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Environmental impacts and causes of conflict in the Horn of Africa: A review

Negasi Solomon[a,c], Emiru Birhane[a,b], Christopher Gordon[c], Mebrahtu Haile[a], Fatemeh Taheri[d], Hossein Azadi[e,f,*], Jürgen Scheffran[g]

[a] Department of Land Resources Management and Environmental Protection, Mekelle University, Ethiopia
[b] Faculty of Environmental Sciences and Natural Resource Management, Norwegian University of Life Sciences, PO Box 5003, No-1432 Ås, Norway
[c] Institute for Environment and Sanitation Studies, University of Ghana, Ghana
[d] Department of Agricultural Economics, Ghent University, Belgium
[e] Department of Geography, Ghent University, Belgium
[f] Economics and Rural Development, Gembloux Agro-Bio Tech, University of Liège, Belgium
[g] Research Group Climate Change and Security (CLISEC), Institute of Geography, University of Hamburg

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ABSTRACT

The Horn of Africa region stands out amongst the planet's territories that are most volatile and vulnerable to armed violence. Conflicts have greatly affected the region over the past 50 years. The conflicts have disrupted the lives of people as well as the environment in ways that are not fully understood. Although armed conflict has generally had a negative impact on the environment, the environmental impact of conflict within the Horn of Africa has barely been evaluated. Similarly, our understanding that climate variability as well as change could have played a role in increasing or decreasing the impacts of conflicts within the Horn of Africa is insufficient. Therefore, this paper looks at the environmental impacts of conflict in the Horn of Africa since 1970 and also the role of climate variability in increasing or decreasing the impacts of conflict. Scientific publications as well as grey literature were reviewed with the aim to understand the status of past and present conflicts in the Horn of Africa, environmental impacts of conflict and the role of climate variability in decreasing or increasing impacts of conflict. The review demonstrates that conflict has extensive negative impacts on the environment in the Horn of Africa with main causes like grievances, government behaviour and interests, resource scarcity and trans-border conflict as well as internal migration and climate variability. Similarly, climate variability plays a great role in exacerbating the impacts of conflict in the region. However, further research is needed to clearly show the impact of conflict and climate variability on the environment in the Horn of Africa.

1. Introduction

The historical backdrop of Africa as a landmass has always been a hot debate (Aladi, 2002). The Horn of Africa area is a champion among the most temperamental and battle-slanted territories on the planet (Tadesse, 2003). Conflict and instability trends in the Horn of Africa keep on making it a standout among the most unsteady areas on the planet (USAID, 2012; Fulgence, 2015). The civil war in Sudan and clan violence in Somalia are only a part of the on-going conflicts (Guha-Sapir and Ratnayake, 2009).

Africa's remarkable size and diversity make it hard to speculate on conflict and instability, especially in the Horn (USAID, 2012). Each case has its own particular progression, drivers and routes; every group distressed by clashes has its own novel arrangement of adjustments and levels of versatility (Aremu, 2010; USAID, 2012). There is no viable alternative to consider specific and relevant information about each instance of contention and shakiness. The reasons for these contentions are ingrained and occurred over a long period of time (Tadesse, 2003; USAID, 2014).

The perpetual political pressures, wars and conflicts in the region have had a negative effect on economic advancement (Conteh, 1998). The immediate impacts of armed conflict on civilians are surely known and have been broadly chronicled (Ismael, 2007; Sidel and Levy, 2008; Tardanico, 2008; Li and Fang, 2016). The aberrant impacts of armed conflict in the light of the using weapons on a country's property, air and water can moreover have unfriendly, long term and far reaching effects on human populations (Joksimovich, 2000). A few studies have reasoned that armed conflict has been hurtful to biodiversity and creatures due to habitat destruction and fragmentation, over-misuse and corruption of regular assets, and incrementally pollutes land and water (Baral and Heinen, 2005; Eniang et al., 2007; Messina and Delamater, 2006). On the one hand, the environmental impact of

* Corresponding author at: Department of Geography, Ghent University, Belgium.
E-mail address: hossein.azadi@ugent.be (H. Azadi).

