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## Environmental health risks and vulnerability in post-conflict regions

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The importance of environmental factors during and after conflict has often not received adequate attention, and is of particular importance when assessing those groups most vulnerable to changing conditions. Post-war reconstruction and aid policies must take note of which groups are most susceptible to environmental health risks, and how the conflict itself often created new vulnerabilities through deliberate destruction of the natural and built environments. The environmental security and public health fields have a good deal to offer in understanding these dynamics, and must work more closely together in the future to identify potential vulnerabilities in advance of conflicts and disasters.

**Keywords:** environment; fragility; health risk; resilience targeting; vulnerability; war and conflict

### Introduction

The impacts of conflicts and disasters on environmental health remains a paramount concern, yet its salience in international policy communities remains fragmented and few direct policies have been undertaken to address such health concerns in reconstruction plans. Past authors have suggested that public health experts engage more directly with the international relations community in issues such as conflict and health, with the hope that further interaction will help both understanding and policy action<sup>1</sup>. It is true that the medical and health communities have a great deal to offer in understanding health and conflict, yet direct approaches to include health concerns in foreign and security policy will continue to meet with difficulties. Partly these difficulties stem from disciplinary barriers that fragment fields of study, and the continued dominance of political science in influencing international policymaking. In contrast to deliberative theories that assume rational action and justice along state lines, the nature of conflict in the

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twenty-first century requires more integrated assessment of the consequences of violent conflict, particularly at the sub-state level<sup>2,3</sup>. Redefining security from the state to the human level has been largely unsuccessful, especially in the United States. The disastrous consequences of the 2003 invasion of Iraq can be measured acutely in terms of public health (or specifically, excess morbidity and mortality), yet the efforts of public health experts to alert the US government to such conditions has largely been met with political dismissal<sup>4</sup>. Even in those cases where the international community can and does implement post-conflict reconstruction efforts, very often a disjuncture exists between the immediate crisis response and long-term development efforts.

This article lays out a conceptual framework for use in examining post-conflict environmental health, with specific emphasis upon how to define those groups most vulnerable to changing environmental conditions following violent conflict. The use of risk analysis, epidemiology, medical geography and policy analysis is paramount in determining best practices in post-conflict environments, and determining long-term policies for addressing how to rehabilitate war-torn regions. Changes in the natural and built environments combine with damage to social networks and 'green' infrastructure, resulting in poorer long-term public health for affected populations. Environmental health risks will not affect all groups equally, and in many cases actions taken during conflicts may be deliberately intended to prevent certain groups from recovering and adapting to new conditions. The specific targeting of vulnerable groups and social networks may also result in 'environmental refugees', those displaced due to environmental factors following conflict or natural disasters, which generally only worsens health conditions and makes more difficult the ability of the medical and public health communities to respond effectively. If conditions remain unresolved, the health of the most vulnerable populations continues to suffer, and underlying resentment may contribute to continuing conflict between groups.

The need for further examination of vulnerability in post-conflict areas stems from several shortcomings identified in development policymaking. One issue is that the immediate emergency aid provided to such areas is not always well coordinated with long-term development strategies, and in some cases short-term provision of aid may counteract effective resolution of long-term public health needs if they are not immediately recognized<sup>5</sup>. Second, environmental health consequences of war and conflict are often not well understood, and yet can be underlying factors that influence the well-being of a community or society for many years. Again, failure to recognize such issues at an early stage may create a later inability to address even more tangible issues that are interrelated with environmental factors<sup>6</sup>. Finally, national and international responses to post-conflict areas are often based upon knowledge and experience in post-disaster situations<sup>7</sup>. Conflicts and disasters have many

factors in common, but there remain several crucial differences between such events that severely hamper reconstruction and rehabilitation efforts. It is hoped that a closer examination of vulnerability patterns following conflict can assist the international community in addressing the most pressing long-term needs following wars and violence, and that overlaps between immediate priorities and long-term needs may be more easily identified.

