



**University of  
Zurich**<sup>UZH</sup>

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# Mining Farmers' Livelihood Strategies

## A Mixed Method Study at Artisanal Small-Scale Gold Mines in Burkina Faso

GEO 511 Master's Thesis

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## Abstract

This master thesis contributes to the debates on de-agrarianization and livelihood strategies. It focuses on the interlinkage of artisanal small-scale gold mining (ASGM) and agriculture concerning labour and capital, the reasoning behind livelihood decisions and the perceived effects on familial agriculture by combining a survey with semi-structured interviews in the provinces Bam and Yatenga in Burkina Faso. After a gold boom event, sites either turn into descending sites (DS) or rarely into permanent sites (PS). DS and PS are compared to understand the effects of the gold extraction in ASGM on livelihood decisions. The study finds that 40 % of the ASGM workers cultivate at PS compared to 80 % at DS. ASGM worker invest into familial agriculture by buying ingredients, tools and livestock. 75% of them remit to the family, the amount depends on the ASGM lifecycle stage. Thus, some household's harvest increases while others diminishes, but those can buy more cereals than they used to produce. Through ASGM the rural community is integrated in the globalised capitalist economy resulting in a social restructuring with the establishment of an ASGM elite. The livelihood trajectories, where some people are shifting their priorities from farm to the non-farm activity ASGM, are observable signs thereof. Farming and mining are complementing rather than competing activities, but farming has become just one out of many activities open to the rural population thanks to ASGM. The assumption that there is a de-agrarianization process happening is not supported in Bam and Yatenga. Most ASGM workers are mining farmers.

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# 1. Introduction

Local people have been looking for gold in addition to their agricultural activity in the centre-north region of Burkina Faso since the 1980s in recent times. The locals used to improve their familial budget in case of need by searching their soils for gold. They used a technique called ‘vannage’ – separating the lighter minerals from gold by puffing air into the sand collected on the surface of their fields or by adding water. ‘Vannage’ is a technique still conducted by women, but abandoned by men. Gold exploration used to be a dry season activity when cultivation does not demand the workforce. The centre-north region is dominated by cultivation and herding for self-sufficiency with few other traditional opportunities to gain a living. Many young men emigrated to find work on plantations in Ivory Coast or tried to find an occupation in the cities of Burkina Faso. The families in this area lived partly on remittances to buy cereals to complement the harvest. The means to earn cash has changed in the past thirty years.

Artisanal small-scale gold mining (ASGM) has become an alternative for the emigration of the young men of the region. Stories of the incredible gold finds of some rise hopes in the ordinary men to become rich. Everyone, so it seems, can be the lucky man who finds a fortune. At the same time, there has been an incredible rise of the global gold price after the last economic crisis 2008. The market price for a gram of gold quadrupled from 2002 to 2012. The money suddenly circulating in the rural regions has changed the social, economic and physical landscape. Many sorghum fields have changed into subsoil labyrinths up to 130 meters of depth with hundreds of holes to enter. Mining camps have appeared and small villages turned into economic hubs for a couple of golden years. The immense attraction of the ASGM activity on the young workforces lead many actors to fear the consequences for the environment, the health of people, agriculture and essentially food security.

The bulk of academic literature has concentrated on the negative impacts of ASGM, overshadowing the interconnectedness of ASGM with agriculture (Hilson, 2016, 548). This study serves to complement the studies discussing human health and environmental risks in ASGM. It looks at the interlinkage of the extraction of gold and agriculture socio-economically by engaging with the debate on agriculture and ASGM complementarity. With this mixed method study giving insights into the local discourse and quantitative information, one can retrace the immense gap between the rural local and the urban media discourse about the ASGM sector, a discourse that is shaped by gold boom periods. The sudden discovery of gold vein that attracts thousands of travelling miners, always on the search of the new big gold vein. This phenomenon is fascinating and shocking at the same time, but it has attracted much research already. This study informs the reader about the adaption and

implementation of ASGM in the livelihoods of the local community after a gold boom. Some years after the start of the rush the mine site becomes a site with some continuity – a ‘Permanent Site’ (PS) or if a gold bust occurs - a ‘Descending Site’ (DS).

Most media article state that it is greed that motivates people to invest their energy in the ASGM activity. Seldom are the articles that argue that it can also be motivated by the lack of an alternative way to gain an income. Neither pure greed nor poverty alone cause the attraction of the ASGM sector, where young men take a big risk by going underground, work with chemicals they do not know and where women spend their time breathing the dust of stone. The diffusion of money by chance and the finesse of distribution are fascinating characteristics of the ASGM sector. But the implications of ASGM on the local agriculture are not sufficiently known. Does ASGM cause de-agrarianization, the process of livelihood and occupational adjustment and settlements away from agrarian patterns (Bryceson, 1996)? This master thesis addresses de-agrarianization as a research problem.

This thesis answers the following research question: How is farming and mining combined by ASGM workers at a permanent ASGM site compared to descending ASGM sites in Centre-North/North of Burkina Faso? It looks at the ASGM workers’ investments of labour and capital into agriculture and displays the reasoning of their choices. Further, it asks after the perception of the effect of their choices on the familial agriculture. The livelihood concept is applied at three analytical scales to understand the change the area undergoes with the rise and fall of ASGM activities. The macro-analytical level serves to see ASGM in the light of de-agrarianization. A meso-analytical concept orders individual livelihood strategies in four categories to see livelihood trends at the ASGM lifecycle stages and an analysis on the micro-level seeks to understand the rational of choices at the household level. The next chapter reviews the literature on the theoretical approach and ASGM. It follows the research gap and how the answer to this gap might be found. Thereafter the empirical results are presented and discussed with regard to the differences between the two lifecycle stages. The thesis ends with a thorough discussion of the findings zooming out from the micro to the macro scale and policy recommendations.

## 2. State of the Art

This chapter reviews the academic literature regarding rural livelihood options, strategies and aspirations in Sub-Saharan Africa. It summarises the publications on how these livelihood strategies are different in regions where Artisanal Small-Scale Mining (ASM) is possible by introducing the different stages a mine site can be in, by presenting the findings on occupational restructuring through Artisanal Small-Scale Mining, and by discussing the complementarity of agriculture and ASM. The chapter ends by presenting the research gap and the questions this thesis will deal with.

### 2.1 Livelihood Strategies – The Theoretical Approach

How do people in different places live? This is not only the root of human geographical questions, but it is also the starting question for any livelihood approach, where 'livelihood' is defined as the complex web of activities undertaken in order to live (Scoones, 2009, 172). This chapter introduces the reader to the livelihood concept and its critiques.

#### Macro-Level Analysis

The body of literature in rural development studies, statistical data and the resulting policy is conventionally built around one activity, such as agriculture. The group of people concerned are those who state this is their main occupation. These macro-analytical approaches have given insight to some broad tendencies in rural areas of developing countries. Often the reports are too focused on one economic sector rather than looking at all the occupational opportunities for analysis in a region.

Bryceson (1996, 2002) and other authors (Ellis, 2000; Rigg, 2006) have argued that rural livelihoods are becoming more and more delinked from agriculture. The phenomenon is called 'de-peasantization' or '**de-agrarianization**'. De-peasantization describes that people who cultivated for subsistence leave their means of production to live in urban areas (Araghi, 1995, 338). The term refers further to "the erosion of an agrarian way of life that combines subsistence and commodity agricultural production with an internal social organisation based on family labour and village community settlement"(Bryceson, 1999, 175). De-agrarianization is defined as the process of livelihood reorientation and occupational adjustment along with a spatial realignment of human settlements away from agrarian patterns. This is observable for example with declining agricultural labour compared to non-agricultural labour (Bryceson, 1996, 99). De-peasantization and de-agrarianization are used interchangeably. De-agrarianization is the term of choice in this thesis.

Through the de-agrarianization process rural poverty is no longer linked to the cultivation practice, environmental conditions or land ownership. Rather “farming [becomes] just one of many activities in rural spaces” (Rigg, 2006: 198 in Pritchard, Vicol, & Jones, 2017: 43). Bernstein (2009 in Pritchard et al., 2017) argues that there has been a profound change in the rural area. The primary asset of rural people is no longer the ownership of land, but it is labour force. Households who have succeeded in improving their livelihood over the past years, are strongly oriented towards non-agricultural sectors (Sen 2003: 515 in Rigg, 2006: 192). Rigg (2006) argues that households that focus on agriculture have been stagnant or have socially descended over the years compared to those who have creatively combined farm and non-farm work, without undermining their health. A positive correlation between total income and non-farm income has been found (e.g. Reardon, Taylor, Stamoulis, & Lanjouw, 2000).

The most important question regarding the rural society is now according to Pritchard et al. (2017) and Rigg (2006), whether there is systemic **class differentiation** processes going on among the rural population. A process which is linked to the politics of labour (Pritchard et al., 2017: 44). The integration of the rural population into the global capitalist economy is seen to cause class differentiation. A rural capitalist class emerges and uses the labour force of weaker households for accumulation. This drives further de-agrarianization and leads to a breakdown of the local social and cultural norms (Djurfeldt, 2013, 219). The de-agrarianization literature has been criticised to have overlooked one of the most important activities in the rural space: ASM (Kamlongera, 2011, 1130). The integration of the rural population in the global capitalist economy in Centre-North/North Burkina Faso is not primarily linked to the agrarian sector, as Djurfeldt (2013) discusses, but rather linked to the gold mining sector.

Another group of scholars, such as McMichael (2012, 2013) and Van der Ploeg (2010) still see land as the central resource of the rural population. “Contemporary livelihood diversification away from own-account agriculture is understood as a hallmark of de-peasantization and distress” (Pritchard et al., 2017: 44). McMichael and Van der Ploeg interpret the phenomenon of de-agrarianization as a process that politicises the rural population against the forces of globalization and commodification of their resources that does and will cause a **re-agrarianization** process (Chigumira, 2018).

Maconachie & Binns (2007) found that the interlinkages of mining and farming are very complex, but describing the development as de-agrarianization process due to ASM seems not right in Sierra Leone, rather due to ASM there has been a agricultural intensification, a further livelihood diversification and caused rural-rural migration. No matter whether de-agrarianization is caused by distress or class formation, the question that remains is, why some families succeed in improving their situation when others do not (Pritchard et al., 2017: 45). The macro-analytical perspectives

might shed light on trends and tendencies but they cannot explain the differences between households satisfyingly.

### **Micro-Level Analysis**

The livelihood approaches seemed to provide a useful methodological toolkit to represent subjectivities of rural social actors about their livelihood choices emerged in the 90s. They have challenged the macro-analytical, single-sector approaches as a means to solve rural development problems in recent years (Scoones, 2009, 172). The approach helps to explain the diversity of people's strategies to make a living (Thieme, 2008, 53), brings the complexity of people's life effectively to the surface and unveils deep knowledge about livelihood pathways for specific groups at a specific place and time (Pritchard et al., 2017: 45f). In many developing countries individuals and households pursue, as Scoones (2009, 172) calls it, a bricolage of activities that are continuously adapted to the current situation (Ellis, 2000, 289). Most rural families have several true income sources, including off-farm wage work in agriculture, wage work in non-farm activities, rural non-farm self-employment and remittances (Ellis, 2000, 291).

A livelihood strategy is sustainable, if one can recover from stresses and shocks by maintaining or enhancing capabilities and assets while not undermining the resource base (Chambers and Conway, 1992 in Haug, 1999, 182). Chamber and Conway's work is seen as the starting point to what is now known as 'sustainable livelihoods approach' (Scoones, 2009, 175). Scoones et al. (1998) developed the sustainable livelihood framework for analysis, a paper that served as a basis for analysis for many studies in academia as a working tool in development projects throughout the early 2000s. Figure 1 gives an overview of the framework that emphasises the economic attributes of livelihoods as mediated by social-institutional processes. The framework links inputs, called assets, with outputs, called livelihood strategies (Scoones, 2009, 177). The livelihood strategies are then linked to concepts such as poverty, employment, sustainability and well-being and the normative outcomes such as 'well-being and capabilities improved' or 'natural resource base sustainability ensured'.