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conflict in the Horn of Africa is scarcely evaluated, and on the other hand, our understanding of how climate variability could have played a part in expanding or diminishing the effects of conflicts in the Horn of Africa is not yet notable. This understanding is critical for conflict prediction and management, climate change adaptation as well as biodiversity and ecosystem preservation in the Horn of Africa. Thus, the target of this paper is to review environmental impacts of conflicts in the Horn of Africa and to review the role of climate variability in increasing or decreasing conflicts.

The review paper starts by defining conflict and its general causes followed by its impact on the environmental issues including forest cover, biodiversity and wildlife, soil, water, and air pollution and also discusses different aspects of the environment. The role of climate variability on conflict is summarized independently. The methods used to collect the information to develop the review paper are given in section 5. The resulting effects of conflict on the environment and their cause in the Horn of Africa are presented and discussed in section 6. The paper concludes with reflections in section 7.

1.1. Definition and causes of conflict

The literature review shows that the meaning of conflict has been characterized differently by researchers. For this paper, four general classifications of conflict strictly related to the study have been distinguished including internal conflict, international conflict, non-state conflict and extra-state conflict. Traditionally, conflict is thought to emerge from contradicting interests including scarce resources, dissimilar objectives and dissatisfaction (Schmidt and Kochan, 1972). Barki and Hartwick (2004) characterizes conflict as a dynamic process that happens between interdependent parties as they experience negative responses to perceived contradictions and obstruction in the accomplishment of their goals. Conflicts could be violent, uncontrollable, escalating and insolvable or latent and resolvable (Ajayi and Buhari, 2014).

For this paper, four general classifications of conflict have been distinguished. Internal conflict (or intrastate conflict) is one in which the number of legislative specialists of a state is restricted by using arms to oust experts (Eminue, 2004). Then, international conflict or interstate clashes again occur between at least two countries and include the political powers of more than one state (Puchala, 1971). Non-state conflict is the utilization of military force between two composed gatherings, neither of which is the legislature of the state. Extra-state conflict happens between a state individual from the worldwide framework and a political unit outside of its regional limits (Kudakwashe and Richard, 2015).

In Africa, the four different conflict types have occurred in varying degrees from place to place. Conflicts in Africa seem to have been brought about by a variety of variables, for example, resource scarcity, arbitrary borders made by the pioneer powers, heterogeneous ethnic compositions of African states, uncouth political initiatives, corruption and negative effects of the burden of obligation outside and poverty (Aremu, 2010).

1.2. Impact of conflict on environment: global perspective

The environmental effects of conflict are generally categorized as direct or indirect (Jha, 2014). Direct impacts relate to those whose occurrence may be physically linked to military action and which typically arise within the immediate short-term, whereas indirect impacts are those that can be reliably attributed to the conflict but they usually tangle with many factors and only fully manifest themselves in the medium to longer term (Partow, 2008). Some examples of direct impacts include deliberate natural resource destruction, environmental contamination from bombing of industrial sites, and military debris and demolition waste from targeted infrastructure. On the other hand indirect impacts include the environmental footprint of displaced populations, collapse of environmental governance and data vacuum as well as the lack of funding for environmental protection. Discussed below are some of the environmental impacts of conflict in the world. Nuclear weapons affect climate and environmental globally (Makhijani et al., 2000; Scheffran et al., 2016). Conflicts induced by climate change could contribute to global insecurity, which, in turn, could enhance the chance of a nuclear weapon being used, could create more fertile breeding grounds for terrorism including nuclear terrorism, and could feed the ambitions among some states to acquire nuclear arms (Scheffran et al., 2016). Another issue is that any war destroys buildings and infrastructures which need to be rebuilt and consume enormous resources and add to emissions.

1.2.1. Impact of conflict on forest cover

The effects that conflict has on forest cover are an emerging concern for conservation, partly due to the occurrence of war in forest's rich areas in a way that various scholars have tried to demonstrate the impact of conflicts on forest cover and its implication on biodiversity. For example, a study in the Atlantic Coast of Nicaragua confirmed that conflict-related factors were partially responsible for forest cover change (Stevens et al., 2011). Another study on woody cover change in Colombia between 2001 and 2010 also showed that the impact of illegally armed groups has reduced forest cover, particularly in areas rich in gold and lands appropriate for cattle grazing (Foster, 2001; Sánchez-Cuervo and Aide, 2013). Similarly a study by Westing (2011) on Vietnam, revealed that aerial application of Agent Orange and other herbicides during war, defoliated 14% of the country's forest cover and over 50% of its coastal mangroves. According to Westing (2013), limited warfare can result in severe, widespread, and long-term environmental damage. This has been demonstrated by a study of the effects of high-explosive munitions (bombs and shells), chemical anti-plant agents (herbicides), and heavy land-clearing tractors (‘Rome plows’) as employed by the USA in South Vietnam during the Second Indochina War of 1961–1975 for the purpose of extending large-scale area denial. Although the ecological damage to South Vietnam was severe, the area-denial techniques used were of a doubtful military success.