The role of such studies is not to make causal claims of harm, but rather to illustrate vulnerable groups who may have been made even more vulnerable from events during conflict. What sorts of exposures are they now subject to, compared to the past? What coping mechanisms do they possess? What is their future outlook, and has it been acknowledged by the international community? In other words, might things be worse now than before the war, or have pre-existing inequalities been maintained or reproduced? Examining excess mortality or morbidity is important, but the specific patterns of illness and exposure may give a more detailed picture of post-conflict effects than aggregate numbers. Of particular concern are disproportionate risks being imposed on women, children and minority groups, those often considered the most vulnerable.

### **Vulnerability concepts**

The concept of vulnerability in environmental health is drawn largely from research on natural disasters and risk, where risk is defined as a cumulative measure of a society's ability to withstand or recover from changing conditions. The risk posed by natural disasters is variable, and one that reflects not so much the external event (be it a hurricane or earthquake) as the properties of the community that is being affected. The disaster itself is a dynamic process that places pressure on a society's or community's ability to maintain its various livelihoods, or to return to a functional state<sup>8,9</sup>. Research has described public health as dependent upon stocks of social capital, or the complex social, political and economic networks that provide measures of support to members of a society<sup>10,11</sup>. Disasters place pressures upon these networks and stocks of social capital, and those with the fewest resources and means of support will be most adversely affected. In this sense, Hurricane Katrina in the United States in 2005 is not understood as an external event damaging a geographic area, but as a multivariate process that exposes underlying vulnerabilities in societies, with the poor and African-Americans most at risk of changing environmental conditions during and particularly after the storm. Wars and violent conflicts provide dynamics that are different in several crucial respects, but the concept of vulnerability remains largely the same and can be useful in determining policy priorities for reducing associated risk.

Vulnerability has four primary components, the first of which is risk. The concept of risk is perhaps the most traditional factor for study, and involves

the potential and probabilistic risk of environmental and anthropogenic hazards. Traditional risk assessments measure the probability of adverse events occurring to members of a given population, such that risk itself is often defined as hazard multiplied by exposure and probability. Taken by itself such risk measures often create the impression of risk existing as a measure of external forces acting upon a static target, with measures of potential loss in a given environment according to probabilities of particular outcomes<sup>12</sup>. As a result of such possible shortcomings, risk in disaster and conflict situations is often combined with other measures such as sensitivity and resilience, in order to give a broader picture of potential impacts.

The second component of vulnerability is sensitivity, or the extent to which a given group will be negatively affected by an outside event. This is conditioned by factors such as geographical location, cultural practices that may minimize effects of environmental change, or other factors that are often largely beyond the control of individuals or authorities save in the long-term<sup>13</sup>. Sensitive populations often live in areas with marginal environmental conditions, yet rely upon modes of existence that are environmentally variable. Many regions in Africa and Asia are said to be vulnerable, for example, because such areas contain large numbers of people with low income, who rely upon agricultural goods for their primary income, and in geographic regions that may exhibit high variability of droughts, floods and poor soil. Likewise, many cities with rapid influxes of populations may force new inhabitants to build settlements in marginal areas more prone to floods, landslides and disease<sup>2</sup>. Policies dealing with disaster risk should aim to foster high resilience and low sensitivity. Resilience is the more important of the two measures, for reducing sensitivity is often more difficult and more costly, and in some cases (such as climatic sensitivity) is largely impossible to change in the short-term. In any case, groups that exhibit low resilience are at greater long-term risk, irrespective of their sensitivity.

The third primary component of vulnerability is resiliency, or the ability of a given group to return to their previous livelihood and equivalent standard of living following an event. Resilience relies upon a combination of social support networks and economic resources, often based upon family or community support to those most severely affected<sup>13</sup>. Closely related to livelihood models of development and economics, resilience is more than the mere access to financial resources or other individuals, but rather represents the ability of a community to help out those less fortunate and view identity as a common trait<sup>8</sup>. Societies or communities that have experienced fractionalization or identity conflicts are less likely to exhibit high resilience, and may retreat further into pre-existing political, ethnic, geographic or economic divisions. High resilience does not depend upon greater wealth, as the baseline for re-establishing livelihoods is not comparable to outside conditions; groups only need return to a previous standard of living, or its closest approximation. Community, family and types of economic ties are

ultimately more important for assessing resilience, as these networks serve as a form of 'safety net' when trying circumstances occur.