The framework laid out by Scoones (1998, 13f), shown in Figure 1, encouraged and inspired me to look at agriculture, off-farm activities, work migration and remittances together. Investigating all the elements of the sustainable livelihood framework is often inappropriate, not doable in a master thesis. The focus of this study are livelihood strategies with indications on the outcome, which is the area framed with a dashed line in Figure 1.

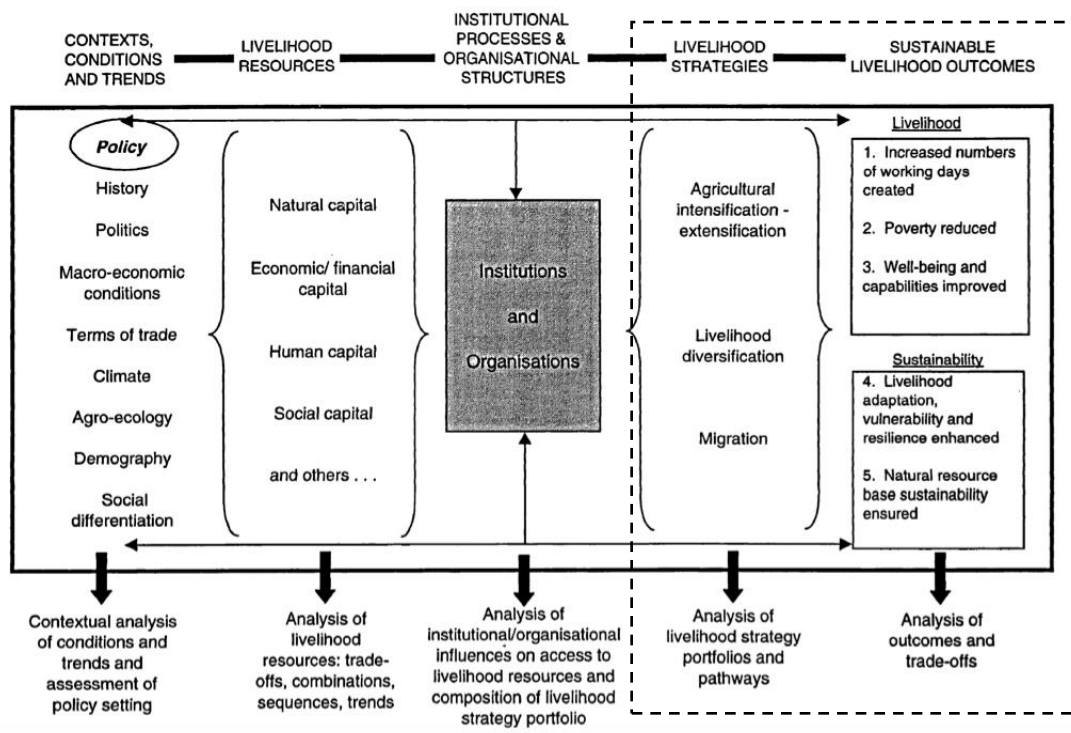


Figure 1: Sustainable rural livelihoods: a framework for analysis. Source: Scoones, 1998.

The **assets** can be described as “an antidote to a vision of poor people as being ‘passive’ or ‘deprived’. The poor may not have cash or savings, but they do have other material and non-material assets such as family, health, skills and natural resources” (Scoones, 1998, 10). Bebbington (1999: 2022) explains that the assets in the livelihood approach are not ‘things’, but are vehicles to make a living, vehicles to make life meaningful and to challenge the structures under which one makes a living (in Pritchard et al., 2017, 45). A combination of diverse activities are called ‘**livelihood portfolio**’. Some livelihood portfolios are highly specialised, others broad and diverse. Some remain stable throughout a year and beyond, others change strongly following the seasons or change rapidly over the years and are more dynamic (Scoones, 1998, 10). Livelihood strategies can be described at all social levels: the individual, the household, the village or even regional or national levels might bring insights (Scoones, 1998, 9), but mostly one refers to the household level as decision unit. The household used to pool their income and decision-making was collective or one followed the decision of the male head within the household. This is on the decline as decision-making is increasingly individual (Bryceson, 1999, 183; Bryceson, 2016, 4).

The motivation for a change in one’s livelihood portfolio is often described in a dichotomy: either it is an active choice to invest into it for **accumulation** and reinvestment or it is forced as one tries to cope with a difficulty or a change and earlier strategies do no longer provide a livelihood (Scoones, 1998, 9). In short, it is choice or **necessity** that motivates diversification (Ellis, 2000, 291). Either way,

diversification is a coping mechanism to response to shocks and stress (Scoones, 1998, 9). But while 'choice' is a proactive behaviour, 'necessity' is a diversification out of desperation (Ellis, 2000, 291). Acting and adopting out of desperation is regarded badly, as it can force households to adopt a worse livelihood portfolio than they pursued before (Ellis, 2000, 292). Ellis (2000, 292) suggests understanding this dichotomy as a continuum of reasons, with the two poles being accumulation and survival. Diversifying one's livelihood is not a change of activity from one full-time occupation to another, rather it is the adaption of the activity portfolio, where several activities are pursued at the same time (Ellis, 2000, 290).

In order to understand a livelihood diversification process at the micro-level, an **extended household economic model**, with considerations for seasonality, risk, labour markets, credit markets, asset strategies and coping behaviour, can serve as an entry point. All these factors are mediated through social relations and institutions (Ellis, 2000). "The household economic model predicts diversification as a function of on-farm returns to labour time compared to off-farm earning opportunities" (Ellis, 2000, 292). Greater opportunities in off-farm activities would lead to a motivation to diversify (Ellis, 2000, 292). It follows an explanation of the factors that influence the livelihood decisions apart from the simple economic model.

While consumption over a year remains relatively constant, labour and income are highly variable throughout the year. Following the cultivation and harvest periods at the respective place, this means that the portfolio might change along with the **seasons**. Another diversification with regard to time is that a household might decide on a strategy with a future goal in mind, diversifying in order to achieve greater livelihood security in the future instead of aiming for immediate lifestyle optimisation. This is what Ellis (2000) calls an **asset strategy**. For example, when a household invests in its human capital (schooling a family member) or natural capital (saving money to buy more land).

Further, livelihood capitals may be accumulated, building reserves to avoid **risk** or spread over space and time, in order to prevent being too strongly affected by a particular shock event (Scoones, 1998). Figuratively spoken, "in means of survival do not put all the eggs into one basket" (Ellis, 2000, 294). Reactions to shock are necessity driven, seeking first not to compromise the future income generating capability, even if one has to cut back on consumption. As a last resort assets critical for future survival might be sold to stave off starvation, but might irrevocably alter the family's livelihood portfolio (Ellis, 2000, 297). Another aspect that influences a household's decision is the **labour-market**. The labour-market is not equally accessible to everyone and in rural Africa poorly developed (Ellis, 2000, 295). Similarly, the poorly developed **credit market** might motivate households to



diversify. They might aim to utilise cash funds generated in off-farm activities in order to purchase agricultural inputs or farm equipment purchases (Ellis, 2000, 295).

While in the late 90s and early 2000s the livelihood approach was very popular and attracted funding, the approach also became more and more criticised. Scoones (2009, 182f) summarised the following flaws: The approach lacks to engage with processes of economic globalization, power and politics and the approach fails to link to governance debates in development studies. Further, long-term changes, in environmental conditions in rural economies are not accounted for, rather the approach is a snapshot analysis in time. Wider questions about agrarian change are generally not included in livelihood analysis. The livelihood approach was also criticised for its methodological implementation. On one hand, the five assets or capitals have often been measured mechanistically, rather than guiding researchers' narrative accounts of people's livelihoods. This has led to pigeonholing of rural dwellers depending on the relative strength in one or another asset. On the other hand, livelihood strategies are often not understood as generated **artefacts** from broader processes and the user misses to position himself regarding the politics of rural development (Pritchard et al., 2017). Rather than working with a framework which only works on one analytical level, this study looks at livelihood strategies on the macro-, meso- and micro-level. It is through the combination of the three analytical levels, the framing of the research question and the methodology that the flaws are dealt with. We have seen that the micro-level of livelihood strategies can explain decision making at the single household. In order to leap from micro-level understanding to the macro-level tendencies a meso-analytical approach is introduced.

### **Meso-Level Analysis**

Three clusters of livelihood strategies are open to a rural population: agricultural intensification or extensification, either capital- or labour-led, livelihood diversification and migration Scoones (1998, 9). Dorward et al. (2009) have developed a "middle-ground conceptualization [...] in which dense and detailed narrative accounts of livelihood pathways are inductively worked into classifications that speak to macro-analytical explanatory models" (Pritchard et al., 2017, 45). This meso-analytical approach offers a broad abstraction for livelihood aspirations. A household '**hangs in**' when current assets remain just stable and current activities are continued in order to maintain the livelihood level. A household '**steps up**' when the assets and activities are invested to improve one's livelihood. Lastly, a household '**steps out**' when activities are conducted with the aim to accumulate assets that are then used as base of investment to start of a new activity providing higher or more stable returns (Dorward et al., 2009: 242f).

Illustrated with the role of livestock: Aspiring to ‘Hanging in’ means that the livestock serves for consumption, supports cropping activity, buffers the seasonal income and serves as an insurance. An aspiration for difficult periods, where one does not want to lose, what you already have. ‘Stepping up’ means that the livestock is kept enabling advancement through accumulation of more productive animals. ‘Stepping out’ would mean that the livestock is used as a mean to save money in order to start another activity later on (Dorward et al., 2009, 243).

Table 1 introduces likely livelihood aspirations depending on market situations, social status and natural resource conditions.

Table 1: Likely livelihood strategies of poor and less-poor livestock keepers. Source: Dorward et al., 2009

		Status	Stagnant market	Dynamic market
Natural-resource potential	Low	Poor	Hanging in (very critical)	Hanging in (local non-farm)
		Less poor	Stepping out (migrate)	Stepping out (local non-farm)
	High	Poor	Hanging in (farm)	Hanging in (farm and non-farm)
		Less poor	Stepping out (migrate), Stepping up (export)	Stepping out (local non-farm) Stepping up (local markets)

Mushongah & Scoones (2011) and Pritchard et al. (2017, 52) enrich the theory with a fourth category ‘dropping out, going backwards or **muddling through**’. This category applies to a household under great distress that is losing a part of their assets, often becoming food insecure. Mushongah & Scoones (2011) used Dorward’s approach to understand long-term livelihood changes in Zimbabwe. Households who succeeded in accumulating assets over twenty years often relied on a combination of ‘stepping up’ and ‘stepping out’. The dependence on either solely farming or solely on an off-farming employment proved risky. Further, a change to ‘hanging in’ or ‘dropping out’ often happened suddenly and as a result of a combination of factors. The strategy ‘stepping up’ was successful where households gained access to additional land and ‘stepping out’ where people get remittances, that are often invested in farm-based assets like equipment or livestock. Later on, these asset investments support the household into an **upward trajectory** given good health and some education in the household (Ellis et al. 2009 in Mushongah & Scoones, 2011: 1253).

Dorward’s approach explicitly understands a livelihood strategy as a generated artefact from broader social processes. Agency is connected to the structure in which a decision is played out (Pritchard et al., 2017: 46). One can see the evolution of the household’s assets over time and therefore makes “explicit the accumulative microanalytical foundations of rural social differentiation (Scoones et al.,

2011: 975 in Pritchard et al., 2017: 46). Dorward's approach takes the leap from household livelihood analysis towards the processes of social class formation and differentiation that are discovered with macroanalytical approaches. This sub-chapter has given the reader the basics to understand the livelihood concept on a macro-, meso- and micro-analytical level. The next sub-chapter introduces the state of literature of Artisanal Small-Scale Gold Mining.

