

Journal of International Development, 23, (2011), 1150-1150

Locking-in carbon, Locking-out Livelihoods? ASM and REDD in Sub-Saharan Africa

Mark Hiron*

*School of Agriculture, Policy and Development, The University of Reading,
Earley Gate, P.O. Box 237, Reading RG6 6AR, UK*

* m.a.hirons@reading.ac.uk

Abstract

This paper examines the potential mutual conflict between interventions aimed at formalising artisanal and small-scale mining (ASM) on the one hand, and policies implemented in response to the Reducing Emissions from Deforestation and Forest Degradation (REDD) initiative on the other. Deforestation caused by ASM undermines sound forest management, and potentially threatens the implementation of REDD. Conversely, the adoption of REDD could further marginalise and criminalise the ASM sector, reducing its contribution to poverty alleviation. Reviewing a series of commonalities between ASM and forest management highlights many difficulties facing policy-makers. Potentially, contradictory outcomes of evolving governance arrangements means novel cross-sectoral institutions will be required in order to realise the full potential of REDD and ASM to address poverty reduction in a complementary fashion. The analysis reiterates the centrality of livelihoods to REDD and the need for policies to take into account local contexts.

Keywords: Artisanal and Small-Scale Mining (ASM), REDD, Land-use Conflict, Poverty Reduction

Introduction

The United Nation's Reducing Emissions from Deforestation and Degradation (REDD) initiative is a market-based policy mechanism designed to compensate developing countries committed to preventing deforestation. It is propounded as an inexpensive, efficient, and relatively quick way to reduce the 17-25% share of anthropogenic carbon emissions associated with deforestation (Stern, 2006; IPCC, 2007). The scope for delivering co-benefits such as enhancement of forest carbon stocks, conservation of biodiversity and support for sustainable forest livelihoods (REDD+) has helped legitimise its standing in policy-making circles.

The integration of REDD with national development plans is an issue which needs to be addressed proactively. Reconciling potentially-contradictory policy approaches to poverty reduction is a critical issue if REDD is to deliver both a reduction in deforestation and development dividend. Implementing policies under the auspices of REDD may threaten existing poverty reduction strategies, particularly in a number of sub-Saharan African countries which have poor forest governance. Of particular concern is the fate of artisanal and small-scale mining (ASM). Across the region, the burgeoning ASM sector is being formalised in recognition of its potential to contribute to poverty reduction. However, if REDD restricts access to suitable mineral reserves in forested areas, it could potentially 'lock-out' a valuable source of rural employment. This paper reviews key aspects of this potential conflict against a backdrop of an emerging pattern of deagrarianisation unfolding across sub-Saharan Africa, and an increasing awareness of the importance of environmental income in rural livelihoods.

The management of ASM and forests are subject to a number of commonalities, including: the difficulty in providing alternative livelihoods, technical monitoring challenges, land tenure, legal plurality, distribution of benefits and governance. The analysis reveals that there may be important lessons to share, provided that appropriate cross-sectoral institutions can be established. However, the analysis also demonstrates how generalised debates on issues such as land tenure and decentralisation neglect differences in local contexts, and how pursuing particular governance agendas can lead to a variety of different outcomes. Future work should consider how best to integrate complex sectors of the rural economy in forest governance, how potentially conflicting outcomes of evolving governance arrangements should be mediated, and how best to place livelihoods at the heart of REDD strategies.

Linking deagrarianisation and forest dependency: contextualising cross-sectoral conflict

Across sub-Saharan Africa, smallholder farmers have diversified their livelihoods in response to inherent risk, seasonality and the inability of reforms to address agricultural failings (Bryceson, 1996; Ellis, 2006). This 'deagrarianisation' means that today, up to 50% of rural incomes in the region are derived from off-farm sources. Furthermore, increasingly diverse households are generally better off and more productive (Reardon, 1997; Ellis and Freeman, 2004). The ASM sector – low tech, labour intensive mineral extraction and processing – is fast becoming a preferred non-farm occupation, largely because there are few barriers to entry (Barrett et al., 2001; Hilson, 2010).

