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Transnational mining corporations and sustainable resource-based livelihoods in Sierra Leone

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This paper draws from world-systems and sustainable livelihoods approaches to analyze the connections between multinational exports of rutile (titanium oxide), diminished ecological resources and resource-based livelihoods, and gendered household dynamics in a peripheralized mining region in Sierra Leone. The discussion focuses on how the extraction of mineral resources instigated by exogenous capital investors forces links to household transformation, particularly the vulnerability context of women. Using archival records and field survey data, the case study of rutile mining in southwestern Sierra Leone connects the low-waged mining labour of traditional resource-based subsistence communities and deepening marginalization of and financial pressures on women in mining households to global mineral markets. The study focuses on women's coping mechanisms that are embedded within traditional social networks in relation to an external intervention, a low-tech mechanical cassava grater, intended to strengthen their livelihoods. It finds that the potential for this transformation is impeded by sociocultural, environmental and financial limitations.

Keywords: mining, sustainable livelihoods, Sierra Leone, gender, world systems theory

Introduction

The location of Sierra Leone on West Africa's Atlantic coast has facilitated its interaction with other regions through trading in natural resources. The country has an area of 71 740 km^2 in the tropical rainforest belt, 75 per cent of which is mineral rich basement terrain. Minerals became an important revenue earner in the late 1920s to early 1930s when diamonds and iron ore were first mined for the British armament industry. Since then the economy has remained heavily dependent on large-scale capital intensive mining of rutile (titanium oxide), diamonds, and bauxite. Before the Revolutionary United Front of Sierra Leone (RUF/SL) insurrection (1991–2001) – the so-called 'blood diamond' war – caused a countrywide shutdown of all operations in 1995, mining contributed 90 per cent of Sierra Leone's export (foreign exchange) earnings while making up 15–20 per cent of its gross domestic product, and provided livelihoods for 16 per cent of its population of some 5.25 million. When mining resumed in 2006, projections were that employment in large-scale mines could reach 38 000, and that the presence of such mines would provide livelihoods for an estimated 300 000 dependents and family members (World Bank, 2008: viii).

Sierra Leone's mineral sector experience fits the world-systems model of unequal exchange and trade between core beneficiary countries and periphery countries that derive little economic benefit from their natural resources (Wallerstein, 1974). Central to this model of international capitalism is the exploitation of local labour as part of commodity chains that are networks for the extraction, production, distribution, marketing and consumption of resources and basic goods; furthermore, the production processes of such commodity chains, particularly those involved in primary resource

extractions, shift socioeconomic, political and environmental costs to peripheral areas. Processes of global capital accumulation thus intersect with social inequality and environmental change at the local scale and undermine the sustainability of traditional gendered resource-based livelihoods (Herkenrath & Bornschier, 2003; Biel, 2006; Hornborg *et al.*, 2007).

Drawing on a case study of rutile dredge mining in Southern Province, Sierra Leone this paper examines the linkages between resource extraction, global trade and household livelihoods within a combined theoretical framework of world systems and sustainable livelihoods. In doing so it highlights core–periphery inequities associated with rutile mining that include local men's low wage labour, unequal access to and differential pressures on natural resources, and specific impacts on traditional women's livelihoods. The case study focuses on women's coping mechanisms to improve household livelihoods centred on a co-op formed around the use of a mechanical cassava grater. The longer term prospects of this project underscore the complex challenges of preserving the bases of sustainable resource-based livelihoods in the context of the core–periphery relations that embody a crucial component of the Sierra Leone economy driven by powerful global market players.

Conceptual framing: world-systems analysis and sustainable resource-based livelihoods

In the world-systems model of international capitalism, the structural constraints of the inequitable core–periphery relationship between transnational mining companies and peripheral countries such as Sierra Leone (Herkenrath & Bornschier, 2003) are perpetuated through state mechanisms, policies and laws, and traditional governance institutions. The peripheral country typically operates as a 'renter state' that receives royalties and taxes from mining and acts as facilitator in global-local negotiations favouring transnational extractive operations (Obi, 2008). In the peripheralized resource extraction environment, traditional kinship modes of governance, including patron-client relationships, overlap and are transformed by new sociopolitical and economic forms such that local traditional authorities, national figures and company personnel often form complicated and contradictory political alliances.

De Haan and Zoomers (2005) emphasize that unequal power relations between stakeholders have an important bearing on their rights, legally sanctioned or not. Households in rural natural resource-based economies find themselves competing for ecological resources or find their rights and access to land and customary land use protocols in direct conflict with arrogations by external interests. Commercial interests supported by state institutions endanger the subsistence livelihoods of often long settled communities and households, causing people to overexploit their natural resources for survival (Mbaiwa *et al.*, 2008). The structure and processes of powerful institutions like transnational mining corporations play a significant role in transforming the economic, social and environmental vulnerability context for livelihoods of traditional subsistence agricultural communities (Figure 1), and represent key linkages between global actors and capital and local households (Bury, 2008).