## 2.2 Artisanal Small-scale Gold Mining – The Field

ASGM emerged or rather gained visibility, during the 1980s in several African countries. The price of gold as well as the neoliberal policies of the 90s and 2000s attracted people to work in the ASGM sector (D. Bryceson & Geenen, 2016, S. 304).

### Stages of an ASGM Life-Cycle and its Workforce

Artisanal small-scale gold mines are heterogeneous in their nature. This is not only due to the different geological conditions and the varying amount of gold bearing ore, but also to the stage of extraction at the mine site. This influences the number of people working on site, as well as the number of extraction holes and the accompanying services.

Bryceson and Jønsson (2010, 389) describe **four stages** for the ASGM site life cycle. Gold is discovered by the local population and thereafter mined by residents in the first stage. The settlement transforms into a gold-boom settlement in the second stage, when many mobile miners are attracted, followed by mobile traders and ASGM service providers. Second stage gold-boom sites tend to be cosmopolitan in character, where inhabitants do not share a common ethnicity or origin (D. Bryceson & MacKinnon, 2012, 527). The gold-boom site is also referred to as rush-site. At the gold rush-site there is often excessive consumption of consumer goods and alcohol. Gambling and prostitution are part of everyday life. When gold is depleted close to the earth surface, increasing extraction depth demands higher investments and the characteristics of the mining site change. Mobile miners move on to another promising site leaving a degraded soil behind (Bryceson & Jønsson, 2010, 381).

The most mobile part of the mining population leaves the site in the **third stage** of the ASGM site life cycle. Thereafter the market opportunities weaken and some traders and service providers follow the traces of the miners, leaving the site. During the **fourth stage** this exodus continues, the agrarian and trading inhabitants outnumber the remaining miners. This does not mean that the ASGM settlement becomes a ghost town thereafter. If the settlement is located at a main road and the infrastructure is superior to the surrounding rural settlements, it is likely to serve as an urban service centre (D. Bryceson & MacKinnon, 2012, 529).

Depending on the stage of a mine site, the socio-economic characteristics and the motivation to get involved in the ASM sector varies and is often categorized in **push and pull** factors. Hilson (2010) has analysed the motivation by looking at the factors for rural diversification. This broader literature is often consulted in the ASM context (Verbrugge, 2016). A summary of push and pull factors for diversifying the income and activity portfolio is presented in Table 2. Push factors are sets of motives linked to risk aversion in agricultural production. Pull factors are linked to an active decision to ‘branch-out’ into another activity, because they believing this can bring a higher income (Hilson, 2010, 298).

Table 2: Summary of selected push and pull factors adapted from Hilson (2010, 298, adapted from Ranjan, 2006).

Push factors	Pull factors
<ul style="list-style-type: none"> <li>• Increased population growth</li> <li>• Increasing scarcity of viable land</li> <li>• Declining farm productivity</li> <li>• Declining returns from farming</li> <li>• Lack of access to farm inputs and their markets</li> <li>• Decline of the natural resource base</li> <li>• Temporary events and shocks</li> <li>• Absence/lack of access to rural financial markets</li> </ul>	<ul style="list-style-type: none"> <li>• Higher return on labour in the rural nonfarm economy</li> <li>• Higher return on investments in the nonfarm sector</li> <li>• Lower risk of rural nonfarm economy compared to farm activities</li> <li>• Generation of cash in order to meet household objectives</li> <li>• Economic opportunities, associated with social advantages in urban centres and elsewhere</li> </ul>
<p>Linked to the narrative ‘poverty’ motivated and ‘necessity driven’.</p>	<p>Linked to the narrative ‘get-rich quick’ motivated and ‘choice driven’.</p>

There are two common explanations for the motivation for ASM that correspond well with the pull and push-factors for diversification more general: pull – **‘get rich quick’** and push – **‘poverty’** (Hilson, 2016, 555). The worker’s motivation seems to vary for different stages in the lifecycle of ASM mine, in rush times attracting with pull factors and in later stages dominated by workers that are pushed into the sector (Hilson, 2016, 555; Barrett et al., 2001; Bryceson, 2002). Individuals that tend to be motivated by the set of reasons stated at the right side of the table, are most likely found at ASGM in the first and second stage. Those that follow, can be associated with the set of reasons on the left are relatively more frequent in ASGM sites in the third or fourth stage (Hilson, 2010, 306). Just like the ASGM sites have been typified, there have been efforts to create a typology of the ASGM work force.

The United Nations Economic Commission for Africa (UNECA) were among the first to stress the importance to view the ASGM workers as a heterogeneous group (UNECA, 2003 in Hilson, 2010, 299) and created a typology for the ASGM workforce: Type 1- the gold-rush miner, who is highly mobile,

always at the site that is currently giving a high yield, motivated to optimise their financial gain. Type 2 – **the permanent miner**, working and entrepreneur on the ASGM site all year around and remaining after the gold-boom has receded. Type 3 – **the seasonal miners**, looking for cash to supplement their basic needs. They are poverty motivated and conduct mining during the season that they cannot cultivate. The last type is type 4 – urban dwellers that seek work in the ASGM sector, equally poverty motivated like type 3, but from a non-agricultural background.

Whether the typology is a static characteristic of the ASGM population or rather variable depending on their career trajectories or the richness of deposits among other factors remains debatable (Hilson, 2010, 299). All the same, failing to recognise the heterogeneity of the people working in the ASGM sector and failing to see that the type of person and motivation to get engaged in the ASGM sector changes over the lifespan of a mine site, re-establishes the narrative of ASGM as informal, anarchic ‘get rich’ activity (Hilson, 2010, 306). This is due to the fact that the public narrative is dominated by the set of pull-factors. This is not surprising giving the rapid changes a village can undergo during a gold-rush that is highly attractive for media reporting. The lifecycle stages that follow are less attractive, as the socio-economic changes are slow and only noticeable if observed at different stages in time. It is the later stages of mine sites that will get specific attention in this master thesis.

### **Occupational Trajectories and Professionalization in ASGM**

ASM has developed discernible **career trajectories** in mining despite the public perception of an exploitative and insecure work place as Bryceson’s and Jønsson (2010) have shown. Especially risk-taking income maximizers, with networking skills and the flexibility for a mobile life style are successful in the ASGM sector (Bryceson & Jønsson, 2010; Jønsson & Bryceson, 2009). Verbrugge (2016) argues that the ability to use ASGM as a platform of wealth creation and social emancipation cannot be realised by everyone, as some lack the needed physical and psychical characteristics. The access to the ASGM sector is socially regulated in the Philippines, where kinship ties and origin are key mechanisms in gaining access to good income opportunities. This is different elsewhere. Bryceson and Geenen (2016) describe the ASGM occupational trajectories in Tanzania as none typified regarding age, level of education and class. ASGM is often seen as an occupation that **levels out social differences** and is in this sense ‘democratic’ (D. Bryceson & Geenen, 2016, 302).

The first experiences ASM workers have functions as an **informal apprenticeship**, where “he earns as he learns” (Bryceson & Jønsson, 2010, 380). The debutant miners find vital social contacts and learn the basic skills. Those that continue working in it, progress with increased specialization, a higher reward, spatial and social mobility. For young men, the ASGM site offers a life away from familial

control and the social pressure of the village, a chance to level out social hierarchies (D. Bryceson & Geenen, 2016, 309). Bryceson and Jønsson (2010, 381) have observed that diggers that have continuously worked in mining for longer than two years, have left ordinary rural income diversifying strategies. They tend to develop a professional identity as miner, characterised by social solidarity, economic autonomy and a proudness of being a self-made man. Bryceson and Jønsson call them 'Real Miners'.

The '**Real Miners**' first site was generally close from home and the ASGM workers were reluctant to leave it. Once moved for the first time, they have become more mobile, spending less time at each site and becoming increasingly independent of their familial ties, but forming stronger relationships to fellow miners. As their career advances they position themselves socially depending on their competences instead of origin or ethnicity (Bryceson & Jønsson, 2010, 383). The 'Real Miners' rarely or never return working in the fields in the mining off-season, but might send money home to hire labour (Bryceson & Jønsson, 2010, 388). Once their labour force weakens, they opt to move on to trade, rather than going back to their original agricultural roots. Moving to **commerce** is seen as the final strategic career decision, after having saved enough money throughout the mining career (Bryceson & Jønsson, 2010, 390). Regarding the agricultural change, it is important to understand the spatial-temporal context of this professionalization in the ASGM sector. It is this context that this thesis will focus on.

### **ASGM and Agriculture – Competing or Complementing?**

The dominant public narrative suggests that the agricultural and the ASGM sector compete for the same production capitals, such as land use and labour force and the environmental changes due to ASGM influence agriculture negatively. Bryceson & Jønsson (2010) observation of a relatively rapid professionalization and thereafter leaving the agricultural activity behind, reinforces this view of competing sectors. In the recent years several scholars have witnessed that in their case studies, overall the activities are rather complementary than competing (Cartier & Bürge, 2011; Dondeyne & Ndunguru, 2014; Hilson & Garforth, 2012; Kamlongera, P & Hilson, 2011; Pijpers, 2014).

The structural adjustment programs throughout the 80s and 90s resulted in the removal of state subsidies for agricultural inputs, as well as readily available staple food from developed countries through reducing trade barriers competing with the inland products. This resulted in diminished returns for the peasants from their agricultural produce. The rural dwellers were forced to look for supplementary incomes in nonfarm activities, such as ASM (Hilson & Garforth, 2012, 452).

Werthmann (2009, 120) states that for Burkina Faso the structural adjustment programs played a minor role, as the formal sector in Burkina Faso is and was relatively unimportant compared to a

period of recurrent droughts in this zone. In Burkina Faso ASGM is an alternative to informal occupation in urban areas or labour migration to the Ivory Coast and Ghana.

No matter the causes, rural households got active in ASGM to supplement incomes, leading to settlements “where farming and ASM have become ‘interlocked’, propelling one another.” (Hilson and Garforth 2012, 444). Pijpers (2014) points out the seasonal character of the two activities in Sierra Leone and Ghana, where the two activities **complement** each other **throughout the year** - cultivation during the wet season and ASM during the dry season. The proceeds from ASM are often relied upon as a disposable income and quite often support the agricultural activity financially. All the same, it is farming that receives the main attention for rural development strategies (Hilson, 2016, 548). Hilson and Garforth (2012) found for Southwest Mali and Southeast Ghana that ASM had replaced smallholder farming as the primary income-earning activity, but agriculture was not abandoned. Farming activity continues to safeguard food security, while the ASM activity provides the needed cash.

When the household earnings are closely tied to a small harvest from a very limited seasonal period, ‘branching-out’ into the nonfarm activities is the most effective strategy to fill the financial void before the next harvest (Hilson & Garforth, 2012, 449). A case study in Malawi (Kamlongera, P & Hilson, 2011) looked at the identity aspect, observing that many ASM workers still ‘see themselves as **farmers first** and by no means have any intention of abandoning agriculture in favour of anything else’ (Kamlongera, 2011, 1136 in Hilson, 2016, 556). Hilson and Garforth (2012, 450) found similar results, many interviewees insisted on agriculture as being their main activity, even though it was clear that ASM is providing the main income for the household. Despite having reconfigured their livelihoods in response to economic change, farming is still viewed as an important activity, as it provides food for the household’s consumption. Labour and finances flow continuously between the two activity sectors. So far, we have heard arguments for a complementary relationship.

Voices that argue that the relationship can best be described as **competing** are rare in academic circles. A case study showed that some had in fact turned their ASGM activity into a full-time activity that they conduct all year around in Zimbabwe (Maponga & Meck, 2003, 353 in Hilson, 2016, 556). This is supported by the professionalization observed by Bryceson & Jønsson (2010) provided the share of people who professionalize is big. This could mean that the relationship is competing rather than complementing regarding labour force. Lanzano and di Balme, (2014, 22) reviewed the media representation of the ASGM sector in Burkina Faso. They found that, local media states that the landscape is destroyed and deforested and therefore agricultural production becomes difficult. The media represents the relationship between ASM and agriculture as competing. If agriculture and

ASM compete for land resources, there should be various reports of **conflicts** between miners and farmers. This is not the case in the current academic literature on this topic.

