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Erwin Rose

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# THE ABCs OF GOVERNING THE HIMALAYAS IN RESPONSE TO GLACIAL MELT: ATMOSPHERIC BROWN CLOUDS, BLACK CARBON, AND REGIONAL COOPERATION

by Erwin Rose\*

## INTRODUCTION

Despite their awesome grandeur, the Himalayas are fragile. The melting of the glaciers as a result of global climate change has emerged as an impending crisis. How can governments in the Greater Himalayan Region (“GHR”) respond most effectively to glacial melt (“GM”)? The elementary principles (“ABCs”) of international environmental law and policy (“IELP”) can provide guidance to those who seek to reduce further loss, and adapt to the consequences of what cannot be prevented.

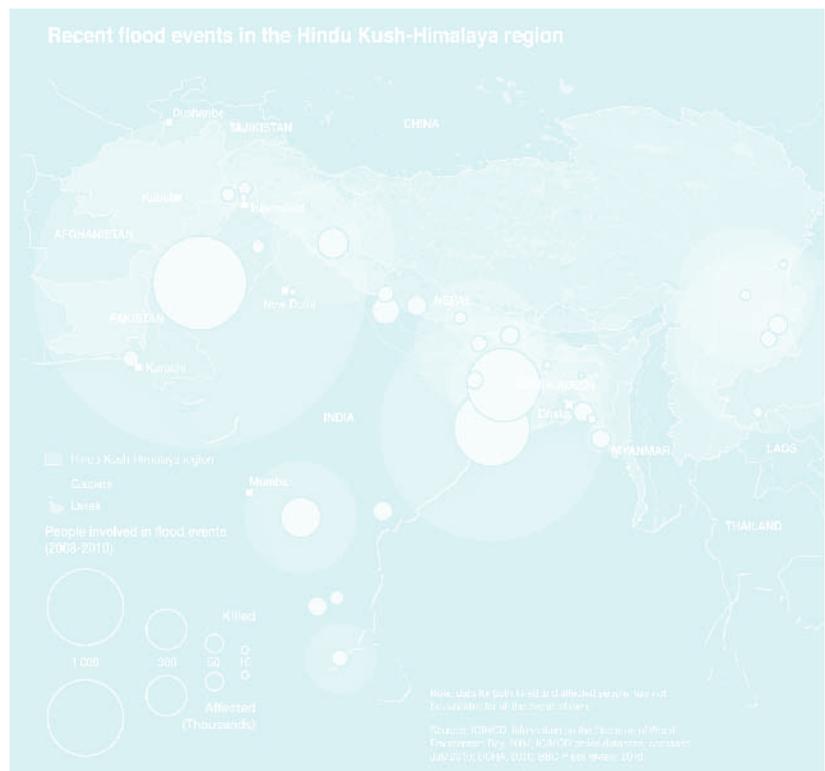
The GHR, for the purpose of this study, includes the Himalayas, Hindu Kush, Karakoram, Kunlun Shan, Pamir, Tian Shan and Qinghai-Tibetan Plateau and the river basins originating in these mountains.<sup>1</sup> Defined as such, the area encompasses parts of sixteen countries: Afghanistan, Bangladesh, Bhutan, Cambodia, China, India, Kazakhstan, Kyrgyzstan, Laos, Myanmar, Mongolia, Nepal, Pakistan, Tajikistan, Thailand, and Vietnam.<sup>2</sup> The size of the GHR and the influence of its glaciers make it a system of global significance. Some refer to the mountains as “the Third Pole” because they contain the third largest glacial mass on Earth (after the polar regions).<sup>3</sup> Their high-altitude topography influences atmospheric warming and circulation<sup>4</sup> and the albedo (reflective power of the snow and ice) of the mountains plays a role in regulating regional climate and global climate.<sup>5</sup>

The mountains affect water availability in the region not only directly through melt that feeds the rivers, but also via precipitation, particularly seasonal monsoons.<sup>6</sup> These glaciers supply the headwaters of the ten largest Asian rivers including the Brahmaputra, Ganges, Indus, Mekong, Yellow, and Yangtze, all of which cross national boundaries.<sup>7</sup> In this way, the glaciers function as the “water tower of Asia” with roughly 500 million to 1.3 billion people living in the GHR watersheds and relying upon these rivers for drinking water, irrigation, fisheries, hydropower and other services.<sup>8</sup> While these communities are separated by rugged physical landscapes and national boundaries, they are united by their dependence upon the glaciers.<sup>9</sup>

Due in part to rapid climate change, the fate of these glaciers and the water resources they provide, are in peril. If glacial loss continues at its present rate, the GHR would experience more floods and ultimately a reduced water supply.<sup>10</sup> This article summarizes existing scientific research, revealing

the extent to which glacial melting—the reduction of ice, snow and permafrost in the glaciers—is occurring, as well as the subsequent causes and impacts. It considers the problem from the perspective of international environmental law and policy (“IELP”) and reviews existing international IELP tools that could mitigate this dire issue.<sup>11</sup> Specifically, the article highlights the potential for implementing air quality initiatives to slow melting and for regional cooperation to stimulate more effective responses to this looming threat to the region’s people and environment.

**Map 1:** Credit: Riccardo Pravettoni, UNEP/GRID-Arendal, [http://www.grida.no/graphicslib/detail/recent-flood-events-in-the-hindu-kush-himalaya-region\\_187f](http://www.grida.no/graphicslib/detail/recent-flood-events-in-the-hindu-kush-himalaya-region_187f).



\*Erwin Rose is a Senior Fellow at the Institute for Governance and Sustainable Development (“IGSD”). He served as the Regional Policy Advisor for East Asia and the Pacific at the U.S. Department of State from 2008-2009 in the Bureau of Oceans, Environment and Science, Office of Policy Coordination and Initiatives. Mr. Rose served in the Bureau’s Office of Environmental Policy from 2001-2006, where he led the negotiation of environmental cooperation agreements. He co-edited Linking Trade, Climate Change and Energy for the International Center for Trade and Sustainable Development in Geneva in 2006. The author thanks Xiaopu Sun and Durwood Zaelke of IGSD for their review of this article.

## ASSESSING HIMALAYAN GLACIAL MELT

### EXTENT AND RATE OF GLACIAL MELTING

In January 2010, the Intergovernmental Panel on Climate Change (“IPCC”) retracted a statement discussing the disappearance of Himalayan glaciers from a 2007 report that read: “the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at the current rate.”<sup>12</sup> Despite this retraction, the preponderance of evidence shows that the glaciers are melting across the world. A study led by glaciologist Shichang Kang and associates at the Institute of Tibetan Plateau Research, Chinese Academy of Sciences found: “Since the 1990s the majority of glaciers have retreated rapidly . . . Recent research showed that more than 80% of glaciers in western China have retreated, losing 4.5% of their combined areal coverage [over approximately the past 50 years] . . .”<sup>13</sup> Climate and Atmosphere scientist Veerabhadran Ramanathan concluded that the glaciers feeding the Indus have retreated by 35-50 % since the 1930s, the main glacier feeding the Ganges “is retreating more than 35 m [meters] per year, nearly twice as fast as 20 years ago,” and the Tibetan glaciers “are melting at an accelerating rate and two-thirds could be gone by 2060.”<sup>14</sup> Furthermore, according to the U.S. National Aeronautic and Space Administration (“NASA”), “since the early 1960s, the acreage covered by Himalayan glaciers has declined by over 20 percent.”<sup>15</sup>

### CAUSES OF GLACIAL MELTING

Many analysts assume that GM is caused directly by global warming from greenhouse gas emissions.<sup>16</sup> However, recent research paints a more nuanced picture. Ramanathan *et al.* conclude that “atmospheric brown clouds” (“ABCs”) consisting of aerosols, particularly black carbon soot, may be as significant as greenhouse gases (“GHGs”) as a cause of the decline in glacial mass.<sup>17</sup> As Kang *et al.* summarize the causation:

Anthropogenic greenhouse gas emissions are generally considered as the main cause of the climate warming in the TP [Tibetan Plateau], and impacts there are probably more serious than the rest of the world. However, other confounding factors, such as changes in cloud cover, snow/ice-albedo feedback, the Asian brown clouds and land use changes, also contribute to recent climate dynamics in the TP . . .<sup>18</sup>

NASA’s research also indicates “that soot and dust contribute as much (or more) to atmospheric warming in the Himalayas as greenhouse gases . . . The brisk melting coincides with the time when concentrations of aerosols like soot and dust transported from places like India and Nepal are most dense in the atmosphere.”<sup>19</sup> Further analysis reveals that two-thirds of the black carbon particles in South Asia may come from burning biomass (cookstoves, slash and burn agriculture and waste disposal), with the remaining third resulting from fossil fuel combustion.<sup>20</sup>

### CONSEQUENCES OF GLACIAL MELTING

The loss of ice and snow in the Himalayas is increasing flooding (particularly glacial lake outburst floods) and landslides, which could severely decrease the quality of and access to water

resources, agriculture, fisheries, energy, industry, migration, and could further exacerbate global climate change.<sup>21</sup> Kang *et al.* point to “[h]ydrological changes resulting from glacial retreat, such as increased discharge, rises in lake level, more frequent glacial lake outbursts leading to flooding, enhanced glacial debris flows, and changes in water resources . . .”<sup>22</sup> Lester Brown, founder of Worldwatch Institute and now President of the Earth Policy Institute, emphasizes the impacts upon agriculture and food security: “The world has never faced such a predictably massive threat to food production as that posed by the melting mountain glaciers of Asia.”<sup>23</sup>

There are significant variances in the extent to which each river in the region depends upon the glaciers, and therefore there are differences as to which regions will be hit hardest. The Indus (44.8%) and the Tarim (40-42%) receive by far the greatest percentage of their flow from melted glacial water.<sup>24</sup> Figures for the Ganges (9.1%), Yangtze (18.5%), and others are much lower; only 1.3% of the Yellow River’s volume is from the glaciers.<sup>25</sup> Given these disparate impacts, the GM consequences on weather patterns, where effects are diffuse, though also substantial, are much more difficult to assess.<sup>26</sup>

But GM is only one aspect of the changes underway in the region’s water systems. The World Meteorological Organization (“WMO”) finds that the devastating flooding in China and Pakistan in summer 2010 was likely the result of climate change-exacerbated monsoons.<sup>27</sup> GHR water supplies face other threats, particularly from population growth, unsustainable consumption rates, pollution, hydropower, and dams.<sup>28</sup> Climate change and GM are not only threats to water resources but also exacerbate the impacts of other threats to a stable regional water supply.<sup>29</sup>

## APPLYING INTERNATIONAL ENVIRONMENTAL LAW AND POLICY

### GOVERNANCE PERSPECTIVE

The transboundary nature of the Himalayan ecosystem, along with its remote and inaccessible terrains, accounts for much of the lack of adequate investment in response to GM.<sup>30</sup> In order to resolve a transboundary issue, it is necessary to adopt a governance approach that effectively captures the dynamic interactions of norms and structures, including varied approaches to law and government.<sup>31</sup> The “New institutionalism” perspective emphasizes the role of institutions in governance. Considering institutions as “clusters of rights, rules, and decision-making procedures” provides a framework on which organizations, as parts of broader regimes, can foster multi-layered coordination on problems such the collective action dilemma, tragedy of the commons, and market failure that exacerbate transboundary environmental problems.<sup>32</sup> Under this new institutionalism framework, various stakeholders can develop sophisticated strategies to overcome cultural, physical, and political barriers to confronting the shared threat of declining glaciers.

These successes are evidenced by findings that tragedy of the commons and game theory experiments move toward more positive outcomes when opportunities for dialogue are provided.<sup>33</sup> International relations scholar Robert Keohane and

his associates argue that “effective environmental institutions” influence policy in three main ways: “They can contribute to more appropriate agendas . . . comprehensive and specific international policies . . . through intergovernmental bargaining; and . . . national policy responses which directly control sources of environmental degradation.”<sup>34</sup> Another recent study on water-related threats in the area emphasizes the need for more coherent, region-wide, long-term systemic planning and coordination, calling for a “cross-regional humanitarian policy-maker/science dialogue” and “greater sharing of scientific information amongst countries in the region.”<sup>35</sup> It seems clear that regional cooperation mechanisms provide the potential for tackling Himalayan GM.

#### CORE PRINCIPLES AND RELEVANT INSTRUMENTS

The international nature of the causes and consequences of glacial retreat fall squarely within the realm of existing IELP, including a wide range of legal and policy instruments. Commonly accepted core legal principles of environmental governance can be useful in guiding national policy responses and advancing domestic interests, even if governments do not place a high priority on compliance with international law.

Examples of these core principles are ever-present in IELP. The principle that nations have a responsibility to prevent harm to others from transboundary pollution has become an established principle of international law.<sup>36</sup> IELP has also developed standards of due diligence, including environmental assessments, that guide sound environmental policy.<sup>37</sup> The duty to cooperate is also a fundamental principle of international law.<sup>38</sup> The Stockholm Declaration of the UN Conference on the Human Environment, the Rio UN Conference on Environment Declaration, and Agenda 21, as well as other precise legal instruments, all elaborate upon these concepts.<sup>39</sup> Other generally accepted principles inform policy on GM, such as sovereignty over natural resources, common but differentiated responsibility, the polluter pays, and the precautionary principles.<sup>40</sup>

There are also several binding multilateral environmental agreements that apply to issues related to Himalayan GM including the Convention on Biological Diversity, Convention and Statute on the Regime of Navigable Waterways of International Concern, and the UN Framework Convention on Climate Change.<sup>41</sup> Further, there are a myriad of nonbinding instruments that could provide guidance, such as the Stockholm and Rio statements, Johannesburg World Summit for Sustainable Development Plan of Implementation,<sup>42</sup> World Charter for Nature,<sup>43</sup> United Nations Environment Programme (“UNEP”) Draft Shared Resources Principles,<sup>44</sup> and UNEP Goals and Principles of Environmental Impact Assessment.<sup>45</sup> And while the UN Convention on the Law of the Non-navigational Uses of International Watercourses is not in force, it nonetheless reflects international consensus on the protection and governance of transboundary freshwater resources.<sup>46</sup> Given the abundance of relevant IELP instruments, regional, national, and local policies Governments and civil society actors in the regions would benefit if they apply these international instruments and principles to facilitate regional and international cooperation to mitigate Himalayan GM and adapt to the impacts that are already underway.

#### COOPERATION MECHANISMS IN OTHER REGIONS

Instructive models can also be found via the intergovernmental mechanisms for other geographic regions, including the Amazon Cooperation Treaty Organization,<sup>47</sup> Arctic Council,<sup>48</sup> and UNEP’s Regional Seas Program.<sup>49</sup> Europe has made progress on air quality through the UN Economic Commission for Europe (“UNECE”) Convention on Long-Range Transboundary Air Pollution.<sup>50</sup> One scholar recommends that Himalayan countries look at the UNECE Helsinki Convention (on the Baltic Sea)<sup>51</sup> and the Zambezi River agreements<sup>52</sup> as models that provide a more concrete example of transboundary water management that could inform arrangements in the GHR.<sup>53</sup>

The Alpine Mountain Convention is a noteworthy example of cooperation within mountain regions. The Alpine Convention (“AC”) commits parties to “a comprehensive policy for the preservation and protection of the Alps by applying the principles of prevention, payment by the polluter . . . and cooperation . . . .”<sup>54</sup> The AC requires the parties to take “appropriate measures” in twelve areas including regional planning, air pollution prevention, water management, transportation, and energy.<sup>55</sup> The AC also contains commitments on “research and systematic monitoring” and “legal, scientific, economic and technical cooperation” and provides a structure for regular meetings to coordinate its implementation.<sup>56</sup>

In addition to emphasizing a responsibility to prevent pollution and to cooperate in the stewardship of shared natural resources, the multilateral instruments and regional mechanisms mentioned above provide a dedicated international forum for governments, and sometimes even other stakeholders, to engage in dialogue and collaborative activities, guideline assessment, notification, consultation, and dispute resolution.<sup>57</sup> These existing regional structures can provide the guidance needed for implementation of these international practices to prevent Himalayan GM.

