Evidence from the Samdrup Jongkhar Initiative

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In with the bad:

Ambient Air Quality and Transboundary Pollution in Bhutan

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The transition is both immediate and inescapable. As you cross the border from the dusty, chaotic sprawl of Darranga, India, into Bhutan, both the pace and the landscape change abruptly. The flat plains of Assam give rise to the rugged and verdant sub-tropical evergreen jungles of Samdrup Jongkhar dzongkhag in the far southeastern part of the country. More than four fifths of the district is covered in forest, and the land is as much a home to a vast array of flora and fauna as it is to the 36,000 people who live there. By comparison the Indian state of Assam teems with a population of more than 27 million—38 times the entire population of Bhutan—340 people per square kilometre compared to Bhutan's average of 17.[1]

Thus, in the span of a short space and time—passing under the dragon and garuda of the border gate—one defining reality becomes crystal clear: Bhutan is extraordinary and unique, but also incredibly vulnerable. In fact, it has fallen victim to some of the worst consequences of industrialization-gone-mad in the rest of the world. For one, although its contribution to the global climate crisis is negligible at best, Bhutan is considered to be highly vulnerable to its effects — in terms of the dangers of glacial lake outburst flooding, other weather-related disasters, and human health impacts.

One recent report revealed that climate change is already causing extreme rainfall in Bhutan, nearly doubling from an average of 644 mm in 2000 to 1,120mm in 2010.[2] Further reports indicate that the entire Himalayan region is perhaps the world's most vulnerable to climate change. "As the climate warms, the river flows will at first increase, causing devastating summer floods, and then, as the glaciers that supply them shrink, the rivers will dwindle."[3]

According to Bhutan's National Environment Commission (NEC), the Bhutan Himalayan range alone is known to have 677 glaciers and 2,674 glacial lakes—25 of which are potentially dangerous. These glaciers are reportedly retreating at an alarming rate—some

by 20-30 metres per year. This could mean increased water flow in the short-term (including outburst floods), but diminished flow in the long term, posing serious supply problems for hydro-power generation as well as for agriculture and drinking water.[4]

But the burning of fossil fuels worldwide isn't just contributing to climate chaos, it's also having a serious impact on Bhutan's air quality that's less often discussed.

Brown cloud penetrates Bhutan

For 5 months, from November 2010 to March 2011, I had the privilege of working with the Samdrup Jongkhar Initiative (SJI), a civil-society based initiative, which aims to raise living standards and self-reliance in the dzongkhag in an ecologically-friendly way. Field research brought me to many villages in that dzongkhag where, over and over again, farmers described the challenges they faced in achieving food security and finding markets that worked for them. They also spoke of how the climate and rainfall amounts were changing and how productivity in their fields was declining.

During that time, the research team was stationed in the town of Dewathang, located approximately 18 km from the steamy border with India, at an elevation of 850 metres. On a clear sky day, one could see beyond the glorious rolling foothills to the plains of Assam and its patchwork quilt of fields. But clear days were few and far between. Most of the time a haze obscured the sun and reduced visibility. At first we thought it was fog, or the result of a forest fire. But as the days became weeks it became apparent that what we were witnessing was much more sinister.

Here, in arguably one of the most pristine countries on earth, we were engulfed in air pollution. Interestingly, what had become obvious to us was not as obvious to the Bhutanese around us, who seemed to have adjusted to the significant change in air quality perhaps because it had occurred gradually, over a long period of time.

The image displayed below was taken in February 2006, by NASA's Aqua satellite. It shows this pale band of haze—covering northern India, just south of the Himalayas. That polluting haze, trapped by the Himalayan range, also intrudes into the skies of southern Nepal, Bhutan, and Bangladesh.[5] This is the haze we looked out into daily from Dewathang.

Studies indicate that what has been called the "Atmospheric brown cloud" (ABC), is worse during the winter months (November until April) when there is less rain to wash the pollution from the air, and it is likely caused by a wide range of anthropogenic sources: coal-fueled power plants in India and China, airborne particles from combustion such as wood fires and forest fires, vehicle emissions, and factories, and the burning of biomass to generate energy.

Health impacts of air pollution

Extensive epidemiologic and toxicologic evidence in the last two decades has established a strong correlation between air pollution and many health ailments. Statistics show that more people die and are admitted to hospital for heart and lung problems on days with elevated levels of air pollution, and that people do not live as long in cities with high levels of air pollution. If air pollution increases susceptibility to sickness, as the evidence clearly indicates, then it also contributes to the social and monetary costs of caring for those affected, and it correspondingly diminishes individual quality of life.