The literature review, revealed that the relationship between small-scale mining and farming as described in academic literature is complementary, rather than competing. Hilson & Garforth (2012, 460) even argue that the ASM sector and smallholder agriculture should no longer be treated in isolation. ASM has alleviated hardship and “failing to acknowledge ASM’s indispensability to rural households’ wellbeing in policy will only exacerbate poverty and further strain fragile relations between African governments and communities.”. Other than supporting subsistence agriculture, ASM enables the construction of improved houses, pays for schooling, business ventures or for some family it has improved their agricultural productivity by being able to hire work forces or buy the needed inputs. Through this some families have become less and less dependent on the ASM activity over time, as it has served as a “platform for wealth creation” (Hilson, 2016, 557). Whether these findings can be supported with the empirical work in Burkina Faso is revealed in later chapters. The next chapter presents, how this research serves to complement literature.



## 2.3 Research Gap and Questions

Agriculture and mining are complementing activities for the ASGM workers, even though some professionalize in mining during their occupational trajectories. An ASGM's lifecycle has been conceptualized in four stages: from the rush site to the dying site. Hilson and Garforth (2012, 443) identify the provision of "clarification of the underlying rationale for households to 'branching out'", the diversification of activities into the non-agricultural sector, as shortcoming in the body of literature in rural livelihood diversification. This study compares the livelihood strategies at the two longest lifecycle stages of an ASGM. Further, it can give the reader an idea of what could possibly happen to a community after the gold is gone, as my research adds novel knowledge of the under-researched Descending type of site. It does not cover the first lifecycle stage, the rush site, as this has sufficiently been discussed and is not a state that lasts for several agricultural periods. Through the comparative concept of the thesis – Permanent Site versus Descending Site – the reader can deepen the understanding of the complementarity of ASM and agriculture. This concept leads me to ask the following overall research question:

**How is farming and mining combined by ASGM-workers at a permanent ASGM site compared to descending ASGM sites in Centre-North/North of Burkina Faso?**

The overall research question is answered by four sub-questions, answered in an empirical chapter each. The chapters end with the discussion of the similarities and differences between the two case studies.

1. **Whom** and **what part** of the ASGM workers **invest their time and work force in agriculture** at a permanent ASGM site compared to descending ASGM sites?
2. **How and to what extent** do ASGM workers **invest their financial gain in agriculture** at a permanent ASGM site compared to descending ASGM sites?
3. **How** do the ASGM workers **reason** their investment **decision** at a permanent ASGM site compared to descending ASGM sites?
4. **How** do ASGM workers **understand the effects of** their investment **decision** on their familial **agriculture** at a permanent ASGM site compared to descending ASGM sites?

The overall research question is discussed and answered in chapter 9, before discussing methodological insights and concluding. It follows chapter 3 on the methodology.

### 3. Methodology

This mixed-method study gives quantitative insights into labour and capital investments in agriculture by ASGM workers and presents their reasoning and perception of the effects of their choices.

#### 3.1 Philosophical Assumptions

The researcher's worldview is generally not discussed in a thesis, as it mostly reflects his discipline's current ontological and epistemological paradigm. Within geography, and also within human geography, post-positivism, realism and post-modernism/post-structuralism underlie current research with uneven popularity, but all paradigms can be found (Davies, Hoggart, & Lees, 2014, 60). This chapter explains the paradigm informing this thesis: critical realism. Critical realism makes its strongest claims on the ontological level (Yeung, 1997, 55), the level that refers to the nature of reality when a researcher conducts his project. It is linked to the epistemological belief, to the positionality of the researcher as well as his chosen methodology and language of research (Creswell & Plano Clark, 2011, 41).

Critical realism seeks to "understand the links between investigated behaviour and broader social structure" and "focuses on assessing whether observed social processes are mediated by often unquestioned structures within which people make behaviour decisions" (Davies, Hoggart, & Lees, 2014, 37). Fielding and Fielding (1986) argue that micro-level (individual action) and macro-level (action guided by collective structure) are both integrated in daily life. Quantitative inquiry serves to discover the macro-level, while qualitative fieldwork is strong in understanding action that can be attributed to individual beliefs. "An intimate 'back-and-forth,' testing, critique, and synthesis" of the two approaches stand "the best chance of specifying powerful solutions" to important inquiry problems" (Fielding and Fielding, 1986 in Greene & Caracelli, 1997, 11)

Applied to my research problem this means I seek to see whether the behaviour decisions ASGM workers make with regard to agriculture is mediated by an unquestioned structure that might be partly recognised with the quantitative methods. The qualitative methods and the fieldwork can help me in understanding the occupational choices that are linked to personal beliefs. Critical realist may apply hermeneutic methods of interpretation, but they do not accept not to intervene or not to judge, what is fundamental to hermeneutics as a methodology (Davies, Hoggart, & Lees, 2014, 45). As development related questions are posed problem-centered, I want to provide answers that can inform legitimizable action. Writing within this paradigm, I allow myself to end this thesis with recommendations, which is something I would not do if I worked within the interpretative paradigm.

Critical realism is not to be confused with a positivist or post-positivist world-view. “Positivists assume that if they follow their seven steps to affirm a hypothesis ‘If X, then Y’, this shows X causes Y. Sayer<sup>1</sup> (1984: 110) counters, ‘what causes an event has nothing to do with the number of times that it has been observed to occur’. Instead critical realists like Sayer subscribe to a ‘depth ontology’, encompassing the ontologically necessary structures of causation lying beneath the surface appearance of things.” (Davies, Hoggart, & Lees, 2014, 35). Critical realists combine what Sayer (1984) calls extensive research<sup>2</sup> with intensive research<sup>3</sup>, how to do this specifically though, is hard to be found in literature (Davies, Hoggart, & Lees, 2014, 36). Yeung (1997) suggests using methodological triangulation, in other words mixed methods, as one out of three options open to critical realists.

There is a persisting debate about the defensibility of mixing methods at the philosophical level. Does mixing methods mean mixing philosophical assumptions? Some primary stances on this issue have been summarised by Somekh and Lewin (2011). On one hand the argument of a stance is: “[P]hilosophical assumptions are useful conceptual tools, but they should not drive practice decisions” (Somekh & Lewin, 2011, 261) on the research design. Similarly argues the pragmatic stance that also de-emphasizes the philosophical tradition. On the other hand, the dialectic stance argues in favour of mixing philosophical assumptions intentionally, because the philosophical assumption can meaningfully and implicitly influence practice decisions. Greene and Caracelli (1997, 12) see contrast, conflicts and tensions between the methods and the findings as a valuable potential. It is especially within “the tensions that the boundaries of what is known are most generatively challenged and stretched” (Greene & Caracelli, 1997, 12). While I agree with Greene & Caracelli’s (1997) argument, stressing the strength of the dialectic stance for research combining epistemological paradigms, I do not find it convincing enough, as it lacks an ontological paradigm frame that holds the research project together. I think that critical realism offers an overall paradigm within which the *methodologies* developed in the interpretative and postpositivist tradition can be integrated. The dialectic stance on the epistemological level inspires this project. The two different methodologies are also reflected in the chosen language for the different chapters and paragraphs thereafter. The qualitative chapters are written in the personal form, narrating the research experience. The quantitative chapter, on the other hand is written impersonally.

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<sup>1</sup> Sayer is a critical realist social theorist and human geographer.

<sup>2</sup> Extensive research explains how frequent a phenomenon is (Davies, Hoggart, & Lees, 2014, 35, which is the strength of quantitative research under the postpositivist paradigm.

<sup>3</sup> Intensive research conceptually abstracts underlying causes for why and how a phenomena happens (Davies, Hoggart, & Lees, 2014, 35). This is the strength of qualitative methodologies under the constructivist paradigm.

### 3.2 Context of Fieldwork and Positionality in the Field

The data was collected at four different ASGM sites: Galong-Tenga next to Tikaré and Alga, near Bourzanga in the province Bam in the region Centre-Nord. Zomkalga and Tiba, near Séguénéga in the province of Yatenga in the region Nord. Figure 2 shows Burkina Faso with its neighbouring countries, provinces and the research area.

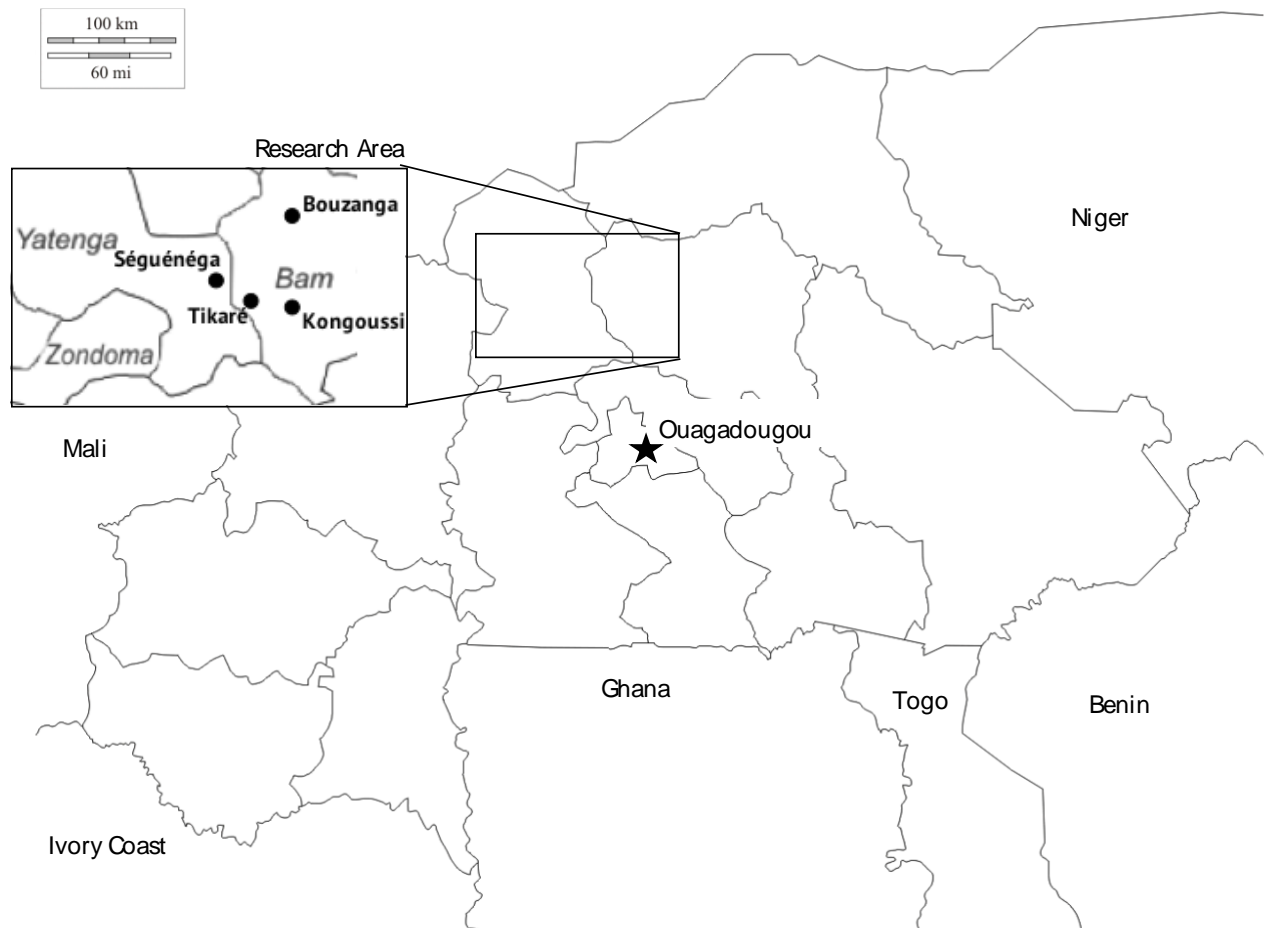


Figure 2: The research area within Burkina Faso. Source: Own illustration based on D-Maps (n.d.)

