically recognize the key risks and vulnerabilities of fragile
231 mountain ecosystems such as the rain shadow districts in the mid and far western region as the most
232 vulnerable and prioritized geographic areas for adaptation interventions. The government has
233 implemented a majority of the climate change adaptation projects in those remote and fragile
234 mountains targeting the population who are suffering from food deficiency and poverty. Another
235 example of a mountain-specific policy response is India’s National Mission for Sustaining the
236 Himalayan Ecosystem, which is one of the eight missions under the country’s National Action Plan on
237 Climate Change. It is the only mission with a geographical focus and its primary objective is to conserve
238 biodiversity, forest cover, and other ecological values in the Himalaya by scientifically assessing the
239 region’s vulnerability to climate change.

BOX 13.1: APPROACH TO THIS ASSESSMENT

This assessment seeks to identify patterns in adaptation response common to the eight HKH countries — Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. We look at both autonomous and planned adaptation response to climate change impacts. In the planned category we seek to distinguish between the government response and the initiatives by non-government actors. For the autonomous kind of response, we try to understand the degree to which policy formulation on planned adaptation is taking feedback from these practices and to what extent autonomous adaptation is receiving policy support. In the case of planned adaptation, institutional capacity constraints are many and we seek to identify the ones that would need to be addressed urgently. The practice domain is populated with many initiatives by non-state actors and the question here is how best to replicate, scale up, and create synergies from mutual learning and coordinated action. Ultimately this assessment hopes to identify solutions that would work for greater connectedness in the science-policy-practice continuum on adaptation.

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241 **Table-13.1: Summary of adaptation components given in country INDCs**

Country	Adaptation vision/goal	Status with respect to NAPA & NAP (or other (sub)-national policy frameworks)	Adaptation priorities (in terms of sectors or actions)	Cost of adaptation	Target years	Date of INDC submission to UNFCCC
Afghanistan	"to protect the country and its population by enhancing adaptive capacity and resilience, effectively respond to the vulnerabilities of critical sectors, and efficiently mainstream climate change considerations into national development policies, strategies, and plans" (p-4)	NAPA and National Capacity Needs Self-assessment for Global Environmental Management (NCSA) completed in 2009. NAP process underway.	<ul style="list-style-type: none"> • Development of the CCSAP and VA monitoring and assessment system • Mainstreaming of adaptation technologies • regional and international cooperation for adaptation technology transfer • Meteorological and hydrological monitoring networks and services • Water resources infrastructure and irrigation systems • Community-based natural resources management • Selected species and habitat conservation • alternative and renewable energy • Regeneration of degraded forests and rangeland areas 	10.785 billion USD (out of a total financial need of 17.405 billion USD)	2020 to 2030	13 October 2015
Bangladesh	"to protect the population, enhance their adaptive capacity and livelihood options, and to protect the overall development of the country in its stride for economic progress and wellbeing of the people" (p-10)	NAPA submitted in 2005 (revised in 2009); NAP roadmap prepared	<ul style="list-style-type: none"> • Improved early warning systems • Disaster preparedness and protection measures • Climate resilient housing, infrastructure and communication • Urban drainage • River training and dredging • Stress tolerant variety improvement and cultivation (including livestock and fisheries) • Research and knowledge management • Health • Biodiversity and ecosystem conservation • Institutional capacity building 	42 billion USD (out of a total financial need of 69 billion USD)	2015 to 2030	25 September 2015

<p>Bhutan</p>	<p>"... to remain carbon neutral ..." (p-1); "Adaptation to adverse impacts of climate change is a priority" and is to be pursued through NAP towards "reducing vulnerability by both integrating climate change adaptation into national development planning and also implementing priority adaptation actions on the ground". (p-5)</p>	<p>NAPA prepared in 2006 and updated in 2012; NAP process to begin on receipt of support</p>	<ul style="list-style-type: none"> • Water security through Integrated Water Resource Management (IWRM) • Climate resilient agriculture and livestock farming • Sustainable forest management and conservation of biodiversity • Resilience to climate change induced hazards • Minimize climate-related health risks • Climate proof transport infrastructure • Climate information services for VA assessment and planning • Renewable and climate resilient energy generation 	<p>costs not indicated</p>	<p>2018-2023 (actions integrated in 12th 5-year Plan)</p>	<p>30 September 2015</p>
<p>China</p>	<p>"...to proactively adapt to climate change by enhancing mechanisms and capacities to effectively defend against climate change risks in key areas such as agriculture, forestry and water resources, as well as in cities, coastal and ecologically vulnerable areas and to progressively strengthen early warning and emergency response systems and disaster prevention and reduction mechanisms." (p-5)</p>	<p>National Strategy for Climate Adaptation under implementation</p>	<p>Measures to enhance overall climate resilience:</p> <ul style="list-style-type: none"> • safe operation of infrastructure of water conservancy, transport and energy against climate change; • optimal water resources management • water conservation facilities for farmlands, to vigorously develop water-saving agricultural irrigation and to cultivate heat and drought-resistant crops • resilience of coastal areas against climatic disasters • to track, monitor and assess the impact of climate change on biodiversity • strengthen forestry infrastructure • effectively safeguard urban infrastructure • contingency planning and capacity building for public health services • to improve early warning and communication system • strengthening disaster risk reduction and emergency response systems 	<p>costs not indicated</p>	<p>by 2030</p>	<p>30 June 2015</p>

India	"To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management." (p-29)	National Action Plan on Climate Change (NAPCC) and State Action Plans on Climate Change (SAPCCs) under implementation	The INDC estimate of 206billion USD is for implementing adaptation actions in agriculture, forestry, fisheries infrastructure, water resources and ecosystems. Apart from this there will be additional investments needed for strengthening resilience and disaster management. (p-31)	206 billion USD (at 2014-15 prices; mitigation cost estimated around USD 834 billion till 2030 at 2011 prices)	2015 to 2030	1 October 2015
Myanmar	"...a vision for achieving climate resilient, low-carbon, resource efficient and inclusive development as a contribution to sustainable development."(p-1)	NAPA under implementation since 2012; NAP to be developed	NAPA priority sectors: 1. First priority level sector: resilience in the agriculture sector, developing early warning systems and forest preservation measures 2. Second priority level sector: public health protection and water resource management 3. Third priority level sector: coastal zone protection 4. Fourth priority level sector: energy and industry sectors, and biodiversity preservation	costs not indicated	not indicated	28 September 2015
Nepal	"Nepal's Climate Change Policy (2011) envisions a country spared from the adverse impacts of climate change, by considering climate justice, through the pursuit of environmental conservation, human development, and sustainable development The Policy has objectives of ...enhancing the climate adaptation and resilience capacity of local communities for optimum utilization of natural	NAPA prepared in 2010; LAPAs being implemented in 90 Village Development Committees and 7 Municipalities, and nearly 2200 Community Adaptation Plans of Action (CAPAs) for community forests developed; NAP preparation ongoing since 2015	<ul style="list-style-type: none"> • NAP formulation and implementation; implementation of NAPA and LAPAs • Strengthening implementation of Environment-Friendly Local Governance (EFLG) Framework in Village Development Committees and municipalities to complement climate change adaptation • Study of impacts of climate change in mountains, hills and lowland ecosystems and landscapes • Research on loss and damage associated with climate change impacts • Sustainable management of forests • Agricultural sector enhancement by adopting climate-friendly technologies and reducing climate change impacts 	costs not indicated	varies for sector to sector	11 February 2016

	resources and their efficient management" (p-3)		<ul style="list-style-type: none"> • Climate-induced disasters in earthquake affected areas • Institutional level capacity building 			
Pakistan	“To build a climate resilient society and economy by ensuring that climate change is mainstreamed in the economically and socially vulnerable sectors of the economy.” (p-15)	Process of developing a NAP underway	<p>Medium to long term actions (up to 2030):</p> <ul style="list-style-type: none"> • Improving irrigation systems • Enhancing water resource management • Strengthening risk management system for the agriculture sector • Implementing a comprehensive Climate Smart Agriculture program • Building climate-resilient infrastructure (focus on water) • Improving the emergency response mechanism for managing extreme climate events and strengthening the development of disaster reduction and relief management systems <p>Near-term actions (2020-2025):</p> <ul style="list-style-type: none"> • Developing NAP • Strengthening sub-national adaptation planning capacity • Implementation of actions under ‘National Disaster Management Plan’ 	US\$ 7 - 14 billion per annum	Medium to long-term actions (up to 2030); Near-term actions (2020-2025)	6 November 2016

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243 **13.2 LOCAL AUTONOMOUS RESPONSES TO CLIMATE VARIABILITY AND EXTREME**
 244 **EVENTS IN HKH**

245 Autonomous adaptation by mountain communities has evolved over the ages and includes possibly
 246 thousands of reactive (ad hoc, retrofitting, or retrospective) and proactive (anticipating, precautionary,
 247 incremental, or prospective) strategies, but very little is systematically researched and documented
 248 that is specific to the HKH.

249 **13.2.1 Many autonomous adaptation practices continue to be highly relevant in the local context**
 250 **and need policy support**

251 In response to climate risks, farmers in the HKH employ a number of reactive and proactive adaptation
 252 practices, such as those used by farmers in Nepal (Table 13.2).

253 **Table 13.2: Examples of reactive and proactive adaptation practices in the agricultural sector in Nepal**

Climate risk	Proactive/Prospective adaptation	Reactive/Retrospective adaptation
Temperature rise	<ul style="list-style-type: none"> • Mulching of crops to retain moisture • Terrace wall farming to avert risk of crop failure and to check evapotranspiration • Management of farmer-managed irrigation systems, community-managed drinking water systems, and traditional water mills • Legume integration with maize 	<ul style="list-style-type: none"> • Changing cropping patterns in response to crop failure to climate risks • Introduction of new crops that didn't grow well in past due to excessive cold (e.g., apple and maize are being introduced to new locations in Mustang)
Erratic rainfall with frequent drought	<ul style="list-style-type: none"> • Dry seedbeds for sowing rice • Introduction of drought-tolerant crops such as millet, soybean, black gram • Mixing of drought-tolerant local varieties with improved varieties of maize for risk distribution • Varying the sowing dates in different plots for spatial risk distribution in case of seasonal droughts 	<ul style="list-style-type: none"> • Direct seeding when drought damages crops • Collection of wild edible foods
Excessive rainfall and flooding	<ul style="list-style-type: none"> • Raised seedbeds for nursery preparation • Fencing land, orchard, houses • Growing flood-tolerant crops • Hedgerow plantation of deep-rooted grasses along the contours of sloppy agricultural lands to prevent loss of top soil and erosion 	<ul style="list-style-type: none"> • Altering planting time and methods (e.g., double-transplanting of rice) when flood damages crops • Migration to safer places
Hailstone	<ul style="list-style-type: none"> • Growing hailstone-tolerant crops such as turmeric, ginger, garlic, onion, yam, cardamom, etc. 	<ul style="list-style-type: none"> • Replacing walnuts with almonds to reduce damage caused by hailstones
Biophysical damage	<ul style="list-style-type: none"> • Shifting cultivation to cultivate less disrupted and deteriorated lands on a rotational basis 	<ul style="list-style-type: none"> • Bamboo fencing to protect land, orchards, and houses • Change of occupation, migration

254

255 Autonomous adaptation practices are rooted in a community's culture, tacit knowledge base,
 256 leadership, innovations, collective action, and experiential learning that are mediated by individuals
 257 and local institutions (Smit and Pilifosova 2001; Agrawal 2008). Examples of autonomous adaptation

258 happening in different sectors are discussed below to illustrate why and how some practices continue
259 to be relevant and need policy support.

260 *Agriculture*

261 There is sufficient evidence from the HKH countries to conclude that farmers are already adopting a
262 wide variety of autonomous adaptation strategies to a changing climate. To take a few examples:

- 263 • In Pakistan, because of increased uncertainty in rainfall patterns, farmers have begun to
264 change their cropping calendar and in some cases have even altered crop varieties. Some field-
265 level studies have documented this practice in some districts in Southern Punjab and Sindh
266 and have written policy recommendations.^{2,3}
- 267 • In China, farmers faced with drought are inclined to choose a crop that is more adaptive,
268 multifunctional, and high yielding, with better economic returns under such conditions. In
269 addition, farmers are willing to increase investment in irrigation infrastructure and adopt
270 water-saving technologies in response to climate change and the prospect of increasing water
271 scarcity (Wang et al 2010).
- 272 • In hill and mountain districts of Nepal, mixing of different varieties of beans and maize seeds
273 is a very common risk aversion strategy, because at least some of the genotypes survive
274 extreme events and environmental stresses. Farmers also alter the sowing dates by a few days
275 in different plots to distribute the risk of short-duration seasonal droughts during peak
276 growing phases (Piya et al. 2012, 2013). People have developed different agro-forestry
277 practices to address frequent drought, landslides, and surface soil erosion and have
278 constructed cost-effective bamboo fencing to protect them from recurrent floods (ICIMOD
279 2007).
- 280 • In the hills of Uttarakhand, India, farmers respond to changes in rainfall by shifting to less
281 water-intensive crops and diversifying their sources of livelihood (Kelkar et al. 2008). Farmers
282 in Sikkim have introduced crops (like maize, cabbage, pumpkin, and carrot) that were
283 previously unable to grow at high altitudes (Ingty and Bawa 2012).
- 284 • In Myanmar, a food security survey in Northern Shan finds farmers' adaptation practices
285 include cultivating wetland paddy, small gardens, orchard and shifting cultivation in the
286 upland area at regular intervals. According to the study, farmers who practiced wet paddy
287 growing, irrigated farming, crop diversification, and growing pulses in their cropping system
288 are more food secure (WFP 2010).

289 *Livestock/Pastoral*

- 290 • Pastoral communities in Nepal have been using various reactive and proactive adaptation
291 techniques, such as changing grazing areas and transhumant routes⁴ and reducing the length
292 of stay at en route points when biophysical conditions deteriorate; stall-feeding animals,

² <http://www.lead.org.pk/lead/Publications/Thematic%20Agriculture%20LAPA.pdf>

³ <http://www.lead.org.pk/lead/Publications/Thematic%20Water%20LAPA.pdf>

⁴ A transhumance system is a strong institution developed to govern animal movements (redirection), prairie management, and rationalization of resources use in response to or anticipated biophysical and ecological changes.