The indirect effects of conflict often have more far-reaching impacts than the direct destruction on battlegrounds. Military expenditures can come at the expense of other government programs, including natural resource management. For example during the wars in Afghanistan and Iraq 2008, the US government military budget was increased alongside an 8% reduction for the budget of the U.S. Forest Service (Daly, 2008). This had an implication in the forest management sector by cutting the budget of the forest service.

The Rwandan genocide led to the killing of roughly 800,000 Tutsis and moderate Hutus (Zorbas, 2004). The war created a massive migration of nearly 2 million Hutus fleeing Rwanda over the course of just a few weeks to refugee camps in Tanzania and the Democratic Republic of the Congo (DeWeerdt, 2008). This large displacement of people in refugee camps put pressure on the surrounding ecosystem. Forests were cleared in order to provide wood for building shelters and used for firewood (DeWeerdt, 2008). These people suffered from harsh conditions and constituted an important threat impact on natural resources (Kanyamibwa, 1998).

However, the effect of conflict on forest cover is not always negative. This view is supported by Suthakar and Bui (2008), a study in Jaffna Peninsula, Northern Sri Lanka. It revealed that the land use/cover pattern has been very dynamic during war, showing a remarkable decrease in agricultural land use and concomitant increase in forest cover. Another study in Nepal showed that forest user groups facing severe armed conflict showed an increase in forest density (Karna et al., 2010). These results emphasize the capacity of local institutions to organize and cooperate even in extremely vulnerable situations, building trust and reciprocity for sustainable forest use and management (Karna et al., 2010). A study in Swat and Shangla, Pakistan also highlighted that deforestation that appeared during periods of conflict was not as

significant as when compared with the long term deforestation patterns of the area (Qamer et al., 2012).

1.2.2. Impact of conflict on biodiversity and wildlife

Human conflict for the most part has plenty of negative effects on wildlife and preservation. Armed conflict usually happens in the regions of high biodiversity. For instance, 64 of the 206 nations of biodiversity Eco region globally have encountered war in the previous 60 years (Fearon and Laitin, 2003). Hence, armed conflict has an extraordinary effect in molding biodiversity and its preservation. In spite of the fact that biodiversity protection commonly endures amid wartime, the changed human movement in struggle ranges now and then makes unmistakable preservation openings (Hanson et al., 2009). For instance, biodiversity conservation should be integrated into military, reconstruction, and humanitarian programs in the world's conflict zones (Hanson et al., 2009). This example has been experienced among tribal regions in New Guinea and the Amazon (McNeely, 2003a) and in the exceptional natural life fixations experienced by the Lewis and Clark Expedition in battle regions between Native American countries (Martin and Szuter, 1999).

The effect of human conflict on wildlife and habitats is unpredictable. Armed conflict regularly hinders wildlife and wildlife habitats (De Merode et al., 2007). Antagonistic effects result from habitat loss as well as broad herbicide use, wildlife mortality from landmines, hunting to nourish soldiers, opportunistic poaching, direct targeting of preservation experts by equipped groups, pest outbreaks coming about because of environmental aggravation and expanded misuse of wildlife by displaced peoples (Dudley et al., 2002; McNeely, 2003b). A review in Eastern Cambodia in the light of ordinal-scale measures demonstrated that both relative wildlife abundance and species richness declined amid war, as a result of significant increase of weapons (Loucks et al., 2009). It exhibits that the legacy of contention for natural life can be significant and ruinous (Loucks et al., 2009).