The concepts of resilience and sensitivity are not merely composed of structural elements, where components add up to a particular value of strength or weakness. Rather, we can also understand such concepts as emergent properties of complex systems, where emergent properties are drawn from interactions rather than static components. Resilience can be defined as the ability of a community to respond to outside events depends not merely upon individual actions, but the combined resources, trust, and shared goals of a group's members<sup>13</sup>. Risk sensitivity, similarly, depends not merely upon the location of dwellings multiplied by the probability of a flood or landslide, but rather relies upon numerous small changes in the underlying support system. Chaotic systems with high sensitivity are more likely to multiply such small pressures into larger effects, often through positive feedback mechanisms that effectively amplify dynamic pressures. Thus, a smaller flood may affect groups disproportionately more because of a series of smaller influences that shift the system towards a new, stable state. Low sensitivity may result from the ability of the system to provide negative feedback, effectively dampening pressures as they become evident, and drawing upon social resilience to improve the situation. In this way, robust systems may actually strengthen during times of stress, rather than be made weaker. Risk and disaster studies have often reflected on how certain groups respond very well to outside pressures, while others are helpless to respond, even when outside measures such as wealth remain constant<sup>14</sup>.

A related fourth factor in vulnerability is the concept of fragility, a measure taken from engineering in describing the ability of a system to withstand stress. Concepts of vulnerability tend to focus on the effects of dynamic pressures on individuals in a group, but it is also important to measure the robustness of the system as a whole. Shifts in stability from one state to another do not merely affect people, but provide an indicator of the ability of the system to retain its essential support characteristics. Should events place too much pressure on such a society, it is possible for a limit state to be reached, beyond which the society or community is unable to respond and fragmentation results. Fragility is a crucial concept because responses to disasters and similar processes are not linear. That is, the greater the pressure placed upon a society the more it will respond, but beyond a certain point no response is possible and the group or society loses its ability to react. In such situations, often misleadingly referred to as 'failed states', humanitarian crises can become quite acute<sup>15</sup>.

### **Resilience targeting**

Despite the valuable contributions that disaster research has made to the understanding of vulnerable populations and health, it is important to note

the differential effects that disasters and conflict have upon communities. Not all events will affect vulnerability in the same manner, nor are all responses intuitive. When groups perceive that the event is external, and either brought about by a natural force or an easily identifiable out-group, internal cohesion may be increased and resilience can be quite high. Terrorist bombings of civilians often provokes outrage more often than terror, while attempts to break the morale of German or British civilians by means of military bombing in World War II met with increased determination to continue the conflict<sup>16</sup>. Likewise, natural disasters often bring out greater incidences of cooperation within a community, and greater willingness to share crucial resources for the good of those less fortunate. In cases where disasters or conflicts result in even greater fragmentation of conditions, as exemplified by widespread looting or violence, generally the society has already been fragmented and the disaster (a dynamic process) only served to expose underlying vulnerabilities and fragility in the society. The psychological components of vulnerability should not be underestimated, for resilience and fragility are not merely physical characteristics of a society or group<sup>17</sup>.

Violent conflicts that operate within a state or community, moreover, can often target those very structures and networks that provide resilience. The precise nature of the conflict must be understood, for the intentions of armed groups may include sweeping attempts to deny access by another group to land or territory. Because of a combination of state-based nationalism, international law and sovereignty, and overlapping ethnic geographies, civil wars often aim to ethnically cleanse areas rather than simply take physical control over a geographic region. As a result, increasingly civilians have become the largest casualty group in wars<sup>18</sup>. Militarily, the most effective way of accomplishing such goals is to focus violence against the resilience of a group, undercutting its support networks and attempting to exploit any fragility. One group of targets is infrastructure, particularly 'green' infrastructure that maintains environmental and sanitary conditions essential for public health. Installations such as water treatment plants or power plants may be targeted, resulting in contaminated water, lack of refrigeration or water pumping, with obvious long-term consequences for environmental and public health.

Another tactic may be to deny access to natural resources of the territory, either through interdiction or long-term damage. Agricultural land may be deliberately and permanently destroyed, while landmines effectively deny access to areas for many years after a conflict. In particular, landmines designed to wound and maim rather than kill are used to place greater burdens upon populations, and provide a form of lasting terror against civilian populations at substantial risk of harm<sup>19-22</sup>. Civil conflicts in recent decades have exhibited a combination of deliberate destruction of agricultural lands and housing, and long-term damage to lands through

the use of landmines or other environmental contaminants. Such actions not only force civilians into more marginal regions, they also remove support networks essential to maintaining health and the ability to return to previous livelihoods.