In this broadly outlined vulnerability context, the household is a local entity embedding gender and generational power disparities over control and access to resources. Gendered labour roles and entitlements remain significant in the reorganization of internal household dynamics, power struggles and inequities in resource allocation (Whitehead, 2002). Environmental changes instigated by global mining operations in

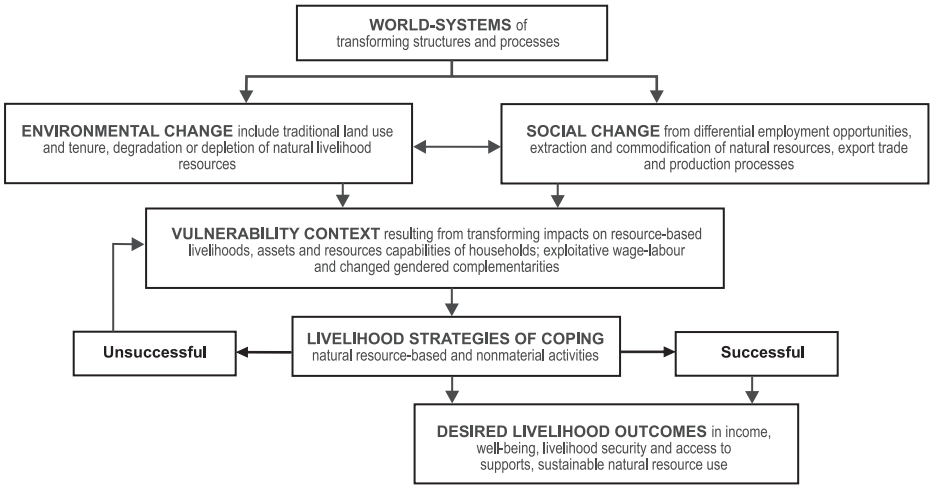

Figure 1. *Combining the world-systems and livelihoods frameworks to contextualize the livelihood vulnerability and coping strategies of women in traditional resource-based agricultural households in the Sierra Leone rutile mining area case study (adapted from Adams et al., 1998; Ashley & Carney, 1999; Dunaway, 2001).*

Sierra Leone impinge on traditional land use through outright privileged control, land degradation and changes to the ecological resource base and local economy that structure social hierarchies (Bebbington *et al.*, 2008). The resulting household vulnerability to external shocks and stress has significant impacts on the assets, resource use and capabilities of households.

Many world-systems analyses have acknowledged the reorganization of internal household dynamics and the existence of power struggles and inequities in resource allocation along gendered lines, but few address these livelihood issues in depth (Smith & Wallerstein, 1992; Dunaway, 2002). Women become part of commodity chains through their nonwaged or unpaid productive and reproductive labour contributions that underpin the survival of households, particularly vital in peripheral countries. For example, households are resource pooling units through women's activities such as fuelwood gathering, water collection and small-scale market productions. In short, as Dunaway (2001: 12) explains:

> [households become] microcosms of the structural inequities of the capitalist world-system . . . Within non-western households women and men frequently conflict over the allocation on ecological resources. When capitalist incorporation creates new wage and trade opportunities for males, these economic activities quite often threaten the ecological resources from which women produce household sustenance and trade commodities.

Sustainable livelihoods research focuses on transformations at the household level that relate to vulnerability and to household insecurity, including that of women. Vulnerability is characterized by an external component of risks, shocks and stress, and an internal component of defenselessness on the part of those impacted by restricted political, economic, and social rights (Chambers & Conway, 1992; Ellis, 2000; Hogan & Marandola, 2005). Limited and diminishing access to local natural resources caused by more powerful external interests force communities to adopt coping mechanisms to maintain livelihood sustainability (Figure 1) that may either lead to successful outcomes

(Adams, Cekan & Sauerborn, 1998), or create economic dependency with implications for self-reliance and long-term sustainability (Nel *et al*., 2000). Three common coping strategies in resource-based household economies are agricultural intensification and extensification, livelihood diversification and migration (Scoones, 1998). Empirical studies of rural African households (as elsewhere) have clearly demonstrated that women typically have very limited access to available resources or institutional supports compared to men, and that they therefore experience external shocks in a much greater way and employ a variety of coping strategies to sustain their households and strive towards positive livelihood outcomes (e.g. Torkelsson & Tassew, 2008). The Sierra Leone case study conceptualizes this vulnerability as compounded by insufficient wages in mine labourer households and the destructive outcomes of environmental exploitation driven by transnational capitalism that undermine the viability of traditional female livelihoods, transforming gender social relations and decreasing the assets, resources and capabilities of households to fully meet subsistence needs. As seen in the diamond areas of Kono District, Eastern Province (Wilson, 2010), for example, in the face of uncertainty and unreliable income, mining households rely heavily on supplementary income derived from a variety of livelihood strategies that women in particular employ.

Ahmad and Lahiri-Dutt (2006) explain that because the gender aspect of livelihood marginalization caused by mining projects has been poorly examined, the commonly held assumption is that men and women experience marginalization, displacement and rehabilitation in similar ways. Nevertheless, Adams and Castle (1994) argue that, although patriarchal systems dominate in West Africa and men typically control decisions on resource allocation, women have decision making powers through certain designated functions and roles. And Lakwo (2006) presents further evidence that African women are not always victims of marginalization but oftentimes negotiate positions of power in households through 'wielding and yielding'. De Haan and Zoomers (2005: 5) are sceptical about achieving positive livelihood outcomes in contexts characterized by unequal power relations because:

> restricted access to resources and opportunities is the result of mechanisms by which people are purposefully excluded from access so as to maximize the returns of other. . . . As a consequence, paying attention to power relations starts with the exploration of the mechanisms and working of institutions as power relations are legitimized by institutions and continuously reproduced by them though, at the same time, they may be challenged during their reproduction.

