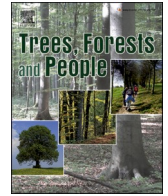




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Armed conflict as an underappreciated driver of conservation outcomes in frankincense (*Boswellia* spp.)[☆]

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ABSTRACT

Frankincense (*Boswellia* spp.) resin is an internationally renowned non-timber forest product (NTFP), generating more than \$1 billion USD annually for its use in aromatherapy, incenses, perfumery, cosmetics, and medicines. However, many *Boswellia* species that produce commercially traded frankincense resins grow in arid, resource-poor environments where human conflict and warfare are common, such as the Sahel and the Horn of Africa. Despite this, the impacts of violent conflict on frankincense or other NTFP production systems have been underexplored in the literature. Drawing on anecdotal reports in frankincense and case studies from other species and geographies, we discuss the likely impacts of both acute warfare, such as the recent Tigray war in Ethiopia, and chronic, low-level conflict, such as the ongoing insurgencies by ISIS and Al-Qaeda-linked groups in Somalia and the Sahel. The effects of conflict are wide-ranging and may include direct damage to forests, disruptions of land tenure, management, and governance systems, reduced monitoring capabilities, and limited capacity for sustainable supply chain operations. We explore these potential impacts, outline an agenda for further research, and urge that further attention be given to conflict as an important driver of forest management and conservation outcomes.

Introduction

Warfare and armed conflict have profound and often far-reaching impacts on biodiversity and conservation, in ways that are still being explored (Douglas and Alie, 2014; Lawrence et al., 2015; Gaynor et al., 2016; Hanson et al., 2009). More than 80 % of major conflicts in the last half of the 20th century took place in biodiversity hotspots, and conflicts continue in many of these areas to the present day either as continuous or recurrent conflicts (Hanson et al., 2009). This demonstrates the importance of armed conflict as an ecological force. The impacts of conflict on conservation are complex, with at least 24 distinct pathways driving primarily negative, but occasionally positive, outcomes for wildlife and ecosystems (Gaynor et al., 2016). These pathways are diverse. Key drivers include: increased arms availability and damage to species and ecosystems from combat; reduced enforcement, research, conservation and traditional management practices; increased reliance, particularly by displaced people, on natural resources for cash and sustenance; the harvesting (and overharvesting) of lootable resources to fund conflict and post-conflict recovery; and the consequent expansion

of extractive industries in the absence of other good economic options (Gaynor et al., 2016).

Interestingly, while the direct effects of combat such as damage to habitats, and the species that live there, clearly have an impact, institutional and socio-economic changes are more commonly cited as drivers of conservation outcomes during and after conflict (Gaynor et al., 2016; Brito et al., 2018; Hanson 2018). Still, direct impact on species may be huge: studies on the effects of armed conflict on species have a strong focus on mammals and particularly megafauna, such as elephants, rhinoceros, and gorillas (Bouché et al., 2010; Beyers et al., 2011; Chase and Griffin 2011; Thapa et al., 2013; Goswami and Ganesh, 2014; Plumptre et al., 2016); the impacts of conflict on various timber species have also been examined (Johnston, 2004; Harwell et al., 2011; Kikuta, 2020). By contrast, there are virtually no studies examining how conflict affects plant species and their products/derivatives, particularly non-timber forest products (NTFPs) (Baral and Heinen, 2006), despite their critical importance to rural livelihoods (Shackleton et al., 2011) and the global market (Shackleton and de Vos, 2022).

Frankincense, a resin produced by trees in the genus *Boswellia* Roxb.