293 growing fodder and forage, reducing herd size, and feeding crop stubbles, by-products, and
294 hay to livestock during dry periods to cope with shortage of feed; preserving native breeds that
295 bear ecological stresses; digging ponds to store water for feeding animals; and moving animal
296 sheds and houses or entire villages to new locations when people face or anticipate some
297 ecological risks (Banjade and Paudel 2008; Moktan et al. 2008; Chetri et al. 2011; Aryal et al.
298 2014).

- 299 • Pastoralists in Sikkim, India, have responded to changes in snowfall and rainfall by replacing
300 sheep by yak and by collectively banning the slaughter and sale of sheep for a few years (Ingty
301 and Bawa 2012).
- 302 • Climate change and overgrazing are believed by policy makers to have been the drivers of
303 grassland degradation in China over the past 30 years. Li and Huntsinger (2011) observe how
304 increasing land privatization and the institutionalization of rigid land tenure in the Inner
305 Mongolia region have weakened traditional practices of pasture and herd management, and in
306 the process reduced the resilience of pastoralists to cope with environmental crises like
307 drought. On the other hand the lack of secure land tenure has been found to constrain
308 adaptation in other contexts.

309 *Water resources*

- 310 • Water is emerging as the most important and pressing climate change impact in Bhutan with
311 drying sources being reported in many parts of the country (NEC 2011). Norbu and Kusters
312 (2012) report that small-scale farmers in Punakha Valley are coping with insufficient water for
313 irrigation from traditional sources by pumping rivers.
- 314 • In the hills of Nepal, villagers have constructed community-managed water tanks sourced
315 from free-flowing natural springs for water storage and use during recurring dry seasons,
316 which are reported to have intensified in recent years (Piya et al. 2012, 2013). However, with
317 springs drying up, such a practice is at risk of losing relevance and possible alternatives may
318 not be immediately clear to communities.

319 *Forests*

- 320 • A community forestry programme in Nepal has mobilized communities to manage forest
321 resources in a sustainable way.⁵ Communities have adopted numerous practices to sustainably
322 manage and benefit from the forest ecosystems, especially in times of stress such as crop
323 failures and droughts.

324 *Disasters*

- 325 • Over the last few years, recurrent long-droughts in Nepal are making a vast tract of land
326 unattended, ultimately leading to substantive yield reduction in several districts across the
327 country. People have responded by migrating to nearby urban centres. Labour migration is a

⁵ More than 25,000 community-based forest management groups across the country are directly engaged in managing about 30% of the country's total forest area. These community-based organizations are not only contributing to sequestering carbon dioxide by sustainable management of forest resources but also playing effective roles in designing and implementing Community Adaptation Plans of Action based on forests and non-forests benefits (Nepal's INDC, p-4).

328 prominent way of diversifying livelihood and securing a source of income that is not affected
329 by difficult local conditions and shocks.

- 330 • In Sikkim, India, indigenous communities are coping with erratic rainfall and unseasonal
331 floods and landslides by using local ecological knowledge and traditional techniques like
332 riverbank retaining walls, terracing, and stabilizing slopes with native plants and rocks (Ingty
333 and Bawa 2012).

334 **13.2.2 Autonomous adaptation may prove to be inadequate in cases of new risks and ‘surprises’** 335 **arising from climate change**

336 Although individual and institutional efforts in adapting to climate change are underway, new
337 challenges continuously emerge as ‘surprises’ and many of them are difficult to tackle. Crop failures
338 and life threats caused by new pests and diseases, long drought, flash flood, glacial lake outburst floods
339 (GLOFs), forest fire, thunderstorms, hail, and other disasters are becoming more unpredictable,
340 irregular, and fierce. Very little is known about ecological, social, economic, and political conditions
341 required to adapt to such surprises and changes (Varma and Mishra 2017). According to the
342 communities in the eastern Himalaya in India, traditional coping strategies enabled them to withstand
343 environmental stresses, but it is not sufficient to fully insure them from the various threats of climate
344 change likely to occur in the near future (Barua et al. 2014).

345 Kusters and Wangdi (2013) argue that as opposed to extreme events such as floods and GLOF, gradual
346 changes such as changes in water supply can be overlooked. They report that individual efforts by
347 farmers in the Punakha region of Bhutan to adapt to changes in water supply are insufficient and
348 require external support. They also argue that such gradual changes not only lead to loss of income
349 but also impact social cohesion from increasing conflicts where water-sharing rights are being
350 stressed.

351 Autonomous adaptation within and across communities varies greatly. Systematic documentation of
352 such responses is limited, and attempts at their scientific validation are rare. Moreover, autonomous
353 adaptation is largely a response to current climate variability rather than future climate change
354 impacts. Even for current climate variability, there is often a time lag in autonomous response which
355 may be explained by structural rigidities.

356 Some autonomous adaptation practices to solve the problems of current climate variability can foster
357 the imbalance in the ecosystem. Robledo et al. (2012) mention that small-scale farmers in Tanzania
358 rely heavily on forest resources for subsistence and income-generating activities. Consequently, their
359 short-term coping practices of fuelwood cutting and selling, charcoal and craft making, and forest
360 products hunting are not sustainable and can hasten deforestation. Such an observation is applicable
361 to the HKH as well.

362 **13.2.3 Local-level knowledge systems on adaptation deserve greater attention from both science** 363 **and policy**

364 Blending of tacit and scientific knowledge can play an instrumental role in generating location-specific
365 and efficient adaptation innovations (Chhetri et al. 2012). However, the current research on adaptation
366 in the HKH largely ignores the local-level knowledge systems that are recognized as repositories of
367 traditional knowledge and management practices (Kreutzmann 2011; Manandhar et al. 2012).

368 In the HKH there are many instances of traditional institutions playing instrumental roles in managing
 369 common resources and sharing benefits accruing from it (Ostrom 1990; Bawa et al. 2008; Chaudhary
 370 2011). For instance, the Dzumsa system is an indigenous system practiced by Lachungpas of northern
 371 Sikkim, *Na Zong Nyo* by Lepchas of Sikkim, *Kipat* by Rai and Limbus, and *Sok shing* in Bhutan (Chettri
 372 et al. 2007) to manage local community, land, and natural resources including forests, water, and
 373 biodiversity. *Kharka pratha* (managing pastures), *mahavir* (bee cliffs), and customary laws in governing
 374 fishing are examples of indigenous practices in parts of the Kanchenjunga Landscape (Khattri 2008).
 375 The winter grass cutting ceremony practiced in the Kanchenjunga region to manage fodder supply is
 376 also a local institution evolved to manage forest resources (Brown 1994; Muller-Boker and Kollmair
 377 2000). Pastoralists perform *ubhauri* (upward movement of herds) and *udhauri* (downward movement of
 378 herds) celebrations at certain times of the year before herds are moved from one location to another.
 379 *Guthi* is practiced to collect and save grain in communal storage to be used when crops fail to epidemics
 380 and endemics.

381 Xu and Grumbine (2014) present examples from the Asian highlands of ‘hybrid’ forms of adaptation
 382 that combine traditional knowledge and bottom-up practices with top-down government-supported
 383 strategies, as an alternative to depending on traditional practices alone. In China’s Yunnan Province,
 384 farmers have been adapting to climate-driven water stress through a combination of local knowledge
 385 (changing planting patterns), market dynamics (switching to commercial crop varieties) and
 386 government support (state-funded water storage). From Bhutan, Nepal and Pakistan there are
 387 examples of rural communities combining expert opinion on climate change impacts with local
 388 knowledge, and engaging with NGOs for disaster risk reduction and management. Xu and Grumbine
 389 (2014), however, also argue that the choice of such hybrid forms does not seem to follow based on
 390 detailed foresight and adaptive planning, and that they are usually taken up randomly when conditions
 391 of climatic stress prevail.

392 13.3 STATE-LED PLANNED ADAPTATION IN THE HKH

393 The HKH countries currently have various adaptation responses at the national and subnational levels
 394 through policies, programmes, and projects (Table 13.3). The majority of the national adaptation
 395 projects and programs relate to watershed management, climate resilient agriculture, improved access
 396 to information for decision making, and disaster risk reduction.

397 **Table 13.3: Status of government response to adaptation needs in HKH countries**

Country	Key adaptation response at policy level and implementation highlights
Afghanistan	<p>Policy response: National Climate Change Strategy and Action Plan (being finalized); National Adaptation Programme of Action for Climate Change (NAPA 2009) and National Capacity Needs Self-Assessment for Global Environmental Management in 2009. Integration of climate change in policies and plans (e.g. National Environmental Action Plan)</p> <p>Implementation highlights: Support provided by international community and multilateral agencies; Global Environmental Facility (GEF) has provided support through enabling activities, mid-size projects, and full-size climate change adaptation projects funded by the Least Developed Countries Fund</p>
Bangladesh	<p>Policy response: Bangladesh Climate Change Strategy and Action Plan in 2009, Bangladesh Climate Change Trust Fund (BCCTF) and Bangladesh Climate Change Resilience Fund; National Adaptation Programme of Action (NAPA) in 2005 (revised in 2009); Adopted a policy</p>

	<p>decision by an inter-ministerial body to mainstream climate change in project design of any project under Annual Development Plan (ADP), to be guided and coordinated by the Ministry of Planning.</p> <p>Implementation highlights: Adaptation projects targeting different sectors and vulnerable geographic areas (e.g., Coastal Afforestation, Pilot Programme on Climate Resilience). Over the last three decades, the Government of Bangladesh (GOB) has invested over 10 billion US dollars (at constant 2007 prices) to make the country more climate resilient and less vulnerable to natural disasters. In recent times, the GOB has been investing about 23 percent of its ADP in projects related to climate variability and change. As of June 2015 BCCTF has funded over 236 projects of which 41 have already been implemented.</p>
Bhutan	<p>Policy response: National Adaptation Programme of Action NAPA (2006) and updated project profiles (2012), assessments of capacity needs for climate change, and technology needs assessment for adaptation (2013), initiation of national climate change policy in 2016. Framework to Mainstreaming Environment, Climate Change and Poverty concerns into Five Year Plan (2013-18), the Integrated Water Resources Management Plan 2016, the National Action Program to Combat Land Degradation 2014, and the National Biodiversity Strategy and Action Plan 2014.</p> <p>Implementation highlights: Urgent adaptation priority projects such as GLOF risk reduction; reducing risk of landslides and flash floods in key economic and industrial zones; strengthening national capacity for early warning for GLOF, flash floods, and weather forecasting; pilot projects in agriculture, forestry, and capacity building of local and community disaster management groups</p>
China	<p>Policy response: National Program on Climate Change, 2014–15 Action Plan for Energy Conservation, Emission Reduction and Low-Carbon Development, National Plan on Climate Change (2014–20), National Strategy for Climate Adaptation, Science and Technology Actions on Climate Change</p> <p>Implementation highlights: Climate adaptation plans and activities in key sectors such as agriculture, water resources, terrestrial ecosystems, coastal zone and regions, and human health</p>
India	<p>Policy response: National Action Plan on Climate Change (NAPCC) 2008 under which there are ten National Missions; seven missions focus on adaptation in sectors like agriculture, water, Himalayan ecosystems, forestry, health, coastal areas, and knowledge management. State Action Plans on Climate Change prepared to mainstream climate change concerns at sub-national level, National Adaptation Fund established since 2015, Indian Network for Climate Change Assessment (INCCA) set up in 2010</p> <p>Implementation highlights: India's expenditure on programmes with critical adaptation components has increased from 1.45% of GDP in 2000–01 to 2.82% during 2009–10. Expenditure on human capabilities and livelihoods viz. poverty alleviation, health improvement and disease control and risk management, constitutes more than 80% of the total expenditure on adaptation in India.</p>
Myanmar	<p>Policy response: Draft Myanmar Climate Change Strategy and Action Plan 2016, Myanmar Action Plan on Disaster Risk Reduction (MAPDRR, 2012), National Adaptation Programme of Action (NAPA) submitted to UNFCCC in 2012</p> <p>Implementation highlights: Myanmar Climate Change Alliance established in 2013, Ongoing major projects funded by the Adaptation Fund and Global Environment Facility (e.g. the 'Building Resilience and Adaptation to Climate Extremes and Disasters', (BRACED) Myanmar Programme launched in March, 2015, project on "Addressing Climate Change Risks on Water Resources and Food Security in the Dry Zone of Myanmar", and project on rehabilitation and restoration of degraded land and reserved Forest through community participation)</p>

Nepal	<p>Policy response: Launch of NAP formulation process in 2015, Climate Change Budget Code 2012, Climate Change Policy 2011, National Framework on Local Adaptation Plans for Action (LAPA) 2011, National Adaptation Programme of Action (NAPA) 2010</p> <p>Implementation highlights: Nepal Climate Change Support Programme, Community-based Flood Risk and GLOF Risk Reduction programme, Ecosystem-based Adaptation Programme, Hariyo Ban Project (climate adaptation component), and Multi-stakeholder Forestry Programme (adaptation co-benefits) under various stages of implementation. The Pilot Program for Climate Resilience (PPCR) is ongoing comprising of four components i) Building Climate Resilience of Watersheds in Mountain Eco Regions, ii) Building Resilience to Climate Related Hazards, iii) Mainstreaming Climate Change Risk Management in Development, and iv) Building Climate Resilient Communities through Private Sector Participation. Climate Change Knowledge Management Centre established.</p>
Pakistan	<p>Policy response: Pakistan Climate Change Act (2017), The 2013 Framework for Implementation of the Climate Change Policy for 2014–30, National Climate Change Policy and National Disaster Risk Reduction Policy (2012), Eighteenth Amendment to the Constitution on devolution of responsibilities for climate action to sub-national level</p> <p>Implementation highlights: The state has been implementing projects on disaster risk management and climate resilience practices in agriculture. Also efforts by GOP to win two Green Climate Fund projects focusing on mountain communities and GLOFs. Specific budgetary allocations at national and sub-national levels for execution of the 2013 Framework illustrate efforts towards mainstreaming of climate actions. Efforts by the Lahore High Court to oversee the implementation by government departments on priority areas identified under various sectors in the framework for the implementation of climate change. The Climate Change Act mandates the establishment of three important institutions, the Pakistan Climate Change Council, the Pakistan Climate Change Authority, and the Pakistan Climate Change Fund.</p>

398

399

13.3.1 Commonalities among policy responses of national governments

400 In terms of the policy goal or vision there is a common emphasis across HKH countries on building
 401 resilience at the community level and in core economic sectors. Resilience in the agriculture sector is
 402 the first priority of Myanmar's NAPA (2012). The 2011 Climate Change Policy of the Government of
 403 Nepal aims to build resilience of local communities by enhancing their capacities for efficient
 404 management of the natural resource base and use of climate-friendly technologies (MoE 2011). The
 405 2012 National Climate Change Policy of the Government of Pakistan gives particular attention to the
 406 needs of economically and socially vulnerable sectors of the economy for the success of climate-
 407 resilient development in the country (MoCC 2012).