Development policy has failed to adequately account for these livelihood dynamics and the growing complexity of the rural economy. In the case of ASM, misdiagnosis of the sector as a predominantly 'rush-type' activity has underpinned attempts at formalisation, regulation and technical support

(Hilson, 2007; 2009). This sentiment is supported by Mathrani (2003:15) who, in reviewing the World Bank's activities in the extractive industries in Ghana, concluded that: improving the ASM sector has remained 'beyond the capability of the Government of Ghana and donor-driven interventions'.

Increasingly, ASM is being seen as a poverty driven activity. Historical marginalisation of small-scale mineral development in policy is slowly changing, with official policy now widely advocating for a growing contribution from natural resource extraction to foster socio-economic development. The burgeoning and dynamic nature of the ASM sector means it does not fit easily into the dichotomy of 'farm' and 'off-farm' income established in popular discourse. This dichotomy masks both the variety of off-farm incomes, and the interlocking nature of many rural livelihoods strategies, which are often characterised by a dove-tailing of activities (e.g. Maconachie and Binns, 2007; Hilson and Banchirigah, 2009; Bryceson and Johnsson, 2010).

Emerging recognition of ASM in the context poverty alleviation, and growing awareness of interlocking livelihoods in deagrarianisation debates have paralleled a literature articulating the importance of environmental income for rural livelihoods (e.g. Sjaastad et al., 2005; Vedeld et al., 2007). Environmental income refers broadly to income from wild or uncultivated resources, but is not well defined (Sjaastad et al., 2005). In this paper, the concept refers to any income derived from these resources, rather than focusing exclusively on poor rural households; thereby, income from REDD is an environmental income even though it may accrue in national accounts.¹ Maximising the potential of emerging sources of environmental income to reduce poverty requires having policies in place that recognise the dynamics of livelihood diversification. Ellis (2006:395) highlights the futility of confining development policy to agricultural development, and underscores the importance of adapting policy in light of dynamic rural economies:

'In the absence of a considerable change in the emphasis of poverty reduction strategies, it seems likely that SSA [sub-Saharan African] peasantries will continue on their downward slide towards ever more tenuous livelihoods'.

Poverty reduction: potential and threats

When REDD was initially tabled in 2005 at the 11th Conference of Parties (COP 11) to the United Nations Framework Convention on Climate Change, it was met with much optimism. The promises of cheap emissions reductions through avoided deforestation, along with financial payments as high \$30bn/yr to developing countries has since garnered significant international commitment, and is now seen as a priority for negotiators (Corbera et al., 2010; Baker et al., 2010). However, among the key concerns surrounding the implementation of REDD is the potential detrimental impacts it may have on local communities, many of which are involved in deforestation in legitimate pursuit of their needs; in some areas of sub-Saharan Africa, 59% of rural income is derived from forests (Mamo et al., 2007).

The complexity of deforestation drivers have impeded efforts to control it (Geist and Lambin, 2002; Kaininen et al., 2007). Understanding and regulating these drivers is critical to the capacity of REDD to deliver reductions in deforestation and contribute to development. The ASM sector is of interest to REDD policy-makers not only because deforestation is among its chief environmental impacts, but

¹ REDD might be more accurately described as a 'Payment for Ecosystem Services' (PES) policy, but for the purposes of this paper it is semantically grouped with environmental income.

because it also provides significant employment in many rural areas. In the case of ASM, activities provide direct employment to more than 13 million people globally and support up to another 100 million dependent family members and downstream workers (ILO,1999).

The contribution of ASM to deforestation is relatively small. However, the predominantly unregulated and informal nature of the sector means that it could potentially undermine REDD strategies. Conversely, if REDD restricts access to mineral reserves that are covered by forests then it may prevent access to a valuable source of income and employment, therefore undermining the delivery of a development dividend.

