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Evaluating conflict surrounding mineral extraction in Ghana: Assessing the spatial interactions of large and small-scale mining

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ABSTRACT

Since implementation of its Economic Recovery Program in 1983, Ghana's extractive industries have come to account for 40% of the total value of the country's exports. An adverse impact of this increase, however, has been increased extraction-related conflict due to heightened competition between large and small-scale operators over mineral-rich lands. This paper characterizes these conflicts in the south-central section of the country by mapping the spatial overlaps between large and small-scale miners. Classification tree analysis of 2013 and 2015 Landsat-7 and -8 imagery was used to identify small-scale mine sites. The overlaps between these sites and large-scale concessions are examined in the context of reported mining conflicts. Results reveal that there is a large amount of resource competition between the two parties, specifically, more than half (i.e., 52%) of the identified small-scale mining activity occurs within the boundaries of large-scale concessions. The northwest corner of the study area contains 50% of the identified overlaps; the southwest corner contains 40%; and the northeast corner contains 10%. In most cases, these overlaps take place on prospecting concessions. The work illustrates how mapping and quantifying areas of spatial overlap between large and small-scale miners can help stakeholders implement more effective policy solutions.

1. Introduction

This paper identifies areas of small-scale mining (SSM) activities using a classification of remotely sensed Landsat data to determine locations of spatial overlap between SSM and large-scale mining concessions, and contextualizes the areas identified within histories of mining-related social conflict. The maps and visualizations produced provide stakeholders with a better understanding of the spatial dynamics that surround extraction-related conflict in Ghana. Mapping SSM and large-scale mining assists policy makers with identifying where areas of competition between the two branches of the sector is high, helping to focus efforts and leading to strategies which better account for the existing tension and spatial relationships within the extractive industries. Tensions between Ghana's large and small-scale miners have been well-documented in the literature (Hilson, 2001; Hilson, 2002a; Hilson and Yakovleva, 2007; Banchirigah, 2008; Aubynn, 2009; Hilson and Banchirigah, 2009; Nyame and Blocher, 2010; Teschner, 2013; Ayelazuno, 2014; Nyame and Grant, 2014), although the spatial distribution of the sector's activities have yet to be brought to bear in efforts to contextualize these conflicts. Highlighting areas where overlaps between SSM and large-scale mining occur, along with an assessment of the contextual histories of tension in specific regions, can provide a more nuanced understanding of extraction-related conflict. These findings can help to inform policy by drawing attention to the fine spatial scale impacts of different strategies for specific areas.

The paper examines the spatial relationships between small and large-scale miners in Southern Ghana where the Central Region, Western Region, Eastern Region and Ashanti Region intersect (Fig. 1). In Ghana, SSM is largely informal, populated by low-skilled workers who use simple technology, and most frequently takes place in areas with shallow mineral deposits, such as alluvial deposits along river channels (Appiah, 1998; Aryee et al., 2003; Hilson and Yakovleva, 2007; Aubynn, 2009). Large-scale mining is typically carried out by foreign companies which use mechanized equipment and employ comparatively fewer, albeit more skilled, workers (Garvin et al., 2009; Amponsah-Tawiah and Dartey-Baah, 2011). All three types of licenses linked to large-scale mining in Ghana – mining, prospecting, and reconnaissance – are used to geographically represent ownership of rights to extractive activities, and in the case of mining leases, the actual *presence* of activity. Reconnaissance licenses are the first step in the mining