408 China's 2013 National Strategy for Climate Change Adaptation aims to significantly enhance the
 409 country's capacity to respond to extreme climatic events and thereby build resilience in key sectors
 410 ranging from human health to infrastructure (ADB 2015). The whole country is divided into three types
 411 of adaptation regions – urbanized, agricultural, and ecological – to undertake specific adaptation
 412 tasks. For example, in the Qinghai-Tibet Plateau, one of the five major ecological regions, the tasks
 413 include assessment of the plateau's grassland carrying capacity, grassland enclosure and recovery,
 414 glacier monitoring, wetland management, development of highland valley agriculture, and so on.

415 The immediate to short-run adaptation interventions identified in the national climate policies seem
 416 to revolve around strategic knowledge generation accompanied by public awareness and institutional
 417 capacity building. For instance, Bhutan's adaptation interventions through the NAPA 1 and NAPA 2

418 projects focus on reducing the physical risk of climate-induced disasters such as GLOF, landslides,
419 flash floods, and forest fires, and strengthening capacity at national and local levels in early warning
420 systems and disaster risk management. Livelihoods and agriculture at the district and community level
421 have also been the focus of recent interventions. The national strategy and adaptation priorities for
422 Bangladesh focus on reducing the risk of climate-induced hazards and extreme events through
423 improved early warning systems for tropical cyclone, flood, flash floods, and drought. The priorities
424 also include sector-specific climate resilient interventions and capacity building at individual and
425 institutional levels to plan and implement adaptation programmes and projects in the country.

426 Governments in the HKH have started to integrate and mainstream climate change in their
427 development planning and budgeting systems (Ahmed et al. 2017). The establishment of a trust fund
428 in Bangladesh and climate change budget code in Nepal are some examples of those mainstreaming
429 efforts. Afghanistan, Pakistan, Bhutan, and China have also devised policy measures to integrate
430 climate change within ongoing sectoral policies and strategies. Bangladesh's adaptation priorities are
431 well integrated into development plans, and development priorities are discussed in the context of
432 climate change adaptation (Saito 2012). Bhutan has been integrating environment and climate change
433 into development planning, with climate change identified as one of the national key result areas of
434 the 11th five-year development plan (2013–18) and in planning at sectoral and decentralized levels
435 through the Poverty Environment Initiative. As indicated in the country's INDC, adaptation will be a
436 focus in the next development plan and the integration of adaptation planning into the development
437 process will be pursued through the NAP process.

438 There are indications of policy convergence happening in HKH countries although implementation
439 continues to be sectoral. The majority of the national commitments in the INDCs of Bhutan, India,
440 Pakistan, Nepal, Bangladesh, and Myanmar have included sectoral policy targets, and many of the
441 sectoral policies in these countries, such as agriculture, forestry, water resources, and energy, are
442 strongly interlinked with climate change policies and programmes. Thus, for instance, the National
443 Integrated Water Resources Management Plan 2016 for Bhutan integrates climate change measures
444 into the actions and strategies.

445 The majority of the adaptation interventions in Nepal, Bhutan, and Myanmar are being guided by their
446 respective NAPAs, which are by design meant to focus on current and immediate threats and to address
447 these rapidly without waiting for lengthy assessment of long-term potential impacts. An anticipatory
448 response to adaptation is reflected in the emphasis on installation of early warning systems and
449 structural interventions for disaster risk reduction through some of the NAPA priorities/projects. Thus,
450 for instance, in Bhutan and Nepal, the government is improving infrastructural adaptation by lowering
451 glacier lake levels and deepening river channels, and installing early warning systems (Adger et al.
452 2007; Hijoko et al. 2014; Mimura et al. 2014). Early warning systems have been developed for extreme
453 weather events such as flooding and wildfires (Shrestha et al. 2015; Molden et al. 2016) at many places
454 in the HKH. In Bhutan, the early warning systems are being tested in infectious disease prevention and
455 vector control programs, as for malaria (Wangdi et al. 2010), and the network of hydrometeorological
456 stations are being strengthened to increase national capacity to provide early warning for various
457 climate-induced disasters. Sustainable land management interventions and watershed management
458 interventions are also being emphasized for the anticipatory approach to providing adaptation benefits
459 (MoAF 2014). In China, the government has attempted to reduce climate vulnerability and impact by
460 adopting adaptation options of early planting, fixing variety growing duration, and late planting (Tao

461 and Zhang 2010). India’s Integrated Agro Meteorological Advisory Service programme has provided
462 climate information services to farmers (Tall et al. 2014). Generally there is a need to strengthen
463 institutional capacity in the HKH countries for more and better anticipatory planning on adaptation.

464 The national-level climate policy documents reviewed in the HKH all aim to build the adaptive capacity
465 of people by means of providing livelihood security in the face of climate change risks (Sud et al. 2015).
466 However, there is an indication of the policy-practice disconnect when one looks at the livelihood-
467 focused adaptation initiatives in the practice domain and contrasts this with the policy emphasis. Out
468 of a total of 21 adaptation projects reviewed by Sud et al. (2015), only three local-scale initiatives in
469 two countries — India and Bangladesh — have an explicit focus on livelihood. But, as Ford et al. (2014)
470 caution, many adaptation actions are undocumented and in many other instances likely to be built
471 into existing mainstreamed programmes to address development priorities. Some adaptation practices
472 may provide unexpected livelihood benefits, as with the introduction of traditional flood mitigation
473 measures in China, which could positively impact local livelihoods, leading to reductions in both the
474 physical and economic vulnerabilities of communities (Yu et al. 2009).

475 From field-level evidence, it is found that government-run adaptation efforts in the South Asia region
476 are mostly extensions of business-as-usual activities, which might be inadequate in the long run to
477 meet the adaptation needs under the post-INDC global emission regime (Ahmed et al. 2017).
478 Exceptions, like GLOF risk mitigation projects, are rare. An enhanced and intensified adaptation
479 response is needed in these countries, and particularly in the mountain regions, in order to reduce gaps
480 between growing adaptation needs and actual adaptation delivery.

481 **13.3.2 HKH countries have established high-level political bodies to coordinate climate change** 482 **responses**

483 The overall governance for climate change in Pakistan is under the Prime Minister’s Committee on
484 Climate Change, an overarching body formed in 2004. Pakistan is also one of the first countries to set
485 up a Ministry of Climate Change in 2012. The recently legislated Pakistan Climate Change Act (on 17
486 March 2017) envisages an over-arching Pakistan Climate Change Council headed by the Prime Minister
487 of Pakistan, with representation of the sub-national governments at the Chief Ministerial level. The
488 new law also envisages establishment of a high-powered Pakistan Climate Change Authority and
489 Pakistan Climate Change Fund.

490 India’s Prime Minister’s Council on Climate Change and Nepal’s Climate Change Council, also headed
491 by the Prime Minister, were established in 2007 and 2009, respectively. In Bhutan the high-level
492 National Environment Commission, which is the highest decision-making body in the government on
493 matters related to environment and chaired by the Prime Minister, functions as the National Climate
494 Change Committee.

495 The Chinese government set up the National Leading Group to Address Climate Change (NLG), headed
496 by the Chinese premier, in 2007 to draw up important strategies, policies, and measures related to
497 climate change. The National Development and Reform Commission (NDRC) under the State Council
498 was vested to undertake the general work in respect of climate change, and a department was
499 established in 2008 in the NDRC responsible for organizing and coordinating action on climate change
500 all over the country.

501 Given the federal structure of government in most of the HKH countries, there is a trend towards
502 decentralization of government action on climate change in the region. Soon after the approval of
503 Pakistan's 2012 climate policy, a constitutional amendment (18th Amendment) delegated most of the
504 action areas to the provincial governments. This constitutional amendment necessitated that the
505 provinces begin to develop their own projects, allocate their own resources, and strengthen their own
506 institutions. Responding to the challenge, Khyber Pakhtunkhwa, Punjab, and Sindh have started
507 developing their own climate change policies and action plans.

508 In China, the governance system and working mechanism to address climate change features the
509 unified leadership of the NLG, administration by the NDRC, division of work with separate
510 responsibilities among relevant departments under the State Council, and wide participation of
511 various localities and industries. Relevant departments have established functional organs to address
512 climate change in their own fields, such as the National Centre for Climate Strategy and International
513 Cooperation of China of NRDC, National Climate Centre of China Meteorological Administration, and
514 Research Centre for Climate Change of the Ministry of Water Resources. All provinces, autonomous
515 regions, and municipalities directly under the State Council have established their own leading groups
516 and working organs to address climate change, and some sub-provincial or prefectural cities have also
517 set up offices to address climate change.

518 In India, subnational policy making has resulted in State Action Plans on Climate Change that identify
519 adaptation interventions relevant to the local context. A number of adaptation projects in Indian
520 Himalayan states are being funded by India's National Adaptation Fund.

521 Effective adaptation interventions require harnessing synergies among various government schemes
522 along with stakeholder involvement in monitoring and evaluation of policy implementation (Sud et al.
523 2015). However, public consultation and stakeholder engagement in adaptation planning and
524 implementation is highly uneven and more often than not ad hoc within HKH countries. For instance,
525 it has been pointed out that in Nepal the NAPA consultations may have missed out on opportunities
526 to foster inclusive climate change responses, particularly to accommodate the concerns of many
527 different community groups affected by climate change in diverse geographic regions and
528 socioeconomic locations in the country (Ojha et al. 2015). In comparison, the multi-stakeholder-led
529 implementation of LAPAs in Nepal is assessed to have led to successful adaptation outcomes at the
530 local level (Regmi et al. 2014).

531 There are examples to show that in the absence of collaboration among local stakeholders and national
532 actors, many of the adaptation measures failed to deliver and instead led to maladaptive practices
533 (Regmi et al. 2015). Lack of participation can also create mistrust and lack of ownership leading to new
534 forms of exclusion or reinforcing existing exclusions. It has been found that adaptation planning,
535 which relies heavily on select institutions and actors, and power and social structure at the local level,
536 is likely to create new powerful groups comprised of elites within the community, and to introduce a
537 new form of dependence of poor and vulnerable households on the elites for receiving benefits from
538 the projects or programmes (Regmi et al. 2016).

539 At present, Nepal is implementing LAPAs in 90 village development committees and seven
540 municipalities (the lowest administrative units in the country). Similarly, about 375 local adaptation
541 plans and nearly 2,200 Community Adaptation Plans of Action for community forests have been
542 developed (Nepal's INDC, p-6). The experience of making LAPAs in Nepal can be considered a

543 replicable model of a bottom-up approach to adaptation planning for mountain communities. With
544 the participation and support of government, development partners, and civil society organizations, a
545 LAPA framework has been developed. Adaptation investments are being costed by the Government of
546 Nepal and integrated into annual and medium-term budget frameworks and resource mobilization
547 strategies. Pakistan, on the other hand, has implemented LAPAs at the state and local levels through
548 the support of non-governmental organizations. An analysis of LAPAs in Nepal and Pakistan concludes
549 that Nepal's focus on official formalization of the process has come at the cost of delayed
550 implementation, while Pakistan's devolved implementation-centric approach lacks official buy-in to
551 nationally scale up the LAPAs (Chaudhury et al. 2014).

552 **13.3.3 Paucity of tailored responses for gender and social inclusion**

553 Some of the HKH countries have national-level climate policies that explicitly identify the most
554 vulnerable groups (indigenous peoples, migrants, women, for instance), but very few that seek to
555 address their specific adaptation needs through tailored responses (see Box 13.2).

BOX 13.2: COUNTRY POLICIES AND TREATMENT OF MARGINALIZED PEOPLE

- Pakistan's National Climate Change Policy 2012 explicitly provides for ensuring the rights of indigenous people in the management of rangeland and pastures. It also has detailed provisions for mainstreaming gender perspectives into climate change adaptation, ensuring women's participation in decision-making on climate initiatives, and utilizing indigenous knowledge of women in climate adaptation (MoCC 2012).
- Nepal's Climate Change Policy 2011 provides for the participation of indigenous communities and women in the implementation of climate change-related programs, and identifies the importance of traditional knowledge in climate adaptation (MoE 2011). Gender is explicitly included as a cross-cutting theme in Nepal's NAPA and gender-differentiated information was collected through participatory approaches during its formulation (Mainlay and Tan 2012). In the ongoing NAP process, gender and social inclusion is a cross-cutting theme.
- Although India's National Action Plan on Climate Change (NAPCC) does not explicitly mention indigenous peoples, the National Mission for Sustaining the Himalayan Ecosystem under NAPCC addresses the importance of traditional knowledge and community-based natural resource management in the Indian Himalaya (NAPCC 2008). India's NAPCC recognizes the differential impacts of climate change with respect to gender, but incorporates only a few gender-specific measures in any of its national missions (Parikh et al. 2012).
- Bangladesh's Climate Change Strategy and Action Plan identifies women as a special category of vulnerable group and has special programs for incorporating gender consideration in climate change management. Within the HKH countries, it is the only climate change policy document which addresses the issue of climate-led forced displacement. The document has provisions to build the capacity for education and training of environmentally displaced people to ease and facilitate their migration and integration in new societies (MoEF 2009).

- Myanmar's Climate Change Strategy and Action Plan (2016) specifies implementation plans for poor and landless households in vulnerable areas of dry zone, delta, mountain, and coastal areas in terms of initiating eco-friendly crops, bioenergy schemes, and livelihood diversification activities (MoNERC 2016).