#### EXISTING MECHANISMS IN THE REGION

The organization that stands out as the best-designed to support regional work on Himalayan GM is the International Center for Integrated Mountain Development (“ICIMOD”). ICIMOD’s principal objectives are to “help promote the development of an economically sound mountain ecosystem and to improve the living standards of the mountain populations of the Hindu Kush-Himalayan region.”<sup>58</sup> It describes itself as “an independent inter-governmental centre that is a regional facilitator and broker with a mountain perspective.”<sup>59</sup> Eight governments participate in ICIMOD: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan.<sup>60</sup> Its governing board is composed of representatives of the eight “regional member countries” and six additional, independent members nominated by donors.<sup>61</sup>

ICIMOD’s budget, \$11.7 million in 2009, mostly comes from European governments and international organizations<sup>62</sup> and enables the organization to foster scientific and technical cooperation and raise awareness about a wide range of development challenges, including GM.<sup>63</sup> ICIMOD’s herculean task was noted by an international meeting of GM scientists in 2008,

which described ICIMOD's work as the "tricky scientific—and diplomatic—task of mapping glacial retreat in the world's highest mountains."<sup>64</sup> With relatively low funding levels given its wide scope, the ICIMOD is surprisingly influential yet still very limited in its ability to make large-scale progress toward accounting and mitigating Himalayan GM.<sup>65</sup>

Another intergovernmental organization, the South Asian Association for Regional Cooperation ("SAARC"), comes next closest to matching the set of countries in the GHR.<sup>66</sup> The SAARC member states are: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.<sup>67</sup> SAARC granted China observer status in 2005, but news reports indicate that India has blocked China's pursuit of SAARC membership.<sup>68</sup> SAARC fosters primarily intergovernmental cooperation on a wide range of issues including a number of areas related to GM.<sup>69</sup> For example, SAARC established a meteorological research center in 1995<sup>70</sup> and supported UNEP's South Asia Environment Outlook 2009.<sup>71</sup>

Several international partnerships and organizations are also working to prevent and reduce GM impacts. The Mountain Partnership fosters links between existing mountain sustainable development mechanisms, such as the Alpine Convention, and has recently taken preliminary steps to work in the GHR.<sup>72</sup> There are partnerships to disseminate improved cookstoves among the rural poor (e.g. Partnership for Clean Indoor Air, Global Alliance for Clean Cookstoves) and to improve urban air quality (e.g. Clean Air Initiative for Asian Cities).<sup>73</sup>

While there are a few sustained regional processes on air quality or climate change within the GHR, there are substantial sub-regional water arrangements. The most comprehensive watershed mechanism in the area is probably the Agreement for the Cooperation on the Sustainable Development of the Mekong River Basin.<sup>74</sup> This agreement provides a broad framework for information exchange, dialogue, and cooperation "in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin . . ."<sup>75</sup> Cambodia, Laos, Thailand, and Vietnam are both parties to the agreement and members of the associated Mekong River Commission ("MRC").<sup>76</sup> It is important to note that although the Mekong originates in China and flows along the Myanmar border, neither China nor Myanmar is party to the treaty.<sup>77</sup> Despite this, both countries do participate in annual meetings, and China has been exchanging data with the commission.<sup>78</sup>

Additionally, China and India maintain agreements to share data on the Brahmaputra and Sutlej/ Langquinn-Zangbu Rivers.<sup>79</sup> In 2006, they established a Joint Expert Level Mechanism on Trans-Border Rivers.<sup>80</sup> To date, the two governments have discussed GM but have struggled to conduct even limited academic information sharing regarding these rivers.<sup>81</sup>

India has other bilateral mechanisms for two of the most populated river areas: the Agreement on Sharing the Ganges Waters between Bangladesh and India and the Indus Treaty binding India and Pakistan.<sup>82</sup> However, nearly all the bilateral river agreements in the region focus on dams, hydroelectricity, and/or water diversion projects, and do not attempt integrated

water resources management or address broader sustainable development objectives.<sup>83</sup>

## IMPROVING GOVERNANCE

### PREVENTION THROUGH REGIONAL AIR QUALITY MANAGEMENT

Despite some preliminary regional and international discussions and efforts to address Himalayan GM issues, opportunities for cost-effective preventive action are being lost due to a lack of investment in research and dissemination of analysis on the complex causes of GM. Specifically, emerging research on the role of regional air pollution, particularly black carbon, must be further developed if regional actors are to take action to slow glacial retreat.<sup>84</sup>

Black carbon abatement programs could have dramatic and immediate effects upon reducing GM and respiratory disease, while also contributing to global warming mitigation objectives.<sup>85</sup> In practice, this means reducing the burning of biomass from slash and burn agriculture and cookstoves, as well as reducing diesel and certain other types of fuel combustion.<sup>86</sup> And while the countries that are most likely the leading sources of emissions—China, India, and Nepal—do not necessarily need other countries in the region to act on black carbon reduction, they would nonetheless benefit from a concerted effort to coordinate investments, conduct joint monitoring and assessments, and exchanging best practices in black carbon abatement and adaptation to GM.<sup>87</sup>

International efforts to address black carbon pollution have recently emerged as UNEP, ICIMOD and the U.S. Environmental Protection Agency held a consultation on regional black carbon mitigation in Kathmandu in March 2011.<sup>88</sup> After three days of consultation, the groups concluded that available, cost-effective methods and technologies are available to reduce black carbon pollution.<sup>89</sup>

In February 2012, U.S. Secretary of State Hillary Clinton announced the formation of a Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants ("Climate and Clean Air Coalition").<sup>90</sup> In the press release unveiling this initiative, the State Department notes that "reducing black carbon is particularly important to address climate change in snow- and ice-covered regions such as the Arctic and the Himalayas."<sup>91</sup> At the opening event, Bangladesh Minister of Environment Hasan Mahmud highlighted the negative climatic impacts of black carbon on crop yields, food security, and freshwater supply for the Himalayan region.<sup>92</sup> Currently Bangladesh is the only Asian country among the six governments that joined the new Climate and Clean Air Coalition, but it is possible that other GHR countries will become involved in this initiative in the future.<sup>93</sup>

### FINDING FORUMS THAT FIT

A complex problem such as GM requires integration of hybrid mechanisms and a polycentric approach that links global, national, and local policy.<sup>94</sup> Networks must be mobilized among the private and public sectors, starting with the crucial "science-policy interface — interaction that facilitates public policy

development based upon sound and current scientific understanding.”<sup>95</sup> Regional cooperation is essential to accomplish the most pressing initial task: the rapid development of an authoritative region-wide assessment.<sup>96</sup>

ICIMOD can provide the forum needed to accomplish this task. ICIMOD’s sustainable development focus enables it to draw connections between GM and related concerns. ICIMOD also provides a bridge for science-policy exchanges and has played a pioneering role in sounding the alarm on GM and disseminating information.<sup>97</sup> However, the modest amount of financial resources and low level of political commitment it has received have prevented it from attaining the scale required to generate large-scale results.<sup>98</sup> Water, climate, and environmental law researcher Katak Malla suggests that ICIMOD might play a role in developing a more holistic regime, including support for the negotiation of “a comprehensive hydro-climate treaty.”<sup>99</sup> While engaging ICIMOD in negotiations risks diverting the organization’s attention away from the technical and capacity-building work through which it has been most productive, increasing commitments to ICIMOD as a communication forum may be the best investment for responding to GM.<sup>100</sup>

