Resource Scarcity and the Prevention of Violent Conflicts

Renée Gendron and Evan Hoffman

Abstract

This article argues that resource scarcity creates multiple impacts on conflicts. It can increase the chances that a nonviolent conflict will become violent and it can re-trigger violence in a previously resolved conflict. Thus, the authors argue that resource scarcity plays an important role in both the monitoring of and response to situations where violent conflict is to be prevented. In terms of monitoring, resource scarcity can be used as an indicator to help provide warnings that a nonviolent conflict is likely to become violent. In terms of responses, dual policies aimed at fair and equitable resource sharing plus managing resources in a manner that helps alleviate poverty may be the most effective for preventing the outbreak of violent conflict. In the case of preventing new violence in a previously-resolved conflict, peace agreements should address resource management issues by building mechanisms for this into the agreement.

Introduction

Increasingly, it seems that many analysts within the peacebuilding field predict that future violent conflicts will likely take the form of resource wars – which can be understood as those conflicts which are primarily waged over access to scarce resources such as rare minerals, water, or oil. The underlying reasoning behind this assumption is that, "as the global population continues to rise, and the demand for resources continues to grow, there is significant potential for conflicts over natural resources to intensify" (UNEP, 2009). The proponents of this view argue that resource scarcity may be an underlying cause of violence as it serves as an indication of poor social capital. The inability of existing social resources to develop, maintain, and implement innovative techniques and solutions to resource scarcity indicates weak overall social capital, translating into weak state institutions. While grievances and motivations for war are unique to every violent conflict, weak state institutions serve as a good indicator of potential for violent conflict.

A reasonable argument has also been made that resource abundance, and not resource scarcity, has been a cause of violent conflict. The more plentiful a resource, the more competition there will be for access and control over a particular resource. More precisely, the argument is as follows: the higher the economic return, the more competition, the higher the likelihood of a violent conflict. The more plentiful a resource, the more competition there will be for access and control over a particular resource. A reasonable argument has also been made that resource scarcity creates multiple impacts on conflicts. It can increase the chances that a nonviolent conflict will become violent and it can re-trigger violence in a previously resolved conflict. Thus, the authors argue that resource scarcity plays an important role in both the monitoring of and response to situations where violent conflict is to be prevented. In terms of monitoring, resource scarcity can be used as an indicator to help provide warnings that a nonviolent conflict is likely to become violent. In terms of responses, dual policies aimed at fair and equitable resource sharing plus managing resources in a manner that helps alleviate poverty may be the most effective for preventing the outbreak of violent conflict. In the case of preventing new violence in a previously-resolved conflict, peace agreements should address resource management issues by building mechanisms for this into the agreement.

In the past decades, natural resources have attracted considerable attention as a source of conflict. Depending on the respective theoretical premises, some scholars have argued that scarcity of renewable natural resources inevitably leads to violence in countries of the global South. Others have tried to show that it is not scarcity, but abundance of natural resources which creates problems (Krummenacher, 2008).

Interestingly, this same report found that, "neither the scarcity of land or water nor the abundance of oil or gas drives a society straight down the road to violent conflict. Resources like water and land or environmental damage can be important ingredients in a complex blend of political, cultural, and economical factors that eventually breed violent conflict (Krummenacher, 2008). This report then goes on to state that,

the institutional settings of the societies concerned, the structure and type of political authority, as well as global mechanisms at play and the historical context are just as important as, if not more, the actual availability of land or water in both explaining and resolving conflicts (Krummenacher, 2008).

In sum, either resource scarcity or resource abundance may play an enabling role in the potential outbreak of violent conflict, depending on the particular historical and contextual circumstances of the situation. A much more robust definition of resource wars than the one previously provided would thus consider them to be those violent conflicts in which access to and control of either scarce or abundant resources is of particular importance.

While resource wars are not necessarily a new phenomena and there are many historical examples of these wars, such as the various civil wars waged in Africa in which diamonds or oil played a significant role and the US-led invasion of Iraq in 2003, there currently appears to be much evidence to support the conclusion that these types of conflicts are more likely to emerge in the coming years (2009, Part II, Chapter 18). Indeed, the fact that the resource constraints may lead to violent conflict is one of the oldest ideas in research on conflict and peace (Crooker et al, 2007, chapter 11). Likewise, a 2005 Organisation for Economic Co-Operation and Development Issues Brief suggested that conflicts and violence over access to water will likely increase in the coming years unless water management and water governance are taken seriously (Organisation for Economic Cooperation and Development [OECD], 2005). Historically, inter-state wars have not been fought over access to water (OECD, 2005). Local tensions, local violence and increased regional tensions can and do occur over water issues however (OECD, 2005). These
tensions will likely continue to increase because, “competition for water exists at all levels and is forecast to increase with demands for water in almost all countries. In 2030, 47% of world population will be living in areas of high water stress” (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2009).