556

557 Despite the policy provisions, realizing adaptation goals for women and socially marginalized groups
558 in the HKH is likely to be very challenging. Recent studies from Nepal and India report that adaptation
559 decisions among women, in particular, can be constrained by cultural and institutional pressures that
560 favour male land ownership (Ahmed and Fajber 2009; Jones and Boyd 2011). Due to women's limited
561 ownership of land, they are still largely excluded from trainings, extension services, irrigation
562 management, and development schemes intended for farmers (Gioli et al. 2014). Within development
563 and poverty reduction programmes it has long been acknowledged that strengthening and improving
564 women's access to and control over assets, access to formal and non-formal education, land rights,
565 mobility, and opportunities to generate income is pivotal to securing progress in development.
566 Addressing and improving on these issues is also essential for enhancing adaptation and building
567 adaptive capacities.

568 **13.3.4 Implementation of adaptation programmes is challenged due to institutional inertia and** 569 **inadequate institutional capacity**

570 Countries in the HKH have weak institutional capacity at both national and subnational levels to deal
571 in an effective and timely manner with climate change impacts. Major gaps exist between policy targets
572 and actual implementation of development and adaptation programmes.

573 Most of the institutional capacity needs are related to access to information, knowledge, and resources.
574 National governments have recognized the seriousness of climate change and have submitted NAPAs,
575 but significant scientific knowledge and data gaps remain (Davis and Li 2013). In China, the findings
576 suggest that there is a need for a knowledge support system to generate, communicate, and manage
577 climate change knowledge and information in support of policy- and decision-making processes at all
578 levels (Li et al. 2012). In the case of India, there are financial, technological, and knowledge gaps in
579 adaptation, as well as capacity building and institutional needs (Garg et al. 2015).

580 The most pervasive of barriers relate to poor coordination within and between organizations
581 responsible for planning and implementing adaptation actions, and a lack of, or irrelevant
582 knowledge/information on, climate change as well as ineffectual communication between
583 stakeholders involved in adaptation actions (Spires et al. 2014). Local governments especially lack
584 institutional capacity or have difficulty gaining coordination among departments as conflicts emerge
585 to obtain scarce resources. In Bangladesh, the limited access of local governments to resources has
586 been cited as a barrier to local adaptation (Christensen et al. 2012). Local councils and planners are
587 often confronted by the complexity of adaptation without adequate access to guiding information or
588 data on local vulnerabilities and potential impacts. Local institutions are affected by lack of
589 coordination with state and national policies and priorities and cross-cutting institutional
590 coordination that is weakening environmental governance processes in the region (Tiwari and Joshi
591 2015).

592 A recent assessment by Appadurai et al. (2015) shows that adaptation to climate change in the rainfed
593 agriculture sector in India is mostly driven by one-off, small-scale pilot projects with limited scale and
594 scalability. Although these projects provide valuable knowledge and learning and help thousands of
595 farmers and their families, their scale is limited — intervention is required for millions, not thousands.
596 This same assessment lists resources, partnerships, knowledge management, and understanding of
597 local context as fundamental enabling factors for scalability. Scalability via traditional government or
598 civil society implementation is limited due to institutional inertia and capacity constraints.

599 In many cases a blanket approach to adaptation interventions has resulted in failure and even
600 maladaptation. A study carried out in Nepal shows that adaptation interventions introduced without
601 considering local context and culture have failed. For example, although the solar-wind hybrid
602 technology was successful to generate adaptation and mitigation co-benefits in other parts of Nepal,
603 it failed in Nawalparasi District due to economic burden on the poor households for the maintenance
604 of the infrastructure and equipment (ICIMOD 2016).

605 **13.4 ADAPTATION INITIATIVES BY NON-STATE ACTORS SHAPING PRACTICE IN THE HKH**

606 Non-governmental actors working on climate change adaptation comprise a wide range of
607 stakeholders including I/NGOs, civil society organizations, community-based organizations, private
608 business, and media. The initiatives by non-governmental actors are of paramount importance,
609 because they are expected to complement, build synergy, and leverage resources with government
610 programs. Presently there is great diversity among such initiatives in the HKH.

611 **13.4.1 There is multiplicity of actors and approaches, but little synergy**

612 It is common to many parts of the HKH that although a number of NGOs may be working on similar
613 adaptation-related issues, more often than not there is very little functional collaboration,
614 coordination, and communication among the actors. This results in isolation, redundancy, and
615 duplication of interventions, and inefficient resource utilization. It is observed that NGOs follow
616 frameworks/approaches to adaptation that are often similar with respect to goals, tools used,
617 envisioned actors and stakeholders, and design elements. For instance, climate-smart agriculture is
618 being promoted by more than a dozen I/NGOs in Nepal to adapt to climate-led challenges in
619 agriculture, but each tends to adopt or modify their homegrown practices, and little effort is made to
620 cross-fertilize the ideas (Bhatta et al. 2016).

621 The frequently used frameworks/approaches in the HKH include sustainable livelihoods framework,⁶
622 community-based adaptation ⁷ (CBA) and ecosystem-based adaptation ⁸ (EBA). Climate-smart

⁶ This framework considers financial, social, physical, human, and natural capital (Brooks and Adger 2005).

⁷ CARE uses climate-resilient livelihoods, disaster risk reduction, capacity building, and addressing underlying causes of vulnerability as the core themes of its community-based adaptation framework (http://careclimatechange.org/wp-content/uploads/2015/04/CBA_Framework.pdf).

⁸ The NGOs and government have collaborated to promote an ecosystem-based adaptation approach in the HKH. For example, EBA focused on agro-forest-based adaptation practices to build resilience of ecosystem and communities in Nepal (Park and Alam 2015). Payment for ecosystem services is widely piloted in the HKH as an EBA approach.

623 agriculture,⁹ climate-smart villages, and climate compatible development adaptation are also concepts
624 that have come to be used in recent years.

625 Bangladesh is possibly the global leader in pioneering people-centric, small-scale adaptation
626 initiatives, which are generally planned and executed by non-state actors. The pioneering role of an
627 early initiative called Reducing Vulnerability to Climate Change, implemented by CARE Bangladesh
628 with numerous partner organizations including local government and non-governmental partners
629 between 2002 and 2005, laid the foundation towards designing and delivering concepts such as CBA
630 and EBA (Ahmed 2010). Although the pilot-scale project was implemented in the southwestern region
631 of Bangladesh, the concepts have been further examined, extended, and tested repeatedly by both non-
632 state and government actors across Bangladesh, and gradually across more than 70 countries.¹⁰

633 By examining the early successes of CBA methodology and efforts, the Government of Bangladesh
634 allocated about 10 percent of its climate financing to engage non-state actors towards further
635 refinement of CBA activities. Such activities encompass micro-level agricultural adjustments to ensure
636 continuation of crop production in climate-affected areas by means of adopting hazard-tolerant crops,
637 adjusting crop calendars based on early signs of climate trends, replicating advanced agronomic
638 practices, and enhancing farmers' skills to switch to livelihood practices that are not directly affected
639 by climate variability or change. Moreover, CBA activities embrace small-scale water management
640 practices, disaster risk reduction practices, and creation of protection measures either to reduce
641 vulnerability by reducing exposure to known climate-induced hazard(s) and/or reduce sensitivity to
642 such known hazards (Ahmed 2010). Although such measures are gaining rapid popularity among the
643 users (because of their relative simplicity to replicate at low cost) as well as among the non-state
644 actors, it is argued that such measures might not be adequate to ensure resilience of affected
645 communities to such a considerable extent that the remaining vulnerability appears only negligible
646 (Ahmed et al. 2017).

647 In China, numerous innovative and indigenous ecosystem-based approaches have been taken for
648 adaptation to climate change over the country. In this regard, the Chinese Ecosystem Research
649 Network (CERN) established by the Chinese Academy of Sciences (CAS) in 1988 provides substantial
650 best practices that are collected and documented during its long-term investigation and management
651 of typical ecosystems in China. Demonstration efforts (Table 13.5) have been made to improve low-
652 yield croplands in the North China Plain, soil and water conservation in the Loess Plateau, re-
653 vegetation of hilly regions in southern China, rehabilitation of eutrophicated lakes, protection and
654 recovery of natural vegetation in ecologically fragile areas such as desertified areas, karst systems,
655 agro-pasture ecotones, and permafrost.

656

⁹ The term 'climate-smart agriculture' (CSA) was coined by the FAO at the Hague Conference on Agriculture, Food Security, and Climate Change in 2010. It is defined as agriculture that "sustainably increases productivity, enhances resilience, reduces/removes greenhouse gas emissions, and enhances achievement of national food security and development goals" (FAO 2010). Various international and national NGOs have been implementing the CSA concept in the HKH (ICIMOD 2015, LI-BIRD 2015).

¹⁰ The London-based International Institute for Development Studies and Dhaka-based Bangladesh Centre for Advanced Studies have been organizing annual CBA conferences and helping global extension of good lessons learnt since 2007.

657 **Table 13.5: Major technologies and demonstration models of CERN on ecosystem-based adaptation**

Demonstration model	Key issues of the ecoregion
Qianyanzhou Model (forest ecosystem)	Comprehensive control and agricultural sustainable development in hilly areas, South China
Technology for saline-alkali soil treatment (cropland ecosystem)	Comprehensive treatment of middle- and low-yield fields in the Huanghuaihai Plain, North China
Zhifanggou Model (cropland ecosystem)	Water and soil loss and ecosystem restoration in Loess Plateau
“1/10 Functional Replacement” Model for Degraded Grassland Restoration (grassland ecosystem)	Adaptive management and sustainable development of the Xilingol grassland, North China
Shapotou Model for Desertification Combating (desert ecosystem)	Construction of sand-fixing vegetation protection system in arid sand area, Northwest China
“Three Ring” Ecology-Production Paradigm of Ordos Plateau (desert ecosystem)	Sustainable management of desertified land in Ordos Plateau, North China
Technology for Water Remediation (lake ecosystem)	Treatment of eutrophication and algal bloom of freshwater lakes, Yangtze River Delta
Model of fenced grassland and artificial grassland (grassland ecosystem)	Wise use of natural grassland and seasonal optimization of livestock structures in Qinghai-Tibetan Plateau

658 Source: Chinese Ecosystem Research Network Annual Report 2012 (in Chinese)

659 **13.4.2 Scaling up and sustainability challenges are common to projects implemented by NGOs**

660 Projects implemented by NGOs are too spread out, small-scale, short-term, and often embarked upon
661 as piloting, testing, and experimentation, with little chance to be scaled up after termination of project
662 funding. The support is not adequate to reach out to a large number of households and make a real
663 lasting impact at wide scale. The technologies and practices sought to be promoted are poorly scaled
664 up partly because the projects are rarely integrated into government programs.

665 There are some success stories though. For instance, the Government of Nepal is scaling up a home
666 garden approach in 20 districts to promote on-farm diversity to contribute to food and nutrition and
667 improve resilience (diversity for adversity) of smallholder farmers with technical support of an NGO.
668 Similarly, river-bed farming practice pioneered in Nepal by a local NGO has recently been
669 mainstreamed into the national policy (Gurung et al. 2014). Riverbed farming is an adaptation practice
670 that utilizes the dry sandy beds left after the flooded rivers recede in the *terai* plains. Nepal’s Ministry
671 of Local Development has recently developed riverbed farming guidelines in collaboration with the
672 Riverbed Farming Alliance.¹¹

¹¹ <http://www.riverbedfarmingalliance.org.np/news-and-events.html>

673 Nepal has developed a novel multilevel institutional partnership in recent years that includes
674 collaboration with farmers and non-governmental organizations. By combining a conventional
675 technological innovation process with the tacit knowledge of farmers, this new alliance has been
676 instrumental in the innovation of location-specific technologies thereby facilitating the adoption of
677 technologies in a more efficient manner. This alliance has improved knowledge networking among
678 institutions, scientists, and farmers and enabled them to seek technologies that are responsive to likely
679 changes in climate, which is evident from NGO work on climate-smart agriculture and participatory
680 plant breeding work (Gyawali et al. 2006, Bhatta et al. 2016).

681 NGOs are good at securing community participation, but they sometimes develop programs and
682 suggest policies without adequate public consultation and validation. In many cases proposals seem
683 to be developed in accordance with donor requirements that lack on-the-ground reality. There is also
684 research showing that NGO-promoted participation can be limited to those who are elite, educated,
685 male, and higher caste, often leading to marginalization of the poor, women, and vulnerable
686 households (Regmi et al. 2016).

687 Media has been playing a supporting role especially to promote good CBA practices and to highlight
688 adaptation needs of certain vulnerable groups and locations in the HKH. Media has also played a
689 significant role in highlighting the need for participatory governance in climate financing in a few HKH
690 countries such as Bangladesh and Nepal (Ahmed et al. 2017). The inspiring features of electronic and
691 printed media in Bangladesh have encouraged many non-state actors to emulate CBA activities in
692 different ecosystems, while the media in Nepal has been involved in the LAPA processes.

693 **13.5 FINANCING ADAPTATION IN THE HKH**

694 Finance is the biggest challenge to achieving an adequate adaptation response to climate change
695 impacts in the HKH. To date, the quantum of funds accessed for adaptation purposes from
696 international sources by HKH countries is grossly inadequate when compared to estimates of what is
697 required for the region.

698 **13.5.1 Estimates of climate change adaptation finance need and availability are lacking for the** 699 **HKH**

700 A comprehensive assessment of climate change adaptation finance need and availability is lacking for
701 the HKH — for both the region as a single assessment unit and any specific geographical area or sector
702 in each country that falls within the HKH.¹² Therefore we have no knowledge of how much finance is
703 available, how much of the available funds have been allocated to mountain regions or spent towards

¹² The closest one is a 2014 ADB report, “Assessing the Costs of Climate Change and Adaptation in South Asia”, (<https://www.adb.org/publications/assessing-costs-climate-change-and-adaptation-south-asia>). According to the report: “To avoid the damage and economic losses from climate change under the BAU scenario, the region needs to provide an average adaptation expenditure of 0.48% of GDP per annum (USD 40 billion) by 2050 and 0.86% of GDP per annum (USD 73 billion) by 2100. Obviously, regional adaptation costs under the C–C scenario are much lower than the BAU scenario as it only requires an average of 0.36% of GDP per annum (USD 31 billion) by 2050 and 0.48% of GDP per annum (USD 41 billion) by 2100. The study took into account investment in building adaptive capacity in anticipation of future climate change as well as climate proofing measures in key sectors toward climate-resilient development” (Ahmed, M. and S. Suphachalasai 2014).