Difficulties in controlling ASM are particularly acute when the activities overlap with forest reserves. Debates over the relative success of protected areas often revolve around their impact on local communities (e.g. Bonta, 2005). In Ghana, for example, the establishment of gazetted forest reserves during the 1960s and 1970s disenfranchised many local resource users, including small-scale miners (Wardell and Lund, 2006). As protected areas are likely to be a central component of most REDD strategies (Scharlemann et al., 2010), the continuing presence of ASM in the reserves threatens policies aimed at curbing deforestation. As Botchie et al. (2007:21) note:

‘[In Ghana] ...Illegal small-scale gold mining poses a major threat to sound management of these reserves. According to authorities of the Forestry Commission, a major part of these reserves have been encroached on by these illegal miners.’

The ASM sector’s constant association with environmental and social degradation has contributed to its widespread marginalisation and criminalisation (Tschakert and Singha, 2007). This has distanced large proportions of it from formalisation and has inhibited attempts at regulation. If REDD leads to a stricter enforcement of forest reserves, this marginalisation could be exacerbated, which could make forest reserve management increasingly difficult. Experiences from Mozambique demonstrate how the exclusion of ASM in socio-economic decision-making attenuates forest management. Dondeyene et al. (2009) detail how frustrated ASM communities around Gorongosa National Park intentionally started bush fires. This case exemplifies why livelihoods should be an integral part of REDD plans, rather than a potential ‘bolt-on’.

The conflict between ASM and forest management is not unique to sub-Saharan Africa. In Guyana, a country pioneering the implementation of REDD, 250,000 km² earmarked for conservation and sustainable management could be compromised by illegal mining left uncontrolled by poorly integrated land-use planning and lack of reclamation (Hammond et al., 2007). The lack of land reclamation in most ASM operations further threatens REDD; contaminated land, disrupted hydrological regimes and soil erosion threatens potential reforestation. However, the severely depleted soil organic carbon and lack of vegetative cover does mean abandoned mine sites could prove to be fruitful locations for reforestation projects, particularly if soil organic carbon is included in national REDD inventories (Shrestha and Lal , 2010; Shrestha and Lal, 2006; Sperow, 2006).

Areas of commonality and avenues for conflict alleviation

Neglecting ASM in REDD plans could potentially undermine attempts to reduce deforestation and to promote local economic development. There are several areas of commonality that are instructive to review. These include, but are not limited to: the difficulty in providing alternative livelihoods,

technical monitoring difficulties, land tenure, legal plurality, distribution of benefits, and governance. Each will be briefly examined in turn.

Providing alternative livelihoods to forest dependent communities is likely to be central to attempts to reduce deforestation, particularly in protected areas. Alternative livelihood strategies implemented to reduce ASM have had limited success. Drop-in projects such as rose gardening, grasscutter² rearing and palm oil production have not been successful because they do not account for the preferences of miners. Additionally, they are unlikely to foster sustainable livelihoods because they favour export markets above domestic job creation (Tschakert, 2009; 2009a). The common need to provide alternative livelihoods in both forestry and minerals contexts suggests that there may be potential synergies. However, the dissonance between the urgency with which REDD and climate mitigation is being pursued, and the length of time required to ensure successful implementation of alternative livelihood projects, renders this an area of considerable concern.

Several authors have suggested that communities should engage with monitoring, reporting and verification (MRV) of emissions for REDD. This has been shown to reduce costs, enhance community ownership of resources and the cultural relevance of interventions, strengthen local institutions, and crucially, to produce accurate data comparable with that produced by experts (Skutsch and Ba, 2010; Fry, 2011). Community monitoring of carbon stocks may not be attractive to some miners, and may not provide substantial employment opportunities. However, the potential to augment existing alternative livelihood strategies and enhance community buy-in to REDD means it warrants further investigation.

Community involvement with MRV may be vital if robust estimates of carbon dynamics are to be produced, particularly in ASM areas, where a lack of census data, widespread illegality and the sector's burgeoning growth makes quantifying its impact on deforestation extremely difficult (Hilson and Potter, 2003; Hilson and Maponga, 2004). Satellite analysis and measurement of ASM's impact is likely to be challenging and costly, given the high resolution required, and the predominance of degradation (rather than deforestation) associated with its activities. Forest degradation is more difficult to monitor remotely than clear felling, but is of vital importance because up to 75% of the carbon stored may be lost (Skutsch et al., 2007). Furthermore, the geographical remoteness of ASM and other forest-degrading activities makes 'ground-truthing', monitoring, and controlling activities difficult (Roopnarine, 2006). Whilst technical issues such as these are important, it is imperative that REDD policy makers do not repeat the mistakes of early interventions in ASM by restricting considerations to purely definitional and technical problems (Hentschel, et al., 2002).

