

## **Political Economy, Poverty, and Polycentrism in the Global Environment Facility's Least Developed Countries Fund (LDCF) for Climate Change Adaptation**

### 1. Introduction

Climate change adaptation refers to altering infrastructure, institutions, or ecosystems to respond to the impacts of climate change. Notwithstanding the great promise it offers society, something might be going softly, silently awry with projects. A survey of hundreds of studies of climate change adaptations implemented over the previous decade reached a worrying conclusion: many projects were not helping the most vulnerable, and were instead strengthening established sectors that had already received large shares of adaptation funding.<sup>1</sup> Another article warned that within adaptation projects, “Deeply entrenched social institutions and norms may influence which group members will be able to have a voice and ultimately exercise rights.”<sup>2</sup> Similarly, Biermann et al. demonstrated how adaptation interventions are geared to serve particular interests, be it donor agencies or the agendas of particular companies.<sup>3</sup> Adger hypothesized that “vulnerability to environmental change does not exist in isolation from the wider political economy of resource use” and that “vulnerability is driven by inadvertent or deliberate human action that reinforces self-interest and the distribution of power in addition to interacting with physical and ecological systems.”<sup>4</sup> Watts and Bohle et al. further elaborate that vulnerability is a “multi-layered and multi-dimensional social space defined by determinate political, economic and institutional capabilities of people in specific place at specific times.”<sup>5</sup>

To explore these themes in a more systematic way, this article documents the presence of four inequitable attributes of adaptation projects—processes we have termed enclosure, exclusion, encroachment, and entrenchment—cutting across economic, political, ecological, and social dimensions. We find the four processes at work simultaneously in our case studies of five projects being implemented as part of the Least Developed Countries Fund (LDCF), the largest

pool of adaptation projects for poor countries. The article concludes with a discussion of the broader implications of the political economy of adaptation for analysts, program managers, and climate researchers at large. In sum, the politics of adaptation must be taken into account so that projects can maximize their efficacy and avoid marginalizing those most vulnerable to the impacts of climate change.

In proceeding on this path, we aim to make three contributions. First, the study focuses on the politics of adaptation in practice. It moves beyond vulnerability mapping to assess the effects of current adaptation efforts. Much policy research related to adaptation centers on providing credible estimates of adaptation costs, or conducting vulnerability assessments, or trying to guide future adaptation strategies at the sectoral or national level. Instead, this article investigates the effects of adaptation efforts. Such an assessment is essential if policymakers and scholars are to prioritize the policies and measures that work best at accomplishing adaptation goals. The article thus contributes to the emerging work on monitoring and evaluation (M&E) of adaptation, and it also underscores some of the social, political, and economic factors (negative or positive) that can influence projects.

Second, the study's focus on poverty and least developed countries is unique. The LDCF is special because, as the name implies, it is dedicated to the countries belonging to the group of "least developed,"<sup>6</sup> meaning they have low incomes (less than about \$900 per capita per year), weak human assets, and high economic and social vulnerability. Least developed countries therefore lack the requisite capacity to implement adaptation projects.

Third, the study analyzes a form of polycentric climate governance—a term that refers to when a given policy or intervention blends together actors from different scales of implementation.<sup>7 8</sup> The LDCF meets this classification as it is a multilateral fund involving

many different actors of varying types across a range of scales. The LDCF program itself is managed by the Global Environment Facility (GEF), an entity operating the financial mechanism of the United Nations Framework Convention on Climate Change (UNFCCC). It thus represents a shift from the “classic” form of governance involving nation states to a newly emerging hybrid model coupling public and private partnerships with decentralized and cost-sharing forms of implementation.<sup>9</sup> This form of governance involves the range of climate governance topographies with global, national, and local scalar interactions and public, private, civil society actors. The wide array of actors involved in this process, as this paper will illustrate, presents a huge challenge in terms of coordination, efficacy and governance of these projects.

## 2. Literature Review and Case Selection

This section briefly introduces readers to adaptation before summarizing some main themes in the literature. “Adaptation” was defined in the Intergovernmental Panel on Climate Change’s (IPCC) Fourth Assessment Report as “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”<sup>10</sup> Adaptation is often contrasted with mitigation, which the report defines as “an anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks.”<sup>11</sup> Put in very simple terms, mitigation is avoiding climate change, whereas adaptation is coping with climate change, or as Brown and Sovacool (2011) put it, mitigation is “avoiding the unmanageable” whereas adaptation is “managing the unavoidable.”<sup>12</sup> That is the simple version. In practice, adaptation can be understood in a variety of ways. Table 1 introduces a number of related, though differing, definitions of adaptation.

### **Table 1: Eight Definitions of Climate Change “Adaptation”**

Definition	Year	Source
“The process through which people reduce the adverse effects of climate on their health and wellbeing, and take advantage of the opportunities that their climatic environment provides”	1992	Canadian Climate Center <sup>13</sup>
“Adjustments to enhance the viability of social and economic activities and to reduce their vulnerability to climate, including its current variability and extreme events as well as longer term climate change”	1993	University of Guelph <sup>14</sup>
“Any adjustment, whether passive, reactive or anticipatory, that is proposed as a means for ameliorating the anticipated adverse consequences associated with climate change”	1993	U.S. Army Corps of Engineers <sup>15</sup>
“The degree to which adjustments are possible in practices, policies, or structures of systems to projected or actual changes of climate”	1996	Intergovernmental Panel on Climate Change Second Assessment <sup>16</sup>
“All adjustments in behavioral or economic structure that reduce the vulnerability of society to changes in the climate system”	1996	Smith et al. 1996 <sup>17</sup>
“Improving country resilience against climate risks”	2011	Organization of Economic Co-Operation and Development <sup>18</sup>
“A range of approaches to address loss and damage associated with the adverse effects of climate change, including impacts related to extreme weather events and slow onset events”	2014	United Nations Framework Convention on Climate Change <sup>19</sup>

Source: Compiled by the authors

A term that sometimes circulates can be informally called “anti-adaptation” or “maladaptation.”<sup>20 21</sup> Early definitions referred to “those actions which tend to increase vulnerability to climate change. It is possible to make development or investment decisions while neglecting the actual or potential impacts of climate change. Such decisions are termed maladaptive.”<sup>22</sup> The IPCC signaled a broader understanding of maladaptation in its 2001 report, which defined the term as: “Any changes in natural or human systems that inadvertently increase vulnerability to climate stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead.”<sup>23</sup> Eisenack et al. underscore that there need not to be an unanimous judgment on whether a phenomena constitutes a barrier to an adaption action, and whether

further barriers can be reduced or overcome, which they distinguished from “limits” to adaption.<sup>24</sup>

None of the established studies above, however, have investigated the LDCF in particular. Created in 2001, the GEF LDCF intends to help the poorest countries in the world prepare and implement National Adaptation Programs of Action (NAPAs) to address the consequences of climate change. Currently one of the largest funds ever created for climate adaptation, the GEF leveraged more than \$900 million in voluntary contributions to support 213 adaptation projects in 51 countries during the scheme’s operation from 2002 to 2015.<sup>25</sup> These projects were implemented in tandem with partner agencies including the World Bank, United Nations Development Program, and United Nations Environment Program.

For an in-depth analysis of the political economy effects of the LDCF, we selected a sample of five major efforts being implemented in Asia. We focused on case studies from the Asia-Pacific region because projections suggest it will be subjected to more land degradation, people displaced, prosperity threatened, and economies disrupted from climatic changes (including sea level rises) than any other part of the planet.<sup>26 27</sup> Already, the Asia Pacific was home to 85 percent of deaths and 38 percent of global economic losses due to natural disasters from 1980 to 2009.<sup>28</sup> These projects, summarized in Table 2, cover a breadth of the funded activities within the LDCF: coastal afforestation in Bangladesh, glacial flood control in Bhutan, agricultural production in Cambodia, community relocation in the Maldives, and integrated coastal management in Vanuatu. Under these projects, Bangladesh not only erected dykes and planted mangrove plantations, it incentivized agriculture and aquaculture to improve community income and training local officials. Bhutan not only altered the physical shape of glacial lakes and rivers, built shelters, and created an early warning system, but educated public and private

leaders about emergency preparedness and climate risks. Cambodia both experimented with crops and rehabilitating canals and ponds, and also educated provincial officials and empowered local villagers to decide on infrastructure investments. Maldivian planners thickened coastal vegetation and nourished coral reefs, and also decentralized planning and disbursed funds directly to local communities so that they can decide what is best for them. Planners in Vanuatu hardened coastal infrastructure, solicited feedback from stakeholders and civil society, and enhanced the informational awareness of indigenous peoples in rural areas.