704 addressing mountain specific issues, basis of allocation of funds, scale of mobilization of private sector
705 finance, and so on.

706 Our assessment presented below has applied several assumptions while translating global and
707 country-level assessments for the HKH.

708 The Fifth Assessment Report by the IPCC (Chambwera et al. 2014) reports global estimates of the costs
709 of adaptation in developing countries ranging between USD 70 billion and USD 100 billion per year in
710 the period between 2010 and 2050. According to UNEP's reports (UNEP 2016) the costs would be much
711 higher — possibly reaching up to USD 300 billion per year by 2030 and USD 500 billion per year by
712 2050. Considering aggregated GDP of all developing countries (low income, lower middle income, and
713 upper middle income), i.e., USD 26.53 trillion (WB 2016), and the estimated cost of adaptation for
714 developing countries, one may argue that the cost of adaptation against each million of GDP would
715 require about USD 80,000 to USD 110,000 per year by 2030 and would increase to about USD 130,000
716 to USD 190,000 by 2050. Considering the number of people living in the HKH and their per capita
717 income by countries, and applying similar argument, one may argue that the region would require USD
718 3.2 billion to USD 4.6 billion per year by 2030, which would increase up to USD 5.5 billion to USD 7.8
719 billion per year by 2050.

720 Recognising financing gaps at the international level and to support the immediate needs of the
721 country, Bangladesh and India have established mechanisms for mobilizing funds from domestic
722 sources. Bangladesh has taken the lead in the region in this regard by establishing a climate change
723 trust fund, and already mobilized USD 600 million of which about USD 400 million is from government
724 internal resources and about USD 200 million from development partners. The Government of India
725 has estimated that it would require about USD 230 billion over five years to support adaptation and
726 climate resilient development including implementation of state-level climate change action plans,
727 and has established the National Adaptation Fund on Climate Change. The Bhutan Trust Fund for
728 Environmental Conservation also supports small-scale activities (up to USD 300,000 each) in Bhutan
729 to address impacts of climate change on ecosystems and species as well as supporting communities to
730 access climate change funds from other sources. The Government of China has established the USD
731 3.1 billion South-South Cooperation Fund as an independent contribution to global climate finance¹³
732 particularly building capacity of developing countries in adapting to climate change.

733 In addition to domestic sources of funding established and supporting climate change adaptation in
734 the HKH, countries in the region have accessed about USD 600 million from different international
735 sources of climate finance (Climate Fund Update, September 2016) of which approximately USD 180
736 million to USD 240 million appears to be for the HKH. Countries in the HKH, except for Bangladesh,
737 are yet to access climate change adaptation funding from Green Climate Fund which has allocated 50
738 percent of the fund for adaptation.

739 There is a lack of reliable estimates of public expenditure on adaptation by national governments in
740 the HKH. Although in some HKH countries like Nepal, attempts have been made to mainstream climate
741 change financing within the national development process (Fenton et al. 2014), the attempts are

¹³ China has made it clear that it would not pledge any money into Green Climate Fund despite developing countries like Vietnam promising to fund it.

742 largely scattered and limited. While estimates vary on the expenditure¹⁴ that the Government of
743 Pakistan undertakes on climate change adaptation and mitigation, there is an ongoing effort to track
744 and review the climate public expenditure.

745 The Government of India (GOI) has estimated a need of USD 273 million over the next five years for
746 evolving management measures for sustaining and safeguarding the Himalayan glaciers and mountain
747 ecosystem as well as to attempt to address key issues such as the Himalayan glaciers, biodiversity,
748 wildlife conservation, and livelihood of traditional knowledge societies. The GOI has already approved
749 about USD 81 million and key achievements to date include establishing six new centres relevant to
750 climate change in existing institutions in Himalayan states, creating an observational network to
751 monitor the health of the Himalayan ecosystem, and instituting several capacity building and training
752 programmes.

753 Climate change-related investments for the most part are presented through projects dealing with
754 improvement in infrastructure to mitigate the risks associated with disaster risk reduction.
755 Conventional budget heads are likely distorting the response towards more infrastructure and sector-
756 specific solutions; decision making on funds flow is also dominated by economic considerations (cost-
757 benefit or least cost considerations).

758 **13.5.2 Business potential in adaptation is high, but investment is limited**

759 Most businesses are yet to take a proactive approach to adaptation in the HKH. Few have even assessed
760 the likely effects of climate change on their operations, although it is understood that adaptation to
761 climate change can add significantly to project cost.¹⁵ That business can be a key stakeholder in
762 adaptation policy and practice is demonstrated by the active participation of the Association of
763 Bhutanese Industries and the Bhutan Chamber of Commerce and Industry in the formulation of the
764 country's NAPA. As a result of their inputs, key industrial areas and investments in the Pasakha area
765 in the foothills of the Bhutan Himalaya were identified and prioritised as being at risk from increasing
766 intensity of rainfall, flash floods, and landslides (ADB 2014). The Punatsangchu Hydro Projects I and
767 II in Bhutan are key stakeholders in the GLOF risk reduction project in the Punatsangchu Valley and
768 have made direct contributions to the installation of early warning systems (UNDP 2012).

769 Often the focus falls on the role of the private financial sector in providing risk management options
770 including insurance and financing for large projects (Khattari et al. 2010). However, there are major
771 sectors of climate financing in India such as renewable energy, energy efficiency, transport sector
772 improvement, clean-tech sector, and waste management sector, which are either from international
773 financing companies or from social-environmental safeguard budgets (GIZ 2015). In Bangladesh the

¹⁴ Based on a CPEIR 2015 report, the climate-related expenditure was estimated to be between 5.8 percent and 7.6 percent of total federal expenditures in the four studied years. The relative proportion of the climate-relevant budget spent on adaptation varied between 25 percent and 60 percent: <http://www.pk.undp.org/content/dam/pakistan/docs/Environment%20&%20Climate%20Change/UNDP%20Climate%20Report%20V10.pdf>

¹⁵ The International Finance Corporation (IFC) did a risk assessment for the Khimti I Hydropower Project in Dolakha District in Nepal using scenarios of future climate change impacts including variable and uncertain streamflow in the dry season and the risks of extreme events like flash floods, landslides, and GLOFs. Incorporating the increased likelihood of floods and GLOFs into dam design leads to increased project cost (Communication from PCD, DHPS, MoEA cited in ADB 2014).

774 private sector is more engaged in agriculture and climate change adaptation (IFC 2010). Case studies
775 show that the role of the private sector can be instrumental during the period of disaster risk and
776 rehabilitation work. It was effective during the case of post-tsunami rehabilitation work in India and
777 other parts of Asia (Chatterjee and Shaw 2015).

778 An assessment¹⁶ carried out in Pakistan on public finance support to stimulate private sector
779 investment in building disaster resilience and climate change adaptation identified public finance
780 interventions required to support two sectors: agriculture and construction. The study establishes that
781 the private sector is yet to be a major feature of disaster and climate risk management planning
782 frameworks. Nor are there specific initiatives targeting the involvement of the private sector within
783 key economic sectors, or at provincial or local levels.

784 Some other areas, such as agribusiness value chains, tourism, insurance, and climate services, in which
785 we see the potential of business-led adaptation in the HKH, are discussed below with examples.

- 786 • As part of the Pilot Programme for Climate Resilience in Nepal executed by the International
787 Financial Corporation, “agribusiness companies (such as processors of rice, maize, and
788 sugarcane) have committed to provide training to farmers to reduce crop losses and increase
789 productivity, with the long-term aim of sustained private sector involvement and
790 transformational change” (ADB 2014).
- 791 • Private companies are experimenting with a range of business models for ICT-based climate
792 and market services — either to open new markets or to safeguard their supply chains. One
793 such mobile-based initiative¹⁷ by Reuters Market Light presently serves thousands of farmers
794 in Uttarakhand State in India. Scaling up of such services in the HKH is technically feasible as
795 much of the forecasting can be based on [private or public European] weather satellites. Of
796 course, to make such products financially sustainable in the HKH, private sector providers will
797 need to address issues of mobile connectivity, low literacy, and [customization, interactivity,
798 responsiveness, call centres, field extension agents] handholding support for farmers.
- 799 • For insurance companies, weather index-based crop insurance is potentially a big market
800 opportunity. Recently the Indian state of Himachal Pradesh opened weather-indexed
801 insurance for ginger, potato, tomato, and pea crops, while a private insurer has implemented
802 a pilot scheme in Uttarakhand and Assam States. A similar effort towards insuring livelihoods
803 and well-being in Bangladesh has experienced the involvement of an insurance agency
804 working with Oxfam to offer pilot scale insurance against flood¹⁸. In Nepal, it is reported that
805 the Insurance Board is making preliminary regulatory changes to introduce rainfall and
806 hailstorm insurance for apple farming on a pilot basis¹⁹. Scaling up of such pilot schemes
807 remains a challenge and requires investment in a dense network of weather stations and
808 regulatory changes. As climate risks increase under a climate change scenario, such schemes

¹⁶

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/305412/stimulating-private-sector-engagement-climate-disaster-resilience.pdf

¹⁷ <http://www.icimod.org/?q=23463>

¹⁸ <http://oxfamblogs.org/bangladesh/wp-content/uploads/2013/08/Product-Brochure1.pdf>

¹⁹ <http://sakchyam.com.np/first-weather-index-insurance-product-launched-in-nepal-for-apple-farmers-of-jumla/>

809 will further need to be backed by a combination of global reinsurance and public climate
810 finance.

811 • Pakistan’s National Disaster Management Authority is working on a disaster risk insurance
812 fund targeting vulnerable populations for protection against climate hazards²⁰. In addition to
813 public sector insurance bodies such as National Insurance Corporation Limited and Pakistan
814 Reinsurance Corporation Limited, private sector insurance organizations have also been
815 engaged through the Insurance Association of Pakistan. One of the key fund design
816 recommendation coming out of this project is for a public-private partnership model.
817 Engagement of the private sector in such an initiative is important to fulfil the capital
818 requirements for setting up the fund and ensuring long-term financial sustainability.

819 **13.5.3 Labour migration and migrant remittances provide an opportunity for building adaptive** 820 **capacity**

821 Human migration is a significant socioeconomic phenomenon in the HKH.²¹ The mountainous region
822 generally has higher out-migration than in-migration. Whether internal or international, remittances
823 are increasingly becoming an important source of income for the households in the HKH. Apart from
824 financial remittance, social remittance (acquired skill, knowledge, and confidence) is also extremely
825 important, and highly under-researched.

826 Research shows that remittance-recipient households may not be using the financial resources in the
827 best possible manner for improving adaptive capacity (Banerjee et al. 2017). The governments have a
828 critical role to create enabling conditions in origin communities through the promotion of livelihood
829 diversification, provision of skill-training opportunities (including financial literacy,
830 entrepreneurship, etc.), improvement in transport and communication infrastructure, enhancing
831 access to market and formal financial institutions, and creation of storage facilities. These
832 interventions should aim to reduce the risks involved in migration, maximize the utility of a
833 household’s income, provide opportunities for the utilization of social remittances, and reduce climate
834 and non-climate risk to its livelihoods.

835 **13.6 THE WAY FORWARD – SOME KEY AREAS FOR PRIORITY ACTION BY COUNTRY** 836 **GOVERNMENTS IN THE HKH**

837 Opportunities do exist for a scaled up, inclusive, and more comprehensive adaptation response in the
838 HKH. This assessment suggests that the way forward for such an adaptation response in the HKH
839 should, among other things, include: (a) greater regional cooperation among HKH countries in areas
840 such as disaster risk reduction (DRR) and food security; (b) stronger integration of adaptation in
841 national development plans and programmes; (c) convergence of adaptation, DRR, SDGs, and
842 resilience-building priorities; (d) investments for generating science-based climate information and
843 knowledge services; (e) promoting policy experimentation through adaptation pilots, building

²⁰ https://cdkn.org/project/disaster-risk-insurance-for-vulnerable-communities-in-pakistan/?loclang=en_gb

²¹ Four countries (India, China, Pakistan, and Bangladesh) in the HKH are among the world’s top 10 highest remittance-receiving countries. Nepal is globally the third-largest recipient of remittances as a share of GDP (World Bank 2016), accounting for 29.6 percent in 2015/16 (NRB 2016).

844 institutional capacity on adaptive governance, and creating knowledge networks; and (f) mobilizing
845 finance for greater social protection and risk insurance.

846 **13.6.1 Regional cooperation on adaptation is a necessity**

847 Adaptation to the impact of climate change can be viewed as a regional public good (Sandler 1998) and
848 therefore justifies the call for greater cooperation among HKH countries. Presently there are very few
849 reports of cross-country adaptation projects or programmes from the HKH (Sud et al. 2015) although
850 upstream-downstream linkages between mountains and plains provide a strong basis for regional
851 cooperation. Among the South Asian riparian countries, enhanced regional collaboration for
852 undertaking integrated scientific research, policy making, and implementation of cross-country
853 adaptation measures has been cited as a necessity (Xu et al. 2009; Mirza 2011; Viviroli et al. 2011).

854 There is scope to structure cooperation among HKH countries around the complete food-water-energy
855 nexus (Rasul 2014). The Climate Summit for a Living Himalayas held in Bhutan in 2011 had produced
856 a regional Framework of Cooperation in which the agreed areas of cooperation include food security,
857 natural freshwater systems of the Himalaya, biodiversity, and energy security. However, there has not
858 been any follow-up action or movement since the summit, which is indicative of the challenges
859 remaining in implementing regional cooperative action on adaptation.

860 **13.6.2 Stronger integration of adaptation in development plans and programmes**

861 Given the diverse socioeconomic and biophysical variability across the HKH, it is a huge challenge to
862 scale up adaptation to achieve transformative results. It is therefore important for policy makers to
863 embed adaptation to climate change in ongoing large-scale development-based activities. The NAP
864 process and associated funding from Green Climate Fund is likely to be helpful in this regard.