There is optimism that technical challenges, especially those relating to carbon measurement, can be resolved relatively swiftly and easily (e.g. Asner, 2009). However, land tenure debates have persistently proved difficult to resolve in sub-Saharan Africa. In the ASM sector, the dissonance between customary and statutory land rights have led to conflict between local communities and large-scale mines (Aubynn, 2009; Nyame and Blotcher, 2010). For example, the large proportion of land in Ghana under concession to mining companies exacerbates the prevalence of land tenure based conflicts. The entire area of the former Wassa West District, a forested region of Ghana, is either gazetted forest reserve or under concession to a mining company (Botchie *et al.*, 2007). With most large-scale companies prohibiting ASM activities on their concessions, displaced ASM

² A Grasscutter (*Thryonomys swinderianus*) is a small mammal farmed or hunted for food.

communities inevitably encroach on to forest reserves. The presence of widespread mineral concessions in forested areas is not unique to Ghana. Many African countries hoping to implement REDD will face similar cross-sectoral conflicts.³

The extensive granting of mineral concessions in forests threatens to undermine policies implemented in light of the broad agreement that securing land tenure is essential for sound community-based forest management. Secure tenure is widely propounded to be based on the expectation that it is a prerequisite for long-term investment in sustainable management (e.g. Eliasch, 2008). Additionally, evidence suggests that payment for ecosystem services (PES) schemes are likely to require secure land tenure, particularly exclusionary rights (Wunder, 2009).

Resolving land tenure disputes should form part of national approaches to reducing deforestation. But it should not be assumed that doing so will automatically lead to improved forest conservation. In the case of ASM, Fisher et al. (2009) argue that improving land tenure security in Tanzania would lead to increased mining activity. This could lead to increased income, but could also concurrently increase deforestation. Furthermore, as Nyame and Blotcher (2010) explain, even where mineral rights are clear, illegal land trading proliferates ASM in countries such as Ghana. Similar experiences observed in the forestry sector led Lawlor et al. (2010) to suggest that a series of social safeguards, including participatory decision-making, transparent management of revenues and access to grievance mechanisms, will be required to ensure that land tenure delivers the desired outcomes.

Land tenure debates are further complicated by the widespread separation of land and resources in law. Statutory laws throughout sub-Saharan Africa endow mineral rights to the state, allowing it to grant mineral concessions, and profit from mineral exploitation revenues. The same is theoretically true for carbon and associated markets (Asare, 2010). However, there is a general acknowledgement that conflicts arise because *de facto* property rights are based on customary, as opposed to statutory, norms. Legal plurality does not only affect resources, but also activities. Engaging with unlicensed ASM operations, and other illegal activities such as logging and charcoal production, poses a serious challenge to REDD. Asare (2010) models three hypothetical carbon rights scenarios, and shows that rights need to be linked with the drivers of deforestation in order to maximise permanence. This requires absorbing existing practices into formal law (Hentschel, 2002, Siegel and Veiga, 2009). Forest governance studies suggest that this is not merely a policy writing exercise, but rather a process which is most likely to succeed when decision making is localised, and benefits of forest conservation accrue to local communities (e.g. Oestreicher *et al.*, 2009; Hayes and Persha, 2010).

There is considerable debate regarding the propensity of REDD to centralise forest governance in light of emerging consensus that decentralisation appears to deliver superior benefits for conservation and development (see Sandbrook et al., 2010; Wunder, 2010; Agarwal et al., 2010). Given the need for local involvement, national carbon accounting⁴ and international oversight, as well as the interlinking nature of deforestation drivers, it is apparent that REDD will require multi-level and cross-sectoral governance, the capacity for which simply does not exist at present. This is recognised in the Ghanaian REDD Readiness Proposal which notes the 'lack of institutional means to

³ See, for example, the map of mining concessions in the Dominican Republic of the Congo recently produced by the International Peace Information Service (IPIS): <http://www.ipisresearch.be/mine-concessions-drc.php>.