Apart from the direct physical damage to health, the environment, and materials caused by air pollution, the available evidence also points to known less tangible pollution-induced economic costs related to lost productivity, diminishing availability of natural resources, and social disruption, which must also be taken into account when assessing the overall cost and effect of air pollution on human society and on the planet.

Studies relating to the "brown cloud" that now penetrates southern Bhutan indicate

alarming health consequences, including bronchitis, pulmonary edema, chronic bronchitis, emphysema, cancer, asphyxiation, and even death in cases of high doses. Most commonly observed effects at lower doses are eye, nose, and throat irritation.[6]

One major 2002 UNEP study—the first time the "atmospheric brown cloud" was assessed for impacts on climate, agriculture, and health—found that nearly 2 million people die each year in India alone from conditions related to the atmospheric air pollution.[7]

According to a 2008 report by Bhutan's National Environment Commission (NEC), the occurrence of respiratory diseases in Bhutan is also very high. During the period 2003-2006, there were more than 1 million respiratory disease-related referral cases and 436 deaths due to respiratory problems—accounting for 20% of deaths caused by all diseases. NEC points out, that despite this high rate of respiratory illness, there is currently no national study assessing the correlation between air pollution and the occurrence of respiratory disease.[8]

Brown cloud cuts farm output

In addition to the untold health effects this transboundary air pollution may be having on the Bhutanese population, research is now indicating that the pollution-laden clouds now drifting into Bhutan could also be adversely affecting agricultural productivity, and rice production in particular. The 2002 UNEP study reported that the haze, which covers roughly 10 million square kilometres, can result in up to 30% reduction in direct solar radiation, causing declines in agricultural productivity.[9] The study also reports that the haze suppresses rain, and can settle on plants as dust, soot, and fly ash, further shielding plant leaves from solar radiation. Another major direct impact is acid rain.[10]

A 2006 report echoed some of these findings. One U.S. study found that the brown clouds, which cloak much of South Asia, have a negative impact on rice output by reducing sunlight and rainfall. The report also noted that elevated levels of greenhouse gas emissions contributed to reduced yields.[11] Using climate models and historical data on Indian rice harvests, the researchers found that if there had been no atmospheric brown clouds between 1985 and 1998, the annual rice harvest would have been 11% higher than it was. The expert team concluded that the brown clouds reduced agricultural productivity. The study also noted that the effect of the brown clouds will be greater on areas that use rain to water their crops and less pronounced where irrigation is used.

Ambient air quality for Bhutan are presently very limited. Data for the Samdrup Jongkhar dzongkhag were not available and, according to the NEC, daily PM_{10} monitoring over time has so far been done only in Thimphu, Rinchending, Pasakha, Gomtu, and Kanglung.[12]

In 2004 the NEC reported that air pollution was an "emerging issue, especially in urban areas," due to the growth of the industrial sector—by 216% over a 5-year period (1997-2002)—and the rapid increase in the number of vehicles on the road—more than

doubling from 11,800 to more than 25,000 between 1997 and 2003.[13] According to a presentation by the United Nations Centre for Regional Development (UNCRD), private vehicle ownership in Bhutan increased threefold in the ten-year period between 1997 and 2007, with the biggest increase in light vehicles. According to the UNCRD, 43% of all vehicles are personal cars, which is causing troubles in urban areas, where they are competing with urban transport systems, making the latter less economically viable.

Despite this recent trend in sharply increased vehicle ownership and industrialization, air quality data from 2004 to 2007 for Thimphu indicate that particulate matter concentrations were still below allowable limits set by the United States Environmental Protection Agency and the European Union's guideline.[14] Data from the 4-year period also showed that concentrations of oxides of sulphur and nitrogen were below detectable levels.