Coping strategies might, therefore, lead to successful livelihood outcomes such as more income, improved food security, reduced vulnerability, and increased wellbeing (Figure 1). Alternatively, unsuccessful coping mechanisms can increase vulnerability and exacerbate environmental and social change. As illustrated in Figure 1, this conceptual framing usefully clarifies the connections among transnational corporations and capitalism, global trade, national institutions, and households in the Sierra Leone mining area outlined below.

Rutile mining in Southern Province, Sierra Leone: background to the case study

Sierra Leone's rutile and ilmenite production mines are located solely within the Special Exclusive Prospecting Licence area comprising 580 km^2 in the Moyamba and Bonthe districts of Southern Province (Figure 2), encompassing the traditional Banta, Mokelle and Imperi polities of the indigenous Mende communities. The authority of the

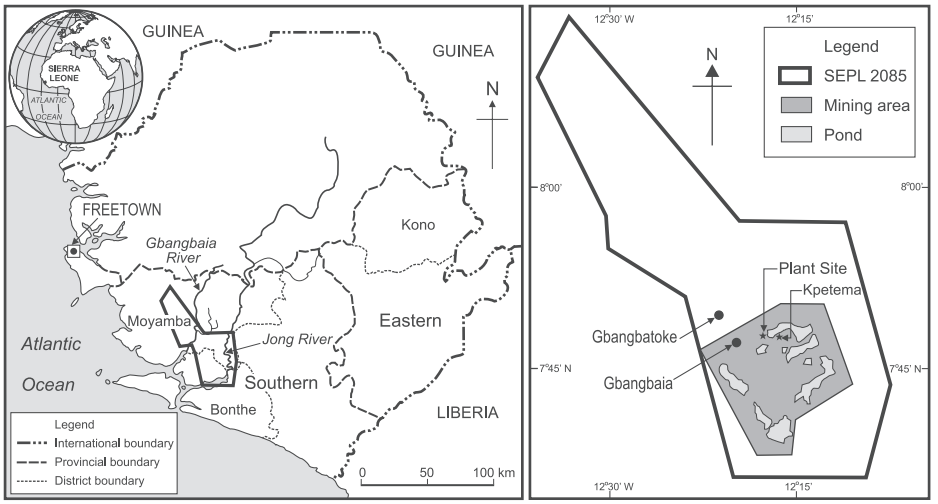

Figure 2. *Locations in Sierra Leone of the study site Kpetema village, the Sierra Rutile Limited (SRL) Plant Site office and the nearest market town, Gbangbaia, in Moyamba District, within the Special Exclusive Prospecting Licence (SEPL) area in Southern Province.*
Source: **modified from Davies *et al.* (1992: 2).**

hereditary paramount chiefs who govern the Mende living in villages amidst one of the world's largest and richest natural rutile deposits is superseded by national governing structures. The SEPL has been held by various mining corporations since 1967 and since 2006 the area has been leased to Sierra Rutile Limited (see further at http://www.sierra-rutile.com/press-releases/titanium-resources-group-press-releases).

The traditional political and socioeconomic regulatory system in which Mende chiefs and elders of land-holding lineages collaboratively decide on land allocations for subsistence agriculture also embodies a custodial oversight that discourages poor land and resource utilization practices such as early burning for shifting cultivation and premature harvesting of commercial tree crops, and so on. Farming households carry out agricultural work throughout most of the year, harvesting and clearing fields for the next farming cycle during November–February, which is the season for initiation and harvest ceremonies. Within this community land use structure, clearly defined gender roles and gender-specific group activities sustain communities and strengthen interdependence; those with no kinship rights or obligations – migrants or strangers – might be permitted access land under historically established community arrangements (Abraham, 2003; Unruh, 2005).

However, the transnational Sierra Rutile's mining operations have imposed new socioeconomic structures on traditional land use systems, impacting customary conditions governing in-migration, the use of and access to land as well as sustainable natural resource use. Migrants, for example, no longer solely exploit land for agriculture but also for mining, and include Sierra Leoneans of other ethnic groups such as Temne and Fullah, and nationals from other countries such Ghana, Mauritius and Australia. Significantly, only some 26 per cent of the 1143 full-time employees of Sierra Rutile in 2009 were Mende from Moyamba and Bonthe districts (*Cocorioko*, 2009). Thus, while the Mende, remain predominantly farmers and fisherfolk, their land use practices and subsistence livelihoods are being inexorably marginalized through the alienation and loss of their ecological resource base. Moreover, although land is not commoditized in

the traditional land tenure system that still operates in most of rural Sierra Leone, in the highly sought after mining areas some land-holding families are prepared to overlook customary laws for monetary gain, often without involving legal documentation (Labi, 1972). Migrants also successfully take advantage of income-generating opportunities in densely populated mining areas as traders and service providers (Cleeve, 1997).

The dredge mining of titanium ore in rutile and ilmenite deposits, in reservoirs or dredge-ponds formed by damming the Jong and Gbangbaia rivers, is a method that destroys the topsoil and significantly alters the local ecological base for the natural resource-based subsistence agricultural communities settled in these areas. The dredge-ponds submerge prime alluvial farmland and gallery forests along streams, also leading to the loss of wild crop resources including plant fibres, medicinal plants, construction timber and fuelwood, as well as sacred sites. Periodic malfunctions in mining operations destroy crops and homes, as well as tracks and bush paths (Akiwumi, 2006; Akiwumi & Butler, 2008). After an 11-year hiatus during the civil war, the resumption in 2006 of Sierra Rutile's dredge mining and surface extraction processes continue to modify and degrade the natural, and thereby social, environments, causing household livelihood insecurity.