**Table 2: Overview of Five Least Developed Countries Fund Adaptation Projects**

<b>Country</b>	<b>Infrastructural Adaptation</b>	<b>Organizational Adaptation</b>	<b>Social Adaptation</b>
Bangladesh	Mangrove plantations, mound plantations, dykes, and embankments; early warning system	Capacity building through training courses for local government officials in forestry, and organizational change through setting up new functional departments	Coupling of forestry programs to income generation through forest products, fish, and food
Bhutan	Lowering glacial lake levels; deepening river channels; early warning system; climate shelters	Workshops for government officials at the nodal level	Community training in search and rescue, evacuations, and first aid
Cambodia	Climate-proofing of canals and communal ponds; experimentation with crop variation and diversity	Education sessions for provincial and local officials	Local empowerment over prioritization of climate-proofing schemes
Maldives	Sea walls; replenishment of sea ridges; mangrove afforestation; beach nourishment; coral reef propagation; repositioning of water tanks	Decentralization of adaptation planning and management to local political units	Community control over adaptation investments
Vanuatu	Roads; bridges; port infrastructure; sea walls	Consultation of adaptation options with community stakeholder	Dissemination of information kits to tribal leaders

Source: Compiled by the authors

### 3. Research Methods and Conceptual Approach

To explore the LDCF in-depth, our primary tool of data collection was semi-structured research interviews. The lead author developed an interview protocol that asked respondents to (a) identify the most serious climate change related concerns facing communities in each country, (b) summarize ongoing adaptation efforts related to the LDCF fund, (c) explicate

expected costs and benefits for those efforts, (d) identify obstacles or barriers to implementation, and (e) elaborate on any broader lessons such projects offered the climate policy community.

One advantage to the approach is it can produce rich, detailed qualitative answers to our questions; one disadvantage is that measures of impacts (positive or negative) are based on perceptions rather than more independent or objective data.

The lead author conducted two sets of interviews, those at the start of projects (in 2010) followed by those done at least a year after the projects were completed (in 2015). The intent was to compare the initial expectations and goals with the results and achievements (or lack thereof). The first batch of interviews, 123 conducted in 2010, were done onsite in each country in tandem with field research and site visits, funded by a grant, and supported by a research team. The 2010 interviews were triangulated with a second batch of 23 interviews done solely by the lead author via telephone and email in January and February 2015, after each of the projects had terminated. Table 3 provides an overview of the interviews disaggregated by time and project. At the request of some participants, the interview data is presented as anonymous with only a respondent number (e.g., “R23” for the 23<sup>rd</sup> interviewee).

**Table 3: Summary Data for Research Interviews (n=146)**

Case study	2010 interviews	2015 interviews	Total
<b>Bangladesh</b>	15	4	19
<b>Bhutan</b>	20	5	25
<b>Cambodia</b>	30	5	35
<b>Maldives</b>	33	5	38
<b>Vanuatu</b>	14	4	18
<b>Other (i.e., the LDCF fund or GEF in general)</b>	11		11
<b>Total</b>	123	23	146

Source: Compiled by the authors

To guide the interpretation of all of this data, the authors decided to draw from the conceptual approach loosely known as the “political economy” of climate change adaptation.<sup>29 30</sup> This approach suggests that adaptation projects must beware of four intersecting processes that can lower their efficacy: enclosure, exclusion, encroachment, and entrenchment. “Enclosure” refers to when an adaptation project transfers a public or social asset into private hands, or expands the role and authority of a private actor into a formerly public sphere. It relates in part to how private institutions, especially corporate actors, intensify their efforts to penetrate into more remote or peripheral areas from which they can derive revenue. “Exclusion” often occurs in tandem with enclosure, and it refers to when an adaptation project excludes or displaces a particular group of stakeholders or limits access to resources related to due process, fairness, and procedural justice. The process of exclusion enables resources to be appropriated or consolidated by state authorities, private firms, or social elites, evident in processes such as “land-grabbing.” “Encroachment” refers to when adaptation projects degrade the environment, interfere with ecosystem services provision, intrude upon biodiversity conservation zones such as protected areas and national parks, or counteract climate change mitigation efforts by involving the emission (embodied, or direct) of greenhouse gases. Adaptation can, because it is primarily concerned with building human resilience, undermine the conservation of biodiversity. “Entrenchment” refers to when an adaptation project aggravates the disempowerment of women, minorities, or the vulnerable. It “entrenches” inequality by interfering with egalitarian systems of distribution or procedural justice, or by further concentrating wealth within a community or transferring risk. Table 4 summarizes these processes, and shows how they criss-cross economic, political, ecological, and social dimensions.

**Table 4: Conceptual Typology of Enclosure, Exclusion, Encroachment, and Entrenchment**



<b>Concept</b>	<b>Dimension</b>	<b>Explanation</b>
Enclosure	Economic	Capturing resources or authority: transferring public assets into private hands, or the expansion of private roles into the public sector
Exclusion	Political	Marginalizing stakeholders: limiting access to adaptation decision-making processes and fora
Encroachment	Ecological	Damaging the environment: intruding on biodiversity areas or other areas with predisposed land uses, or interfering with ecosystem services
Entrenchment	Social	Worsening inequality: aggravating the disempowerment of women or minorities and/or worsening concentrations of wealth

Source: Compiled by the authors based on <sup>31 32</sup>

#### 4. Results: Exposing the Political Economy of Adaptation

This section of the paper utilizes the concepts of enclosure, exclusion, encroachment, and entrenchment to illustrate the implementation challenges facing our sample of 5 LDCF projects being implemented in the Asia-Pacific.

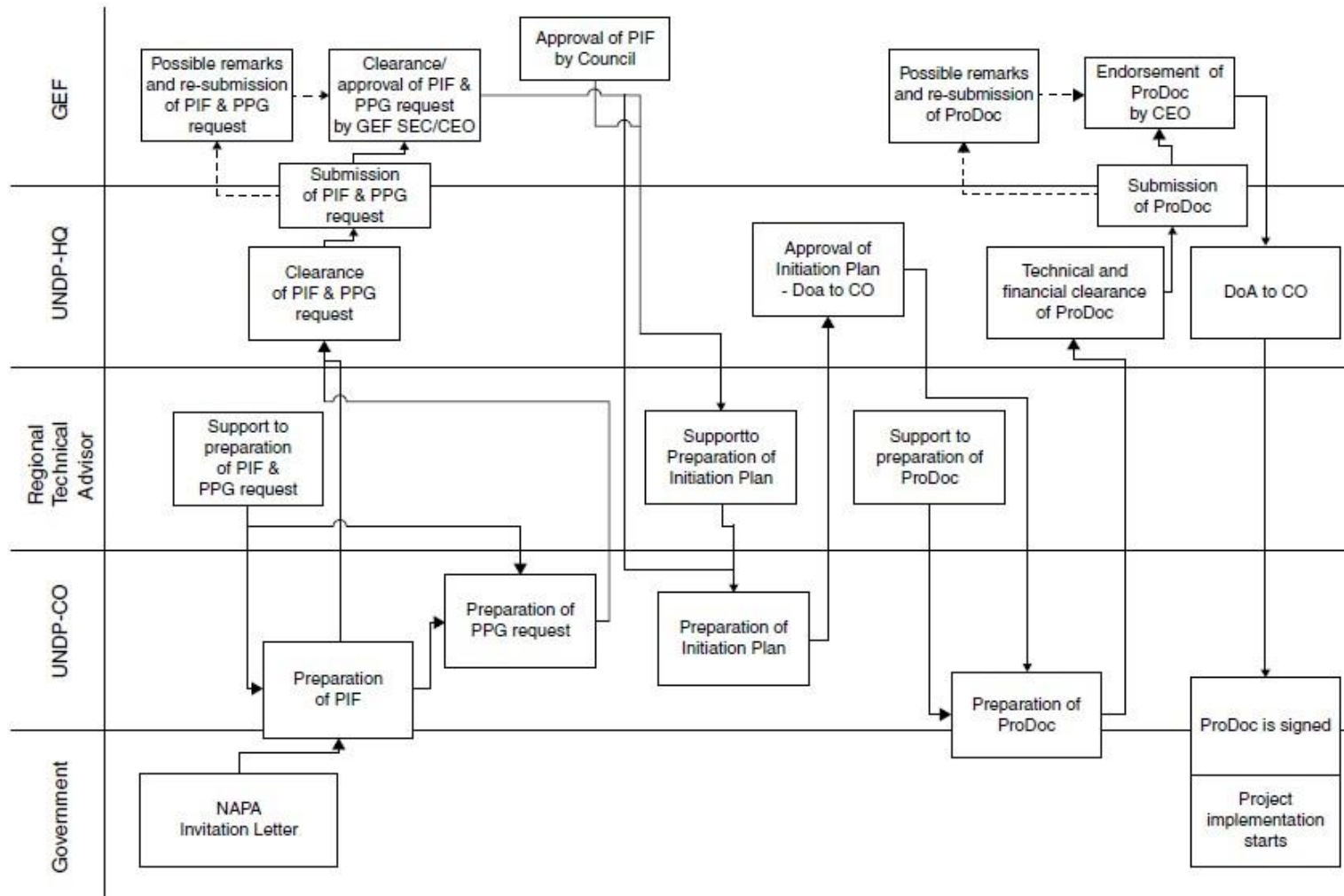
##### *4.1 Enclosing the adaptation agenda*

Although ostensibly well-intentioned, some respondents intimated that the LDCF facilitated enclosure by commandeering decision-making roles that formerly belonged to governments. Despite China and the United States forging a partnership to combat climate change in September 2016, neither China nor the United States have any type of mandatory, nationwide climate policy, and the future of energy policy in the United States is even more uncertain given the recent election of Donald Trump. Therefore, enclosure over climate change as an issue is understandable, perhaps even laudable. The element of government inaction is in a sense a larger source of injustice since, in effect, the result is higher emissions and adaptation burdens. But the LDCF response to this vacuum also inevitably creates political economy problems of its own.