Moreover, there are many institutions which are forecasting increased competition over access to energy resources. The competition may be non-violent or it may lead to increased tensions and subsequently increased localized violence. The Heritage Foundation held a panel discussion on oil producing states and The Coming Energy Wars: A 21st Century Time Bomb? in July 2005. The panelists agreed that those states which were most dependent on oil for generating revenue were most affected by terrorism and internal violence. Two states in particular, Iran and Saudi Arabia, not only face internal domestic violence issues, the governments are also supporters of terrorism and violence abroad (The Heritage Foundation, 2005). Another example in which demand for a natural resource fuels internal violence is due to China's increasing purchases of Sudanese oil. China purchases most of Sudan’s oil output. The British Broadcasting Corporation has alleged that China also assists Sudan militarily, through the supply of munitions, equipment and training, in efforts to maintain cordial relations with a key strategic resource supplier (Andersson, 2006). The demand for energy from BRIC countries (Brazil, Russia, India, and China) increases, the vying for control over energy and raw resources is predicted to increase.

Another example of the growing potential for an increase of resource wars stems from the case of Central Asia. Central Asia is witnessing the resurgence of a Second Great Game, in which competing world powers vie for control and access to natural gas, oil and mineral resources. Kleverman (2003) argues that Central Asia will see increasing violence as world powers seek to maximize their advantage in the region. The situation in Central Asia is also closely related to bloody conflicts in the Caucasus. Most of the conflicts in the Caucasus are separatist in nature: Nagorno-Karabakh, Chechnya, South Ossetia, Abkazia and Javakheti. The conflicts are complicated by the oil-rich Caspian Sea and pipeline routes. The significant, largely unexploited energy reserves of the Caspian, have drawn the attention of the United States, the European Union, Russia, Iran and increasingly China. As each power seeks access to energy resources, the separatist conflicts are exacerbated by outside influence and pressure (The Economist, October 16, 2008).

Moreover, several resource wars are currently being waged in the Sudan and Nigeria. One such resource war has been called “the deadliest conflict since World War II” in a recently-released report from the Enough Project (2009). The Enough Project sounded the alarm over the conflict in the Democratic Republic of the Congo because:

[...], while eastern Congo is a complex crisis—fueled by tensions over land, rights, identity, regional power struggles, and the fundamental weaknesses of Congo as a state—the trade in conflict minerals remains one of the key drivers of the conflict. The same armed groups that reap enormous profits from the mineral trade in eastern Congo regularly commit conscience-shocking atrocities as they jockey to control the region’s most valuable mines, transportation routes and opportunities to impose extortion “taxes” on those involved in this trade (Enough Project, 2009).

If the prediction that resource wars are likely to become more common in the future is correct, then steps should be taken now to prevent these conflicts from erupting in the first place. The question, however, is what steps can be taken now by the peacebuilding community to help prevent these types of conflicts from erupting in the first place, and if they do occur what can be done in the post-conflict phase to help prevent their reoccurrence? This article will explore the intersection between resource scarcity and the prevention of violent conflicts.

**Conflict Prevention and Peacebuilding**

The term “peacebuilding” originates from Johan Galtung's work “Three Approaches to Peace: Peacekeeping, Peacemaking, and Peacebuilding” (Galtung, 1970). According to Galtung’s definition, peacebuilding is the creation and strengthening of institutions and structures which not only remove or significantly diminish the causes of war but create circumstances in which peace is the most likely result.

We borrow the definition of peacebuilding from the John Hopkins University School for Advanced International Studies (SAIS) whereby peacebuilding is defined as: “a process that facilitates the establishment of durable peace and tries to prevent the recurrence of violence by addressing root causes and effects of conflict through reconciliation, institution building and political as well as economic transformation.” (John Hopkins University School for Advanced International Studies [SAIS], website).

Within this wide definition of peacebuilding, conflict prevention can thus be considered to be a component of peacebuilding inasmuch as it constitutes those activities taken to prevent a conflict from becoming violent or those actions taken after a violent conflict has occurred which are aimed at preventing the reoccurrence of another violent conflict. In other words, to work towards the prevention of violent conflicts is to build peace.

Defined in this manner, conflict prevention activities are clearly placed at the beginning of a conflict before it has turned violent or at the end of a violent conflict as illustrated below in Figure 1 [3].

![FIGURE 1](image)

<table>
<thead>
<tr>
<th>STAGE OF THE CONFLICT</th>
<th>Pre-violent Conflict</th>
<th>Violent Conflict Occurs</th>
<th>Post-violent Conflict</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIM AND TYPE OF</td>
<td>Conflict Prevention</td>
<td>--</td>
<td>Conflict Prevention</td>
</tr>
<tr>
<td>CORRESPONDING</td>
<td>Activities Aimed at</td>
<td></td>
<td>Activities Aimed at</td>
</tr>
<tr>
<td>CONFLICT PREVENTION</td>
<td>Preventing the Outbreak</td>
<td></td>
<td>Preventing the</td>
</tr>
<tr>
<td>ACTIVITIES</td>
<td>of Violent Conflict</td>
<td></td>
<td>Reoccurrence of Violent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Conflict</td>
</tr>
</tbody>
</table>