As a result, the Mende communities in the Sierra Rutile mining area are constrained in their efforts to sustain their traditional livelihoods, such as shifting cultivation and women's shallow-water fishing. Farmers are forced to cultivate mostly upland areas that have less productive soils with shorter fallow periods because of scarce land for shifting cultivation. Consequently, cassava, a tuber that grows on low fertility soil and can be processed to produce gari (a dry meal) and foofoo (a fermented starch), important revenue earners, has replaced the rice staple (now imported) as the primary crop. In fact, Bonthe and Moyamba districts are among the five poorest districts in the country, with the loss of livelihoods and resources from the environmental consequences of rutile (and bauxite) mining identified as important contributors to chronic poverty and food insecurity (Winnebah *et al.*, 2006).

Summary of research methods and fieldwork in Sierra Leone

The case study uses a variety of data to link macro processes of mineral extraction with women's livelihoods at the household level. To assess exogenous forces of the world system, archival data on mining in Sierra Leone was drawn from government mining agreements and policy papers and rutile company documents with annual trade and production figures. The analysis of these data included evidence of unequal exchange arrangements between the nation and mining companies in relation to taxes and royalties and loss of land and water resources by communities. Primary data collected during fieldwork from the Sierra Rutile offices at Plant Site which supplied information on mine employees' pay scales and wages for the rutile mineral industry.

The village of Kpetema, located approximately 100 m from a mined out dredge-pond, was selected as a typical example of a subsistence agricultural community impacted by the environmental degradation from rutile mining in Bonthe and Moyamba districts (Figure 2) Kpetema reportedly had a population of around 1000 in 2008, due to its proximity to Plant Site (pers. comm., Kpetema villager, May 2008), though any estimations in mining areas are problematic as migrants drift in and out in search of job opportunities.[1] Two field visits, in 2005 and 2008, were made in early May, the start of the annual farming cycle. In 2005, I carried out a preliminary survey over 7 days to assess how women in communities represented by Kpetema were coping, 11

years after the mine shutdown in 1995. I collected data through informal interviews (in Krio, the national language), key informant meetings and direct observation. The informal interviews worked particularly well with the local women, who were more inclined to respond to questioning when encountered casually during the course of their daily activities. Open-ended questions explored local perceptions of the environmental consequences of the mining process and the socioeconomic and cultural effects of mining on the community's lives. Following the formation of the gari producing co-op in 2006 by some women, including those interviewed in 2005, I continued to collect data on their project via electronic messaging conversations until my follow-up visit in 2008. The data on gari production were useful in assessing *muglomei* (literally 'our future' in Mende) co-op as an alternative livelihood coping strategy, specifically, the value of an external intervention – the acquisition of a mechanized cassava grater (enabled by a donation from a few Sierra Leonean women in the US) – in facilitating this and empowering women in households.

Fieldwork in May 2008 focussed on understanding women's livelihoods and adjustments in mining households using the 10 members of *muglomei*. Questionnaires administered to these women generated qualitative data about their livelihoods and income, the number of school-going dependents in their households, their relationship to the mine employee household member or head and their estimates of these men's mine incomes. In addition to key informant and informal interviews, and direct observation, two focus group meetings involving all *muglomei* members (each lasting several hours) addressed the gari producing co-op project with open-ended questions relating to the impact of the mechanized grating machine on gari production and the cultivation of cassava, relations between co-op members, the effect of women's access to the machine on gender relations in village households, and financial returns and prospects from gari production compared to other economic activities.

Key informants were the *muglomei* co-op management team members and their communications liaison (Ezekiel Kposowa, a draftsman at Sierra Rutile), as well as Sierra Rutile employees, particularly those in its Community Affairs and Human Resources departments charged with communicating directly with local communities on various historically contentious issues of corporate social responsibility for loss of lands and ecological resources including handling village compensation, rehabilitation and resettlement schemes (Kamara, 1997; Josiah, 2001; *Cocorioko*, 2009). I also observed the planting and harvesting (carried out whenever needed) of cassava and gari production. Finally, the accuracy and congruency of reported information and my observations were corroborated through investigator triangulation (Creswell, 2008) by a native Mende speaker (a woman working for the Community Affairs Department at Plant Site).

Linking core-periphery relations, household income and ecological resources: case study in Kpetema village, in Sierra Rutile's mining area in Moyamba District

Transnational control and the peripheralization of Sierra Leone's mining industry

Transnational mining operations have extracted rutile from southwest Sierra Leone since 1967. Core–periphery inequities are evident in colonial government mining policies, agreements and ordinances for the rutile industry and the continued privileging of Sierra Rutile's interests and profits by Sierra Leone's politicians through legislation, cheap pricing, tax holidays and reduced royalty payments. An analysis of available production data for the years 1980–1994, however, revealed that the Sierra Rutile's

Table 1. Differences between Sierra Leone export and world market prices for rutile, 1980–1991.