In a way, the LDCF represents a relatively new form of governance- polycentric climate governance- that is essentially a node of power beyond the state. The LDCF is a parallel bureaucracy that has appropriated, or enclosed upon, what used to be the domain of governments. Even with the best of intentions, and some strong justifications for intervention in the face of a *lack* of governmental action, an international regime like the LDCF requires organizations such as the UNFCCC and their framework of rules, expectations, prescriptions, and conduct to function.

We see this frustration in multiple comments from respondents and reports about the LDCF. During the Fourteenth Conference of the Parties at Poznan, Poland, in 2008, some least developed countries “expressed their frustration” at this structure, at the slow pace with which projects were allocated funding, and at the “long and complicated” process of requesting money from the fund.<sup>33</sup> Figure 1, for example, shows the complexity of a typical LDCF project cycle for the United Nations Development Program, one of ten implementing agencies. The project cycle involves almost a dozen internal “administrators” and requires 14 to 17 *months* to navigate. It was also found that the longest lapse in time in terms of working days from the Initiation Plan approval to ProDoc submission was 311 days on average,<sup>34</sup> as this process had to involve all five main stakeholders as illustrated in the flowchart. This demonstrates the complexity and difficulties of a polycentric climate governance structure, where coordination and engagement of all stakeholders presented added challenges to the already complicated procedure. This finding mirrors comments from our interviews, with R67 (in 2010) commenting that “the LDCF process is a complete headache to deal with, it makes my government even look good,” and R130 (in 2015) stating that “the LDCF is in a way an attempt to monetize adaptation and control the agenda for how poor countries shape their response to climate change.”

Figure 1: Process flowchart for a LDCF Adaptation Project



Source: Modified from United Nations Development Programme

Three independent evaluations of the LDCF suggest that it results in friction and lag in implementing adaptation projects. The first, conducted by the UNDP in 2009, noted “justifiable dissatisfaction” among participants of the LDCF “concerning the lengthy time periods and complex procedures required to move from the NAPAs to concrete projects. In some cases, these procedures have led to time lapses of several years before projects get off the ground.”<sup>35</sup> That review noted, for example, that projects took an average of 471 days to begin due to “bottlenecks” and the “many stakeholders and consultations involved.” It found that even the preparatory phase required “a lot of work” that ended up being “demanding” for country offices; the review cautioned that GEF requirements and project criteria were “complicated” and “poorly understood.” It lastly noted that the co-financing requirement of the LDCF meant some countries did not have the resources needed to get projects started. A second review, conducted by the Danish Ministry of Foreign Affairs in 2010, concluded that “in order for the LDCF to play a complementary role to the emerging other climate change financing mechanisms greater responsiveness and flexibility of procedures will have to be introduced to ensure lack of duplication and complementarity.”<sup>36</sup> And a third review, from the non-profit Climate Change Forum in 2010, criticized management structures at the LDCF that were “too complex,” accused implementing agencies such as the World Bank of adding “further bureaucracy to the process,” and concluded that “rules and structures make accessing funding difficult ... and time-consuming.”<sup>37</sup>

Within this complex bureaucratic structure, some departments and bodies have extended their domain over particular issue areas. For example, most negotiated vulnerability and adaptation action items have been addressed by the UNFCCC’s Subsidiary Body for Implementation. It has reached agreements on a number of issues, including: How Parties should

fund and support developing countries' assessment of impact, vulnerability and adaptation needs; how to spur capacity-building, training, education and public awareness; implementation of concrete adaptation activities; promotion of technology transfer to assist adaptation measures; and regional workshops to exchange experiences of adaptation.

In the LDCF's defense, managers have attempted to address many of these concerns in earnest with some restructuring post 2010. As R138 noted in 2015, "We're aware of these problems and have taken considerable steps to address them." Such awareness seems to translate into increased effectiveness, with one 2012 evaluation from the Australian Government noting that the LDCF should be praised for "successfully working with fragile states that are also least developed countries to develop the national adaptation programs of action" and highlighting that the majority of projects "have made satisfactory progress towards their development objectives." It commented that human resources were well managed, that monitoring for the program was "strong," and that "the Evaluation Office has made commendable efforts to improve and facilitate professional evaluation work in the GEF and to provide leadership, within the GEF partnership and internationally."<sup>38</sup>

In addition, during the eighteenth session of the Conference of Parties in Doha, Qatar, in late 2012, the GEF Secretariat noted that "there is evidence to suggest that LDCs have been able to learn from their initial experiences of NAPA implementation, and to scale up successful approaches and practices. Thanks to a streamlined project cycle, user-friendly guidelines for accessing resources, and enhanced communication between the GEF Secretariat and LDC stakeholders, proposals are being developed and processed faster."<sup>39</sup> As one example, the approval times for NAPA projects decreased from an average of 32 months to 12 months with some taking as little as 75 days, and elapsed time between project approval and CEO

endorsement for the most recent projects shrank from 17 months to 14 months.<sup>40</sup> A review conducted by the Independent Evaluation Office of the Global Environment Facility in 2014 also indicated these NAPA implementation projects had to follow a streamlined approval process and have reduced the project timeline substantially.<sup>41</sup>

Nonetheless, the situation with enclosure does show that establishing the scope of international organisations is subject to constant political bargaining as well as bureaucratic and legal disputes between countries with unequal resources. What poorer countries tend to lose in negotiations is autonomy over planning and implementation processes, as well as project finances. When UN backed organizations such as the GEF or partners in the LDCF, such as the UNDP or World Bank, assume monitoring roles, they often enclose on the public sectors of poor countries. Thus, climate negotiations involve not only struggles between countries with different interests, but also clashes between and within international organisations and bureaucracies over the role of technology, knowledge and skills.<sup>42 43</sup>

#### *4.2 Exclusionary participation and planning*

Discussions and negotiations related to the LDCF at the global level are sometimes non-representative, asymmetrical and exclusionary. The result is that only particular types of adaptation projects are implemented and the overall negotiation process tends to benefit some powerful parties at the exclusion of others. For instance, vulnerable developing countries are not equal partners in international negotiations and lack the ability to advance their own interests in processes such as the UNFCCC, which undergirds the LDCF.<sup>44 45</sup> Such countries have a small market share of the global economy, are not members of the Organization of Economic Cooperation and Development (meaning they are restricted from joining the International Energy

Agency and other groups), and can only afford to send small delegations to key climate meetings.<sup>46</sup>

The result is that industrialized countries such as the United States and industrializing countries such as Brazil, China, and India are able to wield disproportionate influence and control the pace and scope of negotiations, including those that created the LDCF. Even before, at the fourth Conference of Parties (COP) in Buenos Aires, Argentina, in 1998, the delegation from the United States consisted of 83 people. The average delegation from Africa, by contrast, had between two and four people. At the 13<sup>th</sup> meeting at Bali, the United States had a delegation of 224, whereas 79 countries had less than seven people to cover the vastly expanded negotiation agenda. Gordon argues that “African countries seemed to have no, or a weak, position and stance and have received few concessions.”<sup>47</sup> As Schneider and Jane lament, “the most marginalized groups tend to have little political and economic power and hence have little influence in the decision-making process.”<sup>48</sup> Shue even argues that disproportionate representation in negotiations is deplorable not only for being unfair, but also because it results in “dirty development” and higher rates of emissions.<sup>49</sup>

In fact, that climate financing should be channeled through the GEF was one of the contested topics of the 2005 11<sup>th</sup> COP to the UNFCCC. An early criticism from developing countries was that the financial assistance flowing from the GEF was biased towards problems and issues defined by stakeholders in the North (e.g., mitigation of greenhouse gas emissions) rather than those prioritized by local leaders (e.g., deforestation or improved resilience).<sup>50 51 52</sup> Across the entire LDCF program, R88 (in 2010) even stated that “adherence to the stipulations embodied within the LDCF amount to a loss of sovereignty because our government had little to no say in how priorities were set.”