In order to have enough data for the quantitative analysis the quantitative data was collected at all four sites. The qualitative interview data on the other hand, was collected at Tikaré, Zomkalga and Alga, not covering Tiba. This allowed to have enough time for the interviews, while respecting the interdisciplinary groups schedule. The fieldwork took place in Avril and May 2017 for six weeks, including preparation of the collaboration in the field. The fieldwork was organised in a team of three complementing studies, what facilitated logistics and access to the ASGM sites. A part of the team returned mid-October for the restitution of the findings. In total, we held six presentations over six days with discussions, where the customary authorities, the community authorities and the ASGM workers were invited to listen to and discuss the results. Between 25 and 50 people attended each

presentation. The feedback influenced the understanding of the interview data and served as a reassurance.

The project was launched collaboratively with the NGO Action de Carême, based in Luzern, Switzerland and three research teams - conducting one study each. A health study was realised by the Swiss Tropical Institute Basel, looking at the self-reported long-term effects of the cyanide treatment. Another master thesis looked at the dispersion of cyanide and mercury in the environment and the decay of the cyanide at the treatment area. The fieldwork team was complemented by three Burkinabe - two interviewers for the survey and a translator for the semi-structured interview. We entered the field as the team of six with the aid of the local associations collaborating with Action de Carême. The local associations are active in promoting ecological agriculture by educating and reinforcing knowledge about agro-ecological techniques and livestock herding. The local association consist of a political organ and a technical team of four people. Generally, we were accompanied by the animators who are well known in the community. Our contact persons informed us who we had to meet before being allowed on site. We visited the major, the police, the ASGM syndicate and the local village chefs and introduced our projects and aims.

After the visit and gaining consent by all the organs of authority, we were free to move where and talk to whom we wanted. My translator and I spent our days walking around the mine and starting to have easy conversations with the people. Then we introduced, what we were aiming to do and asked whether they would talk to us for about an hour. The first contact was easily established and after installing us comfortably in the shade somewhere we pursued in informing them about the use of their data and ensured anonymity. We advanced with easy introduction question asking about their current work in ASGM and biography. Throughout the talk we shifted towards their familial agriculture and their remittances and investments. The collaboration with the translator was very well. I asked her what I wanted to know and she translated and adapted it, if she thought it was necessary. She informed me with details, if she had changed or adapted the question slightly and translated the response at the same time. When she asked the next question, and talked in Mooré, I had time to take notes and prepare the continuation of the talk.

As a white young woman, it was easy to establish a first contact with the generally young men, as they were often quite curious to know why I was there. Talking about their mining activity was a good entry point and informed me about their role in the ASGM process. The shift to more personal topics such as the familial agriculture was more difficult and demanded that I advanced slowly and gave the control of the talk to the interviewee. When I felt that a topic was not easily approachable, I

tried again in a different way. I did not insist, if I felt that the interviewee got uncomfortable. I finished the interview by talking about their future and their wishes and asked them whether they felt that they wanted to add something or if I had forgotten an important aspect. Then I informed them that for me the interview was terminated I offered some water if it was not needed before. Quite often in this atmosphere they added a little detail, commented on our interest on the topic or asked bluntly whether we could give them material to facilitate their work.

### 3.3 Mixed-Methods Convergent Parallel Research Design

The convergent mixed-method design is a triangulation of methods for the purpose “to obtain different but complementary data on the same topic” (Morse, 1991 in Creswell & Plano Clark, 2011, 77). Generally, the approach brings together the strengths and weaknesses of qualitative methods<sup>4</sup> with the strength and weaknesses<sup>5</sup> of quantitative methods. It serves primarily in corroborating and validating data and secondarily, the complementarity of results help in the development of a more complete understanding of the phenomenon in question (Creswell & Plano Clark, 2011, 77). As the question of validity is a quality criteria for any research, this advantage also motivates my research, but it is the complementarity of the data that I find fascinating and necessary for my research interest. The combination of superficial, quantitative data that looks at social structure and the qualitative data that looks at agency and the reasons behind the behaviour of the individual allows to understand the phenomena at different social levels. For the phenomenon under question the mixed-method approach, shown in Figure 3, with a survey and semi-structured was chosen for several reasons.

1. I had no prior knowledge and especially no experience of the phenomenon ASGM and its context agriculture in Burkina Faso. Therefore, I could profit from the circular approach of qualitative method research – reformulating the research question while being on fieldwork and throughout the analysis.
2. While some qualitative studies exist on ASGM and agriculture, quantitative information and therefore information on trend and structure is lacking.
3. The interdisciplinary nature of the project and the field work schedule offered the possibility to do so without the need of additional financial resources.
4. I acquired theoretical skills in both qualitative and quantitative methods throughout my studies and was/am equally attracted to apply both. Conducting a mixed-method study in

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<sup>4</sup> Strength: in depth understanding of case, adaptable approach, open for the unknown. Weakness: small sample, no generalizability.

<sup>5</sup> Strength: large sample size allows to see trends and generalizability. Weakness: confirming rather than discovering.

the limited duration of a master thesis is a unique learning possibility and poses equally a challenge. As I have had an interest in mixed-method for a while, I was keen to give it a go.

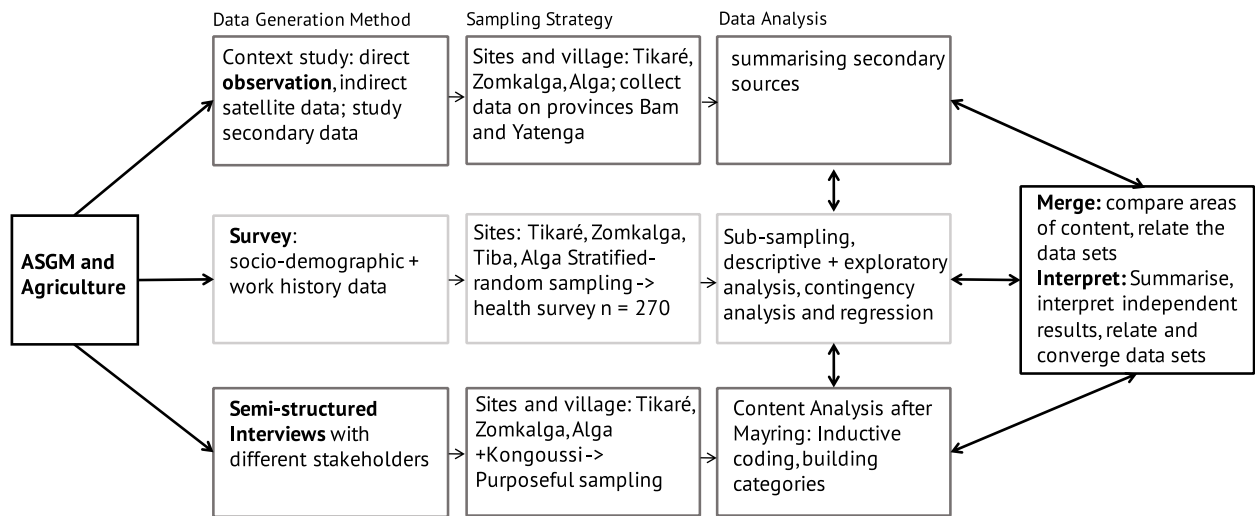


Figure 3: Mixed methods research design. The light grey boxes rely on quantitative methodology and the dark grey on qualitative methodology.

The data collection occurred simultaneously, therefore the design is called ‘convergent parallel design’ with Creswell & Plano Clark's (2011) terminology. The data was analysed independently in a first round. Throughout the analysis I adapted and refined my research question. Thereafter, I did a second round of data analysis, where the qualitative and quantitative data was stronger integrated and focused.

### 3.4 Qualitative Methods

Chapter 6.2, 7 and 8 are based on the data gained with the semi-structured interviews. I conducted a purposeful sampling strategy, selecting all kind of actors, as one can see in Table 3 and in the Appendix in Table 22. The sampling strategy was adapted throughout the fieldwork, as I realised that farmers and miners cannot be separated really, as many of them conduct both activities. I also added people I had not previewed, because I did get a chance for an interview or I felt that it was necessary to consider their perspective. In total 66 interviews with mostly one person were conducted. Sometimes people joined in during the interview, resulting in spontaneous group interviews. The conversations lasted 30 min to 1h 30min, depending how enthusiastic the interviewee was about the topic.

Table 3: Purposeful sampling of the actors influencing the ASGM activity.

Semi-structured Interviews		Authorities		School Personal	ASGM Workers/ Farmers	Other Civilians	Total
		Customary	Government				
<b>Descending Site</b>	Tikaré	1	4	2	6	4	35
	Zomkalga	2	2	2	9	3	
<b>Permanent Site</b>	Alga	2	3	-	19	2	26
Region	Kongoussi	-	3	-	-	2	5
Total		5	12	4	34	11	<b>66</b>

Oral history interviews can be an instrument to link life trajectories of individuals with social transformation caused by the development of the ASM-activity, as demonstrated by Verbrugge (2016, 115). Inspired by his work I conducted semi-guided oral history interviews, going through people's biography in regard to their work history, gain investment and future plans. Whenever one revealed that he was still active in agriculture I asked to hear about how his and his siblings ASGM activity influences their familial agriculture.

The interview was translated immediately by my research assistant. Notes were taken in German and French. Interviews were recorded and transcribed, whenever the atmosphere of the interview allowed for this, otherwise the data is based on the notes taken during the and complemented after the interview. The data was translated to English and analysed with the help of the qualitative data analysis software MaxQDA. The interview notes were inductively codified, ordered and categorised by their content, creating an overview of the body of interview data for each interview theme. Even though the initiation demanded much time, the structuring of the data allowed me to get back to passages within seconds and also to see a statement within the diversity of statements about the same category.

### 3.5 Quantitative Methods

Chapter 5 and 6.1 are based on the quantitative findings. The quantitative data was collected in collaboration with the health survey of the interdisciplinary project. Their research design demanded a sample size of 90 person per group. They compared the blood lactate level of cyanide workers, other mine workers and the surrounding community. As the health survey group selected people according to their activity and under the criteria being older than 18 years, the distribution of age and activity is not representative of the ASGM community.



The quantitative data is a sub-sample of the health survey sample. People, who indicated having worked at least one day at a ASGM site in various activities. The second criteria for sub-sampling was having an agricultural familial background. Out of 287 persons of the health sample size, 237 individuals remained in the sample (Descending Site n=128: Tikaré n=41; Zomkalga n= 39; Tiba n=48; Permanent Site: Alga n= 109). The total population of ASGM worker can only be estimated for sample size calculation and estimation of representability. The visited Descending Sites have a total population between 600-1500 people. The visited Permanent Site has a total population between 1000-2500 people. Table 4 shows the calculation results for the margin of error. These high values mean that the data in the tables of chapter 5 and 6 are not representative for the ASGM population. Rather the data should be written down with a range. It was forborne to do so for a clearer view and comprehensibility. These large margins of error with the ordinary confidence level of 95%, the reader must keep in mind that the results are implicative for the population, but mostly not representative.

Table 4: Margin of error (m.o.e.) for representative results about the respective total population with a confidence level of 95%. The total population in the table represents the estimated minimum.

	<b>Tot. Pop.</b>	<b>n</b>	<b>m.o.e. [%]</b>		<b>Tot. Pop.</b>	<b>n</b>	<b>m.o.e. [%]</b>
<b>Descending Site</b>	600	128	8	<b>Permanent ASGM worker</b>	120	24	18
				<b>Cultivating ASGM worker</b>	480	104	9
<b>Permanent Site</b>	1000	109	9	<b>Permanent ASGM worker</b>	600	65	11
				<b>Cultivating ASGM worker</b>	400	44	14
<b>ASGM Site</b>	1600	237	6				

The individuals were asked while they were working, whether they would be ready to participate in the survey for 30 minutes. Some individuals presented themselves as volunteers and were asked to come back once a spot was free. Two interviewers conducted the data collection asking the questions in Mooré and selecting the appropriate answer in the questionnaire in French. The surveyors placed themselves in a sector of the mine site and aimed at full coverage in the specific sector. Once no new individuals participated the team shifted to another locality.