Violent conflicts also differ from disasters in the manner of direct mortality and morbidity. Large disasters, such as the 2004 Asian tsunami, can have horrible death tolls and lasting consequences for health situations, and similarly conflicts often result in direct mortality and morbidity of large numbers of civilians and military personnel. Beyond the obvious comparisons, however, direct violence against civilians (particularly though not exclusively in civil wars) is often meant as violence against the society rather than against large numbers of individuals. Tactics of ethnic cleansing or genocide are most effective when they target the social resilience or fragility of a society, and social bonds may be destroyed through deliberate traumatization of civilians or prisoners (often through sexual abuse or humiliation). Internecine conflicts shift identity patterns, and those in the out-group are targeted so that not only may many be killed, but to deny such a group the ability to return and rebuild once the conflict ends. One must therefore take account of the nature of the conflict in determining vulnerability, for those which exhibit a sense of territorial 'purity' in claims are far more likely to resort to resilience targeting than traditional, interstate strategic conflicts<sup>23</sup>.

Environmental health consequences of violent conflict are complex, but analysis of vulnerable populations is crucial to proper reconstruction efforts<sup>11</sup>. Within such analyses one must continue to approach the environment as an integral factor, rather than an external force that can be controlled while the population is insulated from its effects. Although health may only be one outcome of the environment – development relationship, it is a key factor to understanding how vulnerabilities shift and influence the course of future development and reconstruction<sup>2</sup>.

### **Israel/Palestinian authority**

In the case of the Israeli–Palestinian conflict, over three million Palestinians living in the occupied Palestinian territories (oPt) are severed from economic and social systems that are integral to enhanced quality of life and resiliency. Palestinians have less access to water and other environmental resources than their Israeli neighbours. Water systems in Gaza lose about 50% of their water supply because of damaged pipes, and the Israeli government often restricts access to water as punishment<sup>24</sup>. The lack of access to water not only results in inadequate safe water consumption, but also poor hygiene and sanitation. Food insecurity in the Palestinian territories, exacerbated by the presence of the Wall, leaves the population more vulnerable to disease<sup>25</sup>. Because of the cycle of food-insecurity, those who are ill become food

insecure, and those who are food insecure are more likely to get ill, unable to work and more susceptible to other environmental factors which may negatively impact their health. These impacts have been felt unilaterally. The Israeli economy has slowly reduced its dependency on its agricultural economy and has increased new technology for efficient irrigation techniques to combat problems of water shortages<sup>26</sup>. These advantages have not been experienced by Palestinians and therefore expose them to an environment that leads to lower health determinants.

The Israeli targeting of Palestinian agriculture and livelihoods has turned the environment into a sort of political weapon. According to the Palestinian Ministry of Environment in Gaza, the Israeli military has bulldozed over 24,000 m<sup>2</sup> of land and uprooted over 4000 olive and orange trees<sup>27</sup>. Many Palestinian livelihoods, especially rural ones, depend on agriculture for economic support; an erosion of this support system creates a vulnerability to other effects of the conflict. In addition to explicit physical attacks on land, curfews and checkpoints make it difficult for Palestinians to harvest and sell crops in markets. Economic independence is decreased resulting in less access to health services due to financial barriers.

Increasing amounts of land have also been rendered unusable by landmines. The Israeli government has identified 16 landmine fields in the occupied territories<sup>28</sup>. At least 2,500 children in the oPt have died because of landmines since 1967<sup>29</sup>. Landmines are a destructive environmental consequence of conflict. Despite international efforts to reduce their use, employment of these weapons continues. Measures to clear minefields are slow and they pose a serious threat in 75 countries worldwide. The effects of landmines are felt long after the end of a conflict, and not merely through direct exposure. Research has also found that water-soluble chemicals contained in landmines often leak into surrounding fields, affecting soil and crop viability<sup>30</sup>.