We found elements of exclusionary participation and planning further manifested at the national level. Decisions during the Bangladeshi NAPA process, for instance, were made by economists and scientists as well as government officials, but not representatives from the most vulnerable groups, their professional associations, and civil society organizations.<sup>53</sup>

Furthermore, though *char* water bodies are an important resource for fishers, national policies exclude *char* dwellers from land auctions, giving elites privileged access. Yet authorities have frequently refused to prosecute or pursue criminal charges for the land grabbing activities mentioned above, dismissing claims from victims as frivolous and limiting access to legal recourse.<sup>54</sup> This process further entrenched *char* dwellers and other marginalized groups into relatively powerless positions where they could not participate in the NAPA process.

#### *4.3 Encroaching on other land uses and biodiversity*

Each of the five LDCF projects enhanced physical and infrastructural resilience in some way according to more than three quarters (76%) of the interviewees. In some situations, such as in Bangladesh and Bhutan, such interventions were beneficial. The project in Bangladesh planted 6,000 hectares of community based mangrove plantations and 500 hectares of non-mangrove mount plantations. As one of our interviewee respondents (R23) put it in 2010, “this part of the project created a ‘green shield’ around vulnerable communities.” In Bhutan, planners improved early warning systems and drained glacial lakes. The government replaced a manual warning system of human monitoring and the sounding of gongs with an automatic one composed of gauges monitoring glacial lake bathymetry (depth) as well as sensors along rivers connected to automated sirens. As R123 commented in 2015, “now we will know within seconds if a glacial lake outburst flood occurs, rather than before when it could take minutes or even hours to properly warn people.”



However, even these interventions came with trade-offs to other types of resilience, often natural or ecological resilience. The Bangladeshi project also erected about 220 kilometers of concrete dykes and more than 1,000 kilometers of earthen embankments. R130 (in 2015) noted that “the associated greenhouse gas emissions with all of those dykes and embankments is significant, and moreover some floods have already breached their protections, requiring energy intensive pumping of water out of the flooded dyke.” R138 (in 2015) similarly noted that in Bhutan “the glacial protection efforts being implemented have also contributed to deforestation and the increased sedimentation of rivers.” Part of Cambodia’s LDFC strategy involved what R140 (in 2015) called “modifying crop patterns, which has seen poorer farmers leave the sector because they cannot afford the more expensive inputs.” Both the Maldives and Vanuatu have focused in part on building sea walls, but such barriers can, in the words of R23 (in 2010), choke the vitality and strength of coral reefs.”

An eminently frustrating component of such encroachment is that it is likely not enough to eliminate climate risks as intended by planners. Put another way, given the level of risk, such interventions are, to a degree, futile. The starting point of the LDCF is the formulation and implementation of country specific NAPAs, which represent a critical first step in implementing adaptation projects. These NAPAs, while useful tools, are essentially only guideposts for how to prioritize adaptation investments; they do not directly provide the financing for those plans. As R12 stated in 2010, “the success of the NAPA process will largely be determined by how well it paves the way for scaled up investments in climate-resilient development in accordance with integrated, long term plans.” In other words, the presence of such plans is no guarantee that their recommended measures will be implemented.

Even when countries adhere strongly to the priorities formulated in their own NAPAs, there is no guarantee that they sufficiently increased resilience or reduced climate-related risks. For instance, if sea levels rise under more extreme scenarios, practically no amount of adaptation or investment in resilience will suffice for countries such as Bangladesh, the Maldives, or Vanuatu. As R30 explained in 2010:

*The challenge Bangladesh now faces is to cope with changes in climate already happening every year. We are strengthening coastal embankments, yes, but the intensity of erosion and frequency of storms are also increasing and I feel like we are often in a race against time where time is running out. We have developed saline-tolerant rice varieties but the concentration of salinity is going up. We can't keep on producing crops when land is flooded and water salty; it's practically not possible at the moment. Adaptation has its limits.*

If the situation worsens, or if adaptation investments are not able to keep pace with vulnerabilities and risks, low-lying countries, and especially small island developing states, may have to switch entirely to what R30 called “retreat” measures such as forcibly relocating communities to higher ground and possibility create a new generation of climate refugees. Similarly, in the Maldives and Vanuatu, a sea level rise of one meter would put the country, as R40 explained in 2010, “completely under water.” In the Maldives, most islands are less than 1 meter high, meaning even small rises in sea level could subject the country to “regular tidal inundations.”<sup>55</sup> In Vanuatu, R140 remarked in 2015 that “under the more severe projections of sea level rise, we may not be able to save the country no matter what we do.” This demonstrates the importance that adaptation must go hand-in-hand with mitigation strategies, but more importantly, the need to assess the resilience of natural ecosystems in light of adaptation strategies.

#### *4.4 Entrenching inequality*

A final political economy dimension is entrenchment, the aggravation of disempowerment or increased income inequality across communities, which is exacerbated by exclusionary participation as alluded to earlier. Because the LDCF operates at the global level, most of its entrenchment is grand in nature and international in scope; it relates to a discernable lack of fair (and promised) funding for adaptation as well as limited technology transfer, which keeps the South locked—entrenched—in technological inferiority and macroeconomic inequality.

One dimension of entrenchment is financial: funds are not relegated to LDCF adaptation projects despite commitments to the contrary. The LDCF is clearly insufficient to ensure the implementation of all needed adaptation projects. As noted earlier, so far the fund has leveraged slightly more than \$900 million. This creates what R78 called “huge gap” between funding amounts and needs, with an estimated \$10 to \$100 *billion* in annual funding needed to prepare all developing countries for climate change. Similarly, an assessment from the Potsdam Institute for Climate Impact Research, European Environment Agency, and other institutions calculated that at least \$70 to \$100 billion of investment will be needed per year for every year from 2010 to 2050 if adaptation needs are to be met.<sup>56</sup> As one recent independent evaluation put it, “the output of these funds falls far short of the estimated needs.”<sup>57</sup> Another concluded that even if all pledges were realized, “it is not clear that it will generate sufficient funds to address the adaptation needs of developing countries.”<sup>58</sup>

In the absence of ambitious emission reduction accomplishments, the need for adaptation finance will increase. However, private financing is unlikely to cover a substantial proportion of this need.<sup>59</sup> In another overview of this finance landscape, Buchner et al. estimated annual global

climate finance flows at roughly \$343 to \$385 billion.<sup>60</sup> Public funding amounted to \$16 to 23 billion whereas private institutions raised \$217 to \$243 billion in both developed countries (\$193 billion) and developing countries (\$172 billion). This all looks promising until one realizes that the vast bulk of the finance (\$330.7 to \$369.3 billion) targeted mitigation activities. Only a small proportion targeted adaptation.

Even when money is awarded, it usually comes with hidden strings attached. As one example, because the LDCF is supposed to prioritize what R55 called “equitable access” for all participating countries, individual projects have a “ceiling” on the amount they support. For instance, from 2001 to 2006 the cap on LDCF projects was \$3.5 million, in 2008 it was raised to \$6 million, in 2010 it was increased to \$8 million, and today it is \$20 million (though most recent projects average between \$6 and \$7 million). Although the LDCF has a mandate to finance the full additional cost of adaptation, without a requirement for matching co-financing, in practice the ceiling inadvertently requires hosting governments to co-sponsor projects, or find other institutions to match contributions—contributing to the unsustainability of long-term projects. Moreover, because the LDCF is voluntary, it is only replenished when donor countries decide to be generous, making it difficult to accurately predict the amount of resources available to countries over long timeframes.<sup>61</sup>

This finding—that the absence of funding and consequent technology transfer patterns can at times enhance vulnerability among particular classes or communities—is partially supported by four studies. For instance one study examining only adaptation efforts being undertaken in small island developing states noted that “international adaptation funding modalities did little to address root causes of vulnerability or support system transformations.”<sup>62</sup> One study looking at NAPAs being implemented in Sub-Saharan Africa noted a “decline in

gender sensitivity throughout the intervention cycle” and that many projects unintentionally marginalize women.<sup>63</sup> Similarly, another assessment of the NAPA process in Burkina Faso noted that “participatory processes were not effectively integrated at the local level.”<sup>64</sup> Yet another study reviewed 41 NAPAs being implemented worldwide and argued that they did not address underlying causes behind climate change such as human population growth or poor family planning.<sup>65</sup> In sum, these studies, when combined with our own primary data, imply that LDCF projects may promote some particular types of resilience in isolated ways but generally fail to promote mainstreamed, comprehensive, social transformation.

#### 5. Discussion: Rethinking the Governance of Adaptation

How can we make sense of the politics and institutions that mediate the relationship between poverty exacerbated by climate change and the governance of global funds for climate adaptation through the LDCF?