The data was first of all sub-sampled, as described above and then explored by plotting the variables and producing cross-tables in all kind of combinations. A correspondence analysis and a multinomial logistic regression model further helped to explore the data. After the initial grasp of the statistical

relationships, the research question was reframed and the goals of the statistical analysis were fixed. Two methods have been used in the final thesis and are therefore explained in more detail.

Cross-tabling and contingency analysis serve to detect correlations between two nominally scaled variables with two or more values each. The test serves to answer the questions: Is there a significant correlation between two variables, how strong is the relationship and is a direction discernible? It is important to select the variables carefully and logically according to the phenomena, otherwise there is a danger to construct relationships arbitrarily. The variables were cross-tabled to explore the data, if it suggested a correlation the contingency analysis was applied. It tests whether the correlation has come up arbitrarily in the sample or whether there is a statistical relationship. The chi-square independence test, compares the following: Is the nominal value of variable X equally distributed for the groups constructed by a nominal value of variable Y, then we cannot expect a statistical relationship between X and Y, is it unequally we can expect a relationship. For observation studies, such as this research, a statistical correlation is not indicating a causal relationship with a direction, such as X causes Y (Backhaus, Erichson, Plinke, & Weiber, 2016, 358ff). Because the chi-square test is not a satisfying approximation for small sample sizes, it is recommended to use the Exact-Fisher-Test and as some variable values count an abundance of less than 20 in this study this test was generally applied. The strength of the relationship is measured with the contingency coefficient and the Cramer's V. They vary between 0 and 1, the closer to 1 the stronger the relationship (Backhaus, Erichson, Plinke, & Weiber, 2016)

Nonparametric analysis of variance is used if the distribution of a variable within sub-groups is strongly asymmetric and therefore does not fulfil the criteria of normal distribution, this was tested with the Kolmogorov-Smirnov Test. The median of two or more samples are compared for differences, in these procedures. If there are two samples the applicable test is Mann-Whitney-U, if there are more than two samples Kruskal-Wallis-Test is appropriate. These tests were applied for the combination of a nominal and a ratio variable. The test for correlation between two ratio variables was done with the nonparametric test Spearman-Rho. The next chapter introduces the regional context of Burkina Faso.

## 4. Regional Context: Bam and Yatenga in Burkina Faso

This chapter introduces the reader to the context of the field study. It treats the demographic and agricultural developments in rural Burkina Faso, introduces the ASGM sector and the place of fieldwork – the four ASGM mines.

### 4.1 Socio-demography, Environment and Agriculture

Burkina Faso is a landlocked West African country with just over twenty million people of twelve major ethnic groups. Over 50 % of the inhabitants are Mossi and speak a Sudanic language called Mooré. The official language is French, an inheritance of the colonialization by the French that ended officially in 1960 with independence. The population growth rate is high at 3% - the result of a steadily high fertility, but a lowering mortality rate. The population is therefore very young – 65 % of the population are younger than 25 years and the median age is 17.3 years (Central Intelligence Agency, 2017). The young and growing population trend is especially pronounced in the rural areas, like the two provinces Yatenga and Bam, where the fieldwork took place. Both provinces are mainly inhabited by Mossi (circa 90 %) and Fula (circa 8%). Yatenga is a Muslim (95 %) and Bam Muslim (75 %) and Catholic (20%) province. 25 % of the people in Centre-North/ North are alphabetized, 10 % below the national mean (Ministère de l'économie, 2016a; Ministère de l'économie, 2016b).

The climate is Sudano-Sahelian, with two distinct seasons and large temperature variations. June to October are warm and rainy, the rest of the year is dry and hot (FEWS Net, 2017, 11). Séguénéga in the province of Yatenga measures 550-800mm of rain per year on 30 to 40 days. Bourzanga in the province of Bam measures 450-750 mm per year on 35-50 days (Ministère de l'économie, 2016a; Ministère de l'économie, 2016b). The terrain is mostly flat in the region with some small hills. Recent reoccurring droughts, deforestation and desertification, degraded soil and overgrazing pose major challenges to the agricultural activity in the area (Central Intelligence Agency, 2017). The forest area has diminished from 25% in the year 1990 to 20% of the countries surface in 2014 (FAO, 2014).

Around 85% of the population indicate that they work in agriculture. This ratio has remained relatively stable over the past 20 years. This has resulted in an absolute growth of the cultivating population, as Figure 4 shows.

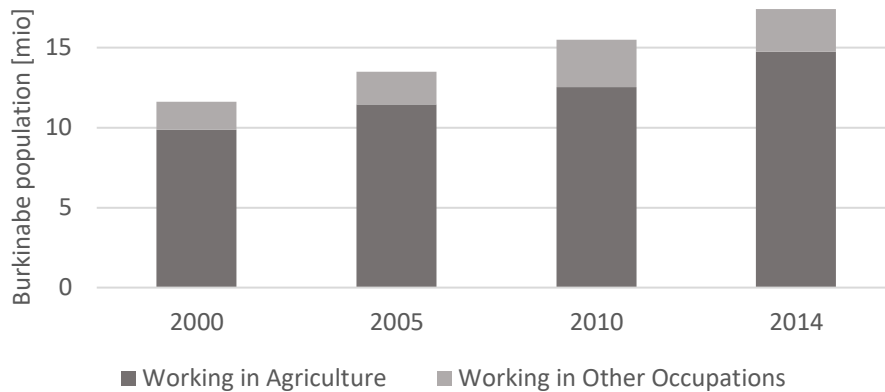


Figure 4: Rural population growth. Source: Own illustration based on FAO, 2014; Ministère de l'économie, 2016

Two distinct seasons partition the rural activities throughout the year, as Figure 5 shows. The graph matches areas further south better, because the rain starts later in Centre-North and North. June to September are lean season, where food is short and food prices are high on the local markets. Land preparation and ASGM overlap in time throughout the year, this is less extreme in Yatenga and Bam.

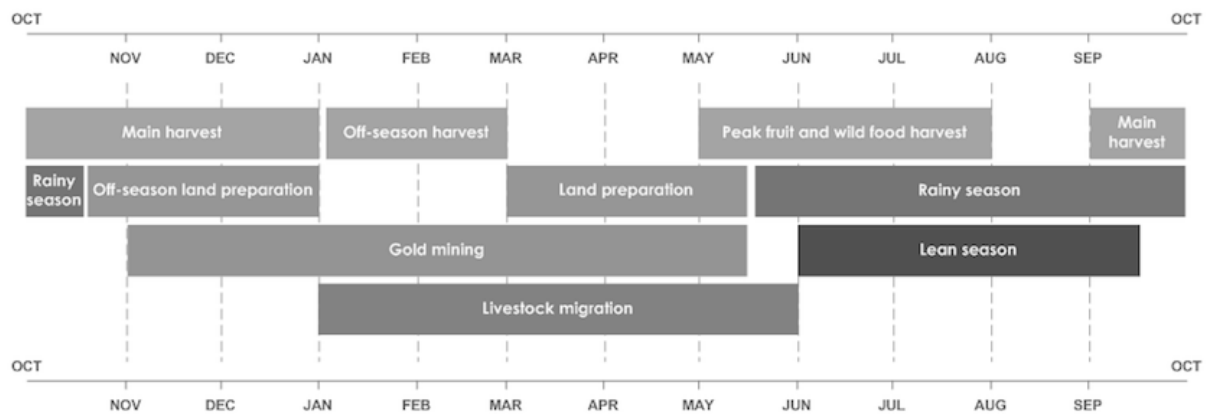


Figure 5: Seasonal calendar of Burkina Faso. Source: FEWS Net (2017)

The cultivation land also has single trees that are harvested for fruit and wild food. The differentiation between pasture land and crop land is not strict, rather the animals move freely on the crop land and beneath the trees after the harvest has been brought in. The area is cultivated with sorghum and millet mainly. Secondary are cowpea, maize and rice. Cash crops are mainly peanut. Other products of the region are hibiscus, nimié, mango as well as wild fruits and leaves that are also harvested consumed fresh and dry and partly sold. Gardening is conducted along the shorelines of surface waters, such as the lake Bam. Apart from chicken, sheep and goats are the most numerous animals, followed by cattle and pig (Ministère de l'économie, 2016a; Ministère de l'économie, 2016b).

The research area is a region with minor surplus of livestock, but regularly highly deficient in cereals. The sustenance degree of the area has varied between 54 and 93 % in 2010-2016 for Bam and between 59 and 113% 2009-2015 for Yatenga (Ministère de l'économie, 2016a; Ministère de l'économie, 2016b) with decreasing tendencies, even though the absolute harvest has relatively remained stable, as Figure 6 shows. The trend for Bam and the Centre-North is slightly positive and the trend for Yatenga and North slightly negative. The diminished subsistence rate is due to the increased population. The harvest season 2011/12 was particularly bad for the North and other regions in Burkina Faso, causing high staple food prices. Years with high cereal prices due to a Burkina-wide bad harvest, cause livelihood strategy adaption in regions that are highly dependent on purchased food, such as Bam and Yatenga. Engaging stronger in nonfarm activities is influenced by adverse staple food prices, stronger than a bad local precipitation regime in a specific year, as one could imagine to be cause nonfarm activity engagement (D'haen, Nielsen, & Lambin, 2014, 159).

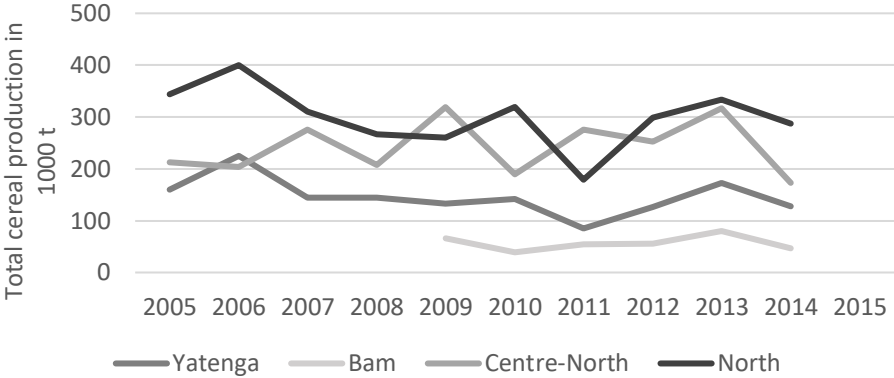


Figure 6: Total cereal production in the two provinces and two regions over the past ten years. Source: Ministère de l'économie, 2016a; Ministère de l'économie, 2016b

The calculation of the sustenance degree is based on a population growth model, rather than recent population counts. It is based on the assumption that the young men in the region have continued to emigrate and are therefore not consuming the local harvest. After FEWS Net (2017, 9) most households buy their food for six months of the year, which corresponds to a sustenance degree of roughly 50%, rather than the higher numbers that figure in the official report of the "Ministère de l'économie". Bam, as well as Yatenga have figured within the most cereal-deficient provinces of Burkina Faso in the past five years in the FEWS Net (2017) report. One of the major difficulties considering food safety in Burkina Faso is the insufficient storage place (FEWS Net, 2017, 15). Cowpeas and rice are the food of choice at ASGM sites, other than the normal preference in rural areas for sorghum and millet (FEWS Net, 2017, 32). Rice is considered a modern food, preferred by the young and is served in any restaurant in Burkina Faso. Cowpeas and cake seem to be a useful

food for going underground, as they constipate and the energy is long-lasting. The land is mostly cultivated by hand with the “dagara”, the local name for hoe. Eroded land is cultivated with the “zai” technique, where holes are hoed, filled with homemade compost and roughly five seeds per hole. Fields that are exposed to wind are cultivated with the “demi-lune” technique, little earth mounds formed in half-moon for wind protection. Some families cultivate with plough and ox, where the soil is sufficiently fertile.