While eight nations within the GHR watersheds and are affected by GM are not included in the ICIMOD, the fact that the Center’s membership includes India, China, and the other mountain nations, combined with its proven track record on GM research and awareness-raising, makes it far more applicable as the core structure for cooperation on GM than the alternatives.<sup>101</sup> For example, SAARC also has a very broad scope, which touches upon climate change and water but generally emphasizes economic integration and trade.<sup>102</sup> Unlike ICIMOD, SAARC is used as a forum for ministerial-level gatherings and thus offers the potential for India and its neighbors to engage in high-profile joint efforts.<sup>103</sup> However, the lack of full participation by China is a major weakness of SAARC as an instrument for comprehensive collaboration on GM.<sup>104</sup> Efforts by the India-based Strategic Foresight Group and the World Bank’s South Asia Water Initiative, including the informal Abu Dhabi Dialogue Group, complement ICIMOD in building regional collaboration.<sup>105</sup>

Progress is most likely to occur within a forum that focuses directly on GM, that brings together China, India, and as many of the other GHR countries as possible, and receives substantial political support and funding. If this is not possible under the ICIMOD, creating a new “Himalayan Glacier Commission” that includes as many GHR countries as possible and convenes high-level leadership could move GM up the policy agenda, develop more targeted programs, and inform national and local responses. Given the synergies with other development issues, a new GM initiative might be more likely to receive support, and be more effective, if situated under a “Himalayan Cooperation

Council” with a broader mandate. New efforts, then, should build strategically upon ongoing projects through ICIMOD and SAARC and complement them as necessary.

Proposing a high-level regional initiative on what has been a relatively obscure and technical issue may seem unrealistic considering the intense political tension in the area and competition for attention to issues that are deemed more pressing. Yet as the glaciers retreat, the cost of inaction increases.<sup>106</sup> Spurring collaboration between India and China may be politically difficult, but cooperation between the two major powers could achieve results that would substantially benefit themselves as well as others.<sup>107</sup> Furthermore, the creation of a new regional mechanism could begin to pinpoint the sources of harmful emissions and the areas most vulnerable to the changes in hydrology. It would raise GM’s profile and provide a forum for concerned stakeholders, including non-state actors who can catalyze further political momentum and provide practical efficiencies to the advantage of all affected countries.

## CONCLUSION

IELP provides a framework for policy-makers who take the threat of GM seriously, whether or not they are concerned about compliance with international law. The duty to prevent pollution that causes transboundary damage and the importance of conducting environmental assessments points toward the potential for regional black carbon reduction to slow the melting. But there is a current incongruence between GHR ecosystem, national jurisdiction, and regional mechanisms. Enhanced cooperation through existing regional entities, or even establishing a new body to focus on Himalayan GM, could produce effective mitigation and adaptation efforts.

The principles and laws discussed in this article can provide the fundamental basis for regional cooperation. International and regional frameworks cannot substitute for political will, but they can stimulate and facilitate engagement by interested private and public individuals and organizations. Science also calls for more focus on the ABCs in the Himalayas as the atmospheric brown clouds have emerged as a significant cause of GM and the affected countries have much more capacity to reduce their regional air pollution than they do to control global warming.

Applying basic principles of IELP could generate positive economic, environmental, and social outcomes in a situation that seems to be deteriorating faster than what used to be known as “a glacial pace.” More detailed research that explores implementation of the approaches proposed here could prove valuable. Given the mounting evidence about the causes and severity of glacial decline, the time is ripe for decisive action.



*Endnotes on page 65*

<sup>5</sup> Although the Clean Air Act Amendments of 1990 authorized the creation of the Acid Rain Program, a cap-and-trade program to reduce the amount of sulfur and nitrous dioxide, the first cap-and-trade program in the United States was California's Regional Clean Air Incentives Market that began in 1993. Compare U.S. ENVTL. PROT. AGENCY, AN OVERVIEW OF THE REGIONAL CLEAN AIR INCENTIVES MARKET (RECLAIM) 1 (2006) (stating that RECLAIM was started in 1993) with *Acid Rain Program*, EPA.GOV (Mar. 2, 2011), <http://www.epa.gov/airmarkets/progsregs/arp/basic.html> (stating that the Acid Rain Program began in 1995). See also CLEAN AIR ACT AMENDMENTS OF 1990, 42 U.S.C. §§ 7651-51o (1990) (authorizing the use of a cap-and-trade scheme to limit sulfur dioxide and nitrogen dioxide); Justin Gerdes, *Cap and Trade Curbed Acid Rain: 7 Reasons Why It Can Do The Same For Climate Change*, FORBES (Feb. 13, 2012), <http://www.forbes.com/sites/justingerdes/2012/02/13/cap-and-trade-curbed-acid-rain-7-reasons-why-it-can-do-the-same-for-climate-change/> (discussing the history of the Acid Rain Program).

<sup>6</sup> See *Cap and Trade Program*, CALIFORNIA ENVTL. PROT. AGENCY AIR RES. Bd., <http://arb.ca.gov/cc/capandtrade/capandtrade.htm> (last visited Feb. 2, 2012) (describing California's cap-and-trade program which started on Jan. 1, 2012).

<sup>7</sup> See CAL. CODE REGS. tit. 17 § 95981 (West 2012) (listing the requirements for offset credits); CAL. CODE REGS. tit. 17 § 95994 (listing the sector-based offset requirements).

<sup>8</sup> See Rob Curran, *Carbon Offsets: Q&A*, WALL ST. J. (Sept. 21, 2001), <http://online.wsj.com/article/SB10001424052970204683204574356303122443192.html>.

<sup>9</sup> Voluntary markets do not have a single set of requirements, but use various industry standards to assure the quality of the carbon credits. See *Voluntary Over-the-Counter (OTC) Offset Market*, ECOSYSTEM MARKETPLACE, [http://www.ecosystemmarketplace.com/pages/dynamic/web.page.php?section=carbon\\_market&page\\_name=otc\\_market](http://www.ecosystemmarketplace.com/pages/dynamic/web.page.php?section=carbon_market&page_name=otc_market) (last visited Mar. 8, 2012).

<sup>10</sup> Compare REGIONAL GREENHOUSE GAS INITIATIVE MODEL RULE Subpart XX-10 (Dec. 31, 2008) (listing the requirements for offsets in the RGGI) with CAL. CODE REGS. tit. 17 §§ 95981-94 (listing the requirements for offsets in California's cap-and-trade market).

<sup>11</sup> See *Compliance Offset Program*, CALIFORNIA ENVTL. PROT. AGENCY AIR RES. Bd., <http://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm> (last visited Mar. 9, 2012) (listing California's offset programs).

<sup>12</sup> See CAL. CODE REGS. tit. 17 § 95802(a)(12) (West 2012) (defining an offset credit as a compliance instrument); CAL. CODE REGS. tit. 17 § 95820(c) (stating that a compliance instrument "does not constitute property or a property right").

<sup>13</sup> See Markus W. Gehring & Charlotte Streck, *Emissions Trading: Lessons From SO<sub>x</sub> and NO<sub>x</sub> Emissions Allowance and Credit Systems Legal Nature, Title, Transfer, and Taxation of Emission Allowances and Credits*, 35 E.L.R. 10,221-22 (2005) (analyzing how the Fifth Amendment will require the

government to compensate regulated companies whose sulfur dioxide allowances are revoked under the cap-and-trade Acid Rain Program); see also 136 CONG. REC. S16,980 (1990) (statement of Sen. Baucus) ("[T]he reason for characterizing the legal or property status of allowances in this title is to make clear that regulatory actions taken subsequent to the issuance of allowances are not subject to the 'takings clause' of the U.S. Constitution."). Compare CLEAN AIR ACT AMENDMENTS OF 1990, 42 U.S.C. § 7651b(f) (1990) (stating that a emissions allowance used in the Acid Rain Program "does not constitute property right") with CAL. CODE REGS. tit. 17 § 95820(c) (stating that a compliance instrument "does not constitute property or a property right").