Peace and Conflict Review · Volume 4 Issue 1 · Year 2009 · Page 2
It is important to note that conflict prevention, defined in this manner, thus has two main parts. First, there must be some type of awareness or warning that a nonviolent conflict will likely become violent. Secondly, this warning must be followed by specific activities aimed at preventing this from happening. Thus, conflict prevention is comprised of both warning and response.\[4\]

Much work has been done on the warning aspect of conflict prevention. For example, entire early warning systems, sometimes based on very complex methodologies, have been constructed in the past and scholars have now defined multiple generations of these systems. The most recent type of early warning system is defined as being fourth generation (4G) which can be understood as a system of people centered information gathering and solution creation (Public Entity Risk Institute, 2006). Fourth generation systems rely heavily on crowdsourcing, in which local actors input their observations into a common platform which is then accessed by other residents and non-residents. Local and international resources are mobilized according to risk and situation.

Currently there are several operational 4G systems. The Humanitarian Early Warning System (HEWSweb) at the World Food Programme tracks the development and progression of floods, storms, volcanic activity and other natural hazards in almost real-time. This facilitates the transmission of weather related information to participants so that they may reposition or relocate resources to handle damage to infrastructure or crops (Humanitarian Early Warning Service, World Food Programme). This helps residents and field workers link environmental hazards to human security needs, and indirectly contributes to peacebuilding, as it reduces stresses on weakened human security infrastructure.

Another 4G system is “Ushahidi”, which means “testimony” in Swahili. It too uses crowdsourcing mechanisms. Anyone can participate in the platform, either by text message, email or directly inputting the information via the website. It is currently being used to monitor the Indian elections and the progression of swine flu (Ushahidi, website). Elections are often events which draw sharp public criticism. If state institutions are weak, there is a greater likelihood of political violence. In situations in which there is an epidemic, members of the public may try to forcibly gain access to medical centres, grocery stores and be in a state of general unrest. Ushahidi facilitates the transmission of information in efforts to monitor for potential sources of conflict. This then encourages the active participation of on the ground resources to reconcile a dispute before it becomes violent or escalates to a point where it is no longer manageable by local officials, representatives or conflict resolution practitioners.

While the above examples of various 4G early warning systems are important to consider in terms of the different ways that these systems can actually be constructed and the different focus of their monitoring activities, ranging from the collection and analysis of crowdsourced election-related information submitted via SMS text messages to the monitoring of floods and droughts, it is also important to consider in much more specific terms how resource scarcity itself can actually be monitored.

The Country Indicators for Foreign Policy (CIFP) project based at Carleton University, Ottawa provides a practical example of how to monitor resource scarcity. This project has several objectives, the first of which is to develop “…a number of wide-ranging tools that encompass, among other things, the monitoring, forecasting, and evaluation of failed and fragile states, as well as the assessment of supporting policies intended to address the development, security, and economic challenges they represent” (Country Indicators for Foreign Policy [CIFP], Carleton University). To this end, the CIFP undertakes conflict risk assessments and as part of their efforts to construct these risk assessments, they examine a number of indicators that are used to measure environmental stress.\[5\]

The three indicators of environmental stress that the CIFP uses are as follows: 1) Rate of Deforestation, 2) People per square kilometre of Arable Land, and 3) Freshwater Resources (cubic meters per capita) (CIFP, no date, p. 18-19). Data for measuring each of these three indicators is derived from various existing sources and for each indicator the CIFP Project has developed a scale from 1 to 9 in order to quantify the measurements (CIFP, no date, p. 18-19). For example, with the Rate of Deforestation variable, one (1) would indicate “low deforestation” and nine (9) is “high deforestation” (CIFP, no date, p. 18-19). In sum, it is possible to accurately quantify and then monitor different indicators related to environmental stress and, more specifically, resource scarcity in order to assess the role that this and several other factors might play in the possible outbreak of violent conflict. The risk assessment generated during this analysis would then be used to issue a warning that new violent conflict is likely to occur.

The response aspect of conflict prevention has also been well-defined and numerous tools which can be utilized to help prevent violent conflicts from emerging from those which are nonviolent have been developed. Some examples of these tools include fact-finding missions, economic sanctions, inter-group dialogue, and security sector reform (Eds. Bercovitch, Kremenyuk and Zartman, 2009, p. 292; Carment, 2003, 419-420)

Having established the definitions of peacebuilding and conflict prevention, we can now examine the role of resource scarcity on the task of preventing violent conflicts.