To understand the effects of adaptation efforts firstly requires an understanding of the way global governance institutions govern in practice; increasingly through polycentric formations which fuse the agency and funds of public and actors, as described by the literature on transnational climate change governance.<sup>66</sup> Global institutions such as the GEF do not occupy a politically neutral space of course and are a riven with the sorts of power relations that run through all areas of global politics. Indeed, the GEF has been subject of critical analysis of its neoliberal credentials<sup>67</sup> and the ways in which its programmes and interventions advance a particular types of ‘green neoliberalism’ or ‘green governmentality’.<sup>68</sup>

Explanations which combine elements of ‘governance from above’ (by global institutions such as the GEF) and ‘governance from below’ (at national and sub-national level)<sup>69</sup> through a political economy lens help to understand the outcomes we observe as a product of political

negotiations between actors within different degrees of power and policy autonomy. These effect decisions about which countries, sectors and projects are worthy of support that reflect the interests and preferences of global funders and national and local policy-makers. Those public actors in turn are shaped by lobbying from private and civil society actors with a stake in the direction of adaptation finance, and decision-making inevitably a product of particular governance systems and policy processes.<sup>70</sup> Such perspectives usefully show how flows of finance from the same donor can have such uneven and inconsistent impacts across different contexts once refracted through local political economies where different social relations, governance systems and rent-seeking practices often conspire to distort the original aims and intentions of the intervention.

Furthermore, what is also significant for us here, is engaging with work which helps to account for the uneven and socially differentiated impact and effectiveness of adaptation finance that we observe here. In order to explain the variation in outcomes, an emphasis on the political ecology of adaptation is helpful.<sup>71</sup> This situates the effectiveness of adaptation in relation to its ability to engage with, navigate and transform local political ecologies in the sites where it operates. At its broadest, political ecology seeks to provide a framework for understanding human-society or ‘socio-natural’ relations.<sup>72 73</sup> ‘Classic’ political ecology concerns include issues of access to material and natural resources, and questions of equity and justice issues in the negotiation and distribution of social and environmental benefits at multiple scales.<sup>74</sup> A necessary step, is to explore how local and global power dynamics produce environmental outcomes, along the lines of a ‘global political ecology’ approach.<sup>75 76</sup> This links the challenges facing the LDCF that we describe in section 5 around funding and management structures

(‘governance from above’) with the documented effects of LDCF finance mediated as they are by local institutions and political ecologies.

Methodologically this requires tracking and tracing the institutions, actors and networks that connect ‘global’ governance of finance to particular ‘local’ outcomes; the approach we adopt here. A political ecology focus enables an understanding of a) the ‘local’ social and environmental consequences of global (environmental) governance and the interests that it embodies and projects, and b) the ways in which ‘regimes’ that govern resources at different levels engage with and are transformed by global adaptation finance. It is through exploring the nature of the relationship between macro and site specific dynamics that we argue interesting theoretical and practical insights might be derived.

Tellingly, these kinds of political dynamics have been highlighted in analyses of other key climate finance mechanisms where global inequities in flows of finance are then exacerbated by exclusion of groups affected by projects at national level. For example, under the Clean Development Mechanism (CDM) China captured 60% of accumulated investment, India 11% and Africa as a whole (including South Africa and the countries of North Africa) received only 3% of accumulated investment.<sup>77 78</sup> Those same governments have been largely unresponsive to claims of displacement, exclusion and land-grabbing associated with CDM projects by marginalized citizens of their own countries.<sup>79 80</sup> This further emphasizes the need to attend to the political and economic impact of supposedly neutral climate finance mechanisms, like the CDM and LDCF.

Moreover, within the landscape of climate finance as a whole (funding mitigation as well as adaptation activities), the bulk of funds have (oddly) gone to industrialized rather than developing countries. The thinking is that poor countries are more likely to accept technology

transfer if devices or processes are available cheaply or accessible through the public domain. Middle-income countries have engineering firms and programs for Research, Development and Demonstration, and are therefore seen as the best conduit for adaptation funding.<sup>81</sup> In the example of the CDM, China has been seen to pursue a strategic, nationally coordinated process of leveraging climate finance to support indigenous technological capacity building<sup>82</sup> in ways that LDCs are unlikely to have the technological or political/administrative capacities to pursue (unless, of course, climate finance mechanisms were specifically used to build such capacities<sup>83</sup>).

Such financing patterns can sometimes exacerbate the dynamics of entrenchment discussed in section 4 above. Developed countries can hoard their innovations and limit investments in capacity training in developing countries, on the pretext that these developing countries lack the training or institutional capacity to appropriate such technologies. Thus, unequal positions in the world economy “entail... selective transfers of technology and know-how while making sure that the impetus for the direction of technological change” remains with developed countries.<sup>84</sup> These issues definitively hamper the rate of technological development.<sup>85</sup> Third, technology transfer policies often encourage the governments of indebted countries to create more favorable conditions for foreign investors and transnational corporations. Research on the unequal exchange of foreign investment dependence and the environment have revealed that increased levels of foreign investment in less-developed countries do not necessarily lead to the spread of cleaner technologies and production processes, but instead risk being an instrument for polluting or resource depleting extraction, ultimately threatening human development.<sup>86</sup> Thus, the selectivity of technology transfer cements a pattern of unequal exchange between rich and poor countries.



Rereading global efforts to finance climate change adaptation (and mitigation) projects as part of a system of exploitation and entrenchment demands that we rethink how these projects are designed, implemented, and evaluated. In this vein, concerns of social justice and politics have been a central focus of recent innovation studies inspired engagements with the issue of technology transfer under international climate policy<sup>87</sup>. Whilst the empirical focus of this literature has tended towards low carbon energy technologies more than adaptation technologies, the emphasis on understanding processes of technological change (e.g. towards more climate resilient socio-technical systems), via an understanding of the incremental<sup>88</sup>, capability building<sup>89</sup> and systemic<sup>90</sup> nature of innovation and development, implies a need for a fundamental shift in how finance occurs. The international community must move away from simple “technology finance” mechanisms (like the LDCF and CDM), towards progressive approaches designed to build context-specific technological capabilities around climate technologies<sup>91</sup>, particularly in LDCs where such capabilities are most lacking. More recent interventions, drawing in part from the socio-technical transitions<sup>92</sup> and sociology<sup>93</sup> literatures, have also stressed the need for investments to be better attenuated to the social practices of poor and marginalized people, whom it is ultimately assumed such mechanisms will benefit. Without such targeted investment in capability building it is likely that climate technology finance mechanisms will continue to reinforce the competitive advantages of rapidly emerging economies and international technology suppliers.<sup>94</sup> Either way, as the analysis here attests, an urgent need exists to revisit such critiques with careful attention to political economy considerations, from the global to the local, in order to articulate possible, more equitable, ways forward.

## 6 Conclusion: Lessons and Policy Implications

To conclude, the LDCF brings to light four salient conclusions related to climate policy and adaptation practice, although generalizability beyond the projects examined must be undertaken with care.

Our first conclusion is the most direct and simple: the political economy of adaptation, namely the processes of enclosure, exclusion, encroachment, and entrenchment, can distort the goals and effects of adaptation projects. No matter how noble the intentions of planners, or how well interventions are designed, adaptation projects within the LDCF have their own underlying political economy and ecology. Adaptation projects can become a flashpoint for competing interests, generating their own sets of winners and losers—even when they might produce a net social gain. Many of these conflicts involve those seeking to enclose agendas or exclude stakeholders from access. In some situations, adaptation projects encroach upon and subvert the intended goals of wildlife conservation, or entrench disparities in wealth and development. Therefore, adaptation should be reconceived as political, a deliberative challenge involving the satisfaction of competing preferences; a social dilemma pitting, at times, the climatic and development goals of improved resilience against the pressing needs of marginalized and vulnerable populations; and a moral quandary revolving around how adaptation burdens and benefits are fairly, or unfairly, distributed.

Secondly, researchers and practitioners need to reconceive the concept of adaptation as more than a local phenomenon. For instance, a slew of academic research has long suggested that mitigation (stopping emissions) is global in scope whereas adaptation (coping with consequences) is local in scope.<sup>95 96</sup> Mitigation is prone to a barrage of common pool resource problems, essentially forcing politicians to sacrifice the present for future gain (which has proven

extremely difficult if it does not hold clear promises on return of investments, such as major infrastructure improvements, or strengthened power positions or sense of security). Conversely, the mantra goes that adaptation projects result in almost immediate local benefits. The LDCF shows, instead, that adaptation interventions can reinforce broader development goals and agendas, strengthen the hegemony of states and markets, create their own type of bureaucracy, or affirm the sovereignty of state institutions. Adaptation's costs and benefits are not necessarily limited to the areas where adaptation projects are being implemented. They become intertwined with multi-scalar issues of unequal power relations between different stakeholder groups, poverty, inequality, and justice.