## 4.2 Artisanal Small-Scale Gold Mining in Burkina Faso

Throughout the 1980s several dramatic droughts in West Africa triggered recent artisanal mining activities in Burkina Faso. Elderly women in Tikaré told me that they had been informed about the gold in their grounds during Sankara’s regime, thereafter they have started to prospect gold on the surface. Thomas Sankara, the revolutionary, who came to power 1983, discouraged artisanal gold mining as he mainly aimed at promoting a self-sustaining agriculture (Werthmann, 2017, 419). Sankara’s regime set up the Burkinabe Precious Metals Counter (CBMP) that held a monopoly over the collection, processing and marketing of precious metals. The CBMP organised the sites they supervised to ensure safety and the control through the state (Côte, 2014, 124 in Werthmann, 2017, 419). Still, according to various estimates 40-60 % of the extracted gold was sold on the black-market (Côte, 2014, 127 and various others in Werthmann, 2017, 419).

The present day ASGM activity moved from the northern and north-eastern Sahelian provinces along the greenstone belts - Birimian volcano-sedimentary rocks to central provinces such as Yatenga and Bam in the early nineties, before reaching the southwest by the end of the 1990s (Werthmann, 2017). The southwestern Poura and Lobi region are historical gold sites and are an exception to this movement of the recent gold frontier. The shift of the ASGM workers towards more humid regions, especially in the cotton-growing areas has caused conflicts about land- and water-use and has equally demanded an adaption of ASGM techniques, as deposits are diverse presenting unique technical constraints (Jaques, Zida, Billa, Greffié, & Thomassin, 2006, 116ff)

Under Blaise Compaoré’s regime and the influence of the IMF and the World Bank the gold sector was more and more liberalized and privatized throughout the late 1990s. The first mining code authorised the creation of private gold trading posts in 1997. The code was intended to open up Burkina’s resources to foreign investors and to unify the different regulations that had been previously applied to mining exploration and exploitation. The code has been revised since in 2003 and 2015. In the long run the CBMP could not compete with the two biggest private Burkinabe gold firms, namely SOMIKA and Sav’Or and was liquidated in 2005. The ASGM sector has since continuously escaped state’s control to the degree that extraction amounts are today unknown and

taxes are most likely paid only on a very limited share of the ASGM extraction (Werthmann, 2017, 419). Jaques et al. (2006) estimate that only 10% of the total extracted ASGM gold were declared in the last CBMP years. A commission of the National Assembly estimated in a report in 2016 that the yearly 15-30 t gold are exported without being declared (Werthmann, 2017, 425).

The ASM sector in Burkina Faso occupies a roughly estimated 200'000 people directly and another million indirectly (UNECA, 2011, 69). This estimation stems from the platform for ASM concerns founded by the World Bank in 2001 Communities and Small-Scale Mining (CASM). The number is very likely to have risen in the past years and by no means exact, as the clandestine nature of ASM and the geographical dispersion makes it nearly impossible to have exact numbers of the people involved. Jaques, Zida, Billa, Greffié, & Thomassin (2006) estimates that gold mining provides a livelihood for at least 650'000 persons in Burkina Faso, but admit that the sector is very dynamic and can only be properly understood with regular observation. Very low productivity due to the low level of material means deployed characterises the sector. Jaques et al. (2006, 120) estimate that the work of 2.5 labourers are needed to produce 1g of gold a day. This must be lower nowadays, with increase mechanization of the crushing and milling process. But still, this low productivity provides considerable employment opportunities.

From extraction to washing the gold each task has a fixed price that only marginally varied from site to site in 2002. Instead of sharing the gain, the diggers and other involved people are often paid in bags of ore, according to fixed rules. The services that follow are generally paid in cash (Jaques et al., 2006, 120). Jaques et al. (2006) calculated that a miner's revenue a day can be roughly 655 XOF (1 Euro) if he mines ore with a gold grad of 43 g/t if he sells it on the official market at 4'500 XOF/g or 32 g/t gold if he sells on the black market for 6'000 XOF/g in 2002. As Figure 7 shows the gold price has immensely risen since 2002. Following Jaques et al.'s calculation and ignoring inflation and possible other changes in production costs this means that at a market price of roughly 20'000 XOF/g, ore of 9.6 g/t gold is still viably mined, calculated with a recovery rate of 60-65 % only.



Figure 7: Spot gold price development over the past 16 years in XOF. Source: Goldprice (2018)

With the development of so called garden plots for cyanidation the viable ore grade has most likely drastically diminished again. The first of this kind of sites were described in 2002 in Burkina Faso (Jaques et al., 2006). Jaques et al. (2006) estimate that the recovery rate of gold in the tailings after the washing with the cyanide garden plots process is approximately 70%. This gives a total estimated recovery rate of 85-90% in ASGM nowadays.

Again, following Jaques et al.'s calculation and adopting the current gold price this means that a viable gold grade of the reworked tailings has dropped from 4 to 1.4 g/t gold. These numbers are not based on current prices for cyanide or processing work, but serves to illustrate the immense change in what can be earned in the sector by the price changes that gold has undergone in the past 15 years. As we will see in the empirical part of this study, there are now teams that have integrated the entire processing chain from extracting the ore, until selling the gold after cyanidation, meaning that they can mine ore that is far below 10 g/t gold, viably but with a low gain for the workers. If the grade is higher, the gain for everyone increases from 1225 XOF/d to an estimation of about 3'000 to 4'000 XOF/d on average at Alga and between 1'500 to 2'000 XOF/at Descending Sites. Women prospecting the surface sand, make about 500 XOF/d <sup>6</sup>.

With decentralization in 2006 district heads, traditional authorities, representatives of rural municipalities and private Burkinabe companies compete for the exercise of authority over the ASGM. SOMIKA and Sav'Or are Burkinabe held firms that are holding the bulk of permits for Artisanal

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<sup>6</sup> This estimation is based on interview data, as well as rough calculations with Jaques et al.'s (2016) formulas. The interviews revealed that payment in the cyanide sector is very variable and does not follow fixed distribution rules, as it has been established among the diggers.



Mining. A permit that was aimed at formalizing ASGM in Burkina Faso. These companies monitor the processing of gold and urge the ASGM workers to sell their gold with their privately held buying companies at lower prices. Therefore, many ASGM workers prefer to work at mine sites without any authorization (Côte, 2013 in Werthmann, 2017, 420). Currently the Burkinabe government has launched a new organisation called ‘Agence Nationale d’Encadrement des Exploitations Minières Artisanales et Semi-mécanisées’, short ANEEMAS. This organisation should be responsible for the gold trade, monitor environmental issues, train miners and improve infrastructures (Werthmann, 2017, 425). It has not been functional in 2017. Media reported that a commission has found that in the first trimester of 2017 400 ASGM were operational producing 9.5 t gold per year (AFP, 2017).

### 4.3 Alga – a Permanent ASGM Site

Alga is an old site and according to estimates the largest ASGM in Burkina Faso. Underground extraction started around 1990 following a period of intensified surface extraction, often called ‘vannage’ for the swinging movement of buckets to separate the gold from the sand. Several intense gold rushes occurred at Alga, attracting thousands of mobile miners. Figure 8 depicts a timeline of the development at Alga.

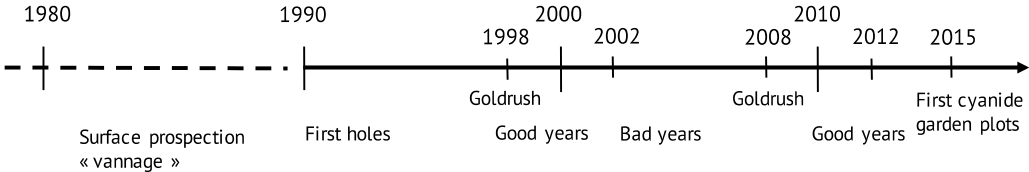


Figure 8: Timeline of ASGM development at Alga. Source: Interview data, 2017.

Alga is not only the name of the site but also the name of a nearby village, whose field have gradually turned into an ever growing mine site. Alga is now the name of another kind of settlement - the ASGM settlement. Most ASGM sites are characterised by improvised housing structures and food stalls are easily demounted and displaced. This is different at Alga, where this kind of housing is present, but not solely. The ASGM settlement has developed into a small mining town with solid houses made out of cement bricks with tin roofs and even housing structures for some familial compounds. Some, who have come as individuals have founded their families there, whose children have never known another village. The market offers the same products as any other small town in the region. Several small shops offer cloths and kitchen tools. There are ‘boutiques’ - small alimentary stores, ‘maquis’ – bars and brothels. Traditional bread is baked in wood stove built with cement. Only the mosques are still simply the form of a mosque laid with stones on the ground and a primary school or health centre has not been constructed yet. The ASGM site has immensely grown

over the past ten years and developed into a settlement with permanency. Figure 9 shows the solid, permanent settlement of 'Alga Site' in November 2017 compared to 2007.

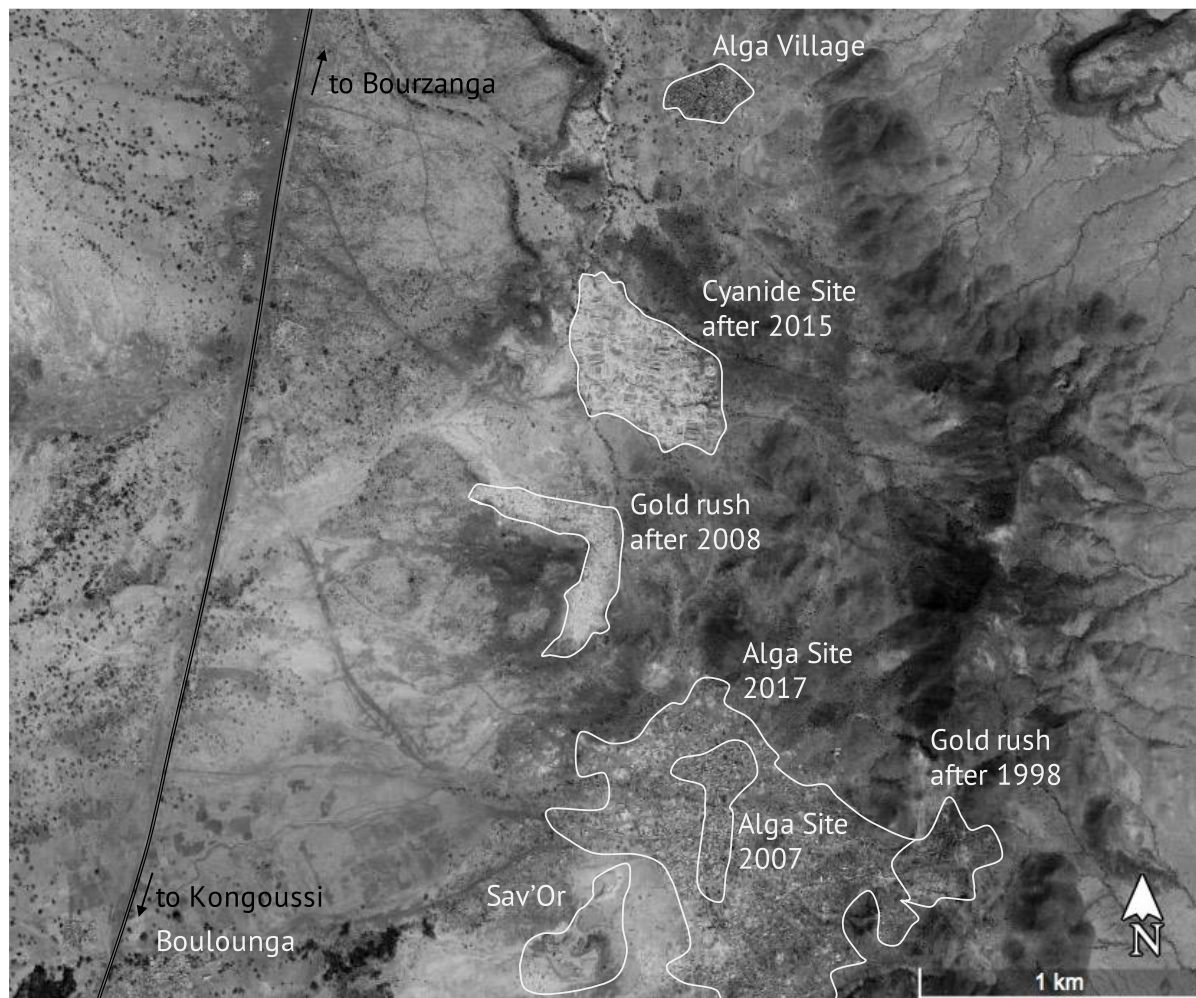


Figure 9: Overview of the situation geographical situation at Alga. Source: Own illustration with satellite image provided by Google Earth 2017 CNES / Airbus.