865 While aiming for an integrated approach, it is still necessary (though difficult) to retain the distinction
866 between adaptation and development in order to prevent diversion of adaptation investments to
867 conventional development activities which could be maladaptation (Ayres and Huq 2009; Ericksen et
868 al. 2011). This approach of distinguishing additional climate change risks or additional environmental
869 benefits has been long practised in the financing of projects by the Global Environment Facility (GEF)
870 where baseline activities need to be demonstrated and additional financing is provided only for the
871 incremental cost of climate change or other environmental action.

872 **13.6.3 Convergence of adaptation, DRR, SDGs, and resilience-building priorities**

873 Climate change adaptation is identified as the cross-cutting priority with clear linkages to DRR,
874 sustainable development goals, and resilience building in most national policies and plans in the HKH
875 that highlight the importance of greater integration. The developing countries that are in the process
876 of preparing NAPs and the countries that already have NAPAs (like Nepal) have clearly indicated the
877 need to link climate change adaptation with DRR and SDG priorities. In addition to the policies and
878 plan, several adaptation initiatives in the region have piloted projects to facilitate the integration of
879 climate change with DRR and SDGs.

880 There is a need to develop overarching national policies and framework which can translate the idea of
881 integration of climate change adaptation, DRR, and SDG in action. This will allow the national
882 governments in HKH to strategically think of policy, legal, and financial instruments that can facilitate
883 convergence of the three.

884 **13.6.4 Investing to enhance the synergies between CBA and EBA approaches**

885 Many EBA projects exist around the world, including several in the HKH. A recent example is the GEF-
886 SCCF-funded project Enhancing Capacity, Knowledge and Technology Support to Build Climate
887 Resilience of Vulnerable Developing Countries, which has been recognized as the ‘first mover’ in
888 catalysing global collaborations on EBA in the context of South-South cooperation. It is a joint
889 initiative between the UNEP and NDRC of China consisting of concrete, on-the-ground EBA
890 interventions in Seychelles, Nepal, and Mauritania, representing coastal, mountain, and arid/semi-
891 arid ecosystems, respectively. Another example is the German-funded mountain EBA which pilots in
892 three mountainous countries: Nepal, Peru, and Uganda.²²

893 These initiatives have demonstrated the significant potential of an EBA approach for addressing
894 climate change in the HKH. Since trade-offs between competing demands for ecosystem services are
895 becoming increasingly significant, strong political leadership and optimal investment are required to
896 enhance the synergies between ecosystem-based adaptation and other approaches.

897 **13.6.5 Generating new knowledge and strengthening the evidence base**

898 The adaptation policies and plans of all HKH countries emphasize generating science-based climate
899 information knowledge and services to enhance resilience of climate sensitive sectors and vulnerable
900 households. For example, in Myanmar and Bhutan, NAPA has identified lack of locally usable
901 knowledge and information on weather and seasonal forecasting to assist farm production operations.
902 The NAPA of Afghanistan also identifies lack of empirical data on the extent and impact of
903 desertification thus hindering effective climate change adaptation. Evidence-based decision making
904 on adaptation warrants greater efforts towards strategic knowledge generation and communication
905 through knowledge networks (for example, Indian Network for Climate Change Assessment,
906 Himalayan University Consortium) and knowledge management platforms.

907 In general, across the HKH, people’s access to climate change information, knowledge, and services
908 continues to be severely limited. People have developed strong community networks to exchange
909 information, knowledge, and skills relevant to climate change risk identification and adaptation
910 (MoSTE 2015). For example, in Pakistan a national-level alliance for climate adaptation comprising
911 almost 200 local-level community organizations has been in existence since 2010. This has contributed
912 to the awareness of local organizations and communities of issues related to climate change.²³ Similar
913 networks can be encouraged and supported in other HKH countries.

914 **13.6.6 A policy environment for social learning**

915 Responding to novel situations requires the capacity to learn. Social learning plays a critical role in
916 building adaptiveness in natural resource management (Lebel et al. 2010) and enabling transitions
917 (Tschakert and Dietrich 2010). Policy experimentation, including piloting, is important in enabling
918 social learning to overcome system lock-in and facilitate restructuring of existing social-technical
919 systems for changes in norms, values, goals, processes, and actors (O’Brien et al. 2012). Discussing the
920 example of specific water resource management pilots such as improved watermill and spring

²² UNEP, UNDP, IUCN. 2013. Building Resilience to Climate Change: Making the Case for Ecosystem-based Adaptation.

²³ <http://www.lead.org.pk/lead/Pages/naca.aspx>

921 recharging in the Garhwal Himalaya, Uttarakhand, Agarwal (2013) argues that adaptation policies in
922 the Himalayan states should encourage the development and adoption of replicable and scalable
923 models of conservation of natural resources and livelihood support, based on decentralized planning.

924 **13.6.7 Building institutions and capabilities**

925 Effective adaptation requires enhancing adaptive capacity, which includes, among other things,
926 change in institutions and institutional processes for better governance. The roles of local institutions
927 in structuring the risks and vulnerabilities, creating an incentive framework, and mediating external
928 interventions in facilitating adaptation have been highlighted by studies. Bouma et al. (2009) observe
929 that while market and institutional access are important determinants of the effectiveness of
930 adaptation strategies, equity and governance factors finally determine the level of access of various
931 social groups to the market and institutions. One approach would be to leverage existing social
932 networks for effective governance outcomes in this regard.

933 Local governance organizations, which have reminiscence of customary institutions but are also
934 legitimized by respective polities to formulate strategies for local natural resources, can take the role
935 of bridging organizations in South Asia. One such example is the Dzumsa in Sikkim (India), which is
936 an administrative unit continuing under the traditions of chiefdom. It regulates the migratory pattern
937 for agro-pastoralists in the area, apart from governing other aspects like benefit sharing from different
938 livelihood activities, social conduct, and cultural practices. It reserves certain pastures from grazing
939 during seasons of normal snowfall and levies fines as an instrument for regulation. However, during
940 seasons of erratic snowfall when local predictions do not apply successfully, the reserved pastures are
941 made accessible for convenience of the agro-pastoralists. Such local governance institutions can fit
942 between resource-using communities, civil society, local universities and technical institutes,
943 government departments, and elected representatives.

944 Planned adaptation in the HKH would essentially require a mix of policy responses that consider a
945 range of options from incremental to adaptive and potentially transformative strategies. Given that
946 climate uncertainty cannot be reduced completely it is critical to deploy a decision-making framework
947 to identify a suite of policy options instead of an optimal or best solution (Smith et al. 2010, Hallegatte
948 et al. 2012). Conditions of 'surprise' might offer little or no scope for decision makers to respond from
949 history or experience (Lempert et al. 2003; Walker et al. 2010). The concept of adaptive policy making
950 (policies adapt over time as conditions change and learning takes place) has received much attention
951 in the past decade as a useful approach to policy formulation under uncertainty (Swanson and Bhadwal
952 2009). Capabilities required for adaptive governance need to be created in institutions at all levels of
953 governance in HKH countries.

954 **13.6.8 Engaging with private business**

955 Business can become a partner in scaling up adaptation efficiently. There is considerable scope for
956 attracting private finance to adaptation provided the risks and transaction costs of such investments
957 can be managed. Business looks for profits and scalability and thus tends to be restricted to regions
958 with a large business presence, market potential, and investment climate sustainability (Chin 2014).
959 Since adaptation is about helping the vulnerable, with a focus on poor and marginal communities,
960 novel models of public-private partnerships are required. Apart from protecting current operations,

961 new revenue streams can be identified, such as ICT and insurance. At the same time local enterprises
962 will need to be supported – not just big business.

963 Corporate social responsibility can play a very powerful role in building infrastructure and human
964 capital. For example, Google has provided funding for disease outbreak monitoring in Myanmar and
965 the Rockefeller Foundation is working to build urban resilience in a number of HKH cities (Shimla,
966 Shillong, Guwahati, and Leh) through the Asian Climate Cities Resilience Network (WRI 2009).

967 **13.6.9 Engaging with the emerging policy regime on loss and damage**

968 Under the UNFCCC a new policy regime to prepare for inevitable losses and damages is covered under
969 the Warsaw International Mechanism on Loss and Damage from Climate Change established in
970 November 2013 and subsequently under the Paris Agreement. This is premised on the existence of a
971 residual policy gap between climate change adaptation, disaster risk reduction, and current social
972 protection and risk transfer mechanisms,²⁴ wherein climate change may generate conditions that can
973 neither be mitigated, nor adapted to, nor insured against (Dow et al. 2013). The assumption is that
974 current insurance instruments will be unable to cover the collective losses entailed, such as those in
975 cultures, languages, indigenous knowledge systems, livelihood practices, social networks, and
976 statehood.

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978 **REFERENCES**

- 979 Aase, T A., Chapagain, P. S., & Tiwari, P. C. (2013). Innovation as an expression of adaptive capacity
980 to change in Himalayan farming. *Mountain Research and Development*, 33(1), 4-10.
- 981 ADB. (2015). Addressing climate change risks, disasters, and adaptation in the People’s Republic of
982 China. Mandaluyong City, Philippines: Asian Development Bank.
- 983 ADB. (2014). Climate risks in the SAARC region: ways to address the social, economic & environmental
984 challenges. Draft Report for SAARC. Mandaluyong City, Philippines: Asian Development Bank.
- 985 ADB. (2013). Regional economics of climate change in South Asia: adaptation and impact assessment.
986 Manila: Asian Development Bank.
- 987 ADB. (2012). Addressing Climate Change and Migration in Asia and the Pacific. Mandaluyong City,
988 Philippines: Asian Development Bank.
- 989 Adger, W., Arnell N., & Tompkins, E. (2005). Successful adaptation to climate change across scales.
990 *Global Environmental Change* 15, 77–86.
- 991 Agarwal, S. K. (2013). Emerging Technological Intervention Models with Scalable Solutions for
992 Adaptation to Climate Change and Livelihood Gains in Indian Himalayan Region: Case Studies on
993 Action Research at the Grassroots Level. In S. Nautiyal et al. (eds.), Knowledge Systems of Societies for

²⁴ As things stand now, the Social Protection Index (SPI) for South Asia, 0.061, is the lowest of any region. Countries such as Bangladesh, Bhutan, and India spend less than 2% of GDP on social protection and have relatively low SPIs of 0.051 or lower. Nepal does moderately better, despite being a low-income country, with an SPI of 0.068 and spending 2.1% of GDP on social protection (ADB 2013).

- 994 Adaptation and Mitigation of Impacts of Climate Change, Environmental Science and Engineering,
995 DOI: 10.1007/978-3-642-36143-2_33, Springer-Verlag Berlin Heidelberg.
- 996 Agrawal, A. (2008). The role of local institutions in adaptation to climate change. Paper Prepared for
997 the Social Dimensions of Climate Change, Social Development Department, The World Bank,
998 Washington, DC, March 5–6, 2008 (2008) Available:
999 from: http://siteresources.worldbank.org/EXTSOCIALDEVELOPMENT/Resources/updated_SDCCWorkingPaper_LocalInstitutions.pdf
1000
- 1001 Ahmed, A.U. (ed.) (2010). Reducing Vulnerability to Climate Change: The Pioneering Example of
1002 Community Based Adaptation in Bangladesh, Centre for Global Change (CGC) and CARE Bangladesh,
1003 Dhaka, p. 156.
- 1004 Ahmed, M. and S. Suphachalasai (2014). Assessing the costs of climate change and adaptation in South
1005 Asia. Mandaluyong City, Philippines: Asian Development Bank.
- 1006 Ahmed, S. & E. Fajber. (2009). Engendering adaptation to climate variability Gujarat, India. *Gender &*
1007 *Development*, 17(1), 33-50.
- 1008 Appadurai, A. N., Chaudhury, C., Dinshaw, A., Ginoya, N., McGray, H., Rangwala, L., & Srivatsa, S.
1009 (2015). *Scaling Success: Lessons from Adaptation Pilots in the Rainfed Regions of India*. World Resources
1010 Institute, Washington DC, p 112.
- 1011 Aryal, S., Maraseni, T. N., & Cockfield, G. (2014). Sustainability of transhumance grazing systems
1012 under socio-economic threats in Langtang, Nepal. *Journal of Mountain Science*, 11(4):1023-1034.
- 1013 Ayres, J., & Huq, S. (2009). Supporting adaptation to climate change: what role for ODA? *Development*
1014 *Policy Review*, 27(6): 675-692.
- 1015 Ayres, J., Huq, S., Wright, H., Faisal, A. M., & Hussain, S.T. (2014). Mainstreaming climate change
1016 adaptation into development in Bangladesh. *Climate and Development*, 6(4): 293-305.
- 1017 Banerjee, S., Kniveton, D., Black, R., Bisht, S., Das, P., & Tuladhar, S. (2017). Does financial remittance
1018 build household level adaptive capacity? A case study of the flood affected households of Upper Assam
1019 in India. KNOMAD Working Paper 18.
- 1020 Banjade, M. R. & Paudel, N. S. (2008). Mobile Pastoralism in Crisis: Challenges, Conflicts and Status of
1021 Pasture Tenure in Nepal Mountains. *Journal of Forest and Livelihood*, 7(1):49-57.
- 1022 Barua, A., Katyaini, S., Mili, B., & Gooch, P. (2014). Climate Change and Poverty: building resilience of
1023 rural mountain communities in south Sikkim, eastern Himalaya, India. *Regional Environmental Change*,
1024 14, 267-280.
- 1025 Bawa K. S., Balachander, G. & Raven, P. (2008). A case of new institutions. *Science*, 319: 136.
- 1026 Bhatta, K. P., Chaudhary, P., Khattri-Chhetri, A., Thapa, K., Rana, R. B., Gurung, D., Rijal, D., &
1027 Paudel, B. (2016). Scaling-up Climate Smart Agriculture in Nepal - Technology Identification and
1028 Piloting Methodology Report. Local Initiatives for Biodiversity, Research, and Development (LI-BIRD)
1029 and The Consultative Group for International Agricultural Research's (CGIAR) Research Program on
1030 Climate Change, Agriculture, and Food Security (CCAFS), Kaski, Nepal.