Third, and critically, is that programs like the LDCF should *not* be abandoned. Our first two conclusions—that political economy can reduce the effectiveness of adaptation, and that adaptation can be influenced by broad global currents alongside more particular local events—might lead some readers to misinterpret our stance on adaptation. We do not believe these findings mean that all adaptation projects should be cancelled, or programs like the LDCF abandoned. We set out to show how the political economy processes of adaptation work, and how they can at times distort or mold adaptation projects and processes to the interests of dominant stakeholders, *not* that they completely undermine or obfuscate all of the benefits of adaptation. Even the specific critiques we raise, some of them quite sobering, are aimed at a target: improving and learning from adaptation's political economy so that the most vulnerable are helped, and so that benefits and burdens are made visible, and distributed fairly and according to representative processes. We argue that planners and practitioners of adaptation projects need to become more cognizant of the potential for projects to harm others, or admit complicity in the processes of enclosure, exclusion, encroachment, and entrenchment.

As we emphasized in the elaboration of exclusion and entrenchment above, there are clear parallels between the political economy dynamics we observe in relation to the LDCF and those observed in other climate finance mechanisms, like the CDM. If our interest is in strengthening processes of *either* climate adaptation *or* mitigation, it is time to take seriously the need for creating and/or strengthening institutions within LDCs, supporting targeted capacity building around knowledge of local contexts through which international climate finance mechanisms might be mediated. This arguably stands a better chance strengthening long term capacity building that is cognizant of the socio-cultural and political practices that characterize any given context. It is unlikely to get us away from the global political economy dynamics we highlight in our analysis above; but it does imply a more devolved and locally owned system of governance were local contexts and local capacity building perhaps stands more chance of exerting agency over the ways in which future climate finance is spent.<sup>97</sup> Either way, such focused spending on institutional and technological capacity building in LDCs would represent at least a partial departure from the kinds of elite capture of the benefits of climate finance we articulate here and elsewhere.

Ultimately, some climate change adaptation interventions can make the present system resistant to change, others more capable of adapting to change.<sup>98</sup> A key challenge for future adaptation efforts will be promoting different types of resilience—infrastructural, institutional, community—especially for the most vulnerable, that do not trade-off with each other, and catalyzing lasting adaptive transformations that only serve to encourage, rather than restrict, positive social and equitable change.

## 7. Bibliography

Adger, W.N. (2006). Vulnerability. *Global Environmental Change*, 16, 268–281.

Anthoff, D., Nicholls, R.J., Tol, R.S.J. and Vafeidis, A.T. (2006). Global and regional exposure to large rises in sea-level: a sensitivity analysis. Working Paper 96. Tyndall Centre for Climate Change Research, Norwich.

Australian Aid, *Australian Multilateral Assessment of the Least Developed Countries Fund (LDCF)*, March 2012.

Baker, L., P. Newell & J. Phillips (2014) ‘The Political Economy of Energy Transitions: The Case of South Africa’, *New Political Economy*, 19(6):791-818.

Barnett J. and O’Neill S.J. Minimising the risk of maladaptation: A framework for analysis. In: Palutikof J., Boulter S.L., Ash A.J., Stafford Smith M., Parry M., Waschka M. and Guitart D. (Eds). 2013. *Climate adaptation futures*. John Wiley and Sons, UK. pp. 87-93.

Barnett, M., & Finnmore, M. (2004). *Rules for the world: International organizations in global politics*. New York, NY: Cornell University Press.

Baumgartner, T., Burns, T.R., & Deville, P. (2015). *The shaping of socio-economic systems: The application of the theory of actor-system dynamics to conflict, social power, and institutional innovation in economic life*. New York, NY: Routledge.

Biermann, F., Pattberg, P., & Zelli, F. (2010). Global climate governance beyond 2012: Architecture, agency, and adaptation. In M. Hulme & H. Neufeldt (Eds.), *Making climate change work for us: European perspectives on adaptation and mitigation strategies* (pp. 263-290). Cambridge, U.K.: Cambridge University Press.

Blaikie, P. (1985) *The Political Economy of Soil Erosion in Developing Countries*. London: Longman; Bryant, R. and S. Bailey (1997) *Third World Political Ecology*. London: Routledge.

Bodansky, D. (2001). The History of the Global Climate Change Regime. *International relations and global climate change*. U. Luterbacher and D. F. Sprinz. Cambridge, Mass. ; London, MIT Press: 23-40.

Brown, M.A., & Sovacool, B.K. (2011). *Climate change and global energy security: Technology and policy options*. Cambridge, MA: MIT Press.

Bryan, E., & Behrman, J. (2013). Community-based adaptation to climate change: A theoretical framework, overview of key issues and discussion of gender differentiated priorities and participation. *CAPRI Working Paper No. 109*. Washington, D.C.: International Food Policy Research Institute.

- Buchner, B., Falconer, A., Hervé-Mignucci, M., & Trabacchi, C. (2012). *The landscape of climate finance 2012*. San Francisco, CA: Climate Policy Initiative.
- Bulkeley, H. et al (2014) *Transnational Climate Change Governance* Cambridge: Cambridge University Press.
- Burton, I. (1992). *Adapt and thrive*. (Ontario, Canada: Canadian Climate Center).
- Callaway, J.M. (2014). The role of technology in adaptation. In I. Galarraga, A. Markandya, & E. Sainz de Murieta (Eds.), *Routledge handbook of the economics of climate change adaptation*. New York, NY: Routledge.
- Danish Ministry of Foreign Affairs. (2010, October 20). Review of the follow up on the LDCF Evaluation and information update on the LDCF and SCCF. GEF/LDCF.SCCF.9/Inf.7 Copenhagen, Denmark: DMFA.
- Eisenack, K., Moser, S. C., Hoffmann, E., Klein, R. J. T., Oberlack, C., Pechan, A., . . . Termeer, C. J. A. M. (2014). Explaining and overcoming barriers to climate change adaptation. *Nature Clim. Change*, 4(10), 867-872.
- Feenstra, J.F., Burton, I., Smith, J.B., Tol, R.S.J. (Eds.). (1998). Handbook on methods for climate change impact assessment and adaptation strategies. Amsterdam, The Netherlands: Institute for Environmental Studies, Vrije University, Amsterdam; UNEP Headquarters, Atmosphere Unit, p. 5-4.
- Flam, Karoline Haegstad and Jon Birger Skjaereth, “Does adequate financing exist for adaptation in developing countries?” *Climate Policy* 9 (2009), pp. 109-114
- Florini, AE and BK Sovacool. 2009. “Who Governs Energy? The Challenges Facing Global Energy Governance,” *Energy Policy* 37(12) (December, 2009), pp. 5239–5248.
- Ford, J.D., Berrang-Ford, L., & Paterson, J. (2011). A systematic review of observed climate change adaptation in developed nations. *Climatic Change*, 106, 327-336.
- Füssel, Hans-Martin Stephane Hallegatte , and Michael Reder, “International Adaptation Funding,” O. Edenhofer et al. (eds.), *Climate Change, Justice and Sustainability: Linking Climate and Development Policy* (Springer, 2012), pp. 311-330.
- Global Environment Facility. *Accessing Resources Under the Least Developed Countries Fund* (Washington, DC: GEF, 2009).
- Global Environment Facility (2010). *Climate Change Forum, The Least Developed Countries Fund & the Special Climate Change Fund: Factsheet, 2010*. Washington, D.C.: GEF Secretariat.

Global Environment Facility, *Adaptation to Climate Change: The Least Developed Countries Fund: Review of the Implementation of NAPAs*. April 2014.

<http://www.gefio.org/sites/default/files/ieo/evaluations/ldcf-napa.pdf>

Goldman, M. (2005) *Imperial Nature: The World Bank and Struggles for Social Justice in an Age of Globalization*. New Haven: Yale University Press.

Gordon, R. (2007). Climate change and the poorest nations: Further reflections on global inequality. *University of Colorado Law Review*, 78(2007), 1559-1624.

Hansen UE and Ockwell D. (2014) Learning and technological capability building in emerging economies: The case of the biomass power equipment industry in Malaysia. *Technovation* 34: 617-630.

Hardee, Karen & Clive Mutunga, Strengthening the link between climate change adaptation and national development plans: lessons from the case of population in National Adaptation Programmes of Action (NAPAs), *Mitig Adapt Strateg Glob Change* (2010) 15:113–126

Hoekman, B.M., Maskus, K.E., & Saggi, K. (2005). Transfer of technology to developing countries: Unilateral and multilateral policy options. *World Development*, 33(10), pp. 1587–1602

Holvoet, Nathalie & Liesbeth Inberg (2014) Gender sensitivity of Sub-Saharan Africa National Adaptation Programmes of Action: findings from a desk review of 31 countries, *Climate and Development*, 6:3, 266-276

Huq, S., & Khan, M.R. Equity in national adaptation programs of action: The case of Bangladesh. In W.N. Adger, J. Paavola, S. Huq, & M.J. Mace (Eds.), *Fairness in adaptation to climate change* (pp. 181-200). Cambridge, MA: MIT Press.