Year	Sierra Leone exports (USD/ton)	World market (USD/ton)
1980	250.3	885.6
1982	353.3	936.2
1985	330.9	540.0
1986	340.0	650–660
1987	421.0	650–660
1988	366.4	631.7
1991	489.4	545.0

Source: Compiled from Davis *et al.* (1994), Kamara (1997), Cleeve (1997), Knight Piesold (2001) and USGS (2005).

export price per ton averaged USD 409.2, while royalties, taxes, and surface rent payments to the Sierra Leone government averaged USD 10.6 – approximately 2.6 per cent of the total sales value. Some argue that Sierra Rutile, like the other mineral mining corporations, also undervalues its export price, pointing to the exceptionally large discrepancies between the world market prices per ton of rutile and that obtained by Sierra Leone as Table 1 shows for the decade 1980–1991.

The practice of setting the Sierra Leone rutile export price much lower than the world market price continued when the mining operations resumed after the RUF/SL rebellion ended. During the government's 2008 review of all Sierra Leone's mining contracts, the Deputy Minister of Mineral Resources acknowledged that renegotiations of Sierra Rutile's mining agreements during a period of political instability, including a 10-year tax holiday on all imports and exports, had clearly not been conducted in good faith for the benefit of the country (*Concord Times*, 2008).

The deepening unequal international exchange inherent in Sierra Leone's mining agreements is reflected in the terms of employment of local people. Daily-rated mine employees in particular, recruited from traditional villages such as Kpetema in the vicinity of mining areas, have livelihoods that barely reach the subsistence level – in stark contrast to the elite compounds and subsidized facilities for expatriate and senior Sierra Leonean executives. At the national level too, disparities that are rooted in a history of colonial exploitation of cheap African resources and labour, including professionals (Rodney, 1981), are easily seen in top management positions held by expatriates (from countries of the global north such as Australia, Great Britain and elsewhere in Europe and the US) on a higher salary scale than their Sierra Leonean counterparts (Cleeve, 1997). Approximately 95 per cent of Sierra Rutile's local mine employees are 'junior' level daily-rated labourers, shift workers and security personnel (pers. comm., internal memo on 'workforce statistics' from production to general manager, Plant Site, 11 January 1991). Average monthly pre-tax pay for daily waged labour in May 2008 was SLL 300 000[2] (pers. comm., mine employee, Kpetema village, 13 May 2008), with benefits including subsidized rice and kerosene, and free medical care for workers and limited members of their households. In 2008, a 50-kg bag of the rice staple to feed an average family of eight for a month cost SLL 150 000 or 50 per cent of the monthly wage. Given these low wages among mine employees, women frequently seek additional income through livelihood diversification to ensure the wellbeing of their families.

The continuing expansion of rutile mining has seen a declining natural resource base and deteriorating livelihoods. The 2002 Sierra Rutile Mining Agreement (GOSL, 2002)

accorded the company the right to dam rivers and flood land for dredging operations without regard to the land and water needs of the indigenous communities, or the historical and customary prohibitions against damming river systems because of the impact on fish breeding cycles (Fenton, 1948). More damming still, the 2009 Mines and Minerals Act arrogates all rights and ownership over minerals in, under, or upon any land in Sierra Leone to the government, an appropriation that supersedes the rights of any others over mineral bearing lands (GOSL, 2009). This is in total contradiction to the existing Provinces (formerly Protectorate) Land Act Cap. 122 which states that: protectorate lands are vested in the tribal authorities (now chiefdom councils) to manage on behalf, and for the benefit, of community members with land rights. This unambiguous contradiction in statutory law remains a concern of members of the judiciary system (GOSL, 2008).

Shifting gendered practices in traditional resource-based livelihoods in the rutile mining area

Male-female social relations among the Mende include clearly defined gender roles and activities that reproduce sustainable practices of living (Leach, 1994). Women, for example, wade into shallow rivers and streams to fish, using *mbembe*, handheld scoop nets made from palm leaf twine. Reservoir construction for mining operations – made possible by government mining agreements – substantially affect this practice of obtaining food for the household as women cannot fish productively in the deeper mine reservoirs.

More critically, the strong spiritual and social connections between women, water, fishing and gender social relations underpin Mende culture. Fishing is a key component in the activities of the Sande, a traditional female religiopolitical and social order that educates young girls in life skills and societal roles, and conducts rites of passage centred on rivers as sacred sites and water as symbolic of the mystical space in the ritual belief systems (Boone, 1986). Following their initiation into the Sande, young girls acquire their own *mbembe* as a symbol of achieving adult status. Women's individual ownership of *mbembe* and their freedom to consume, share, or sell the fish at their own discretion are important gendered norms in Mende society.

Mine closures during the RUF/SL uprising had further eroded the value of women's fishing contribution and community status. Many men, previously dependent on mining incomes, became more active in deep-water fishing using gill nets and canoes in the mine dredge-ponds to generate an income, while women were confined to scooping up fish on the shores of these dredge-ponds or had to travel considerable distances from villages in the mining area to fish in undammed streams. This spatial marginalization of *mbembe* fishing illustrates the threats posed to the viability of the gendered social fundaments of sustainablity in indigenous communities (Mbaiwa *et al*., 2008) that have undermined women's livelihoods and therefore their influence in the household and, collectively, the community.

Women typically contribute to the rural Sierra Leonean household resource pool through not just *mbembe* fishing but also vegetable and fruit cultivation, and gathering firewood and other wild forest resources. All the women interviewed in this study stressed that the portfolio of traditional income streams were necessary to meet their customary obligations in sustaining household livelihoods but that they faced serious environmental challenges in doing so, citing, for example, the growing scarcity of firewood for toasting gari and smoking fish for sale, apart from meeting their own domestic needs. This was evidenced by communities resorting to cutting down the acacia trees planted by Sierra Rutile as part of its environmental rehabilitation efforts

(pers. comm., minutes of 'Meeting with Muglomei Women's Group', 22 July 2005, Environmental Safety and Health Department, Plant Site). This concurs with observations by Mbaiwa *et al*. (2008) that poor rural communities whose once sustainable resource-based livelihoods are threatened by environmental degradation will resort to overexploitation of their environment for survival.