<sup>14</sup> C.f. Gehring, *supra* note 13, at 10,222 (arguing that if an emissions allowance under the Acid Rain Program is revoked, then the owner could be entitled to compensation under the Takings Clause).

<sup>15</sup> CAL. CODE REGS. tit. 17 § 95801.

<sup>16</sup> C.f. Gehring, *supra* note 13, at 10,222 (arguing that compensation for revocation of emission allowances in the Acid Rain Program will impede the government's ability to achieve the goal of reducing emissions); Travis Allan & Kathy Baylis, *Who Owns Carbon? Property Rights Issues in a Market for Greenhouse Gases*, 7 CURRENT ARGU., FOOD & RES. ISSUES 104, 106 (2006) (stating that the Acid Rain Program does not recognize sulfur dioxide emissions allowances as property because the United States is afraid of compensating regulated companies when the allowances are revoked).

<sup>17</sup> *Roseland Plantation, LLC v. U.S. Fish & Wildlife Serv.*, 2006 U.S. Dist. LEXIS 29334, 9-10 (W.D. La. 2006).

<sup>18</sup> *Roseland*, 2006 U.S. Dist. LEXIS 29334 at 9.

<sup>19</sup> *Roseland*, 2006 U.S. Dist. LEXIS 29334 at 8.

<sup>20</sup> *Roseland*, 2006 U.S. Dist. LEXIS 29334 at 9.

<sup>21</sup> *Roseland*, 2006 U.S. Dist. LEXIS 29334 at 7-8.

<sup>22</sup> CAL. CODE REGS. tit. 17 § 95973.

<sup>23</sup> CAL. CODE REGS. tit. 17 §§ 95940-42.

<sup>24</sup> *California, Quebec To Link CO<sub>2</sub> Markets This Year*, THOMSON REUTERS POINT CARBON (Jan. 13, 2013), <http://www.pointcarbon.com/news/1.1716584>.

<sup>25</sup> *Id.*

<sup>26</sup> *C.f. Ormet Corp. v. Ohio Power Co.*, 98 F.3d 799, 807 (4th Cir. 1996)

(holding that emissions allowances under the Acid Rain Program should be treated like economic commodities and such treatment requires that their nature and interest holders be treated the same throughout the entire market).

<sup>27</sup> See U.S. CONST. art. I, § 8, cl. 3 ("[Congress shall have power] [t]o regulate Commerce with foreign Nations, and among the several States").

<sup>28</sup> See *Dennis v. Higgins*, 498 U.S. 439, 447 (1991) (stating that the Commerce Clause limits state laws which interfere with interstate commerce).

## Endnotes: THE ABCS OF GOVERNING THE HIMALAYAS IN RESPONSE TO GLACIAL MELT: ATMOSPHERIC BROWN CLOUDS, BLACK CARBON, AND REGIONAL COOPERATION

*continued from page 37*

<sup>1</sup> MATS ERIKSSON ET AL., THE CHANGING HIMALAYAS – IMPACT OF CLIMATE CHANGE ON WATER RESOURCES AND LIVELIHOODS IN THE GREATER HIMALAYAS, INTERNATIONAL CENTER FOR INTEGRATED MOUNTAIN DEVELOPMENT 1-3 (2009), [http://books.icimod.org/uploads/tmp/icimod-the\\_changing\\_himalayas.pdf](http://books.icimod.org/uploads/tmp/icimod-the_changing_himalayas.pdf).

<sup>2</sup> The terms "Greater Himalaya" and "Hindu Kush-Himalaya region" are often used interchangeably but somewhat inconsistently in various studies. The list of countries here includes all of those that fall within river basins whose sources originate in the mountains referenced above. MADHAV KARKI ET AL., REGIONAL ASSESSMENT FOR RIO+20: HINDU KUSH HIMALAYA AND SE ASIA PACIFIC MOUNTAINS, DRAFT FOR DISCUSSION, FROM RIO 1992 TO 2012 AND BEYOND: SUSTAINABLE MOUNTAIN DEVELOPMENT, HINDU KUSH HIMALAYA (HKH) REGION 9-10 (SEPT. 2011), [www.uncsd2012.org/rio20/content/documents/HKH\\_30\\_9\\_2011\\_0\[1\].pdf](http://www.uncsd2012.org/rio20/content/documents/HKH_30_9_2011_0[1].pdf).

<sup>3</sup> AON BENFIELD, UCL HAZARD RESEARCH CENTRE, UNIVERSITY COLLEGE LONDON ET AL., THE WATERS OF THE THIRD POLE: SOURCES OF THREAT, SOURCES OF SURVIVAL 5 (Nina Behrman ed., 2010), <http://www.humanitarianfutures.org/sites/default/files/Waters%20of%20the%20Third%20Pole.pdf>.

<sup>4</sup> MINISTRY OF ENV'T AND FORESTS, GOV'T OF INDIA, GOVERNANCE FOR SUSTAINING HIMALAYAN ECOSYSTEM: GUIDELINES AND BEST PRACTICES 10 (undated), [http://gbpihed.gov.in/G-SHE\\_Book.pdf](http://gbpihed.gov.in/G-SHE_Book.pdf) (last visited Apr. 26, 2012).

<sup>5</sup> Shichang Kang et al., *Review of Climate and Cryospheric Change in the Tibetan Plateau*, 5 015101 ENVTL. RES. LETTERS 3 (2010), [http://m.iopscience.iop.org/1748-9326/5/1/015101/pdf/1748-9326\\_5\\_1\\_015101.pdf](http://m.iopscience.iop.org/1748-9326/5/1/015101/pdf/1748-9326_5_1_015101.pdf).

<sup>6</sup> ERIKSSON, *supra* note 1, at 2-3.

<sup>7</sup> BENFIELD, *supra* note 3, at 8.

<sup>8</sup> *Id.* at 5-7, 10. See also Eriksson, *supra* note 1, at 3-4.

<sup>9</sup> *Id.* at 7-10.

<sup>10</sup> *Id.* at 10-13.

<sup>11</sup> See, e.g., INSTITUTIONS AND ENVIRONMENTAL CHANGE: PRINCIPAL FINDINGS, APPLICATIONS, AND RESEARCH FRONTIERS, at xviii, xxi, 3-45 (Oran R. Young et al. eds., 2008) (defining "governance" as "[t]he process of steering or guiding societies toward collective outcomes that are socially desirable and away from those that are socially undesirable").

<sup>12</sup> R.V. Cruz et al., *Asia in CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE* 493 (M.L. Parry et al., eds., 2007) [http://www.ipcc.ch/publications\\_and\\_data/ar4/wg2/en/ch10.html](http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch10.html); INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC STATEMENT ON THE MELTING OF HIMALAYAN GLACIERS (2010), <http://www.ipcc.ch/pdf/presentations/himalaya-statement-20january2010.pdf>.

<sup>13</sup> Kang et al., *supra* note 5, at 3.

<sup>14</sup> VEERABHADRAN RAMANATHAN ET AL., U.N. ENV'T PROGRAMME, ATMOSPHERIC BROWN CLOUDS: REGIONAL ASSESSMENT REPORT WITH FOCUS ON ASIA 26-27 (2008), <http://www.unep.org/pdf/ABCSummaryFinal.pdf>.