The continued war in the Democratic Republic of Congo (DRC) (1995–2006) brought about a noteworthy loss of wildlife, including elephants, due to the fall of institutions, wilderness and unbridled abuse of regular assets; for example, minerals, wood, ivory and bush meat Beyers et al., 2011a). The review in Okapi Faunal Reserve, Democratic Republic of Congo demonstrated that there was around a 50% decrease in population which corresponded with the increase in elephant poaching (Beyers et al., 2011a). Post-war progression, for example, debilitated organizations, human developments, and easy access to weapons keep on affecting elephants (Beyers et al., 2011b).

1.2.3. Impact of conflict on soil pollution

One of the most dramatic ways humans can affect soil properties is through military activities. Armed conflict-induced disturbances to soil basically consist of three types of damage at the same time: physical, chemical and biological (Certini et al., 2013). Physical disturbances to soil include sealing due to building defensive infrastructures, excavation of trenches or tunnels, compaction due to machinery and troops traffic, or cratering by bombs and landmines (Certini et al., 2013). Chemical disturbances consist of inputs of pollutants such as oil, heavy metals, nitroaromatic explosives, organophosphorus nerve agents, and dioxins from herbicides or radioactive elements (Certini et al., 2013). Biological disturbances occur as unintentional consequences of the impact on the physical and chemical properties of soil or the deliberate introduction of microorganisms lethal to animals and humans such as botulin or anthrax (Certini et al., 2013).

Fires have numerous positive and negative consequences on the physical properties of soil (Mataix-Solera et al., 2011). The most impressive impact in this view is often indirect, being due to erosion, which easily starts on steep burnt surfaces that do not experience prompt plant resprouting or recolonization. Debris flows and shallow landslides can also occur (Shakesby and Doerr, 2006). In addition to the temporary lack of a vegetation cover, burnt areas are particularly prone to runoff and erosion because of the fire-induced formation of a hydrophobic layer at shallow depth, which prevents or limits water infiltration (Doerr et al., 2000). Like other types of soil turbation, as cryoturbation, vertization, bioturbation, and bombturbation mix the soil horizons, partly canceling the effects of pedogenesis, but overall changes the landscape; hence resulting in the substantial transformation of the soil forming factor topography (Wilkinson et al., 2009).

Considerable human disturbances to soil for defensive purposes was seen as a result of the wide trench systems on the Western Front in World War I and the antitank ditches constructed in World War II (Rose, 2005). During WW II, striking trench systems were also emplaced by civilians for the purpose of saving houses, monuments, or factories from destruction (Shaw et al., 2001). In Alaska, Shaw et al. (2001) found significantly higher concentrations of organic carbon, total nitrogen, phosphorus and potassium within depressions caused by explosions, concluding that the displacement of soil material acts as a ‘catalyst’ for pedogenesis.

Indirect contamination of soil by fuels (hydrocarbons) occurred during warfare as soon as the internal combustion engine was introduced (Hussain and Gondal, 2008). An impressive example of oil contamination is that of the 1991 Gulf War when 770 km of coastline from Southern Kuwait to Abu Ali Island were involved (Hussain and Gondal, 2008). The Gulf War also resulted in the contamination of large areas of inland Kuwait (Al-Senafy et al., 1997). The contamination of soil by radioactive residue from depleted uranium (DU) bullets used in the war is another example. Iraq and Kosovo may be thousands of miles apart, but they share the dubious distinction of contamination with radioactive residue from depleted uranium bullets used in American air strikes (Peterson, 2006).

Today's contamination of soils by warfare activities is largely made up of explosive compounds (Qasim et al., 2007). However, there are a few positive effects of military activities on soil, such as the fertilization by nitrogen and phosphorus contained in nitroaromatic explosives or the creation of no-man's lands where the natural succession is allowed (Brady, 2012).

1.2.4. Impact of conflict on water pollution

Water pollution is yet another result of war. Of the many wars led since the Vietnam War, the Gulf War during January and February 1991 shows the courses in which the technology of war and industry can be utilized to bring about natural demolition across the board (Leaning, 2000). Importing of around 10 million barrels of Kuwaiti oil into the by Iraqi waters stretching along 1500 km and costing more than $700 million to tidy up brought about extraordinary worry to water bodies which officially experienced many years of mishandling (UNEP, 1991). A noteworthy groundwater aquifer, two fifths of Kuwait's whole freshwater hold, stays sullied right up til today (McLaren and Ian, 2003). Other natural impacts of the 1991 Gulf War included the devastation of sewage treatment plants in Kuwait, bringing about the release of more than 50,000 cubic meters of crude sewage consistently into Kuwait Bay (McLaren and Ian, 2003).