Intergovernmental Panel on Climate Change [M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. Van der Linden, & C.E. Hanson, eds]. (2007). *Climate change 2007: Impacts, adaptation, and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, U.K.: Cambridge University Press, 9. Intergovernmental Panel on Climate Change, (2007).

Jorgenson, A.K., & Givens, J.E. (2014). The emergence of new World-Systems perspectives on global environmental change. In D.A. Sonnefeld, S. Lockie, & D.R. Fisher (Eds.), *Routledge international handbook of social and environmental change* New York, NY: Routledge.

Juhola, S, Glaas, E., Linnér, B-O, Neset, T. (2016). Redefining maladaptation. *Environmental Science & Policy* 55, Part 1: 135-140.

Kalame, Fobissie Blese & Denboy Kudejira & Johnson Nkem, Assessing the process and options for implementing National Adaptation Programmes of Action (NAPA): a case study from Burkina Faso, *Mitig Adapt Strateg Glob Change* (2011) 16:535–553.

Keeley, J. and Scoones, I. (2003) *Understanding Environmental Policy Processes* London: Earthscan.

Klein, R.J.T, Nicholls R.J., Thomalla F. 2003. Resilience to Natural Hazards: How Useful is This Concept? *Environmental Hazards* 5, pp. 35-45.

Kim L. (1993) National Systems of Industrial Innovation: Dynamics of Capability Building in Korea. In: Nelson R (ed) *National Innovation Systems : A Comparative Analysis*. Oxford: Oxford University Press.

Kuruppu, Natasha and Reenate Willie, Barriers to reducing climate enhanced disaster risks in Least Developed Country-Small Islands through anticipatory adaptation, *Weather and Climate Extremes* 7 (2015) 72–83

Linnér, B.-O. (2006). Authority through synergism: The roles of climate change linkages. *European Environment*, 16(5), 278-289.

Linnér, B-O and Jacob, M. (2005). From Stockholm to Kyoto and Beyond: A Review of the Globalisation of Global Warming Policy and North-South Relations, *Globalizations*. 2 (3):403–415.

Mulugetta, Y., Jackson, T., & van der Horst, D. (2010). Carbon reduction at community scale. *Energy Policy*, 38(12), 7541-7545.

Newell, P. N. Jenner and L. Baker (2009) ‘Governing Clean Development: A Framework for Analysis’, *Development Policy Review*, 27(6): 717–739.

Newell, P. and A. Bumpus (2012) ‘The Global Political Ecology of the CDM’, *Global Environmental Politics*, Vol. 12 No.4 , pp.49-68.

Ockwell D and Mallett A (eds). 2012. *Low carbon technology transfer: From rhetoric to reality*. Abingdon: Routledge

Ockwell D and Byrne R. (2016) Improving technology transfer through national systems of innovation: climate relevant innovation-system builders (CRIBs). *Climate Policy* 16: 836-854.

Ockwell D and Byrne R. (2016) *Sustainable Energy for All: Innovation, Technology and Pro-Poor Green Transformations*, Abingdon: Routledge.

Organisation for Economic Co-operation and Development. (2011). *Adaptation to climate change*. Available at: <http://www.oecd.org/env/cc/adaptation.htm>.

Ostrom, E. 2010. Polycentric Systems for Coping with Collective Action and Global Environmental Change. *Global Environmental Change* 20, 550–557.



Paavola, J., Adger, W.N., & Huq, S. (2006). Multifaceted justice in adaptation to climate change. In W.N. Adger, J. Paavola, S. Huq, & M.J. Mace (Eds.), *Fairness in adaptation to climate change* (pp. 263-277). Cambridge, MA: MIT Press.

Peet, R., P. Robbins and M. Watts (2011) *Global Political Ecology*. London: Routledge.

Phillips, J., and P. Newell (2013) The Governance of Clean Energy in India: the Clean Development Mechanism (CDM) and Domestic Energy Politics *Energy Policy* (59): 654-662.

Republic of Maldives. 2007. *National Adaptation Program of Action: Republic of Maldives* (Malé: Ministry of Environment, Energy, and Water).

Robbins, P. (2004) *Political Ecology: A Critical Introduction*. Oxford: Blackwell.

Roberts, J.T., & Parks, B.C. (2007). *A climate of injustice: Global inequality, North-South politics, and climate policy*. Cambridge, MA: MIT Press.

Rolffs P, Ockwell DG and Byrne R. (2015) Beyond technology and finance: Pay-as-you-go sustainable energy access and theories of social change. *Environment and Planning A* 47: 2609 – 2627

Roy, R.C. (2000). Land rights of the indigenous peoples of the Chittagong Hill Tracts, Bangladesh. *IWGIA Document No. 99*. Copenhagen, Denmark: International Work Group for Indigenous Affairs.

Schneider, S.H., & Lane, J. (2006). Dangers and thresholds in climate change and the implications for Justice. In W.N. Adger, J. Paavola, S. Huq, & M.J. Mace (Eds.), *Fairness in adaptation to climate change* (pp. 23-51). Cambridge, MA: MIT Press.

Schroeder, H., Boykoff, M.T., & Spiers, L. (2012). Equity and state representations in climate negotiations. *Nature Climate Change*, 2(12), 834-836.

Shove E. (2010) Beyond the ABC: climate change policy and theories of social change. *Environment and Planning A* 42: 1273 - 1285.

Shue, H. (1992). The unavoidability of justice. In *The International Politics of the Environment: Actors, Interests, and Institutions* (pp. 373-397). Oxford, U.K.: Oxford University Press.

Smit, B. (1993). Adaptation to climate variability and change. *Environmental Paper No. 19*. Ontario, Canada: University of Guelph. .

Smith, J.B., Bhatti, N., Menzhulin, G., Benioff, R., Campos, M., Jallow, B., Rijsberman, F., Budyko, M.I., Dixon, R.K. (Eds.). (1996). *Adapting to climate change: An international perspective*. New York, NY: Springer-Verlag.

Smith, Joel B., Thea Dickinson , Joseph D.B. Donahue , Ian Burton , Erik Haites , Richard J.T. Klein & Anand Patwardhan (2011) Development and climate change adaptation funding: coordination and integration, *Climate Policy*, 11:3, 987-1000.

Sovacool, B.K. 2011. An International Comparison of Four Polycentric Approaches to Climate and Energy Governance. *Energy Policy* 39(6), 3832-3844.

Sovacool, BK, BO Linnér, and ME Goodsite. “The Political Economy of Climate Adaptation,” *Nature Climate Change* 5 (7) (July, 2015), pp. 616-618.

Sovacool, BK and BO Linnér. *The Political Economy of Climate Change Adaptation* (Basingstoke UK/New York USA: Palgrave Macmillan and the Nature Publishing Group, 2015).

Sovacool, BK, BO Linner, and RJL Klein. “Climate change adaptation and the Least Developed Countries Fund (LDCF): Qualitative insights from policy implementation in the Asia-Pacific,” *Climatic Change* (in press, 2016)

Stakhiv, E. (1993). *Evaluation of IPCC adaptation strategies: Draft report*. Fort Belvoir, VA: U.S. Army Corps of Engineers.

Taylor, M. (2015) *The Political Ecology of Climate Change Adaptation* Oxon: Routledge.

UNESCAP, *Low Carbon Green Growth Roadmap for Asia and the Pacific* (Bangkok: UNESCAP, 2012).

United Nations Development Programme. (2009). *Evaluation of UNDP work with Least Developed Countries Fund and Special Climate Change Fund resources*. New York, NY: UNDP Evaluation Office

United Nations Framework Convention on Climate Change, *Report of the Global Environment Facility to the Conference of the Parties* (September 20, 2012), available at <http://unfccc.int/resource/docs/2012/cop18/eng/06.pdf>.

United Nations Framework Convention on Climate Change. (2014). *Adaptation: Thematic areas of the work programme on loss and damage*. Available at [http://unfccc.int/adaptation/workstreams/loss\\_and\\_damage/items/7546.php](http://unfccc.int/adaptation/workstreams/loss_and_damage/items/7546.php).

USAID, *Asia Pacific Regional Climate Change Adaptation Assessment: Final Report Findings and Recommendations* (Washington, DC: USAID, April, 2010).