- <sup>15</sup> Gretchen Cook-Anderson, *New Study Turns Up the Heat on Soot's Role in Himalayan Warming*, NASA (2009), <http://www.nasa.gov/topics/earth/features/himalayan-warming.html>.
- <sup>16</sup> Kang et al., *supra* note 5, at 4, 6.
- <sup>17</sup> Veerabhadran Ramanathan et al., *Warming Trends in Asia Amplified by Brown Cloud Solar Absorption*, 448 NATURE No. 7153 511, 575 (2007).
- <sup>18</sup> Kang et al., *supra* note 5, at 6.
- <sup>19</sup> Cook-Anderson, *supra* note 15.
- <sup>20</sup> Orjan Gustafsson et al., *Brown Clouds Over South Asia: Biomass or Fossil Fuel Combustion?*, 323 SCI. No. 5913 495, 495-97 (2009).
- <sup>21</sup> Kang et al., *supra* note 5, at 1-3.
- <sup>22</sup> *Id.* at 3.
- <sup>23</sup> Lester Brown, *Melting Mountain Glaciers Will Shrink Grain Harvests in China and India*, EARTH POLICY INST. (Mar. 20, 2008), [www.earth-policy.org/index.php?plan\\_b\\_updates/2008/update71](http://www.earth-policy.org/index.php?plan_b_updates/2008/update71).
- <sup>24</sup> BENFIELD, *supra* note 3, at 8-10.
- <sup>25</sup> BENFIELD, *supra* note 3, at 8-10.
- <sup>26</sup> See, e.g., MINISTRY OF GOV'T AND FORESTS, *supra* note 4, at 10 (describing the distinctive climate of the Himalayas, which influences much of Asia's climate). See also Kang, *supra* note 5, at 1-2 (characterizing the Tibetan Plateau as a "huge influence on regional and global climate").
- <sup>27</sup> *Weather Extremes in a Changing Climate*, WMO, [www.wmo.int/pages/mediacentre/news/extremeweathersequence\\_en.html](http://www.wmo.int/pages/mediacentre/news/extremeweathersequence_en.html) (last updated Mar. 18, 2011).
- <sup>28</sup> Eriksson, *supra* note 1, at 15; BENFIELD, *supra* note 3, at 14-23.
- <sup>29</sup> See BENFIELD, *supra* note 3, at 10-13, 18-23.
- <sup>30</sup> See *id.* at 23 (describing the insufficiency of institutional mechanisms for governing transboundary water resources).
- <sup>31</sup> Oran R. Young, *Governance for Sustainable Development in a World of Rising Interdependencies*, in GOVERNANCE FOR THE ENVIRONMENT: NEW PERSPECTIVES 12-40 (Magali A. Delmas and Oran R. Young eds., 2009).
- <sup>32</sup> Young et al., *supra* note 11, at 4-5, 6-9; quote at 7.
- <sup>33</sup> ELINOR OSTROM, A DIAGNOSTIC APPROACH FOR GOING BEYOND PANACEAS, PROCEEDINGS OF THE NATIONAL ACADEMIES OF SCIENCES 104 (39): 15181, 15183 (B.L. Turner II ed., 2007), <http://www.pnas.org/content/104/39/15181.abstract>.
- <sup>34</sup> Robert O. Keohane, Peter M. Haas & Marc A. Levy, *Effectiveness of International Environmental Institutions*, in INSTITUTIONS FOR THE EARTH: SOURCES OF EFFECTIVE INTERNATIONAL ENVIRONMENTAL PROTECTION 8 (Haas, Keohane, and Levy eds., 1993).
- <sup>35</sup> *Id.* at 3-4.
- <sup>36</sup> See, e.g., United Nations Conference on the Human Environment, Stockholm, Swed., June 5-16, 1972, *Declaration of the United Nations Conference on the Human Environment*, U.N. Doc. A/Conf.48/14/Rev.1 (Jun. 16, 1972) [hereinafter *Stockholm*] (setting forth the ideas of cooperation and duty to surrounding states in Principles 6 (prevention), 21 (harm), and 24 (cooperation)); see also, e.g., United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3-14, 1992, *Rio Declaration on Environment and Development*, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. I), Annex I (Aug. 12, 1992) [hereinafter *Rio*] (supporting cooperation among neighbors in Principles 7 (responsibility) and 15 (precaution)).
- <sup>37</sup> See, e.g., *Rio*, *supra* note 36 (providing for environmental impact assessment in Principle 17).
- <sup>38</sup> See, e.g., Stockholm, *supra* note 36 (identifying international cooperation as a goal in Principles 22 and 24).
- <sup>39</sup> See Stockholm, *supra* note 36. See also, *Rio*, *supra* note 36; United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3-14, 1992, *The United Nations Program of Action from Rio*, U.N. GAOR, 46th Sess., Agenda Item 21, Sec. II, Ch. 13, UN Doc A/Conf.151/26 (1992).
- <sup>40</sup> See, e.g., PATRICIA BIRNIE, ALAN BOYLE & CATHERINE REDGWELL, INTERNATIONAL LAW & THE ENVIRONMENT 128-205 (3d ed. 2009); DAVID HUNTER, JAMES SALZMAN & DURWOOD ZAELEKE, INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 469-537 (2d ed. 2007).
- <sup>41</sup> See generally Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79, 31 I.L.M. 818 (1992); United Nations Framework Convention on Climate Change, May 5, 1992, 1771 U.N.T.S. 107, U.N. Doc. A/AC.237/18; <http://unfccc.int/resource/docs/convkp/conveng.pdf>; Convention and Statute on the Regime of Navigable Waterways of International Concern, Apr. 20, 1921, 7 U.N.T.S. 36 (1921).
- <sup>42</sup> UN Department of Economic and Social Affairs, Johannesburg, S. Afr., Aug. 26-Sept. 4, 2002, *Johannesburg Plan of Implementation*, Ch. IV, ¶42 (2002).
- <sup>43</sup> World Charter for Nature, G.A. Res. 37/7, U.N. GAOR, 37th Sess., Supp. No. 51, U.N. Doc. A/37/51 (1982).
- <sup>44</sup> U.N.E.P., Environmental Law Guidelines And Principles On Shared Natural Resources, <http://hqweb.unep.org/law/PDF/UNEPEnvironmental-Law-Guidelines-and-Principles.pdf>.
- <sup>45</sup> UNEP Goals and Principles of Environmental Impact Assessment, UNEP Res. GC14/25, 14th Sess. (1987), endorsed by GA Res. 42/184, UN GAOR, 42nd Sess., UN Doc. A/Res/42/184 (1987).
- <sup>46</sup> See generally Int'l Law Ass'n, Berlin Conference on Water Resources Law, Fourth Report (2004), [http://www.unece.org/fileadmin/DAM/env/water/meetings/legal\\_board/2010/annexes\\_groundwater\\_paper/Annex\\_IV\\_Berlin\\_Rules\\_on\\_Water\\_Resources\\_ILA.pdf](http://www.unece.org/fileadmin/DAM/env/water/meetings/legal_board/2010/annexes_groundwater_paper/Annex_IV_Berlin_Rules_on_Water_Resources_ILA.pdf) (explaining which aspects of the Convention are obligatory and relevant rules of customary international law).
- <sup>47</sup> Treaty for Amazonian Cooperation, July 3, 1978, Bol.-Braz.-Colom.-Ecuador-Guy.-Peru-Surin.-Venez., 17 I.L.M. 1045 (entered into force Aug. 3, 1980).
- <sup>48</sup> Declaration on the Establishment of the Arctic Council, Sept. 19, 1996, 35 I.L.M. 1382.
- <sup>49</sup> Regional Seas Programme, UNEP (last visited May 1, 2012), <http://www.unep.org/regionalseas>.
- <sup>50</sup> Wolfram Krewitt et al., *Assessment of Environmental and Health Benefits from the Implementation of the UN-ECE Protocols on Long Range Transboundary Air Pollution*, 61 JOURNAL OF HAZARDOUS MATERIALS, Aug. 1998, at 239-47 (estimating that the measures taken as a result of the convention saved an average of 1% of annual GDP for 15 European countries and preserved 90,000 years of life expectancy each year).
- <sup>51</sup> Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Mar. 17, 1992, 31 ILM 1312 (1992).
- <sup>52</sup> See, e.g. Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System, May 28, 1987, 27 I.L.M. 1109; Agreement Between the Republic of Zambia and the Republic of Zimbabwe Concerning the Utilization of the Zambezi River, Zambia-Zimb., July 28, 1987, <http://www.fao.org/docrep/W7414B/w7414b17.htm>.
- <sup>53</sup> Katak B. Malla, *Hydro-climate Legal Management of the Hindu-Kush Himalayas*, 12(1) ASIA PAC. J.ENVTL. L. 51-83, 83 (2009).
- <sup>54</sup> Convention on the Protection of the Alps (Alpine Convention), art. 2, ¶ 1, Nov. 7, 1991, 1917 U.N.T.S. 135 (entered into force Mar. 6, 1995), <http://treaties.un.org/doc/Publication/UNTS/Volume%201917/v1917.pdf>.
- <sup>55</sup> *Id.* art. 2, ¶ 2.
- <sup>56</sup> *Id.* arts. 3, 4, and 5.
- <sup>57</sup> See, e.g., Young, *supra* note 11, at 267 (showing the importance of creating a framework for discussing problems of governance). See also Alpine Convention, *supra* note 54 (calling for general obligations of all parties to the Convention (art. 2)).
- <sup>58</sup> INT'L CTR FOR INTEGRATED MOUNTAIN DEV. [ICIMOD], STRATEGIC FRAMEWORK 4 (Jan. 2008), [www.icimod.org/resource.php?id=21](http://www.icimod.org/resource.php?id=21).
- <sup>59</sup> *Id.* at 8.
- <sup>60</sup> *Id.* at 4.
- <sup>61</sup> *Id.* at 8.
- <sup>62</sup> ICIMOD ANNUAL REPORT 2009 48-50 (2009), [http://books.icimod.org/uploads/tmp/icimod-annual\\_report\\_2009.pdf](http://books.icimod.org/uploads/tmp/icimod-annual_report_2009.pdf).
- <sup>63</sup> See Strategic Framework, *supra* note 58, at 20.
- <sup>64</sup> David Cyranoski, *Glacial Melt Thaws South Asian Rivalry*, NATURE NEWS, April 16, 2008, at 793, <http://www.nature.com/news/2008/080416/full/452793a.html>.
- <sup>65</sup> See generally ICIMOD ANNUAL REPORT, *supra* note 58.
- <sup>66</sup> SOUTH ASIAN ASS'N FOR REGIONAL COOPERATION [SAARC], [www.saarc-sec.org](http://www.saarc-sec.org) (last visited Apr. 23, 2012).
- <sup>67</sup> See generally SAARC Charter, SAARC, <http://www.saarc-sec.org/SAARC-Charter/5/> (last visited Apr. 24, 2012).
- <sup>68</sup> M.K. Bhadrakumar, *China Breaks the Himalayan Barrier*, ASIA TIMES (May 1, 2010), [http://www.atimes.com/atimes/South\\_Asia/LE01DF03.html](http://www.atimes.com/atimes/South_Asia/LE01DF03.html).
- <sup>69</sup> See Area of Cooperation, SAARC (2009), <http://www.saarc-sec.org/#> (last visited Apr. 24, 2012).
- <sup>70</sup> See generally SAARC, Area of Cooperation: Science and Technology, [www.saarc-sec.org/areaofcooperation/cat-detail.php?cat\\_id=46](http://www.saarc-sec.org/areaofcooperation/cat-detail.php?cat_id=46) (last visited Apr. 24, 2012).
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- <sup>72</sup> Douglas McGuire, *The Mountain Partnership and Regional Cooperation*, INT'L MOUNTAIN P'SHIP (Special Event in Bolzano), 16-18 (2006), [www.mountainpartnership.org/common/files/pdf/Int-Partnerships-EN.pdf](http://www.mountainpartnership.org/common/files/pdf/Int-Partnerships-EN.pdf).
- <sup>73</sup> See generally P'SHIP FOR CLEAN INDOOR AIR, <http://www.pciaonline.org/> (last visited Feb. 20, 2012); GLOBAL ALLIANCE FOR CLEAN COOKSTOVES, <http://>