The war between Russian military and Chechen guerilla warriors in 1994–1996 have greatly affected Chechnya's water supply (Al-Shishani, 2006). Around 20,000 tons of oil spilled into waterways (Al-Shishani, 2006). Waterways are sullied in a way that there is a rising concern that the pollution from waterways could spread into the Caspian sea (Al-Shishani, 2006).

The Rwanda catastrophe of 1994 brought about the pollution of water bodies. It is evaluated that in the vicinity of 500,000 and 1 million individuals lost their lives inside a period of around 3 months (Wachira, 1997). This immediately caused a body disposal crisis. Appropriate entombments were unrealistic and bodies were discarded in mass-graves or by and large, were left to decay in the open. Different bodies were discarded in waterways and lakes and others suffocated while attempting to cross swollen streams and lakes, in this manner dirtying the waters (Wachira, 1997).

1.2.5. Impacts of conflict on air pollution

Conflict has a great role in exacerbating air pollution. The impact of conflict on the environment, particularly on air pollution, starts with the development and testing of all aspects related to military weapons, hardware and armament, and the necessary training in its use. For example in World War I and World War II, extensive testing of inflammable bombs was made to produce the firestorms (Protopsaltis, 2012). The effects of the by-products of intense fire on the air quality were made obvious in the World Trade Centre incident, where pollution from the burning of the buildings and their contents included toxic metals, asbestos, dioxins, Polycyclic Aromatic Hydrocarbons, Polychlorinated Biphenyls and hydrochloric acid (Protopsaltis, 2012).

Other forms of chemical warfare included the development of particular dioxins such as Agent Orange which was used in the war in Vietnam (Protopsaltis, 2012). It was used as a defoliant and was delivered by plane, as a tool of war and not necessarily applied as a weapon (Protopsaltis, 2012). However, it proved very effective as a pollutant (Protopsaltis, 2012).

With the high degree of mechanization of the military, large amounts of fossil fuels are used as a result. Fossil fuels are a major contributor to global warming and climate change and it one of the issues of increasing concern. The United States Department of Defense is a government body with the highest use of fossil fuel in the world (Karbuz, 2006).

The wars in Iraq, Afghanistan and Pakistan have had a serious impact on the natural environments of these countries, in particular on air pollution. Military vehicles consume petroleum-based fuels at an extremely high rate, with the vehicles used in the war zones having produced many hundreds of thousands of tons of carbon monoxide, nitrogen oxides, hydrocarbons and sulfur dioxide in addition to CO_2 (Crawford et al., 2011).

2. Methods

The target of this paper is to review environmental impacts of conflict in the Horn of Africa (the countries of Djibouti, Eritrea, Kenya, Ethiopia, Uganda, Sudan and Somalia) (Fig. 1), and to review the role of climate variability in increasing or decreasing conflicts. This was done in the context of a comprehensive review, the process of collecting, appraising, and then synthesizing data from a large number of sources. The main method for selecting the literature was cumulating research findings across different studies on the same issue which, in our case, was “environmental impacts of conflict”. The methodology employed comprises of a review of published articles and grey literature on conflict, the impact of conflict on the environment and the impact of climate variability on conflict. The published literature search was carried out in Google scholar, ScienceDirect, Wiley online library and Jstor with having access to the University of Ghana Library and the grey literature included reports and websites. Search terms used in the academic databases include “conflict” and/or “environment”, “climate” and “conflict”. The following phrases were also used in the Google search engines: “conflict in the Horn of Africa”, “conflict and environment”, “the impact of conflict on the environment”, “causes of conflict”, “role of climate change on conflict”. The documents retrieved from the various searches were read, evaluated and synthesized in the write up.

Fig. 1. The study area (Horn of Africa).

3. Results and discussion

3.1. Overview of conflict in the Horn of Africa since 1970

While parts of the region are moderately steady and serene today, noteworthy bits of the Horn of Africa remain unable to break free of a ruthless and delayed history of furnished clashes, rough wrongdoing, radicalism, collective brutality, political unsteadiness, dislodging, human rights misuse and state disappointment (USAID, 2012). Since the 1970s, many clashes have occurred in the Horn of Africa. The greater part of the contentions are affable war and interstate clashes (Table 1).