Women's coping strategies: *muglomei* co-op in Kpetema village

Changes in scoop-net fishing brought on by the loss of men's mining income have the potential to eradicate traditional women's technical skills, weaken the social connections among women, and erode women's influence in their households and communities. Nonetheless, Kpetema women found new spaces for female interaction and camaraderie and alternative ways of coping with losses in income generation. Group cooperation is the norm in pooling labour resources for farmwork and creating social networks among Mende women. Access to a mechanized cassava grater and generator in 2005 became the impetus to formalize this group dynamic by establishing the *muglomei* co-operative as one strategy to mitigate their socioeconomic marginalization. The members felt that making their traditional group an official and modern co-op group increased the likelihood of leveraging donations and microcredit. Prior to this, access to a mechanical grater was through renting the only machine in Kpetema, which belonged to a local mineworker.

The original *muglomei* co-op consisted of 12 members, with an elected president, a treasurer and the village Sande elder as an advisor. Membership fluctuated, reaching 18 at one point, but by May 2008, there were only 10 active members, 2 of whom originated from other Mende communities and had relocated with husbands who were looking for mine work, while another 2 belonged to land-holding Kpetema families. The co-op's communications liaison, a polygamous household head whose two wives and daughter are co-op members, was seen as a useful asset as he could access email (through his work) and communicate on the group's behalf (reporting on their farming progress, technical problems with the machine and various members' concerns). Each member paid a monthly fee of SLL 500 to build a fund to support operations and help members in times of crisis.

Table 2 summarizes the basic household information for the 10 *muglomei* co-op members in May 2008 and also reveals the financial limitations of and challenges to mining employees' efforts to support large households (including two who have polygamous households). The large number of children (2 women had given birth to 12 children, for example) is not uncommon in rural households where not all are expected to survive childhood. However caring for and educating children in particular required a significant financial outlay, the main expense being the two school uniforms that were required. Apart from two members who had children being raised in other parts of the country by extended family members and friends. For the other members with children enrolled in school in Kpetema, their household financial obligations and need to access resources was made more pressing by having to bear the annual cost of two school uniforms stipulated for each school-going child: SLL 60 000 for each one in secondary grades and SLL 30 000 for each one in the primary grades. In addition to meeting other material needs, a daily-waged mine employee earning some SLL 3600 000 per year, for instance, would struggle just to provide uniforms for all his children to attend school. Also reflected in Table 2 is the large numbers of adults in households, compared to the national average of 6.6 (Winnebah, 2006). In mining areas

Table 2. Basic household data for the 10 *muglomei* co-op members in Kpetema village, Moyamba District, May 2008.

SRL mine employee in household		Total persons	Total adults	School children in household		Relationship of mine employee to *muglomei* member
Rank	Monthly income§ (pre-tax; SLL '000s)			No.	Cost of uniforms (annual; SLL '000s)	
Draftsman††	890 (USD 297)	32	16	16	690 (USD230)	Husband to 2 members†
Foreman*	750 (USD 275)	24	16	6	240 (USD 80)	Husband to 2 members†
Security**	500 (USD 167)	3	2	0	0	Son‡
Worker**	300 (USD 100)	7	4	6	240 (USD 80)	Husband
Worker**	300 (USD 100)	20	8	5	210 (USD 70)	Husband
Worker**	300 (USD 100)	19	10	3	150 (USD 50)	Husband
Worker**	300 (USD 100)	5	3	3	90 (USD 30)	Husband
Worker**	300 (USD 100)	10	3	2	60 (USD 20)	Husband's brother

††the intermediate level staffer who is *muglomei's* communication liaison; *junior level staff; **daily-rated workers; †polygamous household; ‡member is *muglomei's* president: a widow and household head who is raising an infant grandchild; §data from Sierra Rutile's Plant Site Human Resources Department.

these include family members and friends, who while they wait (indefinitely) for mine employment, may fish, farm, or find other activities and means of helping out such as contributing farm labour.

All the co-op members farmed individual plots of cassava to produce their own gari, on land made available through customary arrangements for subsistence livelihoods. The farm of the communication liaison's two wives was on sand tailings extending to the village edge, underscoring the conditions of scarce ecological resources. With access to the mechanical grater, *muglomei* members jointly cultivated cassava farms in 2007 and 2008 on accessible fallow land in the mined out surrounds (Figure 3). The group also began buying cassava from other farmers to increase the amount available for gari production. These financial transactions by the women's co-op reveal the changing social values of landownership in rural Sierra Leone, where they relate to regional mining operations driven by global markets and transnational capital (Labi, 1972).

Once cassava is harvested, women collectively do the peeling, grating, fermenting and screening. However, they hire men for the final toasting step in gari production, in exchange for bags of gari or cash. The men also transport the bags of gari in rented vehicles to a major rural market centre at Gbangbatoke, 18 km away, for which women also make contributions of cash or bags of gari (pers. comm., Kposowa, emails 15 November 2006; 22 November 2007). Trucks bound for the neighbouring Guinea come directly into gari producing villages such as Kpetema to make bulk purchases. Because manual grating with traditional graters is the most labour intensive and time-consuming part of the production process, for the *muglomei* co-op members there are obvious benefits of using mechanized cassava processors – as well as challenges, as later seen (Odebode, 2008).