cleancookstoves.org/ (last visited Feb. 20, 2012); CLEAN AIR INITIATIVE FOR ASIAN CITIES, <http://cleanairinitiative.org> (last visited Feb. 20, 2012).

<sup>74</sup> See Malla, *supra* note 53, at 67.

<sup>75</sup> Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, art. 1, Apr. 5, 1995, 2069 U.N.T.S. 3, [www.mrcmekong.org/assets/Publications/agreements/agreement-Apr95.pdf](http://www.mrcmekong.org/assets/Publications/agreements/agreement-Apr95.pdf).

<sup>76</sup> *Id.* at 1.

<sup>77</sup> See *id.* See also Malla, *supra* note 53, at 73.

<sup>78</sup> Press Release, *China Ready to Share Data on Mekong Water Levels Ahead of Regional River Summit*, MEKONG RIVER COMM'N (Mar. 26, 2010), [http://ns1.mrcmekong.org/MRC\\_news/press10/China-ready-to-share-data-26-mar-10.htm](http://ns1.mrcmekong.org/MRC_news/press10/China-ready-to-share-data-26-mar-10.htm).

<sup>79</sup> See Saira Kurup, *Water Wars: India, China and the Great Thirst*, THE TIMES OF INDIA (July 25, 2010), [http://articles.timesofindia.indiatimes.com/2010-07-25/special-report/28308457\\_1\\_water-wars-water-resources-water-deficit](http://articles.timesofindia.indiatimes.com/2010-07-25/special-report/28308457_1_water-wars-water-resources-water-deficit) (describing the need for a bilateral agreement that goes beyond sharing hydrological data).

<sup>80</sup> GOV'T OF INDIA, MINISTRY OF WATER RES., *India- China Co-operation*, <http://wrmin.nic.in/index3.asp?subsublinkid=290&langid=1&ssid=372> (last visited Feb. 20, 2012). See also, Mirza Zulfikar Rahman, *Quiet Flows the Brahmaputra?* INSTITUTE OF PEACE AND CONFLICT STUDIES (Oct. 2, 2008), [www.ipcs.org/article/south-asia/quiet-flows-the-brahmaputra-2695.html](http://www.ipcs.org/article/south-asia/quiet-flows-the-brahmaputra-2695.html).

<sup>81</sup> See Kurup, *supra* note 79.

<sup>82</sup> GOV'T OF INDIA, MINISTRY OF WATER RES., *Bilateral International Cooperation*, <http://wrmin.nic.in/index2.asp?slid=368&sublinkid=365&langid=1> (last visited Feb. 20, 2012).

<sup>83</sup> See Malla, *supra* note 53, at 51, 80-83.

<sup>84</sup> See Jessica Seddon Wallack & Veerabhadran Ramanathan, *The Other Climate Changers: Why Black Carbon and Ozone Also Matter*, 8(5) FOREIGN AFF. MAG., Sept./Oct. 2009, at 105-113.

<sup>85</sup> See, e.g., *id.* at 108-09. See also Cook-Anderson, *supra* note 15.

<sup>86</sup> See generally Gyami Shrestha, Samuel Traina, & Christopher Swanston, *Black Carbon's Properties and Role in the Environment: A Comprehensive Review*, 2 SUSTAINABILITY, 1, 294-320 (Jan. 15, 2010), [http://www.nrs.fs.fed.us/pubs/jrnl/2010/nrs\\_2010\\_shrestha\\_001.pdf](http://www.nrs.fs.fed.us/pubs/jrnl/2010/nrs_2010_shrestha_001.pdf).