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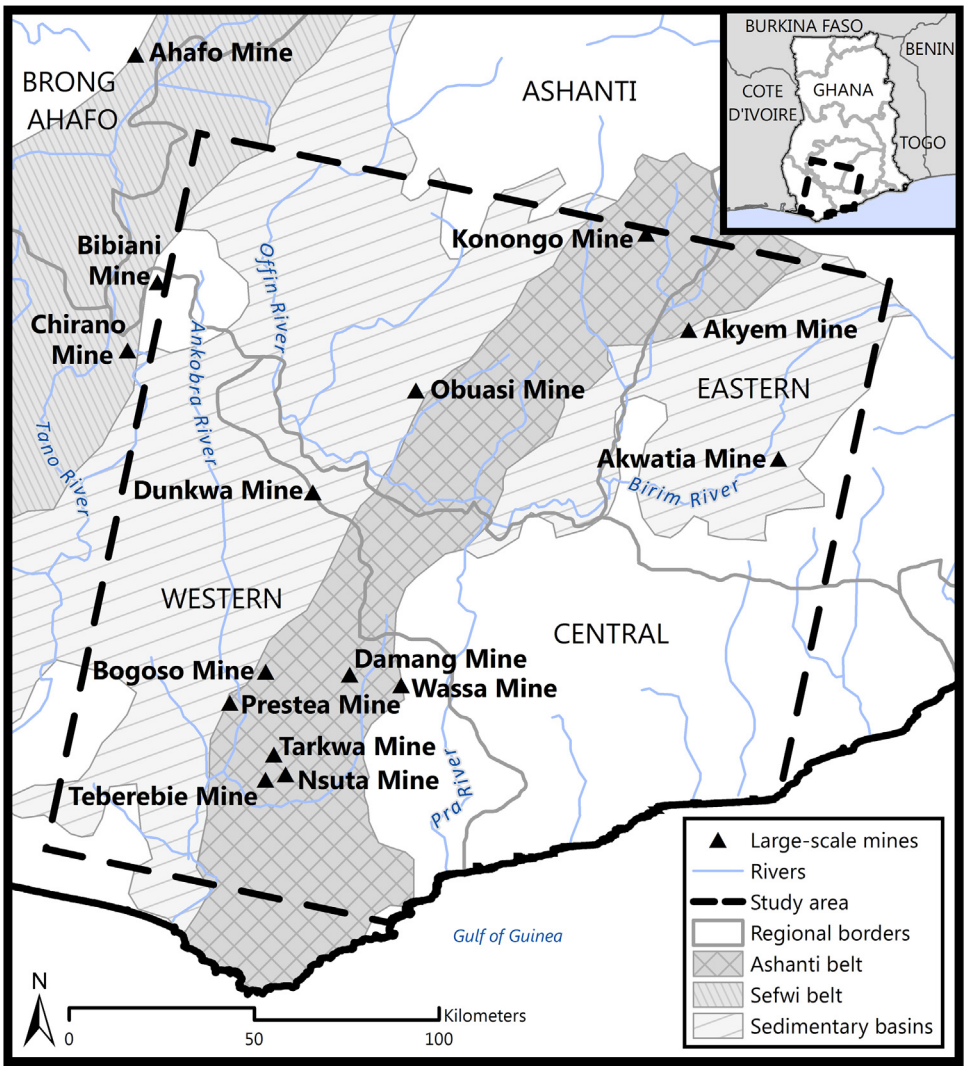

Fig. 1. Study area is shown along with large-scale mines, regional borders, rivers, and the major geological formations running throughout the area.

process, are valid for up to one year, and allow for only aerial and/or field surveys; prospecting licenses are valid for up to three years and allow for sub-surface examination of mineral deposits; and mining licenses allow for extraction and are issued for up to 30 years (Cuba et al., 2014). The three types of corresponding concessions are differentiated to indicate what stage in the mining process an area is in which can influence the amount of extraction-related conflict, as most conflict occurs after periods of surveying (Hilson, 2002b), activity mainly associated with reconnaissance and prospecting concessions (Cuba et al., 2014). Although actual mining occurs on a very small percentage of large-scale concessions, these are used to delineate large-scale mining activity as they represent a right to explore the mineral resources within their boundaries (Cuba et al., 2014) that when encroached upon by small-scale miners can lead to extraction-related conflict (Hilson, 2002a; Hilson, 2002b; Ayelazuno, 2014).

The paper uses a classification of Landsat-7 and Landsat-8 imagery and a set of ancillary variables to map SSM locations in south-central Ghana. The locations of classified SSM are then examined in conjunction with large-scale concession data, unofficial government-designated areas for SSM, as well as information on the existing tensions in specific areas to assess how spatial interactions of the two sectors influence the occurrence of conflict. The amount of tension in an area is represented by records of negative interactions between large and small-scale miners discussed throughout the academic literature, conflict databases, news sources, and publications of some non-governmental organizations. These conflict data range from recorded instances of violence between the sectors, to accounts of tension due to SSM encroachment. The work provides stakeholders with an understanding of the spatial dynamics and relationships between SSM and large-scale mining contextualized within recorded instances of conflict. This information can be used to formulate policy solutions that more effectively decrease or resolve extraction-related conflict.

2. Small and large-scale mining in Ghana

Global material use has increased eightfold over the last century (Krausmann et al., 2009) leading to increased demands for traded commodities, such as food, fuel, water, and timber (Behrens et al., 2007). In response to the greater use of, and demand for, these traded goods, extraction of raw materials has increased by roughly 80% in the last 30 years (Dittrich et al., 2012). The use of non-renewable minerals grew 340% between 1945 and 1973, becoming the most widely-demanded group of resources

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