Technology and household finances: women's vulnerability context

Thus though the mechanized cassava grater and group support were incentives to become a member of *muglomei* co-op, it was clear during fieldwork that members did not intend giving up their individual livelihood activities. A waiting list to become a member of the co-op developed because this machine greatly facilitated production

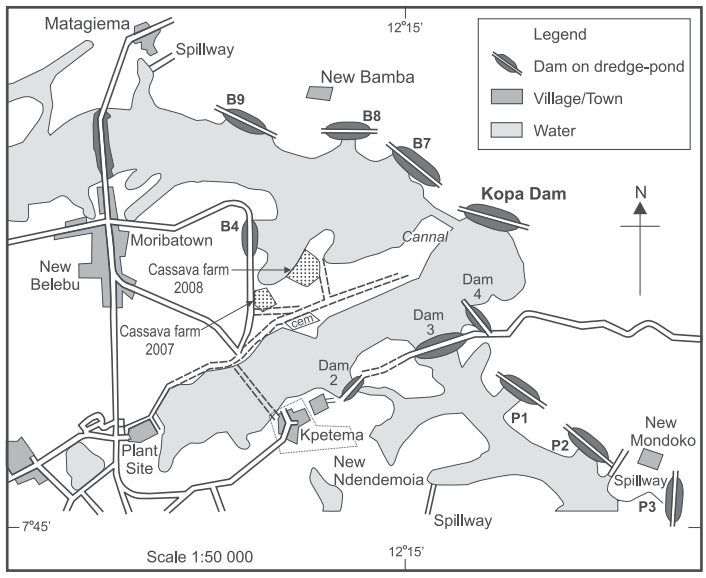

Figure 3. *Location of muglomei members' cassava farms set up in 2007 and 2008 in the mined out area surrounding Kpetema village, Moyamba District.*
Source: **modified from Sierra Rutile's Mines Planning Department map.**

Figure 4. *Using traditional hand-graters (left) and the generator-driven mechanized grater (right) in gari production, Kpetema village, XXX District, May 2008 (author's photographs).*

by requiring only 5 minutes to grate 150 kg of cassava compared to taking 20 minutes to grate 3 kg with the traditional handheld grater (Figure 4). After the toasting process, 150 kg of cassava yields a 50-kg bag of gari.

Although the machine greatly increased production, some challenges emerged in the co-op. Some members resigned (two because of disapproval from husbands and one over disillusionment with the group) and there was dissatisfaction, as emerged in a focus group discussion, about registered members who were inactive and did not regularly attend meetings, failed to pay the monthly dues, or did not participate in group farming tasks like planting. Women also reported that their communications liaison was going beyond his intended role to communicate by electronic mail on their

behalf, allegedly making unilateral decisions on membership selection and loaning the grating machine gratis to other villages, in collusion with the treasurer. The group preferred to limit membership for fear of machine overuse and recruitment of more non-paying members. Finally, the members believed that group management was weak and that the president did not take a firm stand on behalf of members and expressed a desire for strong leadership that would support efforts to reorganize the management structure and recruit responsible members.

The 2008 fieldwork revealed that the influx of migrants after the reopening of the mine in 2006 had made more labour available for hire in cassava cultivation, which is labour intensive. Although *muglomei* co-op, men are hired to help with physically demanding (and typically male) farming tasks of land clearing, digging and toasting cassava. Men also worked the cassava farms. As de facto members of the co-op, these men were entitled to use the grating machine. The *muglomei* women's discussion and agreement to allow men to become members of their co-op underscored the significance of complementarity in social gender relations in their local rural society.

While mine employees receive a monthly bag of rice from Sierra Rutile, women are largely responsible for the daily feeding of their entire households by also providing fish, vegetables and other complements. The co-op members did not know how much their mine employee husbands earned (as men did not share such information) but had the impression that they had important well paid jobs because they worked for a 'company' – wore smart uniforms, had access to vehicles and email, and so on. Ironically, therefore, the women generally feel that their husbands were simply avoiding their responsibilities to provide better for their families. As one woman at a focus group discussion stated: 'The men make enough money so they go off and marry new wives and have more children. Then they abandon their responsibilities to children from older wives'. Anxious about their husbands' increasing expectations as to how much they can contribute toward household livelihoods, the co-op members were reluctant to divulge their incomes. In fact, many low-income mine employees rely on charity, such as from senior mine employees, to meet their familial obligations. Only the two *muglomei* member households whose husbands earned the highest salaries claimed that their husbands helped them with the cost of childrearing, including school fees. And it is also likely that their husband's relative seniority gave them greater access to senior mining executives to request help and favours. Women's incomes from various livelihood strategies thus comprise an integral part of household livelihoods in Sierra Leone's rutile area as in other rural mining districts (Wilson, 2010). It is important, therefore, to pay attention to whether positive livelihood outcomes can accrue from their coping strategies and shifting activities in mining environments characterized by exploitation, uncertainty and unreliable incomes.