⁴ Required in order to account for policy issues of permanence, leakage and additionality, see Angelsen, 2009.

address conflicts between agriculture, forestry, conservation and mining' (Government of Ghana, 2010:39).

Duffy (2007) casts further doubt on decentralisation as a panacea for REDD governance. In ASM gemstone communities in Madagascar, decentralisation has simply ceded power to clandestine illegal networks, which inhibits the benefits of the sector from reaching the local communities. This exemplifies how generalised discourses of governance arrangements mask the plethora of outcomes particular governance arrangements could induce depending on the local context. Implementing best practice in forest governance may be necessary for REDD, but on its own it is insufficient. Ensuring that evolving governance arrangements facilitate forest conservation and poverty reduction requires mediation. Evaluating this area is beyond the scope of this paper, but which combination of community-based organisation, non-government organisation, state and private sector involvement best serves that purpose will be context specific.

The equitable distribution of benefits is a critical component of REDD, which may prove difficult to achieve, a contention exemplified by experiences from the minerals sector. In theory, a proportion of mineral revenues from large-scale operations in sub-Saharan Africa should be distributed to local communities.⁵ However, in reality this money rarely reaches local communities (Garvin *et al.*, 2009) due to elite and community elite capture. In REDD, 'The opportunities for fraud, and the associated risks of corruption, should not be underestimated' (Skutsch and Ba, 2010:269). Potentially, REDD funds could be distributed directly to land-users, although this would require significant improvements in the resolution of MRV of emissions.

Conclusion

The importance of non-farm sectors of the rural economy in sub-Saharan Africa has historically been underestimated in academic and policy circles. Recent developments in the understanding of deagrarianisation, and the dovetailing of mining and agriculture, have not yet been translated into policy. The REDD policy presents an emerging source of income that has the potential to contribute to rural poverty alleviation through large areas of the developing world.

Participatory decision making is likely to be a critical component in resolving conflicts between mineral exploitation and forest conservation. In the case of ASM, this requires a willingness to engage with groups marginalised in policy and law. If REDD exacerbates the marginalisation of the sector then not only would ASM become a less effective route out of poverty, but it would also then be increasingly likely to undermine attempts to reduce deforestation.

Governance is central in ensuring that the mutual conflict between ASM and REDD is resolved without undermining either local livelihoods or prospects for reducing deforestation. However, resolving land-use competition in the context of attempts to reduce both deforestation and poverty is not simply a matter of building capacity for 'good governance'.

Reviewing of areas of commonality between ASM and REDD has strengthened the consensus that governance is critical to REDD success, but has cast doubt on the applicability of generic governance reforms to resolve conflict involving ASM communities; securing land tenure and decentralising

⁵ 3% of mining companies' gross sales is paid to the central government, of which 10% is meant to be distributed to local communities via the Office of the Administration of Stool Lands (Garvin *et al.*, 2009)

decision-making may not incentivise forest conservation, nor provide benefits to local populations. That there is an urgent need to establish cross-sectoral institutions to facilitate the sharing of lessons and effective decision-making is well known; what these are, and how to implement them are questions for which there are currently few answers.

In the case of ASM and REDD conflict, implementation of governance arrangements are likely to require monitoring and mediation in order to ensure that livelihoods are protected and deforestation is reduced. In addition, the discussion has strengthened the case that livelihoods should take a central part in REDD strategies, because neglecting to do so would threaten the capacity of livelihoods strategies, such as ASM, to contribute towards poverty reduction as well as undermine attempts to reduce deforestation. The promotion of livelihood considerations within REDD, therefore, is not simply an expression of political preference. It is rather central to the integrity and success of REDD in *any* of its proposed forms.