- 1031 Bouma, D. J., Chu, E. K.-W., Mack, C. B., & Parry, P. A. (2009). *Institutional Capacity and Market*
1032 *Accessibility as Determinants of the Effectiveness of Climate Change Adaptation Strategies. The Case of*
1033 *Three Middle Hill Communities in Nepal*. Michigan: University of Michigan.
- 1034 Brooks, N., & Adger, W. N. (2005) Assessing and enhancing adaptive capacity. In B. Lim, E.
1035 SpangerSiegfried, I. Burton, E.L. Malone and S. Huq (Eds.), *Adaptation Policy Frameworks for Climate*
1036 *Change* (pp. 165-182). New York, NY: Cambridge University Press.
- 1037 Brown, T. (1994). *Livelihood, Land and Local Institutions. A Report on the Findings of the WWF*
1038 *Feasibility Study for the Conservation of the Kanchen- junga Area*. WWF Nepal Program Report Series
1039 4. Kathmandu: World Wildlife Fund (WWF).
- 1040 Cameron, E., Shine, T., & Bevins, W. (2013). *Climate Justice: Equity and Justice Informing a New*
1041 *Climate Agreement*. Working paper. World Resources Institute, Washington DC and Mary Robinson
1042 Foundation – Climate Justice, Dublin. Accessed from
1043 [http://www.wri.org/sites/default/files/climate_justice_equity_and_justice_informing_a_new_climate_a](http://www.wri.org/sites/default/files/climate_justice_equity_and_justice_informing_a_new_climate_agreement.pdf)
1044 [greement.pdf](http://www.wri.org/sites/default/files/climate_justice_equity_and_justice_informing_a_new_climate_agreement.pdf) [Retrieved on October 7, 2016].
- 1045 Cao, J., Yeh, E. T., Holden, N. M., Qin, Y., & Ren, Z. (2013). The Roles of Overgrazing, Climate Change
1046 and Policy As Drivers of Degradation of China's Grasslands. *Nomadic Peoples*, 17(2), 82-101.
- 1047 Chambwera, M., G. Heal, C. Dubeux, S. Hallegatte, L. Leclerc, A. Markandya, B.A. McCarl, R. Mechler,
1048 and J.E. Neumann, 2014: Economics of adaptation. In: *Climate Change 2014: Impacts, Adaptation, and*
1049 *Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth*
1050 *Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J.
1051 Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B.
1052 Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge
1053 University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 945-977.
- 1054 Chatterjee, R., & Shaw, R. (2015). Role of regional organizations for enhancing private sector
1055 involvement in disaster risk reduction in developing Asia. In *Disaster management and privates*
- 1056 Chaudhury AS, Sova CA, Rasheed T, Thornton TF, Baral P, Zeb A. 2014. Deconstructing Local
1057 Adaptation Plans for Action (LAPAs) - Analysis of Nepal and Pakistan LAPA initiatives. Working Paper
1058 No. 67. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
1059 Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org
- 1060 Chaudhary, P. 2011. Transboundary Conservation in Kangchenjunga Landscape in the Eastern
1061 Himalayas. *Graduate Doctoral Dissertations*. Paper 61.
1062 http://scholarworks.umb.edu/doctoral_dissertations/61
- 1063 Chhetri, N., Chaudhary, P., Tiwari, P. R., & Yadaw, R. B. (2012). Institutional and technological
1064 innovation: Understanding agricultural adaptation to climate change in Nepal. *Applied Geography*, 33,
1065 142-150.
- 1066 Chhetri N, M Subedi and S Ghimire (2013) Niche based responses in addressing the climatic constraints
1067 to farm production: analogues to climate-change adaptation in Nepal, *Climate and Development*, 5:2,
1068 174-181, DOI: 10.1080/17565529.2013.789790
- 1069 Chhetri N. and P. Chaudhary 2011. Green Revolution: Pathways to Food Security in an Era of Climate
1070 Variability and Change? *Journal of Disaster Research*, 6: 486-497.

- 1071 Chetri D.K., D.B. Nepali Karki, R. Sah and N.R. Devkota 2011. Transhumance Effect on Husbandry
1072 Practices and Physiological Attributes of Chauri (Yak-Cattle) in Rasuwa District. *Our Nature*, 9:128-
1073 137.
- 1074 Chettri N., R. Thapa and B. Shakya 2007. Participatory conservation planning in Kangchenjunga
1075 transboundary biodiversity conservation landscape. *Tropical Ecology*, 48: 163-176. Chin, C. 2014. Time
1076 for business partnerships in the Himalayas. [https://www.thethirdpole.net/2014/01/27/time-for-](https://www.thethirdpole.net/2014/01/27/time-for-business-partnerships-in-the-himalayas/)
1077 [business-partnerships-in-the-himalayas/](https://www.thethirdpole.net/2014/01/27/time-for-business-partnerships-in-the-himalayas/)
- 1078 Christensen, K., S. Raihan, R. Ahsan, A.M.N. Uddin, C.S. Ahmed, and H. Wright, 2012: Ensuring Access
1079 for the Climate Vulnerable in Bangladesh: Financing Local Adaptation. ActionAid Bangladesh (AAB),
1080 Action Research for Community Adaptation in Bangladesh (ARCAB), Bangladesh Centre for Advanced
1081 Studies (BCAS), and International Centre for Climate Change and Development (ICCCAD), AAB,
1082 Dhaka, Bangladesh, 126 pp.
- 1083 Davis, M. and L. Li 2013. Understanding the Policy Contexts for Mainstreaming Climate Change in
1084 Bhutan and Nepal: A Synthesis. Regional Climate Change Adaptation Knowledge Platform for Asia,
1085 Partner Report Series No. 10. Stockholm Environment Institute, Bangkok. Available online at
1086 www.asiapacificadapt.net or www.weADAPT.org.
- 1087 Dow, K., F. Berkhout, B. L. Preston, R. J. T. Klein, G. Midgely, and M. R. Shaw. 2013. Limits to
1088 adaptation. *Nature Climate Change* 3:305-307. <http://dx.doi.org/10.1038/nclimate1847>
- 1089 Eriksen, S., P. Aldunce, C. S. Bahinipati, R. Martins, L. Sygna, K. Ulsrud, K. O'Brien, C. Nhemachena, J.
1090 Molefeji, F. Olorunfemi and J. Park, (2011), "When not Every Response to Climate Change is a Good
1091 One: Identifying Principles for Sustainable Adaptation", *Climate and Development*, 3(1): 7-20
- 1092 FAO. 2010. Climate Smart Agriculture: Policies, Practices and Financing for Food Security, Adaptation,
1093 and Mitigation. Food and Agriculture Organization (FAO) of the United Nations, Rome, Italy.
- 1094 Fenton, A., Gallagher, D., Wright, H., Huq, S., & Nyandiga, C. (2014). Up-scaling finance for
1095 community-based adaptation. *Climate and Development*, 6(4), 388-397.
- 1096 Ford, J. D., Berrang-Ford, L., Bunce, A., McKay, C., Irwin, M., & Pearce, T. (2015). The status of climate
1097 change adaptation in Africa and Asia. *Regional Environmental Change*, 15(5), 801-814.
- 1098 Garg A, V Mishra and H Dholakia, 2015. Climate Change and India: Adaptation Gap (2015) - A
1099 Preliminary Assessment. Working paper of Indian Institute of Management Ahmedabad (IIMA) W.P.
1100 No. 2015-11-01.
- 1101 GIZ, 2015; The role of the Private Sector to Scale-up Climate Finance in India: Final Report;
1102 International Climate Initiative / German Federal Ministry of the Environment
- 1103 Gioli, G; Khan, T; Bisht, S; and Scheffran, J. (2014) "Migration as an Adaptation Strategy and its
1104 Gendered Implications: A Case Study From the Upper Indus Basin" in *Mountain Research and*
1105 *Development*, 34(3):255-265.
- 1106 Gurung, G. B., Pande, D. P., and Khanal, N. P. (2014). Riverbed vegetable farming for enhancing
1107 livelihoods of people: a case study in the Tarai region of Nepal." In *Communities and Livelihood*
1108 *Strategies in Developing Countries*. Springer, Japan, 97-108.
- 1109 Gyawali S, Sthapit BR, Bhandari B, Shrestha P, Joshi BK, Mudwori A, Bajracharya J and Shrestha PK.
1110 2006. Participatory Plant Breeding: A strategy of on-farm conservation and improvement of landraces.

- 1111 In: Sthapit BR and Gauchan D, editors. Proceedings of a national symposium, 18–19 July 2006,
1112 Kathmandu, Nepal. On-farm Management of Agricultural Biodiversity in Nepal: Lessons Learned.
1113 Nepal Agricultural Research Council, LIBIRD, Bioversity and IDRC. pp 164–173.
- 1114 Hallegatte, S., Shah, A., Lempert, R., Brown, C. and Gill, S., 2012. Investment decision making under
1115 deep uncertainty - application to climate change. Policy Research Working Paper Series 6193, The
1116 World Bank.
- 1117 Hijioka, Y., E. Lin, J.J. Pereira, R.T. Corlett, X. Cui, G.E. Insarov, R.D. Lasco, E. Lindgren, and A. Surjan,
1118 2014: Asia. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects.
1119 Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on
1120 Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M.
1121 Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R.
1122 Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New
1123 York, NY, USA, pp. 1327–1370.
- 1124 Kusters, K. and Wangdi, N. (2013) ‘The costs of adaptation: changes in water availability and farmers’
1125 responses in Punakha district, Bhutan’, *Int. J. Global Warming*, Vol. 5, No. 4, pp.387–399.
- 1126 ICIMOD 2015. <http://lib.icimod.org/record/30770/files/CSV15.pdf>
- 1127 ICIMOD 2007. http://lib.icimod.org/record/22140/files/attachment_143.pdf
- 1128 IFC, 2010; A Strategy to Engage the Private Sector in Climate Change Adaptation in Bangladesh; Study
1129 carried out by Asian Tiger Capital Partners
- 1130 IGES, ICIMOD. 2013. Technical Report: Climate Change Adaptation Needs of People of the Hindu Kush
1131 Himalayas. Hayama, Japan: IGES.
- 1132 Ingti, T. and Bawa, K.S. (2012) Climate change and indigenous people. In: M. L. Arrawatia and S.
1133 Tambe (Eds) *Climate Change in Sikkim: Patterns, Impacts and Initiatives*. Published by: Information
1134 and Public Relations Department, Government of Sikkim, Gangtok, India. pp. 275–290.
- 1135 Jones, L., and Boyd, E. (2011). Exploring social barriers to adaptation: Insights from Western Nepal.
1136 *Global Environmental Change*, 21, 1262–1274.
- 1137 Kelkar, U., Narula, K. K., Sharma, V. P., & Chandna, U. (2008). Vulnerability and adaptation to climate
1138 variability and water stress in Uttarakhand State, India, *Global Environmental Change*, 18, 564–574.
- 1139 Khattri, A., D. Parameshwar, and S. Pellech. 2010: Opportunities for Private Sector Engagement in
1140 Urban Climate Change Resilience Building. Rockefeller Foundation, Bangkok, Thailand, 94 pp.
- 1141 Khatri N. K. 2008. Traditional Practices and Customary Laws of the Kirat People of Eastern Nepal and
1142 Comparison with Nepal’s Statutory Laws. In *Biodiversity Conservation in the Kanchenjunga*
1143 *Landscape*, N. Chettri, B. Shakya and E. Sharma (eds.). International Center for Integrated Mountain
1144 Development (ICIMOD), Kathmandu, Nepal.
- 1145 Kusters, K. and Wangdi, N. (2013) ‘The costs of adaptation: changes in water availability and farmers’
1146 responses in Punakha district, Bhutan’, *Int. J. Global Warming*, Vol. 5, No. 4, pp.387–399.
- 1147 Kreutzmann, H. (2011). Scarcity within opulence: Water management in the Karakoram Mountains
1148 revisited. *Journal of Mountain Science*, 8(4), 525–534.

- 1149 Lebel, L., L. Li, C. Krittasudthacheewa, et al., 2012. Mainstreaming climate change adaptation into
1150 development planning. Bangkok: Adaptation Knowledge Platform and Stockholm Environment
1151 Institute. 32 pp.
- 1152 Li, L., Fei, X., Xu, J. and Slater, H. 2012, Scoping Assessment of Knowledge Needs in Climate Change
1153 Adaptation in China, Adaptation Knowledge Platform, Partner Report Series No. 2., Stockholm
1154 Environment Institute, Bangkok. Available at <http://www.sei-inter>
- 1155 Li, W. and L. Huntsinger, 2011: China's grassland contract policy and its impacts on herder ability to
1156 benefit in Inner Mongolia: tragic feedbacks. *Ecology and Society*, 16(2), 1,
1157 www.ecologyandsociety.org/vol16/iss2/art1/.
- 1158 LI-BIRD. (2015). Scaling up climate smart agriculture in Nepal. Project brochure. LI-BIRD, Pokhara,
1159 Nepal.
- 1160 Mainlay J and Tan SF. 2012. Mainstreaming Gender and Climate Change in Nepal. IIED Climate Change
1161 Working Paper No. 2. International Institute for Environment and Development (IIED), London.
- 1162 Manandhar, S., V. P. Pandey, H. Ishidaira, and F. Kazama. 2012. 'Perturbation study of climate change
1163 impacts in a snow-fed river basin'. *Hydrological Processes* 27(24): 3461-3474.
- 1164 Maraseni, T. N. (2012). Climate change, poverty and livelihoods: adaptation practices by rural
1165 mountain communities in Nepal. *Environmental science & policy*, 21, 24-34.
- 1166 McDowell, G., Stephenson, E., & Ford, J. (2014). Adaptation to climate change in glaciated mountain
1167 regions. *Climatic Change*, 126(1-2), 77-91.
- 1168 Mimura, N., R.S. Pulwarty, D.M. Duc, I. Elshinnawy, M.H. Redsteer, H.Q. Huang, J.N. Nkem, and R.A.
1169 Sanchez Rodriguez, 2014: Adaptation planning and implementation. In: *Climate Change 2014:
1170 Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working
1171 Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field,
1172 C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O.
1173 Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White
1174 (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 869-898.
- 1175 Ministry of Environment [MoE]. 2011. Climate Change Policy, 2011. Kathmandu, Nepal: Government
1176 of Nepal.
- 1177 Mirza M M Q. 2011. Climate change, flooding in South Asia and implications. *Regional Environmental
1178 Change* 11: S95-S107.
- 1179 Mirza, M. (2007). *Climate Change, Adaptation and Adaptive Governance in Water Sector in South Asia*.
1180 Scarborough (Canada): Adaptation and Impacts Research Division (AIRD), Department of Physical and
1181 Environmental Sciences, University of Toronto.
- 1182 Moors EJ, Stoffel M, Changing monsoon patterns, snow and glacial melt, its impacts and adaptation
1183 options in northern India: Synthesis, *Sci Total Environ* (2013),
1184 <http://dx.doi.org/10.1016/j.scitotenv.2013.11.058>
- 1185 MoCC. 2012. National Climate Change Policy. Government of Pakistan, Ministry of Climate Change.
1186 Islamabad, Pakistan. Accessed from [http://wp.cedha.net/wp-content/uploads/2014/05/Pakistan-
1187 Naitonal-Climate-Change-Policy.pdf](http://wp.cedha.net/wp-content/uploads/2014/05/Pakistan-Naitonal-Climate-Change-Policy.pdf) [Retrieved on October 20, 2016].