**Resource Scarcity**

Resource scarcity can be defined according to three principals. The first is basic human security. A resource is deemed scarce within a specific location if the human population cannot meet its basic dietary requirements. This is known as the minimalist approach, the absolute minimum of resources required to sustain human life. A second interpretation can be defined as current resource availability to meet rising or projected increased demand. A resource in this scenario is considered scarce if there are insufficient resources to meet projected demands. The maximalist approach considers both human and non-human demands on a particular resource (Matthew, 2008)

Resource scarcity can further be conceptualized as one of three structural issues: 1) supply induced scarcity, in which environmental degradation occurs; 2) demand induced scarcity in which there is increased consumption of a commodity; or 3) a structural scarcity in which infrastructure and distribution mechanisms unevenly redistribute the resource in question (Kameri-Mbote, 2004, slide 4).
Resource scarcity, it should be noted, is not the same as environmental degradation. That is, "resource scarcity can occur without environmental degradation, simply because a nonrenewable source runs dry or demand exceeds what a renewable source can supply. In the event of environmental degradation-usually conceived as a man-made disturbance of the ecosystem-the supply of the resource will become insufficient more quickly(Crooker et al, 2007, p. 179). Defined in this way, what role might resource scarcity have on the two distinct types of conflict prevention situations described earlier?

Resource scarcity during the pre-violent conflict stage

Resource scarcity can play a role in both types of conflict prevention situations which were discussed earlier. In the first case, resource scarcity can exacerbate a conflict thus increasing the likelihood that it might become violent. For example, it has been found that natural resources play role in at 40 percent of all [violent] intrastate conflicts (United Nations Environment Program [UNEP], 2009) his fact creates important implications for both conflict prevention warning and response.

Resource scarcity is an important factor to consider in both conflict prevention warning and response. In terms of warning, resource scarcity can be used as an indicator, that when combined with other indicators, might help to predict the occurrence of violent conflict. In terms of response, for those conflicts where resource scarcity is a potential cause of violence, responses which address this cause of the conflict may help to avert the outbreak of violent conflict. Both of these situations are more fully described below.

Resource scarcity may serve as an important warning indicator that violent conflict may erupt from a nonviolent conflict. There are limitations, however, with using this as an indicator. Le Billon, for example, notes that, the term of resource war often implies an exclusive analytical focus on resources, and asserts a direct link between conflicts and resources. Such narrow engagement overlooks the multidimensionality of conflicts and resources(Bercovitch et al., 2009, Part II, Chapter 2). In other words, this factor alone may not be predictive of whether violent conflict will erupt or not.

Furthermore, Le Billon states that, “the mere presence of resources should also not be simply understood for the current or future stakes that they represent. Rather, the influence of a resource in conflicts needs to be understood in historical terms” (Bercovitch et al, 2009, Part II, Chapter 2). Hence, we can conclude that any conflict prevention warning system that uses resources as an indicator should place a strong emphasis on the analysis of what this indicator means in the context of this particular conflict at this particular time as well as provide longitudinal data to track historical changes of resource use.

Addressing resource scarcity may also play an important role in the response aspect of preventing violence in conflicts. For example, Lund lists several conflict prevention tools and one of the hands on” targeted structural actions (which are those that address basic societal, institutional and policy factors affecting conflict and peace) that he lists is natural resource management (Bercovitch et al., 2009, Part III, Chapter 1)

What exactly is meant by natural resource management and what types of management may contribute to the prevention of violent conflicts? We posit here that there are two distinct types of natural resource management policies and mechanisms that may make a meaningful contribution to the prevention of violent conflicts: 1) those that divide resources in a fair and equitable way between those parties that desire said resources (i.e. resource sharing), and 2) those that manage natural resources in such a manner that they will alleviate poverty.

There are several situations in which an abundance of resources is likely to trigger violent conflict. Much of the violence in the Democratic Republic of Congo, especially the Kivu's, can be attributed to the perceived need to control Kivu's resources. The conflicts in Sierra Leone and Angola were prolonged as many of the parties to the conflicts vied for control over diamond mines. The violence in Nigeria is in part attributable to the abundance of petroleum reserves and the competition between groups for access to oil rents. The separatist conflict in Katanga, Republic of Congo can also be partly attributed to the discovery of significant copper, gold and uranium deposits. It must also be taken into consideration that the type of abundant resource can have an impact on the method of fighting. An easily lootable resource, such as diamonds, tends to create situations in which warlords emerge to oppose government forces. Warlords are most likely to arise to power in regions with easily lootable resources and that are away from the centre or seat of government power (Tschorig, 2004, pp. 378-80) which require extensive extraction and transportation practices, tend to spark separatist conflicts.

Conversely, in situations in which there is resource scarcity, the trigger to violent conflict is not necessarily the scarcity of the resource rather the lack of social capital to use that resource more wisely and effectively, Tamas argues that researchers and early warning systems must distinguish between the causes of the scarcity and whether it is a perceived scarcity, or an actual scarcity of a resource. There are situations in which there is intentional reduction of access to a particular commodity, be it a resource, a political deliverable, or a social resource (Tamas, 2001-2003, p. 11)

This provides monitors, researchers, aid agencies and governments with insights as to kinds of indicators necessary for early warning systems. The types of resources available in a given region need to be considered as well as the availability of specific kind of social capital. The knowledge and skills required to further develop a particular resource in an appropriate manner need to be taken into account. If there is water scarcity in a given locale but sufficient human capital to use that resource in an innovative way, and distribute that resource along broadly equitable lines, then the likelihood of violent conflict is reduced. The intersections of political, social, economic and ethnic competition for possession and exploitation of particular resource, to the exclusion of everyone else, significantly increases the likelihood of violent conflict. Weak social capital also tends to be an indication of high poverty levels, as there is little skill diversification. Again, poverty in and of itself does not cause violent conflict. The perceived inequality of distribution of social goods and economic goods, can in some situations, serve as class mobilizers or ethno-class mobilizers, which may contribute to the formation of violent conflict.