Acknowledgements

The author wishes to thank the participants of the Conference *Artisanal Mining, Smallholder Farming and Economic Development: Developing a Strategy for Poverty Alleviation in sub-Saharan Africa*, in Reading in September of 2010, and Dr. Gavin Hilson for his invitation and support. The author would also like to thank the two anonymous reviewers who helped improve this paper.

References

- Agrawal, A., Nelson, F., Adams, W.M. and Sandbrook, C. 2010. Governance and REDD: a reply to Wunder. *Oryx* **44** (3): 337–338.
- Angelsen, A., Brown, S., Loisel, C., Peskett, L., Streck, C. and Zarin, D. 2009. *Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment Report*. Meridian Institute. Available online: <http://www.REDD-OAR.org>.
- Asare, R.A. 2010. *Implications of the Legal and Policy Framework for Tree and Forest Carbon in Ghana: REDD Opportunities Scoping Exercise*. Katoomba Incubator – Forest Trends, Nature Conservation Research Centre, Accra, Ghana. Available online: http://www.forest-trends.org/documents/files/doc_2452.pdf [04.01.2011].
- Asner, G.P. 2009. Tropical forest carbon assessment: integrating satellite and airborne mapping approaches. *Environmental Research Letters* **4**. DOI:10.1088/1748-9326/4/3/034009
- Aubynn, A. 2009. Sustainable solution or a marriage of inconvenience? The coexistence of large-scale mining and artisanal and small-scale mining on the Abooso Goldfields concession in Western Ghana. *Resources Policy* **34** (1-2): 64-70.
- Baker, J., Richard, G., Grainger, A., Gonzalez, P., Brown, S., Defries, R., Held, A., Kellendorfen, J., Ndunda, P., Ojima, D., Skrovseth, P., Souza, C. and Stoll, F. (2010). Achieving forest carbon information with higher certainty: A five-part plan. *Environmental Science & Policy* **13** (3): 249-260.
- Barrett, C.B., Reardon, T., Webb, P. 2001. Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. *Food Policy* **26** (4):315–331.
- Bonta, M. (2005). Becoming-forest, becoming-local: transformations of a protected area in Honduras. *Geoforum* **36** (1): 95-112.
- Botchie, G., Akabzaa, T., Gyasi, E. and Sarpong, D.B. (2007). *Land Tenure, Land Use and Environment in Ghana. Technical Publication No. 72* Institute Of Statistical, Social & Economic Research. University of Ghana: Legon.
- Bryceson, D. and Jønsson, J. 2010 Gold Digging Careers in Rural East Africa: Small-Scale Miners' Livelihood Choices. *World Development* **38** (3): 379–392.
- Bryceson, D. F. 1996. De-agrarianization and rural employment in sub-Saharan Africa: A sectoral perspective. *World Development* **4** (1): 97–111.
- Corbera, E., Estrada, M. and Brown, K. (2010). Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation in Developing Countries: Revisiting the Assumptions. *Climatic Change* **100** (3-4): DOI: 10.1007/s10584-009-9773-1.
- Dondeyne, A., Ndunguru, E., Rafael, P. and Bannerman, J. 2009. Artisanal mining in central Mozambique: policy and environmental issues of concern. *Resources Policy* **34** (1-2): 45–50.
- Duffy, R. 2007. Gemstone mining in Madagascar: transnational networks, criminalisation and global integration. *Journal of Modern Africa Studies* **45** (2): 185–206
- Eliasch, J., 2008. *Climate Change: Financing Global Forests. The Eliasch Review*. Office of Climate Change, London.