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(Burseraeae: Sapindales), is one such NTFP affected by armed conflict. Traded internationally for up to 5000 years (Groom, 1981; Hull, 2008; Scheck, 1995), frankincense is today likely worth \$1 billion or more for its use in perfumery, aromatherapy, cosmetics, incense, and various medicinal traditions (Cunningham and DeCarlo, 2022, Johnson et al. unpublished data). Frankincense resin is harvested by making incisions into *Boswellia* tree bark and scraping off the resin that exudes. The cut is then widened and deepened to allow more resin to exude. The specific harvesting practices vary from species to species, but all harvesting systems include rules to restrict the number, depth, and frequency of cuts in order to ensure the longevity of the harvested trees (Cunningham and DeCarlo, 2022). There are approximately 24 species of *Boswellia*, distributed across Sahelian Africa, the Arabian Peninsula, and India (Fig. 1). Most species face some combination of threats, including grazing, fire, damage from inappropriate or excessive resin harvesting, insect attacks, and conversion of land for agriculture (Bongers et al., 2019; Soumya et al., 2019; DeCarlo et al., 2020; Thulin, 2020; Lvončfk et al., 2020; Sabo et al., 2022, Johnson et al. in review, Maděra et al. in review). Although only 4 *Boswellia* species have had their IUCN Red List status formally assessed in the last ten years, the majority of species (including commercially harvested species) are believed to be threatened (Bongers et al., 2019; Thulin, 2020, Maděra et al. in review). Only 5 of the 24 species are suggested to qualify as Least Concern (Thulin, 2020).

While *Boswellia* species are found in more than 20 countries (Thulin, 2020), the majority of the resin, both in terms of volume and value, is produced in the Horn of Africa, particularly in Ethiopia, Sudan, and Somalia (Bongers et al., 2019; Cunningham and DeCarlo, 2022). Frankincense trees grow in arid, resource poor environments, many of which have experienced continuous or recurrent violent conflict for several decades, such as the Sudanese Civil War (1983–2005), Darfur War (2003–2020), 2023 Sudan Conflict, Ethiopian Civil War (1974–1991), Eritrean-Ethiopian War (1998–2000), Tigray War (2020–2022), and the Somali Civil War and ongoing insurgency by Al-Shabaab and ISIS (1988–Present). Likewise, many range states of *Boswellia* species suffer from high levels of corruption and political instability and recurrent violence and/or the presence of groups using terrorism as a political strategy (Transparency International, 2023; World Bank, 2023). Governance resources to promote conservation and sustainable use of *Boswellia* trees are correspondingly limited, and governance is deeply affected by conflicts (Cuvelier et al., 2014).

Despite the recent research into *Boswellia* ecological and social sustainability issues (Bongers et al., 2019; Soumya et al., 2019; DeCarlo et al., 2020; Sabo et al., 2022), little attention has been paid to conflict as a potential force driving sustainability outcomes. Here we explore how conflict may be affecting *Boswellia* trees and resin production, drawing on the literature and the lived experiences of ourselves and our colleagues. We discuss the various likely or confirmed impacts of conflict and outline areas for further investigation.

Acute warfare impacts and legacies

The most straightforward route for armed conflict to impact *Boswellia* forests is by direct damage due to military activities. Many major wars and armed conflicts, including guerilla warfare, have had theaters of combat in regions where *Boswellia* trees grow. Combat in multiple forms can affect forests: bombing and artillery strikes can kill trees, bullets can cause damage and open wounds that allow insect and pathogen attacks, and forest fires can be started either intentionally to flush out enemies or unintentionally as a side effect of incendiary munitions (Chandler and Bentley, 1970; Henig, 2012; Daiyoub et al., 2023; Martin, 2023, Fig. 2).

Chemical contamination can further impact forests. A variety of chemicals, from propellants, solvents, explosives, fuels, to lead and white phosphorus can contaminate areas of active combat or staging operations (Hanson, 2018). This chemical contamination can directly impact growth and germination rates and can in extreme cases drive community composition change towards hardy, resilient species that can withstand contaminated conditions (Via and Zinnert, 2016). These impacts are similar to the contamination effects of surface mining, for instance for gold (Timsina et al., 2022; Abdul-Wahab and Marikar, 2012) and other heavy metals (Cooke and Johnson, 2011; Asati et al., 2016).

The direct impact of combat operations on *Boswellia* species has not been quantified but reports from northern Ethiopia suggest significant deforestation has taken place (F.B. pers. comm. with E. Birhane, Negash et al., 2023). There is little information available about the impacts on other species in combat areas (e.g., *B. dalzielii* in Mali and Burkina Faso or *B. rivae*, *B. neglecta*, and *B. microphylla* in southern Somalia), but the impacts, at any level, are likely to be negative.