The reasoning here is simple. In the first case, violent conflict over access to and control of natural resources will not likely occur because those parties that would likely wage the conflict no longer have a valid reason for doing so. In the second case, the reasoning is that if the parties are wealthy they will not wage violent conflict and this notion is based on the findings of one recent study which argues that:
the most robust finding on the causes of war by researchers is that the higher the per capita income a country enjoys, the lower its risk of armed conflict. This is why most wars take place in very poor countries. The evidence for this war-poverty association is overwhelming (Human Security Report Project, 2007, p. 6).

What examples, if any, are there of these two types of natural resource management policies effectively being used to help reduce the outbreak of violent conflict? Four examples are presented here.

One example stems from the case of Haiti:

For years, severe environmental problems have been among the roots of Haiti’s social, economic and even political crises. Following the devastating floods of May and September 2004, which killed approximately 3,000, Crisis Group warned that the ecological disaster was a “time bomb” that needed to be addressed to prevent new instability. Subsequent governments have not had sufficient commitment and strength to tackle the situation comprehensively. Consequently, Haiti in 2009 risks further economic decline and possible political destabilization, compounded by the impact of the global financial crisis (International Crisis Group, Briefing No. 20, 2009).

Consequently, the same report argues that, “beginning to halt the depletion of the natural environment and factoring the social and economic consequences into national policy must be an integral part of the strategy to prevent new instability” (International Crisis Group, Briefing No. 20, 2009).

Another example arises from the experience of the Green Belt Movement, throughout Africa. The Green Belt Movement started in 1977 by planting seven trees on World Environment Day. The Green Belt Movement identified rural African women as being some of the most vulnerable populations of resource depletion. As these women were extremely dependent on water and forest resources for their basic survival, the Green Belt Movement taught simple environmental stewardship techniques to rural African women:

The experience of the Green Belt Movement underscores the link between the environment, development, democracy, and peace. A country cannot develop where there is no peace; peace, in turn, will not prevail if resources are mismanaged or put in the hands of a few at the expense of many. Finally, sustainable development and peace can only be ensured if citizens participate in protecting and restoring their environment and demanding a place at the decision-making table. Understanding these indivisible links is critical to promoting sustainable development. [...] The goal of the partnership is to promote economic development and alleviate poverty through conservation programs in the region, improve local governance through natural resource conservation, and enhance resource management through control of illegal logging and wildlife poaching (Hagthaï, 2008, p. 27).

The third example stems from the case of the Nile Basin:

The Nile Basin is an unlikely example of conflict prevention. Many of the countries in the volatile region are beset by high levels of civil conflict, and their widespread dependence on the Nile’s waters have led many to flag this river basin as the most likely to experience international water wars. For the past nine years, the basin’s riparian states—Burundi, the Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda—have convened the ministerial-level Nile Basin Initiative (NBI) to develop a shared vision of sustainable use of those waters. The initiative centers around eight “Shared Vision” projects—including the Regional Power Trade, Water Resources Management, and Efficient Water Use for Agriculture projects—meant to foster trust and encourage investment. While formally framed as a development enterprise, these efforts also implicitly serve as a means to prevent conflict predicated on environmental interdependence. However, the NBI process is not without its critics, and issues of transparency and wider stakeholder participation remain concerns (Dabelko, 2008).

The fourth and final example is based on Lake Tanganyika:

The multi-country Lake Tanganyika project was designed in the early 1990s as one of the first GEF projects. The East African lake is the second deepest lake in the world, with globally significant biological diversity. [...] Of additional significance is that since the end of 1999, the Lake Tanganyika region governments were discussing the fourth draft of an international treaty (entitled, ‘The Convention on the Sustainable Management of Lake Tanganyika’) to affirm their political support for the restoration and protection of the Lake Tanganyika ecosystem. The draft convention would establish a Lake Tanganyika Authority consisting of a joint Management Committee and a Secretariat to assist the nations in operationalizing sustainable management of the lake, in conserving its biological resources and in reversing degradation of the catchment area draining to the lake (Uitto and Duda, 2003, p. 369).

In sum, resources have played a role in the trajectory of many different conflicts around the world. The four cases above also illustrate that an equally diverse number of resource management policies have been utilized. Despite the wide variance in the specific details of these policies, they all appear to be centred on two common themes: 1) sharing or dividing resources in an equitable manner, and 2) utilizing resources in a way that aims to build broad-based wealth.