However, in the dry winter months, air quality in Thimphu was found to be worse, with higher concentrations of particulate matter than in the rainy season. This was attributed to "emission from source points, the constant winter high pressure system that sits over the South Asian region and temperature inversions during dry winter seasons."[15]

The NEC attributed the sources of air pollution in the capital to combustion of biomass, combustion of fossil fuels from vehicular emissions, industries, and fugitive dusts from unpaved roads and new construction sites. Heating bitumen along road construction sites and burning of waste were also contributing to urban air pollution.[16]

However, the NEC report goes on to make a statement that may not be applicable to all of Bhutan, especially given the presence of the "atmospheric brown cloud":

> On the basis of analysis of ambient quality data for Thimphu, it can be said that ambient air quality in most other places will be even more pristine because of smaller population, fewer vehicles, and less industrial activities.[17]

Bhutan can lead SAARC pollutant control efforts

At the same time, transboundary pollution is recognized by the NEC as a concern. In its most recent 2008 report *Environment Outlook* it notes that in 1998 South Asian countries, including Bhutan, were party to a declaration on trans-boundary pollution focusing on the need for all signatories to initiate studies and programmes on air pollution.[18]

A transboundary air pollution monitoring station has been established at Gelephu, and NEC reports that there are plans to set up more air quality monitoring stations in "strategic locations around the country." At the time of writing, data from the Gelephu station (also bordering the Indian State of Assam) were not readily available. Once they are, it will be possible to identify the severity of the transboundary pollution in Bhutan, the quality of the air being breathed, whether it is correlated with declines in human health, and whether it could be the culprit in the reduced agricultural productivity being reported by farmers in the southern reaches of Bhutan.

That evidence will give Bhutan a much stronger voice in SAARC and other regional negotiations aimed at implementing the 1998 transboundary pollution agreement and at reducing the brown cloud air pollution that is now penetrating Bhutan.

While it might be comforting to think that the Samdrup Jongkhar Initiative could achieve all its improved quality of life objectives in isolation, the reality is that Samdrup Jongkhar does not exist in a bubble. In order to see blue skies again in Dewathang, in order to ensure the health and security of Samdrup Jongkhar villagers, and in order to protect the productivity of their farms, genuine progress in Samdrup Jongkhar will be directly linked to national, regional, and international initiatives to reduce air pollution.

As guardian of some of the world's most precious natural heritage — including vital water sources and rich biodiversity — and as a key ecological "conscience" of the region and the world, Bhutan will have a positive influence in these global initiatives far beyond its size.

ENDNOTES

[1] Population figures for Assam state are for 2001. Population estimate for 2011 is 30 million.
[2] Dawa T. Wangchuk. "Extreme rainfall caused by climate change." Business Bhutan. March 12, 2011.
[3] Cribb, Julian. 2010. The Coming Famine. The Global Food Crisis and What We Can do to Avoid it. University of California Press. Berkeley, pp. 142-143.
[4] National Environment Commission. 2008. Bhutan Environment Outlook. National Environment Commission Secretariat, Royal Government of Bhutan, pp. 36-42.
[5] Scripps Institution of Oceanography: http://scrippsnews.ucsd.edu/pressreleases/images/india_web.jpg. Image courtesy Jeff Schmaltz, Moderate Resolution Imaging Spectroradiometer Land Rapid Response Team at the NASA Goddard Space Flight Center.
[6] United Nations Environment Programme. 2002. Asian Brown Cloud: Climate and Other Environmental Impacts Study. UNEP. Available from http://www.rrcap.unep.org/issues/air/impactstudy/Executive%20Summary.pdf. p. 42.
[7] Ibid. Health effects and morbidity figures cited in *The Lancet.* Pollution cloud over south Asia is increasing ill health. Volume 360, Issue 9332. August, 2002. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(02)09762-3/fulltext
[8] NEC, 2008, p. 50.
[9] UNEP, 2002, p. 38.
[10] Ibid.
[11] British Broadcasting Corporation (BBC News). Pollution Reducing Rice Harvest. December 5, 2006. http://news.bbc.co.uk/2/hi/science/nature/6206766.stm
[12] NEC, 2008, p. 49; Personal communication with Tshewang Dorji, Senior Environment Officer, NEC, April 26, 2011.
[13] National Environment Commission. 2004. Brief Report on State of the Environment. Royal Government of Bhutan, Thimphu, pp. 6-7.
[14] Average PM_{10} concentration in Thimphu between June 2004-May 2007 was 20 ug/m^3. US-EPA limit is 50 ug/m^3 and EU guideline has set it at 40 ug/m^3. Ibid.
[15] Ibid. p. 8.

[16] Ibid.
[17] Ibid, p. 50.
[18] Bhutan is party to the 1998 Male Declaration on Control and Prevention of Air Pollution and its Likely Trans-boundary Effects for South Asia. UNEP serve as the Secretariat for the Declaration, which focuses on the need for countries to carry forward, or initiate studies and programmes on air pollution in each country in the South Asian subregion. NEC, 2008, p. 54.