In the rutile mining environment case study, gari production as a coping strategy has the potential for both positive livelihood outcomes and continuing vulnerability. Women do not consider the availability of the mechanized grater as a reason for continuous production despite its potential to increase household income. In 2008, a 50-kg bag of gari sold for SLL 75 000, a price rise that paralleled that of imported rice to SLL 150 000 a 50-kg bag. In 2007, one co-op member had sold 9 bags of gari produced from her personal cassava farm for SLL 40 000 a bag. Production activities in the Mende culture are a part of a well-ordered timetable of community obligations and events including rites of passage activities and harvest celebrations. In the environmental uncertainty of mining areas, however, conforming to traditional norms sustaining

complementary and sustainable livelihoods in exacerbates vulnerability around improved food security.

Another limitation to positive livelihood outcomes is that the machine is not used to generate revenue from rental fees; instead it is used as a resource for building social networks important in communal cultures. Hence the communications liaison and co-op treasurer generally made the machine available to selected non-members at no cost. Further, members did not recognize the usefulness of paying a nominal fee to use the generator-run machine toward its upkeep and maintenance (in May 2008 petrol cost SLL 17 000 per gallon). More important, they did not consider the machine as an investment that would yield initial capital to build upon: access to individual microcredit was more desirable. So, group members did not keep track of or calculate profits from their mechanized gari production and the monthly fee log reflected a sporadic payment history since 1 July 2006. Some members attributed this reluctance to pay to disillusionment with the weak management of the organization.

A subsequent and telling update revealed that a donation of USD 700 from the Sierra Rutile Foundation (a corporate development fund) in 2008, towards what was perceived as a viable endeavour, had served as a catalyst for increasing membership to 20, but was used for a micro-credit loan fund instead, and furthermore, that the women were reluctant to repay loans. Also, in September 2010, problems with maintenance and periodic breakdowns of the grater were met with women's refusal to contribute to the cost of repairs and spare parts (pers. comm., Kposowa, email on 'Update of the Women's Project', 9 September 2010).

In sum, conflict over available resources for household expenses and symptomatic of the uncertainty of meeting costs are indicators of decreased wellbeing in daily waged mining households. As Dunaway (2001: 12) notes, conflict in households arise 'when capitalist incorporation creates new wage and trade opportunities for males'.

Conclusion

This case study in a Sierra Leone rutile mining area exemplifies the conceptual model linking the world-systems and sustainable livelihoods frameworks. This approach examines the external shocks from global mineral resource extraction and its concomitant environmental and socioeconomic consequences in the local extractive environment. The analysis relates to the micro-level adjustments forced on *muglomei* co-op women members as they adapted their household structures to maintain sustainability and complementarity. The rutile mining case study reveals specific power imbalances between activities and external manipulations of a global transnational rutile mining corporation and the nation of Sierra Leone since 1967 that have affected the foundational sustainability of traditional resource-based household livelihoods that, in turn, forced dynamic gender restructuring within households and the local community. Wages of mine employee heads of households were clearly insufficient for household subsistence needs. Women created inventories of their available household livelihoods assets and adopted new coping strategies alongside the increasingly complex socioeconomic dynamics of the local mining environment. Household tensions rose as co-op members struggled to access depleted environmental resources and meet their financial obligations.

Although increasing vulnerability caused by economic externalities had the potential to undermine female unity, women adapted through solidarity networks such as the Sande heritage. Their collaborative gari production co-op provided another means of

income generation that maintained this female cooperation. However, while the mechanized cassava grater clearly had the potential to increase productivity and networking, perceived weak management caused some discord. Even in their quest for social and economic empowerment, women respected the traditional complementarity of gender social relations honouring defined gender roles in farm work. They exhibited astute rationality in their invitation to men to become *muglomei* co-op members in attempting to maximize future income for their households. The mechanical cassava-grater became an interventional catalyst to improve on an alternative coping strategy, and some men recognizing the benefits to be gained from the machine willingly associated with a women's co-op.

Women receive varying sums of money over the year rather than a fixed monthly income through the group and so rely on individual strategies that enable them to sustain their households. While the machine could potentially increase production, and consequently income, the preliminary findings here, two years after its acquisition, show that sociocultural relations and norms pose limitations that might need a longer period of negotiation and gestation to be overcome. Periodic harvesting and processing of cassava around labour availability and the women's lack of conceptualization of the role of the machine beyond 'improved technology' to maximize income in the immediate term limits continuous production. The results so far point to an unsuccessful coping strategy that, as shown in the conceptual world-systems local livelihoods model framing the study, links back to and further entrenches the vulnerability context of women in households.

More pressing questions remain, however, concerning how long additional land for cassava cultivation will be accessible to support increased gari production within limited communal property resources. It remains debatable whether the Kpetema mechanical gari production co-op will evolve into a viable community-based, socioeconomic rehabilitation model for achieving sustainable livelihood outcomes which might be adopted by women residing in other villages in the Sierra Rutile mining area. More empirical data on mining operations in the context of rural Sierra Leone regarding the exploitation of labour that forms the basis of commodity chains will be useful in a continued longitudinal analysis. In sum, the unified world-systems and sustainable livelihood model provides an appropriate framework that also applies to other peripheral countries in Africa and parts of the world with similar global trade dynamics.

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Endnotes

1 Based on Sierra Rutile's resettlement action plan for village relocations in 1985–1994 – prior to the hiatus during the civil – Kpetema's population could have ranged from 162 to 1649, with anywhere from 16 to 328 houses (Knight Piesold, 2001).

2 In 2008 USD 1 = SLL 2850–3000.

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