Watson, R.T., Zinyowera, M.C., & Moss, R.H. (Eds.). (1996). *Climate change 1995: Impacts, adaptations and mitigation of climate change: Scientific-technical analyses*. Cambridge, U.K.: Cambridge University Press

Watson J, Byrne R, Ockwell D, et al. (2015) Lessons from China: building technological capabilities for low carbon technology transfer and development. *Climatic Change* 131: 387-399

Watts, M.J. and Bohle, H.G., 1993: The space of vulnerability: the causal structure of hunger and famine, *Progress in Human Geography*, 17, 1, 43-67

Young, Z. (2002) *A New Green Order? The World Bank and the Politics of the Global Environment Facility*. London: Pluto Press.

Zimmerer, K. and T. Bassett (2003) *Political Ecology : An Integrative Approach to Geography and Environment-Development Studies*. New York: London: Guilford Press.

## 8. Notes

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<sup>1</sup> Ford et al., “A systematic review.”

<sup>2</sup> Bryan and Behrman, *Community-based adaptation*, p. 12.

<sup>3</sup> Biermann et al., “Global climate governance.”

<sup>4</sup> Adger, “Vulnerability.”

<sup>5</sup> Watts and Bohle, “The space of vulnerability.”

<sup>6</sup> United Nations, List of Least Developed Countries, January, 2015, available at [http://www.un.org/en/development/desa/policy/cdp/ldc/ldc\\_list.pdf](http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_list.pdf)

<sup>7</sup> Ostrom, “Polycentric systems.”

<sup>8</sup> Sovacool, “Polycentric Approaches to Climate and Energy Governance.”

<sup>9</sup> Florini and Sovacool, “Who Governs Energy?”

<sup>10</sup> IPCC, *Climate change 2007*, p. 9.

<sup>11</sup> Ibid.

<sup>12</sup> Brown and Sovacool, *Climate change and global energy security*.

<sup>13</sup> Burton, *Adapt and thrive*.

<sup>14</sup> Smit, “Adaptation to climate variability.”

<sup>15</sup> Stakhiv, *Evaluation of IPCC adaptation strategies*.

<sup>16</sup> Watson et al., *Climate change 1995*.

<sup>17</sup> Smith et al, *Adapting to climate change*.

<sup>18</sup> OECD, *Adaptation to climate change*.

<sup>19</sup> United Nations Framework Convention on Climate Change, *Adaptation*. .

<sup>20</sup> Juhola et al, “Redefining maladaptation.”

<sup>21</sup> Barnett and O’Neill, “Minimising the risk of maladaptation.”

<sup>22</sup> Feenstra et al, *Handbook on methods for climate change impact assessment and adaptation strategies*.

<sup>23</sup> IPCC, *Climate change 2007*, p. 378.

<sup>24</sup> Eisenack et al., “Explaining and overcoming barriers to climate change adaptation.”

<sup>25</sup> Sovacool et al., “Climate change adaptation.”

<sup>26</sup> Anthoff et al., *Global and regional exposure to large rises in sea-level*.

<sup>27</sup> USAID, *Asia Pacific Regional Climate Change Adaptation Assessment*.

<sup>28</sup> UNESCAP, *Low Carbon Green Growth Roadmap for Asia and the Pacific*.

<sup>29</sup> Sovacool et al, “The Political Economy of Climate Adaptation.”

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- <sup>30</sup> Sovacool and Linnér. *The Political Economy of Climate Change*.
- <sup>31</sup> Sovacool et al, "The Political Economy of Climate Adaptation."
- <sup>32</sup> Sovacool and Linnér. *The Political Economy of Climate Change*.
- <sup>33</sup> UNDP, *Evaluation of UNDP work with Least Developed Countries Fund*.
- <sup>34</sup> Ibid.
- <sup>35</sup> Ibid.
- <sup>36</sup> Danish Ministry of Foreign Affairs, "Review of the follow up on the LDCF Evaluation."
- <sup>37</sup> Global Environment Facility, *Climate Change Forum*.
- <sup>38</sup> Australian Aid, *Australian Multilateral Assessment*.
- <sup>39</sup> UNFCCC, *Report of the Global Environment Facility to the Conference of the Parties*.
- <sup>40</sup> Ibid.
- <sup>41</sup> Global Environment Facility, *Adaptation to Climate Change*.
- <sup>42</sup> Barnett and Finnmore, *Rules for the world*.
- <sup>43</sup> Linnér, "Authority through synergism."
- <sup>44</sup> Paavola et al., "Multifaceted justice in adaptation."
- <sup>45</sup> Roberts and Parks, *A climate of injustice*.
- <sup>46</sup> Schroeder et al., "Equity and state representations in climate negotiations."
- <sup>47</sup> Gordon, "Climate change and the poorest nations."
- <sup>48</sup> Schneider and Lane, "Climate change and the implications for Justice."
- <sup>49</sup> Shue, "The unavoidability of justice."
- <sup>50</sup> Bodansky, "The History of the Global Climate Change Regime."
- <sup>51</sup> Linnér and Jacob, "From Stockholm to Kyoto."
- <sup>52</sup> Young, *A New Green Order?*
- <sup>53</sup> Huq and Khan, "Equity in national adaptation programs of action."
- <sup>54</sup> Roy, "Land rights of the indigenous peoples of the Chittagong Hill Tracts."
- <sup>55</sup> Republic of Maldives, *National Adaptation Program of Action*.
- <sup>56</sup> Füssel et al., "International Adaptation Funding."
- <sup>57</sup> Flam and Skjaereth, "Does adequate financing exist?"
- <sup>58</sup> Smith et al., "Development and climate change adaptation funding."
- <sup>59</sup> Buchner et al., *The landscape of climate finance 2012*.
- <sup>60</sup> Ibid.
- <sup>61</sup> Global Environment Facility, *Accessing Resources*.
- <sup>62</sup> Kuruppu and Willie, "Barriers to reducing climate enhanced disaster."
- <sup>63</sup> Holvoet and Inberg, "Gender sensitivity of Sub-Saharan Africa National Adaptation Programmes of Action."
- <sup>64</sup> Kalame et al., "Assessing the process and options for implementing National Adaptation Programmes of Action."
- <sup>65</sup> Hardee and Mutunga, "Strengthening the link between climate change adaptation and national development plans."
- <sup>66</sup> Bulkeley et al., *Transnational Climate Change Governance*.
- <sup>67</sup> Young, *A New Green Order*.
- <sup>68</sup> Goldman, *Imperial Nature*.
- <sup>69</sup> Newell et al., "Governing Clean Development."
- <sup>70</sup> Keeley and Scoones, *Understanding Environmental Policy Processes*.
- <sup>71</sup> Taylor, *The Political Ecology of Climate Change Adaptation*.
- <sup>72</sup> Robbins, *Political Ecology*.

- <sup>73</sup> Zimmerer and Bassett, *Political Ecology*.
- <sup>74</sup> Blaikie, *The Political Economy of Soil Erosion*.
- <sup>75</sup> Newell and Bumpus, "Global Political Ecology."
- <sup>76</sup> Peet et al., *Global Political Ecology*.
- <sup>77</sup> Ockwell and Byrne. *Sustainable Energy for All*.
- <sup>78</sup> Ockwell and Byrne, "Improving technology transfer."
- <sup>79</sup> Phillips and Newell "The governance of clean energy"
- <sup>80</sup> Baker et al "The political economy of energy transitions"
- <sup>81</sup> Hoekman et al, "Transfer of technology to developing countries."
- <sup>82</sup> Watson et al., "Lessons from China."
- <sup>83</sup> Ockwell and Byrne, "Improving technology transfer."
- <sup>84</sup> Baumgartner et al., *The shaping of socio-economic systems*.
- <sup>85</sup> Callaway, "The role of technology in adaptation."
- <sup>86</sup> Jorgenson and Givens, "The emergence of new World-Systems perspectives on global environmental change."
- <sup>87</sup> Ockwell and Mallett, *Low carbon technology transfer*.
- <sup>88</sup> Ockwell and Mallett, *Low carbon technology transfer*.
- <sup>89</sup> Hansen and Ockwell, "Learning and technological capability."
- <sup>90</sup> Kim, "National Systems of Industrial Innovation."
- <sup>91</sup> Ockwell and Byrne, "Improving technology transfer."
- <sup>92</sup> Rolffs et al., "Beyond technology and finance."
- <sup>93</sup> Shove, "Beyond the ABC."
- <sup>94</sup> Think, for example, about the stark statistics above of how little investment Africa was able to accrue under the CDM, a statistic that would likely look even more stark if it were possible to disaggregate to only focus on LDCs.
- <sup>95</sup> Mulugetta et al., "Carbon reduction at community scale."
- <sup>96</sup> Ostrom, "Polycentric systems."
- <sup>97</sup> Ockwell and Byrne, "Improving technology transfer."
- <sup>98</sup> Klein et al., "Resilience to Natural Hazards."