By contrast, landmines are a legacy of violent conflict that may have some positive side effects for *Boswellia* trees, albeit at a terrible cost in



Fig. 1. Map of the distribution of *Boswellia* species. Known range areas are highlighted in green. Reproduced with permission from the natural and medical sciences research center, University of Nizwa, Sultanate of Oman.

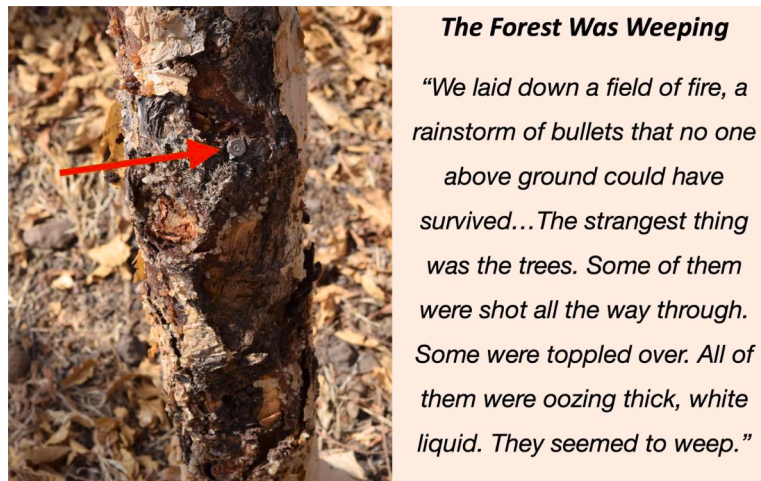


Fig. 2. (Left) *Boswellia papyrifera*¹¹ (Delile) Hochst. tree in northern Ethiopia showing severely damaging harvesting practices. A bullet casing is visible in the tree (red arrow) (Photo copyright Stephen Johnson). (Right) Memoir of a US soldier, describing a firefight between US forces and Viet Cong guerillas in a rubber plantation (*Hevea brasiliensis*) and the resultant damage to the trees (Linnemeier, 2014).

human lives and misery. Several regions of *Boswellia* habitat, such as the border regions between Ethiopia and Somalia and Ethiopia and Eritrea have been, and remain, heavily landmined (Kudyba, 2002; Halo Trust, 2023). Landmines help reduce grazing pressure, as pastoralists are reluctant to bring their herds into areas where they or their animals are likely to be severely injured or killed (Garbino, 2019; Halo Trust, 2021). This is important because grazing is a key threat to *Boswellia*, blocking regeneration in some species (Bongers et al., 2019; Lvončík et al., 2020). Likewise, the threat posed by landmines likely reduces resin harvesting activity, firewood gathering, and other forms of land use. Landmines thus create refugia for trees that may otherwise be threatened by grazing or other threats, representing an unintentional natural exclusion experiment on the impact of pastoral grazing on *Boswellia* and other palatable species. However, this may also concentrate grazing pressure and deleterious impacts on non-landmined populations.

Another direct impact is conflict-related deforestation. The presence of armed insurgent groups in forested areas may lead both to higher local deforestation due to the demand for wood and other products and income for these groups (Álvarez, 2003). In contrast, it can also lead to lower local deforestation by non-group actors, due to the fear of violence from these groups reducing willingness to enter forests to cut trees and exploit natural resources (Burgess et al., 2015). In Sub-Saharan Africa, many protected areas have been partly deforested as a result of armed conflicts (Glew and Hudson, 2007), for instance Virunga National Park in the Democratic Republic of the Congo (Nackoney et al., 2014; Butsic et al., 2015), various protected areas in Liberia (Johnston, 2004), and Gorongosa National Park in Mozambique (Hatton et al., 2001). In Colombia, in contrast, deforestation was lower during the decades long conflicts and has increased strongly post-conflict (Clerici et al., 2020), probably as a result of the reduced protection of the forests by armed groups and reduced fear from loggers. Direct destruction of *Boswellia* forests due to conflict is poorly documented, but recent reports on the impacts of the Tigray war indicate extensive deforestation of high-density *Boswellia* areas. In this case, forests are reported to have been burned or cut down as part of a “scorched earth” campaign to deny enemy fighters resources or cover, and to facilitate movement of military units and equipment (F.B. pers. comm. with E. Birhane). Remote sensing suggests that overall, dry Afromontane forest cover in Tigray declined from 17 % to 12 % from 2020 to 2022 (Negash et al., 2023). Prior to the war, most deforestation was directly related to land use change for agriculture (Bongers et al., 2019).