**Monitoring of Resource Scarcity**

In a previous section, it was argued that resource scarcity in addition to weak social and human capital, collectively contribute to an increased likelihood of violent conflict. In efforts to monitor these conditions, there are several variables which are situation-specific which need to be taken into account. The first set of variables pertain to the resources themselves. Which...
Resources are physically available on location and what is the nature of the resource. The available or scarcity of resources can be measured according to use or need on a per capita basis, the amount of people per square kilometre and size of mineral or oil deposits, as measured in cubic meters or tons. The size of a mineral or oil find is important as it serves as an estimate of current or future worth of a resource. The larger the finds which remain to be economically exploited, the more likely a group will want to control the resource. If a particular mineral deposit or oil find is small, and requires intensive development, there may be less interest from groups in controlling it.

As argued in the first section, the type of resource has a direct impact on the type of violence, should a situation escalate to violence. Easily lootable resources tend to create circumstances in which warlords emerge and resources which require significant capital to exploit, such as the building of large mines or pipelines, tend to generate separatist conflicts. A second series of variables pertain to social capital and social composition of specific region. These variables include the quality of relations between ethnic groups, diversity of skills, power relations between genders, classes, ethnic groups, and other social categories, as well as social infrastructure, meaning the degree to which the people living within a particular region feel as though they are one group. This may also be called social cohesion.

Tamas presented several types of resource scarcity Early Warning Models. Four models of early warning were identified (Tamas, 2001-2003, p. 11). They are:

1. Correlation Model such as the Minorities at Risk
2. Sequential Models which follow a particular series of events which increase or decrease the likelihood of violent conflicts.
3. Conjunctual Models which identify alternative scenarios. The purpose of these models, according to Tamas, is to focus on how a conflict can intensify.
4. Response Models, which according to Tamas, intend to anticipate responses and identify ways of strategic intervention.

In terms of monitoring tools, UN Water has a set of key indicators used to determine access to water, water scarcity and sustainable development of water resources. While this model was not designed for the express purposes of monitoring water resources for the prevention of violent conflict, this model may serve as a good basis to further develop such a model. The UN Water indicators are divided into three categories: i) context, ii) performance, iii) governance. Each of these categories is further specified for purposes of monitoring. In the “Context” category, the following indicators are monitored (UN Water, website):

1. Total actual renewable water resource
2. Storage capacity
3. Importance of national expenditure for water supply and sanitation

In the “Function” category of this index, the following sub categories are monitored:

1. Intensity of use
2. Relative importance of water to other sectors
3. Change of inland fish production (which takes into consideration aquaculture)

In the “Performance” section, UN Water monitors the following variables:

1. Percentage of population using improved drinking water
2. Percentage of population using improved sanitation facilities
3. Change in water productivity in agriculture
4. Change in water productivity in industrial sector
5. Change in hydropower productivity
6. Change in the quality of aquifers
7. Waste water treatment
8. Trends in freshwater species

Resource scarcity during the post-violent conflict stage

Resource scarcity is not only a relevant concern before a conflict has turned violent, but it is also a consideration for preventive work which takes place after a violent conflict has already occurred. That is, if this factor was a major cause of the violent conflict in the first place, then it must be adequately addressed in order to minimize the chances that it may play a role in the re-eruption of further violent conflict.

This is an important consideration as it has been found that, “intrastate conflicts that are associated with natural resources are twice as likely to relapse into conflict in the first five years” (UNEP, 2009, p. 8). Moreover, less than a quarter of peace negotiations aiming to resolve conflicts linked to natural resources address resource management mechanisms (UNEP, 2009, p. 30). Clearly, natural resources should be managed in order to help prevent the reoccurrence of future violent conflicts in cases where this was a factor in the outbreak of the violent conflict, and one of the simplest steps to take towards this end would be to build resource management mechanisms into the peace agreement.

However, to further appreciate the task of preventing the recurrence of violent conflict when resource scarcity is a concern, it is necessary to consider how the conflict itself contributed to the scarcity of resources and environmental degradation in the first place. For example, a growing body of research indicates that conflicts in and of themselves contribute to environmental degradation, for reasons indirectly related to the fighting. One way in which this occurs is that the displacement of internationally displaced people and refugees puts additional strains on local environmental resources and infrastructure.

In 2005, Tanzania was home to the world's fourth largest refugee population. Tanzania has hosted refugees for several
decades, particularly Burundi and Congolese refugees. It was noted in a 2008 United Nations High Commission for Refugees report, that deforestation and significant degradation of forest resources, had been consistently reported in Western Tanzania, where most of the refugees were located. The additional population coupled with lack of basic human infrastructure worsened environmental conditions. An increase in forest fires, water scarcity and illegal harvesting was reported in four villages, though not all environmentally harmful activities were attributed to the refugees (Berry, 2008, p. 7)

The situation in Guinea is equally concerning. Guinea has hosted thousands of refugees fleeing the conflicts in Sierra Leone and Liberia for nearly two decades. Refugees have located in both urban and rural areas. As a direct consequence of hosting so many refugees, local customs around land use have been modified. Land is lying fallow for far shorter periods of time, leading to soil depletion. The significantly higher demand for arable land has led to an increase in deforestation and a diminution of water resources. This has been coupled with a loss of biodiversity due to loss of habitat (UNEP, 2000, pp. 10-12)