Relatively, Sudan and Uganda have had many conflicts followed by Somalia and Kenya (Fig. 2). In terms of conflict duration, Eritrea had a long lasting war with Ethiopia starting from 1961–1991 for their freedom.

3.2. Causes of conflict in the Horn of Africa

Though it is acknowledged that many conflicts do have their origin

Table 1
Major conflict events in the Horn of Africa since 1970.
Source: (Tucker, 2009; Wikipedia, 2016).

Country	Events	Year of war
Djibouti	Djiboutian Civil War	1991–1994
Djibouti, Eritrea	Djiboutian-Eritrean border conflict	2008–2008
Eritrea	Eritrean Civil Wars	1972–1981
Eritrea	Eritrean War of Independence	1961–1991
Ethiopia	Ethiopian Civil War	1974–1991
Ethiopia, Eritrea	Eritrean-Ethiopian War	1998–2000
Somalia, Ethiopia	Ethio-Somali War	1977–1978
Kenya	Garissa Massacre	1980
Kenya	Wagalla massacre	1984
Kenya	Turbi Village Massacre	2005
Kenya	Kenyan crisis	2007–2008
Somalia	Somali Rebellion	1986–1991
Somalia	Somali Civil War	1991-*ongoing*
Somalia	Insurgency in Ogaden	1995–2008
Sudan	Second Sudanese Civil War	1983–2005
Sudan	Lord's Resistance Army insurgency	1987-ongoing
Sudan	War in Darfur	2003-ongoing
Sudan	Chad-Sudan conflict	2005–2010
Sudan	Sudanese nomadic conflicts	2009-ongoing
Sudan	Ethnic violence in South Sudan	2011-ongoing
Sudan	Third Sudanese Civil War	2011-ongoing
Sudan	Sudan–South Sudan Border War	2012–2012
Sudan	South Sudanese Civil War	2013-ongoing
Uganda, Tanzania	Uganda-Tanzania War	1978–1979
Uganda	Uganda National Rescue Front	1980–1985
Uganda	Ugandan Civil War	1982–1986
Uganda	Uganda People's Democratic Army	1986–1988
Uganda	Holy Spirit Movement	1986–1987
Uganda	Lord's Resistance Army	1987-ongoing
Uganda	Allied Democratic Forces	1996
Uganda	Uganda National Rescue Front II	1996–2002

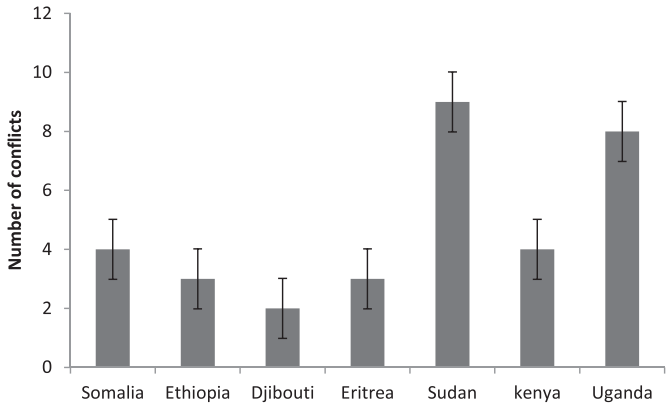

Fig. 2. Comparative analysis of conflicts in the Horn of African countries since 1970. (Source: (Tucker, 2009; Wikipedia, 2016)).

in their colonial past, there is a generally wide-spread perception and agreement that contemporary conflicts in the Horn of Africa are caused by some of the factors mentioned below.

3.2.1. Grievances

Over the Horn of Africa, many armed conflicts including insurrections, civil wars and violent radicalism are filled to some degree by disappointment over constrained monetary open doors; neediness; unemployment; legislative issues of prohibition ethnic, religious, or class lines (Ylonen, 2005). High population development rates of the area have created a young population boom which intensifies issues of unemployment prompting to unfaltering urban float that bolsters the development of huge ghettos where these grievances are concentrated. In provincial regions, grievances are most articulated over land and the estrangement of land. The majority of these grievances are established via what one might say ethnic or partisan minimization (USAID, 2012).