Forest management systems in conflict zones

Sustainable resource management almost always requires sacrificing some short-term gain in order to secure long-term continuous utilization of the resource. In *Boswellia*, this means reducing the amount of frankincense resin harvested in any given season and protecting trees from the effects of grazing, cutting, lopping and burning in order to secure the long-term health of the trees and continuous production of resin year to year. However, for this to be an attractive strategy, resource managers need to have assurance of ongoing access to the resources. Weakened land tenure is associated with decreased sustainability of NTFP harvesting, as harvesters seek to maximize returns (DeCarlo et al., 2020; Kozanayi et al., 2022). Violent conflict likely weakens land tenure and resource security, reducing harvester confidence in continuing resource access and leading to more intensive harvesting upon opportunity (Plumptre et al., 1997). Violent conflict also changes power relations among groups, with consequences for resource capture (Homer-Dixon, 1994). A review of natural resources and violent conflict shows a gradual shift in focus from cross-country to micro-level conflicts (Nillesen and Bulte, 2014). Conversely, conflict periods may provide some respite to *Boswellia* trees if harvesters are excluded from collection areas due to insecurity (Adam et al., 2004). This has been reported in Ethiopia, where both major conflict during the Tigray War (2020–2022) and low-level conflict with regional rebel groups such as the Benishangul People’s Liberation Movement have reduced or excluded tapping activity on *B. papyrifera* in the major harvesting regions of Tigray, Amhara, and Benishangul (F.B. Pers. Comm. Emiru Birhane, Yeshimebet Tegenie, and Abeje Eshete).

Simultaneously, armed conflict significantly alters institutional dynamics and the ability of formal governance structures such as national park staff, national and local governments, and NGOs to influence forest management. State institutions that may previously have sought to manage and control resource access and exploitation practices can be rapidly removed from (local or regional) relevance. In Kafta-Sheraro National Park in Ethiopia, for example, elephants and *Boswellia papyrifera* trees had both enjoyed protection, including a ban on resin extraction for more than 15 years prior to the Tigray War. During the conflict, however, staff were evacuated and facilities protections were largely abandoned, leading to extensive burning, cutting of trees, illegal tapping of *Boswellia* trees, and new trade in ivory and bushmeat hunted in the park (F.B. pers. comm. with E. Birhane, Negash and Birhane, 2023). There is a general trend towards the devolution of *Boswellia* forest governance from state-level institutions to local cooperatives and community-level institutions (Farah, 1994; Farah, 2008; DeCarlo et al.,

2020, Tegenie et al. in review), though conflict can greatly accelerate the process. While community-level forest management is often successful in more stable contexts, armed conflict can drive the collapse of traditional management practices (Stevens et al., 2011; Ingalls and Mansfield, 2017) and/or armed actors can directly infiltrate community-level organizations (Baral and Heinen, 2006). Frankincense harvesting systems are typically heavily dependent on traditional ecological knowledge and community-level traditional management systems. However, it is unclear how the disruptions of armed conflict may be affecting these systems, or how conflict is interacting with pressures driven by environmental degradation and change, long-term demographic changes, and sedentarization (Beyene, 2017; DeCarlo et al., 2020).

The displacement and movement of people, both harvesting and non-harvesting communities, has already had a significant impact on harvesting systems. Both armed conflict and environmental processes such as climate change-worsened drought and rangeland degradation drive displacement. In Ethiopia, for instance, state sponsored resettlements started in the 1950's where large numbers of people were supported and stimulated to leave the degraded highlands and move to the more fertile lowlands in the north west, the region where *Boswellia* forests abound (Lemenih et al., 2014). For such internally displaced or otherwise transitory people, harvesting frankincense resin may represent a quick source of income. The presence of "illegal" harvesters collecting resin without the permission of the legitimate landowners further degrades land tenure security; they are also likely to use less sustainable tapping methods as they have no long-term stake in the resource (DeCarlo et al., 2020, SJ Pers. Comm. with land managers in Humera, Ethiopia April 2018). A similar pattern has been seen in post-conflict northern Uganda, where weakened land tenure and governance resulted in reduced incentives for agricultural investment and increased land conflicts (Mugizi and Matsumoto, 2021).