- 1188 MoE. 2011. Climate Change Policy, 2011. Ministry of Environment, Government of Nepal. Kathmandu,
1189 Nepal. Accessed from
1190 <http://www.climatenepal.org.np/main/?p=research&sp=onlinelibrary&opt=detail&id=419> [Retrieved
1191 on October 20, 2016].
- 1192 MoEF, 2009. Bangladesh Climate Change Strategy and Action Plan 2009. Ministry of Environment and
1193 Forests, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh. xviii + 76pp.
1194 Accessed from http://www.climatechange.org.bd/Documents/climate_change_strategy2009.pdf
1195 [Retrieved October 20, 2016].
- 1196 MoNERC (2016). *Myanmar Climate Change Strategy and Action Plan*, Final Draft, Naypyitaw, Myanmar.
- 1197 MoSTE (2015). Indigenous and Local Knowledge and Practices for Climate Resilience in Nepal,
1198 Mainstreaming Climate Change Risk Management in Development, Ministry of Science, Technology
1199 and Environment (MoSTE), Kathmandu, Nepal.
- 1200 Muktan M.R., L. Norbu, H. Nirola, K. Dukpa, T.B. Rai, and R. Dorji 2008. Ecological and social aspects
1201 of transhumant herding in Bhutan. *Mountain Research and Development*, 28(1):41-48.
- 1202 Molden, D. J., Shrestha, A. B., Nepal, S., & Immerzeel, W. W. (2016). Downstream implications of
1203 climate change in the Himalayas. In *Water Security, Climate Change and Sustainable Development* (pp.
1204 65-82). Springer Singapore.
- 1205 Müller-Böker U and Kollmair M. 2000. Livelihood strategies and local perceptions of a new nature
1206 conservation project in Nepal: The Kanchenjunga Conservation Area Project. *Mountain Research and*
1207 *Development*, 20: 324-331.
- 1208 NAPCC. 2008. National Action Plan on Climate Change. Government of India, Prime Minister's Council
1209 on Climate Change. Accessed from <http://www.moef.nic.in/downloads/home/Pg01-52.pdf> [Retrieved
1210 October 20, 2016].
- 1211 NEC. (2011). Second National Communication to UNFCCC. National Environment Commission, Royal
1212 Government of Bhutan, Thimphu.
- 1213 Norbu, W. and K. Kusters (2012). The costs of adaptation in Punakha, Bhutan: Loss and damage
1214 associated with changing monsoon patterns, Climate Development Knowledge Network (CDKN).
1215 <http://loss-and-damage.net/download/6902.pdf>
- 1216 O'Brien, K., M. Pelling, A. Patwardhan, S. Hallegatte, A. Maskrey, T. Oki, U. Oswald-Spring, T.
1217 Wilbanks, and P.Z. Yanda, 2012: Toward a sustainable and resilient future. In: *Managing the Risks of*
1218 *Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F.
1219 Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M.
1220 Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental
1221 Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA,
1222 pp. 437-486.
- 1223 Ojha, H. R., Sulaiman V, R., Sultana, P., Dahal, K., Thapa, D., Mittal, N., ... & Aggarwal, P. (2014). Is
1224 South Asian agriculture adapting to climate change? Evidence from the Indo-Gangetic Plains.
1225 *Agroecology and Sustainable Food Systems*, 38(5), 505-531.

- 1226 Ojha, H.R., S. Ghimire, A. Pain, A. Nightingale, D.B. Khatri, H. Dhungana (2015) Policy without
1227 politics: technocratic control of climate change adaptation policy making in Nepal *Clim. Policy* (2015),
1228 pp. 415–433
- 1229 Onta, N., and Resurreccion, B. P. (2011). The role of gender and caste in climate adaptation strategies
1230 in Nepal. *Mountain Research and Development*, 31(4), 351-356.
- 1231 Ostrom E. 1990. *Governing the Commons: the evolution of institutions for collective action*.
1232 Cambridge University Press, P: 280.
- 1233 Parikh J, Upadhyay DK, and Singh T. 2012. Gender perspectives on climate change and human security
1234 in India: An analysis of national missions on climate change. *Cadmus* 1(4): 180-186.
- 1235 Park, J., and Alam, M. (2015). Ecosystem-based Adaptation Planning in the Panchase Mountain
1236 Ecological Region. *Hydro Nepal: Journal of Water, Energy and Environment*, 17, 34-41.
- 1237 Piya, L., Maharjan K.L., and Joshi, N.P. (2012). Comparison of adaptive capacity and adaptation
1238 practices in response to climate change and extremes among the Chepang households in rural Mid-
1239 Hills of Nepal. *Journal of International Development and Cooperation*, 18(4): 55-75.
- 1240 Piya, L., Maharjan, K.L., and Joshi, N.P. (2013). Determinants of adaptation practices to climate change
1241 by Chepang households in the rural Mid-Hills of Nepal. *Regional Environmental Change* (2013) 13: 437-
1242 447. DOI 10.1007/s10113-012-0359-5.
- 1243 Rasul, G. (2014). Food, water, and energy security in South Asia: a nexus perspective from the Hindu
1244 Kush Himalayan region. *Environmental Science & Policy*, 39, 35-48.
- 1245 Regmi, B. R., and Bhandari, D. (2013). Climate change adaptation in Nepal: Exploring ways to overcome
1246 the barriers. *Journal of Forest and Livelihood*, 11(1), 43-61.
- 1247 Regmi, B. R., & Star, C. (2014). Identifying operational mechanisms for mainstreaming community-
1248 based adaptation in Nepal. *Climate and Development*, 6(4), 306-317.
- 1249 Regmi, B. R., & Star, C. (2015). Exploring the policy environment for mainstreaming community based
1250 adaptation (CBA) in Nepal. *International Journal of Climate Change Strategies and Management*, 7(4),
1251 423-441.
- 1252 Regmi, B. R., Star, C., & Leal Filho, W. (2016). An overview of the opportunities and challenges of
1253 promoting climate change adaptation at the local level: a case study from a community adaptation
1254 planning in Nepal. *Climatic Change*, 1-14.
- 1255 Robledo, C., Clot, N., Hammill, A., & Riché, B. (2012). The role of forest ecosystems in community-
1256 based coping strategies to climate hazards: Three examples from rural areas in Africa. *Forest Policy and
1257 Economics*, 24, 20–28.
- 1258 Saito, N. (2012). Mainstreaming climate change adaptation in least developed countries in South and
1259 Southeast Asia. *Mitigation Adaptation Strategies for Global Change*, 18, 825–849.
- 1260 Sandler T. 1998. Global and regional public goods: a prognosis for collective action. *Fiscal Studies*
1261 19(3): 221-247.
- 1262 Shrestha, AB; Agrawal, NK; Alftan, B; Bajracharya, SR; Marechal, J; and van Oort, B. (eds.) (2015) The
1263 Himalayan Climate and Water Atlas: Impact of climate change on water resources in five of Asia's
1264 major river basins. ICIMOD, Grid-Arendal, and CICERO.

- 1265 Shrestha, M. S., Grabs, W. E., & Khadgi, V. R. (2015). Establishment of a regional flood information
1266 system in the Hindu Kush Himalayas: challenges and opportunities. *International Journal of Water*
1267 *Resources Development*, 31(2), 238-252.
- 1268 Smit, B. and O. Pilifosova 2001. Adaptation to Climate Change in the Context of Sustainable
1269 Development and Equity. In Mcarthy, J.J., Canziani, O.F., Learty, N.A., Dokken, D.J. and White, K.S.
1270 (ed.) Climate Change 2001: Impacts, Adaptation and Vulnerability, International Panel on Climate
1271 Change. Cambridge University Press, Cambridge, UK and New York, USA, pp. 877–912.
- 1272 Smith M S, Horrocks L, Harvey A and Hamilton C, 2010. Rethinking adaptation for a 4° C world.
1273 *Philosophical Transactions of the Royal Society*, 2011.
- 1274 Spires, M., Shackleton, S., & Cundill, G. (2014). Barriers to implementing planned community based
1275 adaptation in developing countries: A systematic literature review. *Climate and Development*, 6(3), 277-
1276 287.
- 1277 Su, Y., Lu, J., Manandhar, S., Ahmad A., & Xu J. (2013). – *Policy and institutions in adaptation to climate*
1278 *change: Case study on tree crop diversity in China, Nepal, and Pakistan*. ICIMOD Working Paper 2013/3.
- 1279 Sud R., A. Mishra, N. Varma and S. Bhadwal (2015). Adaptation policy and practice in densely
1280 populated glacier-fed river basins of South Asia: a systematic review. *Reg Environ Change* 15:825–836
1281 DOI 10.1007/s10113-014-0711-z.
- 1282 Swanson, D. and S. Bhadwal (Eds.), 2009. *Creating Adaptive Policies: A Guide for Policymaking in an*
1283 *Uncertain World*, Sage, New Delhi/IDRC, Ottawa.
- 1284 Tall A, Hansen J, Jay A, Campbell B, Kinyangi J, Aggarwal PK and Zougmore R. 2014. Scaling up climate
1285 services for farmers: Mission Possible. Learning from good practice in Africa and South Asia. CCAFS
1286 Report No. 13. Copenhagen: CGIAR Research Program on Climate Change, Agriculture and Food
1287 Security (CCAFS). Available online at: www.ccafs.cgiar.org
- 1288 Tao, F., & Zhang, Z. (2010). Adaptation of maize production to climate change in North China Plain:
1289 quantify the relative contributions of adaptation options. *European Journal of Agronomy*, 33, 103-116.
- 1290 Tiwari, P. C., & Joshi, B. (2015). Local and regional institutions and environmental governance in
1291 Hindu Kush Himalaya. *Environmental Science & Policy*, 49, 66-74.
- 1292 Tschakert, P., & Dietrich, K. A. (2010). Anticipatory learning for climate change adaptation and
1293 resilience. *Ecology and Society*, 15(2), 11.
- 1294 UNDP. (2012). “Technical and Social Impact Assessment: Reducing Climate Change-induced Risk and
1295 Vulnerabilities from Glacial Lake Outburst Floods in Punakha, Wangdue and Chamkhar Valleys”
- 1296 UNEP., (2016). *Adaptation Gap Report Update*, the United Nations Environment Programme (UNEP),
1297 Nairobi, Kenya.
- 1298 Varma, N. & Mishra, A. (2017). Discourses, narratives and purposeful action- Unraveling the social-
1299 ecological complexity within Brahmaputra basin in India. *Environmental Policy and Governance*. DOI:
1300 10.1002/eet.1745
- 1301 Viviroli D, Archer DR, Buytaert W, Fowler HJ, Greenwood GB, Hamlet AF, Huang Y, Koboltschnig G,
1302 Litaor MI, LopezMoreno JI, Lorentz S, Schadler B, Schreier H, Schwaiger K, Vuille M, Woods R (2011)

- 1303 Climate change and mountain water resources: overview and recommendations for research,
1304 management and policy. *Hydrol Earth Syst Sci* 15(2):471–504
- 1305 Walker W, Marchau V and Swanson D, 2010. "Addressing deep uncertainties using adaptive policies".
1306 *Technological Forecasting & Social Change*, Vol. 77, No. 6, Special Section 2.
- 1307 Wang, J., Huang, J., and Rozelle, S. 2010. Climate Change and China's Agricultural Sector: An Overview
1308 of Impacts, Adaptation and Mitigation, ICTSD–IPC Platform on Climate Change, Agriculture and
1309 Trade, Issue Brief No. 5, International Centre for Trade and Sustainable Development, Geneva,
1310 Switzerland, and International Food & Agricultural Trade Policy Council, Washington, DC.
- 1311 K. Wangdi, P. Singhasivanon, T. Silawan, S. Lawpoolsri, N.J. White, J. Kaewkungwal Development of
1312 temporal modelling for forecasting and prediction of malaria infections using time-series and ARIMAX
1313 analyses: A case study in endemic districts of Bhutan *Malar. J.*, 9 (251) (2010), pp. 251–259
- 1314 WB. (2016). World Development Indicators database, World Bank, 11 October 2016
- 1315 WFP. (2010). An Overview of the Food Security Situation in Selected Areas across Lashio Area, (March),
1316 1–26.
- 1317 WRI. (2009). http://pdf.wri.org/making_climate_your_business.pdf
- 1318 Xu, J., & Grumbine, R. E. (2014). Integrating local hybrid knowledge and state support for climate
1319 change adaptation in the Asian Highlands. *Climatic Change*, , 93–104.
- 1320 Xu, J., Grumbine, R. E., Shrestha, A., Eriksson, M., Yang, X., Wang, Y., & Wilkes, A. (2009). The Melting
1321 Himalayas: Cascading Effects of Climate Change on Water, Biodiversity, and Livelihoods. *Conservation*
1322 *Biology*, 23(3), 520–530.
- 1323 Yu, X., Jiang, L., Wang, J., Wang, L., Lei, G. & Pittock, J. (2009). Freshwater management and climate
1324 change adaptation: experiences from the central Yangtze in China. *Climate and Development*, 1, 241-
1325 248.