<sup>87</sup> Jeremy Carl, *Rising From the Ashes: India's Black Carbon Opportunity*, INDIA IN TRANSITION BLOG (Jul. 19, 2009), <http://casi.ssc.upenn.edu/it/carl>.

<sup>88</sup> *Consultation Meeting Explores Measures to Reduce Emissions of Short-lived Atmospheric Pollutants*, ICIMOD (MAR. 25, 2011), [www.icimod.org/?q=3147](http://www.icimod.org/?q=3147).

<sup>89</sup> *Id.*

<sup>90</sup> Press Release, U.S. Dep't of State, Briefing on Global Climate Change and Clean Air Initiative (Feb. 16, 2012), [www.state.gov/r/pa/prs/ps/2012/02/184042.htm](http://www.state.gov/r/pa/prs/ps/2012/02/184042.htm).

<sup>91</sup> Press Release, U.S. Dep't of State, The Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (Feb. 16, 2012), [www.state.gov/r/pa/prs/ps/2012/02/184055.htm](http://www.state.gov/r/pa/prs/ps/2012/02/184055.htm).

<sup>92</sup> See *Id.*

<sup>93</sup> Press Release, U.S. Dep't of State, Briefing on Global Climate Change and Clean Air Initiative (Feb. 16, 2012), [www.state.gov/r/pa/prs/ps/2012/02/184042.htm](http://www.state.gov/r/pa/prs/ps/2012/02/184042.htm).

<sup>94</sup> Young, *supra* note 31, at 21-23; see also, Elinor Ostrom, *A Polycentric Approach for Coping with Climate Change*, 32-39 (World Dev. Rep. Policy Research Working Paper No. 5095, 2009), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1494833](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1494833).

<sup>95</sup> Heike Schroeder, Leslie A. King, & Simon Tay, *Contributing to the Science-Policy Interface in INSTITUTIONS AND ENVIRONMENTAL CHANGE: PRINCIPAL FINDINGS, APPLICATIONS, AND RESEARCH FRONTIERS IN YOUNG*, *supra* note 11, at 262-275.

<sup>96</sup> See BENFIELD, *supra* note 3, at 27-31, 147-86.

<sup>97</sup> See generally ICIMOD, *About Us*, <http://www.icimod.org/?q=122> (last visited Feb. 20, 2012).

<sup>98</sup> See generally ICIMOD, *MIDTERM REVIEW 2007 OF THE ICIMOD STRATEGIC FRAMEWORK AND MEDIUM TERM ACTION PLAN 2008-2012* (Sept. 30, 2010).

<sup>99</sup> See Malla, *supra* note 53, at 83.

<sup>100</sup> See Malla, *supra* note 53, at 83.

<sup>101</sup> See generally ICIMOD, *Hindu-Kush Himalayan Region*, <http://www.icimod.org/?q=1137> (last visited Feb. 20, 2012).

<sup>102</sup> See, e.g., SAARC, 17th SAARC Summit, Addu, Maldives, Nov. 11, 2011, *Addu Declaration of 11 Nov. 2011*, SAARC/SUMMIT.17/13 (2011), [www.seventeenthsaarcsummit.mv](http://www.seventeenthsaarcsummit.mv).

<sup>103</sup> SAARC Charter, *supra* note 66, art. 4.

<sup>104</sup> Ashfaque H Khan, *China and SAARC*, THE INT'L NEWS (Dec. 20, 2011), <http://www.thenews.com.pk/Todays-News-9-83089-China-and-Saarc>.

<sup>105</sup> Naser Mermon, *Shared Waters and Glacial Melt*, DAWN (Jan. 1, 2012), <http://www.dawn.com/2012/01/01/shared-waters-glacial-melt.html>. See also Second International Workshop Himalayan Sub-regional Cooperation on Water Security, Dhaka, Bangladesh, Jan. 15-16, 2010, *Dhaka Declaration on Water Security* (2010), <http://www.strategicforesight.com/Dhaka%20Declaration.pdf>. The multi-donor Abu Dhabi Dialogue, led by the World Bank, has brought together high-level representatives of Afghanistan, Bangladesh, Bhutan, China, India, Nepal, and Pakistan; see Geneive Connors, The South Asia Water Initiative, Presentation from the 2011 World Water Week in Stockholm, [worldwaterweek.org/documents/WWW\\_PDF/2011/Sunday/K23/Promoting-Cooperation-in-the-Ganges-Basin-through-Dialog/Connors-SAWI-Seminar-ADD-Retrospective.pdf](http://worldwaterweek.org/documents/WWW_PDF/2011/Sunday/K23/Promoting-Cooperation-in-the-Ganges-Basin-through-Dialog/Connors-SAWI-Seminar-ADD-Retrospective.pdf).

<sup>106</sup> Simon Montlake, *Climate Change: Southeast Asia's Preparation Falls Short*, CHRISTIAN SCI. MONITOR (Apr. 29, 2009), <http://www.csmonitor.com/World/Asia-South-Central/2009/0428/p06s07-wosc.html>.

<sup>107</sup> See Kurup, *supra* note 79.

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## Endnotes: OFFSETTING PROGRAMS: STRUGGLING TO FIND AN EQUITABLE SOLUTION INTERNATIONALLY

*continued from page 39*

<sup>28</sup> See Ostrom, *supra* note 14, at 8 (communicating the difficulty of social dilemmas where benefits of a solution are diffuse).

<sup>29</sup> See, e.g., David Crossland, *The Durban Climate Agreement 'Is Almost Useless'*, SPIEGEL ONLINE INT'L (Dec. 12, 2011), <http://www.spiegel.de/international/world/0,1518,803158,00.html> (describing the new Durban agreements as too vague and reflecting slow progress in extending the Kyoto Protocol for five years, creating a delay in deciding on a wider pact); see also *Disastrous outcome from international climate talks in Durban*, News Releases, FRIENDS OF THE EARTH (Dec. 14, 2011), <http://www.foe.org/news/news-releases/2011-12-disastrous-outcome-from-international-climate-talks> (expressing concern that Durban failed to set clear, binding goals to reduce emissions).

<sup>30</sup> See Kate Horner, *The Durban Deal – An initial analysis of the outcomes*, Blog, FRIENDS OF THE EARTH (Dec. 12, 2011), <http://www.foe.org/news/blog/2011-12-the-durban-deal—an-initial-analysis-of-the-outcome> (observing the establishment of a process for developing new market mechanisms and potential of carbon offsets through REDD as part of the Durban Platform).

<sup>31</sup> See Mohamed Adow, *Durban Climate Talks: Mind the Gap*, Time for Climate Justice, CHRISTIAN AID (Nov. 2011), <http://www.christianaid.org.uk/images/time-for-climate-justice-durban.pdf> (recognizing that the Kyoto Protocol's Article 3 principle of “common but differentiated responsibilities” allows for a heavier burden on developed countries).

<sup>32</sup> See *id.* (outlining the accounting loopholes present in CDM, to demonstrate how credits loosen the degree to which developed countries must comply internally with Kyoto Protocol commitments).

<sup>33</sup> See United Nations Framework Convention on Climate Change, Draft Dec. –/CP-17, *Conference of the Parties, Green Climate Fund-Report of the Transitional Committee*, 17th Sess., Nov. 28-Dec. 9, 2011, U.N. Doc. FCCC/CP/2011/L.9 (Dec. 10, 2011), [http://unfccc.int/files/meetings/durban\\_nov\\_2011/decisions/application/pdf/cop17\\_gcf.pdf](http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_gcf.pdf) (establishing the Green Climate Fund to channel financial resources to developing countries in support of their efforts to reduce greenhouse gas emissions).