In addition to transitory or informally re-settled displaced people, refugee camps may represent an outsized impact on *Boswellia* trees in the vicinity of the camps. Refugees utilize locally available forest resources for firewood, charcoal, and construction material, and this demand can drive significant deforestation and land degradation around the camps (Allan, 1987; Hagenlocher et al., 2012; Braun et al., 2016). Refugees who find themselves living in forest areas in the absence of refugee camps also depend heavily on forest resources, and while *Boswellia* trees may not be specifically targeted, the general demands for resources can drive wide-scale deforestation (McNeely 2003; Langer et al., 2015). This heightened demand on forest resources has been developing in northern Ethiopia during and after the Tigray War (2020–2022), in which local people found themselves increasingly dependent on forests for food, fuel, and water management (Gebrekirstos and Birhane, 2023). Intriguingly, while the increased demand has undoubtedly degraded areas of forest, it has also reportedly fostered greater interest in conservation and sustainable management, as people see the critical services provided by natural forests and move away from an "agriculture only" mindset (F.B. pers. comm. with E. Birhane). However, it remains to be seen how important human displacement is to determining management outcomes, and how this affects traditional management systems.

Finally, an underappreciated but likely important factor in natural resource management is psychological trauma. Severe conflict, both acute and chronic, creates significant trauma both individually and at community and society levels, particularly as a result of the human rights abuses often accompanying warfare (Anckermann et al., 2005, FERN, 2001). In many cases in frankincense, conflict is either re-occurring (ex. Ethiopian Civil War 1974–1991, then the Eritrean-Ethiopian War (1998–2000) and recently the Tigray War

2020–2022) or ongoing long-term (Somali Civil War and insurgency, 1988–Present), which means that impact is multigenerational. This trauma can hamper efforts for external actors such as companies, NGOs, or national governments to engage communities in sustainable production projects (Boege and Franks, 2011). The effect of psychological trauma on the perception of human-environment relationships and use of traditional knowledge that underpins many frankincense resin harvesting systems is little-explored but may be an important factor in how management inputs are applied in conflict and post-conflict settings.

Conflict involvement in value chains

Armed conflict can fundamentally re-shape value chains and local economics by denying access to resources, altering trade routes, and either closing markets or opening opportunities for broader exploitation of natural resources (Gaynor et al., 2016). Natural resources may also be sources of revenue for armed actors. This can be concentrated on specific high-value resources such as ivory (Beyers et al., 2011), cocaine (Clerici et al., 2020), or rhino horn (Anagnostou and Doberstein, 2022) or on broader revenues, such as the Maoist rebels' capitalization on community Forest User Groups in Nepal (Baral and Heinen, 2006) and Congolese rebels' capture of ecotourism revenues from national parks and gorilla tourism programs (Nellemann et al., 2010). Similarly, it has been reported that the Russian Federation Armed Forces plan to log occupied Ukrainian forests as a source of material and revenue to support the war effort (Petrenko, 2022).

The use of the frankincense trade as a funding source for VNSAs (Violent Non-State Actors) is uncertain, but there is suggestive evidence that this is taking place in northern Somalia. Both Al-Shabaab (AS) and the Islamic State Somalia (ISIS) have theaters of operation based in major frankincense harvesting areas in the Cal Madow and Cal Miskeed mountains, respectively (Karr et al., 2023; Weiss and O'Farrell, 2023; Fig. 3). The proximity between resin harvesting and VNSA activity is highlighted by a 2019 US military drone strike near Timirshe village in Puntland, a major frankincense trading hub and the site of a clinic built by a major US essential oil company purchasing frankincense. The strike