3.2.2. Trends in government behaviour and interests

Both an oppressive and inadequate government are regularly said to be the blame, as protestors clash and unsteadiness ensues (USAID, 2012). Both of them are features of the Horn of Africa. Governments in the region vary broadly in their attitudes and legislation toward non-state or civic society actors in overseeing trans-border conflicts; some are profoundly prohibitive while others are manageable and produce hybrid peace-building partnerships with civil society groups along border areas (Fulgence, 2015).

3.2.3. Resource scarcity and trans-border conflict

Growing populations and settled or declining natural resources, particularly land and water, feature as the reason for most local conflicts over the region and are intensifying. Dozens of borders over the Horn of Africa are uncertain and challenged (USAID, 2012). At the point when unrest occurs or significant assets are found in these zones, strains spike between neighbouring states, stalling peace-building endeavors (Meier et al., 2007; Leroy, 2009; van de Giessen, 2011).

3.2.4. Internal migration

Migration from the rural to urban areas has led to urbanization pressures that manifest themselves in violent forms in different ways. All the countries in the region have thousands of youth who flock to the urban centres daily hoping to find better prospects (Chikwanha, 2007). With job scarcity and no opportunities for mobility due to inferior educational standards in rural areas, the result is urban violence between hawkers and traders and between slum dwellers, developers and civic authorities over land evictions. These have become a permanent feature in Nairobi, Mombasa and Kisumu (Oyugi, 2002).

3.2.5. Climate variability

Climate variability is defined as variations in the mean state and other statistics of the climate on all temporal and spatial scales, beyond individual weather events. Although climate variability is usually regarded as a potential future threat, some authors argue that global climate variability has already been a contributing factor to current conflicts such as the Darfur conflict (Byers and Dragojlovic, 2004) while other researcher question a significant climate contribution in the Darfur conflict (Verhoeven, 2011). Recent studies concerning the possible relationship between climate trends and the risks of violent conflict have yielded contradictory results, partly due to choices of conflict measures and modeling design (Ide et al., 2014; Scheffran et al., 2014; Schilling et al., 2015).

O'Loughlin et al. (2012) in his study of climate–conflict relationships using a geographically disaggregated approach for East Africa from 1990 to 2009, showed that wetter deviations from the precipitation norms decrease the risk of violence, whereas drier and normal periods showed no effects. The relationship between temperature and conflict showed that much warmer than normal temperatures raise the risk of violence, whereas average and cooler temperatures have no effect. In addition, a study by Hendrix and Glaser (2007) found that interannual variability in precipitation had a significant impact on the likelihood of conflict onset in Sub-Saharan Africa.

Miguel et al. (2004) estimated the effect of economic shocks on the likelihood of civil conflict in Sub-Saharan Africa. They found that increased rainfall had a positive impact on income growth and a negative impact on the likelihood of conflict, mediated by its effect on economic growth. Climate variability, especially temperature changes in seasonality, has an appreciable impact on livelihoods and economic development, rights and responsibilities of citizens and the state, resource governance and the performance of political institutions as well as relations among privileged and disadvantaged identity groups. A large body of literature indicates that these are important, and the enduring conflict varies in the Horn of Africa (USAID, 2014). Raleigh and Kniveton (2012). On the basis of data from East Africa, studies also found that rainfall deviations in either direction are associated with conflict, but argue that civil war is more likely to occur in anomalously dry conditions whereas wet conditions are more likely to be associated with non-state conflict.

In Southern Ethiopia, Yabelo, recurrent drought as a result of rainfall has made the search for water and pasture more difficult, and moving into new areas in search of these resources often provokes conflict (USAID, 2014). Similarly, in Somalia, a one standard deviation increase in drought intensity and length raises the likelihood of conflict by 62% (Maystadt and Ecker, 2014). Drought affects conflict through livestock price changes, establishing livestock markets as the primary channel of transmission in Somalia (Maystadt and Ecker, 2014). Maystadt et al. (2015) also studied the link between local variations in weather shocks and conflicts by focusing on a pixel-level analysis for North and South Sudan between 1997 and 2009. They found that temperature anomalies greatly affect the risk of conflict.