### **Sri Lanka**

The island nation of Sri Lanka has been embroiled in a violent civil war for over 20 years. Although violence has waxed and waned during this period, a recommencement of violence in the last couple of years has displaced over 300,000 people within the country and sent 20,000 refugees to India<sup>31</sup>. According to the Internal Displacement Monitoring Center (IDMC), more than half a million people were displaced before the 2006 violence and due to the tsunami in December 2004. These numbers only include those registered as IDPs and not the thousands that are unregistered and therefore unable to qualify for official assistance.

These influxes of IDPs have strained health and sanitation facilities putting the well-being of thousands of IDPs in danger. Food resources are

also affected for those in IDP camps and for host communities<sup>32</sup>. Health facilities in the north and east have been intentionally targeted by fighting forces and both the Liberation Tigers of Tamil Eelam (LTTE) and Government forces have deliberately blocked access by relief groups. Lack of information about the region (due to this isolation) conceals the magnitude of the situation faced by vulnerable groups in these areas. In some conflict-affected districts, only 30% of the population has access to latrines, clean water and sanitation<sup>32</sup>. Situations of inadequate water and sanitation seriously jeopardizes community health, particularly that of children.

Unlike Aceh, Indonesia, the tsunami did not lead to de-escalation in armed conflict within the island. The civil war has hampered tsunami recovery efforts in the north and east compounding the difficulties these communities face. Specific numbers are hard to site as the most seriously affected areas are cut off from relief efforts. There are reports, however, that Tamil-associated groups have had greater difficulty in obtaining reconstruction funds, and that certain livelihoods (such as fishing) have been destroyed in favour of more centrally or foreign-controlled tourist industries.

The environmental consequences of war are evident in Sri Lanka. An estimated 99 km<sup>2</sup> of land is contaminated by explosive remnants of war (ERW) and 730 villages are contaminated by landmines<sup>33</sup>. Landmines are indiscriminate by nature, posing threats to military personnel and civilians. In a study by Meade and Mirocha in Sri Lanka, higher incidences of landmine injuries are associated with agriculture and returning home after displacement due to the country's protracted civil war<sup>33</sup>. Landmines disproportionately target civilians, particularly since they kill and maim people years after conflict has ceased. Civilians injured and killed by landmines are in poorer socio-economic brackets as they are more likely to be involved in manual labour<sup>19</sup>. For years after the end of a conflict, populations will have limited mobility and access to land which may have been previously vital to their well-being. The risks associated with landmines are not only the result of physical injury. Victims also often suffer from post-traumatic stress disorder, depression, and anxiety<sup>20</sup>.

## Conclusions

Policies to address environmental health vulnerability can be taken either before or after events occur, but co-ordinated assessments and responses preferably take into account both ex-ante and post-facto conditions. Vulnerability assessments can provide both a baseline for data and warning of potential areas for necessary mitigation, but not merely for better coordination of disaster response. Rather, foreign and development policies must take greater note of the risks associated with vulnerable populations, and provide greater capacity for reducing vulnerability in advance of either disasters or conflicts<sup>35,36</sup>. Failure to focus on capacity-building and conflict

prevention, particularly in fragile societies, may result in situations where even the most capable and well-executed response cannot restore an acceptable level of human or state security.

Efforts are already underway to identify vulnerable populations from disaster, but this is incomplete without a larger political analysis of the associated security conditions. Whether it is the response to the 2008 Cyclone Nargis in Myanmar/Burma, or the continued cycle of violence and environmental disaster in Sudan and Chad, effective response requires political awareness and involvement prior to adverse events occurring. The public health community must not only engage with the political experts and policymakers, but broaden analyses and training to include consideration of those factors that lead to vulnerability and insecurity.

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Moneeza Walji previously worked in Ethiopia on Gender-Based Violence and Female Genital Mutilation (FGM) before enrolling in the Forced Migration MPH programme at Columbia University. She has recently helped complete a survey in the occupied Palestinian territories concerning how the Barrier and checkpoints have influenced refugee access to health care. She is equally interested in how the intersection between health and politics continues to influence this conflict.

Lucy Anderson is a graduate student at Columbia University's Mailman School of Public Health. Her focus is Forced Migration and Health, particularly issues affecting women and children. After completing her undergraduate degree at the University of California at Berkeley, she worked at Direct Relief International in Santa Barbara, California.

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