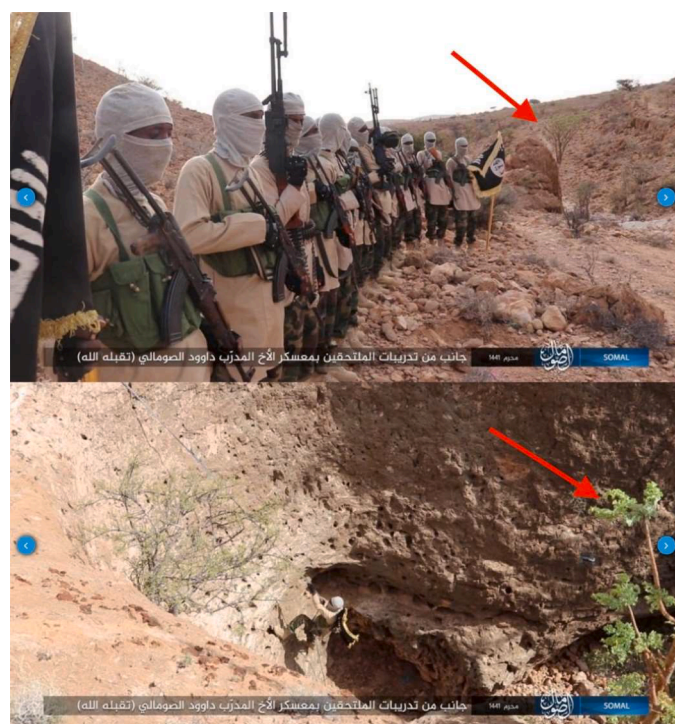


Fig. 3. Propaganda photos released by ISIS on September 19th, 2019, showing insurgents training. *Boswellia* trees are visible in the photos (red arrows).

¹ Commonly referred to as Sudanese, Ethiopian, Eritrea-Type, or Tigray-Type Frankincense.

killed several people; the US military asserts that they were insurgents, while local elders insist they were frankincense harvesters (Hassan, 2019). Additionally, both VNSA groups use extortion of local businesses and communities to fund their activities (Levy and Yusuf, 2021), and with few major industries operating and generating export dollars in this region, frankincense traders and harvesters are a prime target. Indeed, multiple traders have acknowledged (albeit on the condition of anonymity) both publicly (Hassan, 2022) and privately (S.J. Pers. Comm. with two traders, 2023) that payments are sometimes made to these VNSAs to ensure safety and continuity of trade. Anonymity is rule here and the informants deny that they themselves have ever made such payments. Funds may also flow to these groups indirectly, in the form of “taxes” levied upon the local (harvesting) populace, for whom frankincense is a major source of income (FSNAU, 2016; Levy and Yusuf, 2021).

One aspect in need of clarification is the role of clan ties and social networks in mediating the VNSA involvement in the trade. Kinship ties are essential to the functioning of Somali society, and kinsmen feel obligated to support one another (Lewis, 2003). This obligation extends to the frankincense sector as well, where kin relations play a role in regulating access to frankincense fields and may be invoked by traders to achieve priority access to resins or trade deals (Farah, 1994; Ibrahim, 2023). The importance of kin relations can be seen in the case of ISIS in Somalia. Most ISIS leadership is drawn from the Ali Saleban sub-clan of the Majerteen clan, which has its roots in central Puntland (northern Somalia). As a result, this is the primary area of operation for the group, providing a range of benefits. Villagers and traders feel obligated to trade with their VNSA-associated kinsmen. This clan solidarity provides a deterrent to large-scale military assaults, as a large-scale military expedition which would likely be seen by the clan as an attack on the clan as a whole. ISIS has been able to use networks of businesses owned by Ali Saleban clan members to move funds around Africa (Viktor, 2019; Houreid, 2023). This support from their clan has been cited as a key reason for ISIS’s continued survival (Viktor, 2019).

Whether frankincense trade revenue from other *Boswellia* species or areas supports conflict is unclear, although there are other VNSAs operating in areas producing frankincense that could potentially benefit from the revenue. Examples are Al Qaeda in the Arabian Peninsula (AQAP) in Yemen, the Rapid Support Forces (formerly Janjaweed) in Darfur, Sudan, the Sudan People’s Liberation Movement-North (SPLM-N) in southern Sudan, Boko Haram in Nigeria and ISIS related groups in Mali, Niger and Burkina Faso (Haddad, 2022; Fletcher et al., 2022, Olaniyan, 2018). Although these groups may benefit from frankincense revenue, it is unlikely to be a major funding source given the relatively limited trade value at origin. The export value of frankincense from the country of origin is often no more than a few tens of millions of dollars in total (Cunningham and DeCarlo, 2022). However, it may play an outsized role in certain circumstances for groups like ISIS that have few other funding options and for which it is one of the major export products in their theaters of operation (FSNAU, 2016).