3.3. Environmental impact of conflict in the Horn of Africa

The impacts of armed conflict on environments are complex and difficult to assess due to restricted access to affected areas during wartime. However, there are a few studies which show the impact of conflict on environment in East Africa. A study by Alix-Garcia et al. (2013) showed that conflict caused land abandonment which increased with proximity to insecurity, and welfare losses to rural land owners in Darfur, Sudan. This can cause disruptions in short-term production, with abandonment of agriculture far from the cities, and intensification of land use on their periphery.

In Ethiopia, one of the main problems arising from the war which finally ended in 1991 was the severe decline in the morale of wildlife staff due to drastic cut backs in government funding and support for

conservation (GebreMichael et al., 1992). The Simen mountains World heritage site, for instance was particularly badly affected. The park was inscribed as a World heritage site in 1978 but was totally closed down when the Tigre Peoples Liberation Front (TPLF) occupied it and the surrounding area in 1984 (GebreMichael et al., 1992). It was not reopened until 1991. In the intervening seven years, no wildlife management was possible. Of the 63 administrative and residential buildings that the park contained, only four in one outpost survived the bombardments and looting inflicted on it. During the seventeen years that war raged, development progress was negligible (GebreMichael et al., 1992). Conservation activities declined and eventually ceased and in the absence of incentives and support for wildlife conservation, a hapless and lethargic attitude prevailed. This, coupled with the relative lack of education in the lowlands where most wildlife conservation is concentrated, generally, meant that wildlife conservation management in the field became considerably weakened (GebreMichael et al., 1992).

Meanwhile, the frequent massacre of wildlife animals, especially of those considered clean under Mosaic Law, continues to be a problem in the Senkelle Swayne Hartebeest Sanctuary and particularly in the Bale mountains National park (GebreMichael et al., 1992). This is because the number of firearms in the hands of civilians, originally very high anyway, has increased as a result of the looting of military camps and cheap purchase from retreating military forces. Populations of Swayne's hartebeest, an endemic race, and the Mountain Nyala and Simen jackal, which are both endangered endemic species, are the most affected (GebreMichael et al., 1992; Ylonen, 2005).

In Uganda, local proliferation of small arms led to increased hunting for bush meat, wildlife products and sport, often by the soldiers themselves. Examples include the decimation of Uganda's elephant (*Loxodonta africana*) and hippopotamus (*Hippopotamus amphibius*) populations during the 1970s (Eltringham and Malpas, 1980; Fulgence, 2015).

However a study in South Sudan and Uganda in three forest areas on forest cover showed that armed conflict did not have a negative impact on forest cover. It indicated that the rate of forest recovery was significantly higher than the rate of disturbance both during and after wartime and the net rate of forest cover change remained largely unchanged. In contrast to this finding, one of the study areas experienced relatively high rates of disturbance during wartime; however, post war period losses were largely offset by some gains in forest cover (Gorsevski et al., 2012; Aremu, 2010).

4. Conclusion

The review covers general aspects of conflict-environment and demonstrated that conflict has extensive negative impacts. The impacts of conflict on environments in the Horn of Africa included declining wildlife conservation activities, the frequent massacre of wildlife animals, increased hunting for bush meat and negative impact on forest cover. Conflicts in the Horn of Africa have been caused by a variety of variables like grievances, government behaviour and interests, resource scarcity and transborder conflict as well as internal migration and climate variability. Similarly, climate variability plays a great role in exacerbating impacts of conflict in the region.

The Horn of Africa region stands out among the weaker, struggle inclined zones on the planet. Despite the perception that many conflicts have distinctive causes, as of late, climate variability has played a significant part in fueling the effect of contentions in the Horn of Africa. The environmental conflicts which are facing and challenging the Horn of Africa in the forthcoming years, particularly with change in climate variables, require and demand that more consideration to be given to the contentions underlying causes instead of its appearances.

Conflict in the Horn of Africa has left a broad legacy on the environment. Deforestation, loss of wildlife and biodiversity are just a part of the environmental impacts of conflict in this region. However, there is a knowledge gap regarding the environmental impacts of conflict in the Horn of Africa. Thus, there is a need for orderly, similar and cross-scale research in order to increase our understanding on the environmental impacts that is created as the result of the fighting, as well as the conflict that climate variability creates in this region.

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