- Ellis, F. 2006. Agrarian change and rising vulnerability in rural sub-Saharan Africa. *New Political Economy* **11**(3): 387-397.
- Ellis, F. and Freeman, H.A. 2004. Rural Livelihoods and Poverty Reduction Strategies in Four African Countries. *Journal of Development Studies* **40** (4): 1–30.
- Fisher, E., Mwaipopo, R., Mutagwaba, W., Nyange, D. and Yaron, G. 2009. “The ladder that sends us to wealth”: Artisanal mining and poverty reduction in Tanzania. *Resources Policy* **34** (1-2): 32-38.
- Fry, B. 2011. Community forest monitoring in REDD+: the ‘M’ in MRV. *Environmental Science and Policy* **14** (2): 181-187.
- Garvin, T., McGee, T.K., Smoyer-Tomic, K.E. and Aubynn, E.A. 2009. Community–company relations in gold mining in Ghana. *Journal of Environmental Management* **90** (1): 571-586.
- Geist, H.J and Lambin, E.F. 2002. Proximate Causes and Underlying Driving Forces of Tropical Deforestation. *BioScience* **52** (2): 143-150.
- Government of Ghana. 2010. *Ghana Readiness Preparation Proposal*. Government of Ghana. Available online: http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/Feb2010/Final_version_Ghana_R-PP_with_disclaimer_21810.pdf [04.01.2011]
- Hammond, D., Gond, V., Thoisy, B., Forget, P. and DeDijn, P.E. 2007. Causes and Consequences of a Tropical Forest Gold Rush in the Guiana Shield, South America. *Ambio* **36** (8): 661-671.
- Hayes, T. and Persha, L. 2010. Nesting local forestry initiatives: Revisiting community forest management in a REDD+ world. *Forest Policy and Economics* **12** (8): 545-553.
- Hentschel, T., Hruschka, F. and Priester, M. 2002. *Global Report on Small-Scale and Artisanal Mining*. Mining Minerals and Sustainable Development – a project of the International Institute for Environment and Development (IIED), London.
- Hilson, G. and Banchirigah, S.M. 2009. Are Alternative Livelihood Projects Alleviating Poverty in Mining Communities? Experiences from Ghana. *Journal of Development Studies* **45** (2): 172-196.
- Hilson, G. and Maponga, O. 2004. How has the shortage of census and geological information impeded the regularisation of artisanal and small-scale mining? *Natural Resources Forum* **28** (1): 22-33.
- Hilson, G. and Potter, C. 2003. Why is illegal gold mining activity so ubiquitous throughout rural Ghana? *African Development Review* **15** (2): 237-270.
- Hilson, G. 2007. What is wrong with the Global Support Facility for small-scale mining? *Progress in Development Studies* **7** (3): 235-249.
- Hilson, G. 2009. Small-scale mining, poverty and economic development in sub-Saharan Africa: An overview. *Resources Policy* **34** (1-2): 1-5.
- Hilson, G. 2010. ‘Once a miner, always a miner’: Poverty and livelihood diversification in

Akwatia, Ghana. *Journal of Rural Studies* **26** (3): 296-307.

ILO. 1999. *Tripartite Meeting on Social and Labour Issues in Small-scale Mines – Note on the proceedings*. ILO, Geneva

IPCC (International Panel on Climate Change). 2007. *Fourth Assessment Report (IPCC 4AR)*. Intergovernmental Panel on Climate Change, Geneva.

Kanninen, M., Murdiyarsa, D., Seyour, F., Angelsen, A., Wunder, S and German, L. 2007. *Do trees grow on money? The implications of deforestation research for policies to promote REDD*. Center for International Forestry Research (CIFOR), Bogor, Indonesia.

Lawlor, K., Weinthal, E. and Olander, L. 2010. Institutions and Policies to Protect Rural Livelihoods in REDD+ Regimes. *Global Environmental Politics* **10** (4): 1-11.

Maconachie, R., Binns, T., 2007. 'Farming miners' or 'mining farmers'? : diamond mining and rural development in post-conflict Sierra Leone. *Journal of Rural Studies* **23** (3): 367–380.

Mamo, G., Sjaastad, E. and Vedeld, P. 2007. Economic dependence on forest resources: A case from Dendi District, Ethiopia. *Forest Policy and Economics* **9** (8): 916-927.

Mathrani, S. 2003. *Evaluation of the World Bank Group's Activities in the Extractive Industries: Background Paper - Ghana Country Case Study*. World Bank, Washington DC.

Nyame, F.K. and Blocher, J. 2010. Influence of land tenure practices on artisanal mining activity in Ghana. *Resources Policy*. **35** (1): 47-53.