The presence of armed conflict in frankincense production zones has broader implications than direct funding of violent actors. The danger resulting from the presence of armed groups stymies opportunities for external actors such as companies or multilaterals to meaningfully invest or improve value chain governance. Many organizations have policies prohibiting their employees from operating on the ground in conflict zones, which in turn severely reduces their ability to trace the value chain to source or enforce code of conduct standards. Conflict may also incentivize opacity in the value chain. While layers of middlemen (Cunningham and DeCarlo, 2022) reduce the ability to enforce standards (zu Ermgassen et al., 2021), they also insulate risk-averse actors from direct involvement with conflict, providing plausible deniability should evidence of abuses surface. This was the initial response of international companies to the child and forced labor scandal in West African cacao (Schrage and Ewing, 2005).

On the other hand, the threat of conflict involvement may provide a greater incentive to trace individual value chains, in order for companies

to differentiate themselves from the broader market, should customer awareness of these issues develop, or the denial of responsibility prove inadequate (as it did in West African cacao). The diamond trade has seen a similar pattern of corporate conduct: diamond firms spent years denying the involvement of conflict in their supply chains, but were forced into action under threat of boycotts, regulatory processes, and massive losses as a result of “blood diamond” and “terror diamond” pressure campaigns by consumer advocacy groups (Le Billon, 2006). These campaigns forced improvements in traceability, although the ultimate benefits to miners remain questionable in many cases (Deberdt and Le Billon, 2021). The recent reporting on rape and sexual abuses committed against girls and women in Somaliland by personnel of a large frankincense exporting company is a direct example of the threat posed by a lack of value chain transparency. While these abuses were not directly the result of armed conflict, the opacity in the value chain, partially resulting from chronic low-level conflict and insecurity, created the conditions in which they were able to take place. In this case, the opacity was not a benefit to downstream companies; the exporter’s largest commercial partner, in the wake of repeated negative publicity about the abuses (Hassan, 2022; Fobar, 2023a, 2023b), declared they were suspending operations in Somaliland and hiring external investigators. The attitudes, incentives, and strategies behind value chain actors’ approaches to conflict risks have not been well-explored but are certainly pertinent to frankincense value chains.

Future directions

Armed conflicts of various types, intensities, and durations are a pervasive force across the ranges of many species of *Boswellia*, particularly in the Horn of Africa and Sahel. These conflicts likely have substantial impacts on these species and frankincense production systems, in both subtle and dramatic ways. Given the impoverished literature on this topic, it is a fertile area for further inquiry. Key outstanding questions include:

1. How significantly do direct combat operations and unexploded ordnance affect *Boswellia* regeneration, forest structure, and harvesting and grazing impacts? Under which conditions are these impacts net negative or net positive for *Boswellia* forests?
2. How do the effects of armed conflict, particularly the displacement of people and psychological trauma, impact land tenure, the transmission of traditional ecological knowledge, use or enforcement of traditional resource management practices, and human-environment relationships? How does this interact with political and historical processes?
3. To what degree do revenues from frankincense harvesting feed into conflicts, and how do the social and kinship networks surrounding frankincense production and armed conflict actors influence this?
4. What is the role of conflict in incentivizing or disincentivizing value chain involvement by external actors such as international companies?

Better understanding the role that armed conflict plays in determining frankincense production and socio-ecological management will be key to ensuring the efficacy of programs designed to enhance livelihoods and secure the conservation of *Boswellia* species. Research into these issues will necessarily need to be interdisciplinary, sensitive to the social and political delicacy of conflict issues, and conducted in collaboration with affected communities both local, national, and international. Doing so will be critical to securing long-term conservation for frankincense in regions that are likely to be affected by conflict for the foreseeable future.

CRedit authorship contribution statement

Stephen Johnson: Writing – review & editing, Writing – original

draft, Visualization, Investigation, Conceptualization. **Frans Bongers:** Writing – review & editing, Supervision, Investigation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Stephen Johnson reports a relationship with FairSource Botanicals, LLC that includes: equity or stocks. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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