Thus, the environmental consequences of war should not be thought of as being location-specific – of where the bombs drop. Rather, the environmental consequences of violent conflict should be thought of in horizontal terms, following those fleeing the carnage and violence. Moreover, the social aspects of conflict, human security concerns, and the potential for flash points of violence, should also be considered along a horizontal axis – following the internally displaced and the refugees. Significant influxes of populations, particularly into socio-economic conditions with weak human security infrastructure, places additional hazards and risks onto the local populations. How the conflict impacts their human security, well being, and environment should also be taken into consideration when fully assessing the consequences of a conflict.

The above discussion has illustrated that conflict can contribute to resource scarcity and environmental degradation, and thus any efforts to prevent the re-occurrence of violent conflict need to take this past history into consideration. Also, as noted earlier, resource management mechanisms should therefore be built into a peace agreement and there are a few, but not many, examples of this.

For example, Article 26, Section H of the 1996 Peace Agreement between the Republic of Sierra Leone and the Revolutionary United Front of Sierra Leone (RUF/SL) specifically states that monopolies will be prevented from forming in the resource extraction sector. Additionally, Article 26 states that the parties agree to cooperate on general socio-economic improvement for all of Sierra Leone’s citizens.

In another example, a resource distribution mechanism was included in the peace settlement with the separatist movement in the province of Aceh, Indonesia. In this case, the Indonesian government agreed to remit seventy percent (70%) of Aceh’s petroleum revenue to the future generation fund (Aceh then has full control and authority on how to disburse those funds).

A third and final example of building a mechanism for natural resource management into a peace agreement stems from Sudan’s Agreement on Implementation Modalities of the Protocols and Agreements which forms part of the March, 2005 Comprehensive Peace Agreement which is, in turn, a collection of agreements agreed to December 31, 2004 and signed, in a formal ceremony, on January 9, 2005 (United States Institute of Peace, Peace Agreements: Sudan)Most notably, for our present purposes the agreement on wealth sharing is of particular interest. Within this agreement there are a number of activities related to wealth sharing which are listed under the following headings: Land Ownership, Oil Resources, Existing Oil Contracts, Sharing of Oil Revenue, the Sharing of non-Oil Revenue, and so on (United States Institute of Peace, 2004, pp. 43-66). Under the heading of Oil Resources, the agreement calls for consultation and participation of communities in the management of natural resources plus the establishment of a National Petroleum Commission (NPC) which is tasked with the duty of reviewing current relevant legislation in oil sector so as to bring it in line and to comply with the Comprehensive Peace Agreement (United States Institute of Peace, 2004, pp. 44-46). Moreover, under the heading of Sharing of Oil Revenue, the agreement calls for a fairly elaborate sharing system to be established by completing the following steps:

1. Define net revenue from oil.
2. Establish a system to monitor daily production of oil in all Sudan.
3. Reveal to the Sudanese Peoples Liberation Movement (SPLM) production sharing formula between Government of Sudan (GOS) and oil concessions.
4. Agree on a mechanism to monitor Oil Revenue Stabilization Account (ORSA).
6. Agree on the annual benchmark price.
7. Establish a system to calculate and monitor net oil revenue.
8. Transfer of (2%) of producing State share of net oil revenue.
9. Transfer of the GOS share of 50% of net oil revenue.


Monitoring of Resource Scarcity Costs

The costs for monitoring a particular resource depends on several factors, including but not limited to the number of variables which need to be monitored, the method of monitoring, the frequency of data input and whether or not there is local expertise which can be utilized for the purposes of monitoring. Danielsen et al argue that the costs of a bird monitoring project in the United Kingdom would take $40 million USD annually. However, that particular project is undertaken by volunteers who contribute more than 1.6 million hours annually, effectively reducing the costs of monitoring (Danielsen et al, 2009, pp. 35-37). Other monitoring programs, such as the Water Action Volunteers, extensively use local residents for active participation in the monitoring process of local water ways (Water Action Volunteers, 2009)

The examples of volunteer-driven monitoring do focus on one particular resource in a very specific region. While these projects are done in locations with sufficient infrastructure for the communication and tally of results, other methods of combing the collaborative efforts of volunteer activities, community groups and professionals for the targeted micro-grants, targeted
interventions and peace building. As society is composed of many different actors, collaborating with a broader array of local actors, not only for data collection, but also solution implementation, may yield broad, positive and long term impacts. Relative (in)access to one resource may be insufficient to motivate local groups for violent conflicts. Relative (in)access to a local resource, in combination with other factors such as class power or isolation of a social group, may be sufficient in some cases to generate a violent conflict. Designing such a monitoring tool and tailoring it to meet specific local needs may prove beneficial for the monitoring of not only the likelihood of a violent conflict developing but also the charting the development of social capital and social linkages required for more comprehensive sustainable development.