Oestreicher, J.S., Benessaiah, K., Ruiz-Jaen, M.C., Sloan, S., Turner, K., Pelletier, J., Guay, B, Clark, K.E., Roche, D.G., Meiners, M. and Potvin, C. 2009. Avoiding deforestation in Panamanian protected areas: An analysis of protection effectiveness and implications for reducing emissions from deforestation and forest degradation. *Global Environmental Change* **19** (2): 279-291.

Reardon, T., 1997. Using evidence of household income diversification to inform study of the nonfarm labor market in Africa. *World Development* **25** (5): 735–747.

Roopnarine, L. 2006. Small-scale gold mining and environmental policy challenges in Guyana: protection or pollution. *Canadian Journal of Latin American and Caribbean Studies* **31** (61): 115–43.

Sandbrook, C. Nelson, F., Adams, W.M. and Agrawal, A. 2010. Carbon, forests and the REDD paradox. *Oryx* **44** (3): 330–334.

Scharlemann, J., Kapos, V., Campbell, C., Lysenko, I., Burgess, N., Hansen, M., Gibbs, H., Dickson, B. and Miles, L. (2010). Securing tropical forest carbon: the contribution of protected areas to REDD. *Oryx* **44** (3): 352-357.

Shrestha, R. and Lal, R. (2006). Ecosystem carbon budgeting and soil carbon sequestration in reclaimed mine soil. *Environment International* **32** (6): 781-796.

Shrestha, R. and Lal, R. (2010). Carbon and nitrogen pools in reclaimed land under forest and pasture ecosystems in Ohio, USA. *Geoderma* **157** (3-4): 196–205.

- Siegel, S. and Viega, M. 2009. Artisanal and small-scale mining as an extralegal economy: De Soto and the redefinition of “formalization”. *Resources Policy* **34** (1-2): 51-56.
- Sjaastad, E., Angelsen, A., Vedeld, P. and Boj c, J. 2005 What is environmental income? *Ecological Economics* **55** (1): 37-46.
- Skutsch, M. and Ba, L. 2010. Crediting carbon in dry forests: The potential for community forest management in West Africa. *Forest Policy and Economics* **12** (4): 264-270.
- Skutsch, M., Bird, N., Trines, E., Dutschke M., Frumhoff P., de Jong, B.H.J., van Laake, P., Masera, O. and Murdiyarso, D. 2007. Clearing the way for reducing emissions from tropical deforestation. *Environmental Science and Policy* **10** (4): 322-344.
- Stern, N. 2006. *The Economics of Climate Change - The Stern Review*. Cambridge: Cambridge University Press.
- Sperow, M. (2006). Carbon Sequestration Potential in Reclaimed Mine Sites in Seven East-Central States. *Journal of Environmental Quality* **35** (4): 1428-1438.
- Tschakert, P. and Singha, K. 2007. Contaminated identities: Mercury and marginalization in Ghana’s artisanal mining sector. *Geoforum* **38** (6): 1304-1321.
- Tschakert, P. 2009. Digging Deep for Justice: A Radical Re-imagination of the Artisanal Gold Mining Sector in Ghana. *Antipode* **41** (4): 706–740. DOI: 10.1111/j.1467-8330.2009.00695.x
- Tschakert, P. (2009a). Recognizing and nurturing artisanal mining as a viable livelihood. *Resources Policy* **34** (1-2): 24-31.
- Vedeld, P., Angelsen, A., Boj , J., Sjaastad, E. and Berg, G.K. 2007. Economic perspectives and analyses of multiple forest values and sustainable forest management. *Forest Policy and Economics* **9** (7): 869-879.
- Wardell, A.D. and Lund, C. 2006. Governing Access to Forests in Northern Ghana: Micro-Politics and the Rents of Non-Enforcement. *World Development* **34** (11): 1887-1906.
- Wunder, S., 2009. Can payments for environmental services reduce deforestation and forest degradation. In *Realising REDD+: National Strategy and Policy Options*, Angelsen, A. (ed.). CIFOR; Bogor; 213-224.
- Wunder, S. 2010. Forest decentralization for REDD? A response to Sandbrook et al. *Oryx* **44** (3): 335–337.