To summarize, resources clearly play an important role in the lasting resolution of violent conflicts which is achieved, in part, by aiming to prevent further violence from erupting. When considering these effects, a broad perspective should be employed. Then, based on this broad perspective, specific preventive actions such as building natural resource management mechanisms into the peace agreements can be identified. The examples above further illustrate that the exact shape and structure of these resource management mechanisms can vary widely.

**Policy Recommendations**

Broadly speaking, the policy recommendations stemming from the above discussion of resource scarcity and the prevention of violent conflict are quite simple: reduce poverty through profitable environmental stewardship and equitable access to resources while continuously monitoring the situation for warnings that violent conflict may become more likely because of resource scarcity. In other words, there is a need to build[Environmental Security](http://www.environmentalsecurity.org), which Gleditsch has defined as, "…the freedom from environmental destruction and resource scarcity" (Crooker, 2007, p. 178).

Similarly, Le Billon states that:

> based on most of the available literature, poverty alleviation is an essential ingredient in reducing conflicts. Doing so in a way that address group-based inequalities is also important, even if debates about linkages with conflicts remains debated. A strong growth rate thus appears as one of the best avenues to avoid conflicts, especially with respect to the long-term security poorest countries. This is where attention should be mostly devoted.

Moreover, in-line with the philosophy guiding the design 4G early warning systems, the monitoring of the situation should be the responsibility of local actors. This consideration becomes especially relevant when the statement made earlier in this paper that resource scarcity, as a conflict warning indicator, needs to be interpreted within the context of that particular conflict and its previous history is factored in. This, of course, being two specific types of information that local actors may be more privy to than their international counterparts.

In more practical terms, however, achieving these three inter-related objectives would likely be difficult to achieve. As with any effort to prevent violent conflict, mobilizing the needed political will in order to seize opportunities for undertaking new preventive activities will likely be a challenge. Thus, for any given conflict that currently has a resource element associated with it, the proper groundwork will need to occur in order to ensure interest in monitoring the conflict is built and funds are secured for undertaking the preventive work. Moreover, even if sufficient funds and interest could be generated, another obstacle to consider stems from the actual process of undertaking poverty reduction through environmental stewardship while working for equitable access to resources. For example, multiple case studies illustrate the difficulty with effectively addressing conflicts with some sort of natural resource dimension and this has been well-documented.

In sum, while the policy recommendations may appear to be simple, their implementation may prove to be much more challenging because of the various obstacles that must be overcome. Nevertheless, despite these challenges to effective prevention we remain optimistic. Accordingly, we share the view of Lawrence Woocher from the United States Institute of Peace who states in a recent report that preventing violent conflict is, indeed, difficult, and the challenges to advancing the prevention agenda are formidable. But they are not insurmountable. Consistent deployment of effective conflict prevention strategies is possible(Woocher, 2009, p. 15).

**Conclusion**

Resource wars have occurred in the past, are occurring now, and will likely continue in the future -- they may even become more frequent in the coming years as the demand for resources spikes while the supply diminishes. Conflicts in which resources play a role present unique challenges and opportunities for those interested in preventing the outbreak of violence in these situations. First of all, the effective prevention of violent conflicts requires that there is some type of warning, and resource scarcity can become an indicator, that when interpreted historically and contextually, can help predict the possible outbreak of violent conflict.

Secondly, resources should be managed in order to help prevent the outbreak of violent conflict and to prevent the reoccurrence of more violence in those conflicts which have been previously resolved. In the first case, dual policies aimed at fair and equitable resource sharing plus managing resources in a manner that alleviates poverty may be most effective for preventing the outbreak of violent conflict. In the second case, violent conflict may be prevented if the peace agreement can address natural resource management by building mechanisms for this into the agreement.

Furthermore, these concepts can be integrated into a specialized warning and response system whereby local actors are primarily responsible for monitoring warning indicators that violent conflict may erupt and then enabled to act should the warning signs tell them that responses are warranted. One recent report concludes that integrating environmental management and natural resources into peacebuilding, therefore, is no longer an option -- it is a security imperative, and based on the discussion presented in this paper on resource scarcity and the prevention of violent conflicts, those charged with this task would be well-advised to give consideration to the environmental and resource factors (UNEP, 2009, p. 6).

**References**
Footnotes


[4] Likewise, Jacob Bercovitch and Richard Jackson define conflict prevention in a similar manner. They state that, ‘conflict prevention is essentially about means and ends: how to identify situations that might become dangerous, violent, and very destructive and how to stop them from becoming so.’ See Jacob Bercovitch and Richard Jackson ‘Conflict Resolution in the Twenty-first Century: Principles, Methods, and Approaches’ (Ann Arbor: The University of Michigan Press, 2009), 89.


University, Victoria where he teaches a course on the prevention of deadly conflict, and an Adjunct Professor with the Graduate Program in Conflict Resolution at Antioch University McGregor. Evan holds a PhD in Political Science from the University of Canterbury (New Zealand). His doctoral thesis focused on the topic of international mediation and the creation of durable peace.