There are several conflicting authorities in Alga. The area has been under extraction concession by Sav'Or twice for five years starting in 2006. The small-scale mining company's concession has expired and not been renewed by May 2017. According to one of the responsible people on site, Alga has currently four different sites of gold extraction, each being managed by someone else. The village people from Alga are currently in conflict with Sav'Or as they have started to rework residuals from the area that is under the control of Alga village. The gold that is extracted within the perimeter of Sav'Or, which is about 60 km<sup>2</sup>, should be sold with Sav'Or, who are being taxed weekly at 20% by the community. It is estimated that only a small part is actually sold with Sav'Or, as clandestine gold buyers pay prices that are nearly twice as high. Customary community leaders such as the 'Tengsaba' – land chef, the former user of the fields and the 'Naaba' – village chef, feel that they have missed out and are not adequately remunerated. Further, decentralization has led to new political leaders

within the village community, who are the key persons of contact by the commune. Further, the commune Bourzanga has installed a police post on site.

Currently Alga is not in gold rush phase and the best years from 2012 to 2015 are over. Still the shafts that are up to 130 m deep are still being mined. Nowadays, the gain is made with the cyanide garden plots that are numerous and locally concentrated, as one can see in Figure 9. Alga has big quantities of residual sand that is being reworked with the cyanide method. The site can be described as cycling between the current stage three and a stage two mine site with Bryceson and Jønsson's (2010) terminology. Within Hilson's (2010) categorization of miners, the current population is best described as permanent miners and seasonal miners. The gold rush miners are not currently at Alga. Several gold rushes and especially the rework of the residuals of 30 years extraction work have turned Alga into, what I will call, a Permanent Site (PS). Even though, compared to Alga's history, the gain has been smaller in the past two years, it is still higher than at any of the three other sites – the Descending Sites.

#### 4.4 Galong-Tenga, Zomkalga and Tiba – Three Descending ASGM Sites

Galong-Tenga is an ASGM site, located in Tikaré on the road from Kongoussi to Séguénéga. Galong-Tenga can be translated as 'the land of immigration', reflecting the erstwhile attraction. Tikaré is a small town and sub-regional market-centre with a long history and tales that reach back to the first settlers in the region. The 'Naaba Zitenga' the chef of the canton, the customary leader of all the village chefs in the region, has his royal court in Tikaré. 'Vannage' the sub-surface gold prospection has been an activity that in recent years has been practiced since the 1980s. In the year 2009 the first holes appeared near the little town and by 2010 a gold vein was struck. After this, the town seemed to be out of control and the commune was not prepared for what would happen. The big gold rush lasted three years, attracting thousands of mobile ASGM workers and the local population of all ages. This period was described as vibrant, vivid, but also harsh. School teachers stated that during the most promising extraction the students did a relay race at school. They organised themselves in groups, where one would take notes in school, while the others were working on site. Teenage pregnancy among the girls raised remarkably, leading to many school drop-outs. Behavioural problems were more pronounced. The situation has calmed down since 2014 and not only the diggers but especially the shop keepers and artisans talk wistfully about the golden years. Others, mostly those from well-regarded families and the commune authorities, are glad that the gold rush is over. Today the site occupies around 100-200 diggers and about another 50-100 people in sand washing and hidden cyanide jobs.

Zomkalga-Marancé and Zomkalga-Mossi are two small villages by two ethnos that are mostly just called Zomkalga. The village is made up of several familial compounds, each having an ancient artisanal activity. Some have continued their specialities, such as the pot-makers and metal workers, others have given up, such as the tissue dyers. Some of the village men had been working on sites in neighbouring villages for the past ten years. In 2013 'vannage' was especially successful for the women on one of the village's fields, some ASGM workers started to dig some hole and found more gold. A family who used to cultivate this area, has members who are involved with SOMIKA and are therefore highly experienced in ASGM matters. Officially the site is not under SOMIKA's control, but is in collaboration with them. SOMIKA and SASMIR another firm in the ASGM business both tried to gain control over the gold sale (Nikiema, 2016). It is not quite clear what happened thereafter.

The experienced family members of the SOMIKA collaborator, decided to develop the field as an ASGM site early 2016, as they state in order to benefit the village (Interview 01.05.2017). They introduced clear and strict rules. A village committee constituted of all family heads is on site at all times, demanding two out of ten bags of ore plus taxes per hole as a village tax. No one is allowed to leave the site with ore, in order to keep all the work activities on site not disturbing the village life and forcing them to buy water for sand washing with the local women and children, who make up to 1'000-2'000 XOF/d with the water. The first couple of months went well and thousands of ASGM workers were attracted to work at the new site. 17.05.2016 the situation changed, after a heavy rain many galleries collapsed, burying an unknown number of diggers (Nikiema, 2016). The site was officially closed and has not been reopened since. After the rainy season 2016 a new area has been dug up, but the rich gold vein has not been crossed since and many ASGM workers do not longer want to work at this dangerous site. Extraction continues at a low activity level.

Zomkalga is just one out of five big mines on the area of the commune Séguénéga. Another ASGM site that is even a bit closer to Séguénéga town is Tiba. The site has many cyanide garden pits and is close to the industrial open pit mine Kalsaka that was productive for about a year in 2012-2013. It is a site that is more dispersed and due to the closeness to town it is less of a living quarter for the ASGM workers. The best years at Tiba were before the industrial mine installed itself and secure access. After their departure, the ASGM workers returned. Currently Tiba brings gold, again mainly through the cyanide process, but it is not a site that attracts mobile diggers.

With the appearance of more and more ASGM sites, Séguénéga has immensely grown in the past 10 years. At the time of the fieldwork, there was no vibrancy in town, the gold was not going as well as it used to. With the typology of ASGM mines by Bryceson and Jønsson (2010), Galong-Tenga is judged to be a stage four mine. Zomnkalga and Tiba are stage three ASGM. The ASGM workers are

mostly seasonal miners described with Hilson's (2010) terminology. They are poverty driven and it is push factors (Hilson, 2010), that explain their motivation well. Seasonal miners look for cash for basic needs and are occupied in agriculture during the cultivation period. All three sites Galong-Tenga, Zomkalga and Tiba have had years of gold rush. Even though the gold is still being extracted, it is not going as well as it used to, the sites have reached stage three and four. These three sites are called Descending Sites (DS) in this study, indicating that they are in their period of bust. It follows a visualisation of Zomkalga at stage one and stage two. Figure 10 shows the ASGM site in Zomkalga two years before the big gold rush. The first holes are discernible at the left side of the top image. The image below shows the same location a year into the gold rush, but already after the deadly incident. Since then, the site has gotten much smaller and cyanide garden pits have appeared. The image visualises the immense attraction a discovered gold vein can have.

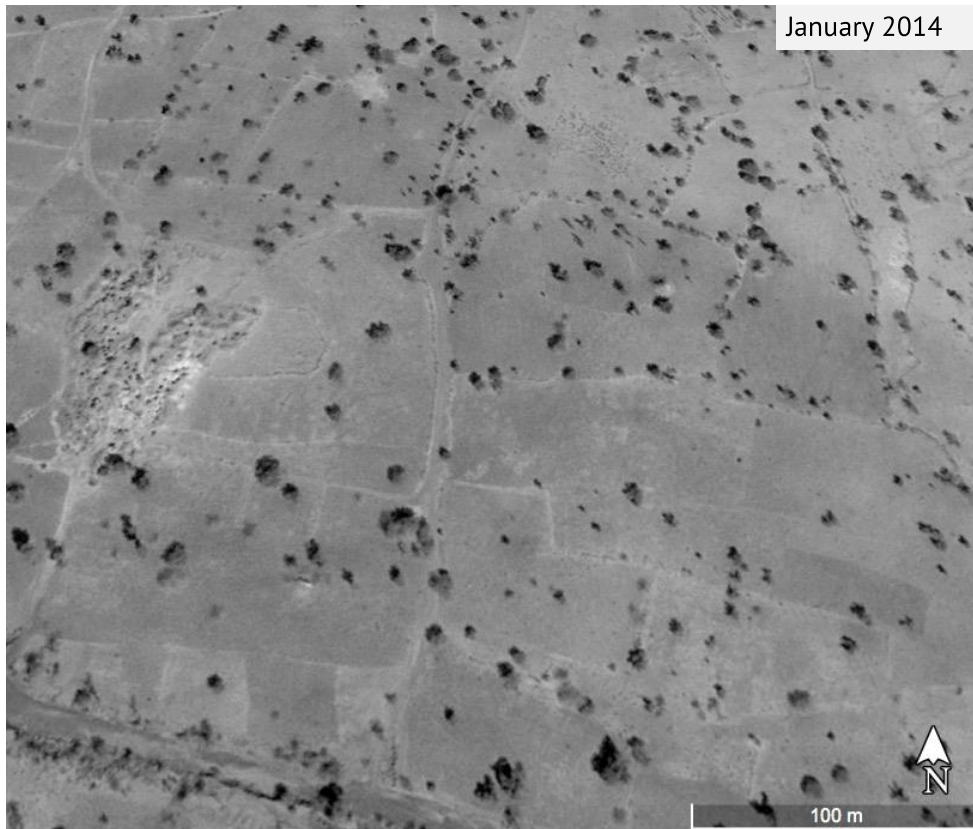


Figure 10: The ASGM site in Zomkalga a year before the gold rush and the same location in the second year of extraction. Source: Own illustration with satellite image provided by Google Earth 2017 CNES / Airbus.

# 5. Labour Investment in Agriculture

This chapter gives answers to the first of the four research questions:

**Whom and what part of the ASGM workers invest their time and work force in agriculture at a permanent ASGM site compared to descending ASGM sites?**

This chapter is about how ASGM workers invest their workforce during the wet season by giving a quantitative overview of the wet season activity for the case studies. It follows a discussion of the differences and similarities for a Permanent versus a Descending Site.

## 5.1 Characteristics of Cultivating ASGM workers

The answers to the question after the wet season activity, can be summarised in three categories: staying on the mining site and continuing to work in the respective activity, combining their activity on site with the familial agriculture or leaving the site to spend the wet period in cultivation. The distribution of the answers to this question is highly site dependant, as one can see in Figure 11, a mosaic bar graph. The Y-axis of the graph represents the percentage of answers at each site coloured differently for each category of wet season activity. The relationship between the activity during the wet season and the site is significant (Exact Fisher = 60.55,  $p=.000$ ,  $n=237$ ). The dependency of the wet season activity on the site is middle strong ( $CC=.457$ ,  $p=.000$ ).



Figure 11: Representation of the distribution of the activity during the wet season and the different sites. The absolute number of answers per category is indicated on the bars. Source: Survey data, 2017.

People working on site all year around are most frequent at Alga, on the biggest and oldest site. Sixty percent of the questioned people replied that they continue their work on site during the rainy

season and therefore do not cultivate. This is significantly different to the other three sites, where around eighty percent of the people work in cultivation during the wet period at least a part of their time. A combination of activities during the wet season such as agriculture and the work on the mine site is abundant at the two sites close to Séguénéga, but seldom for Tikaré and Alga. It is remarkable that the part of ASGM workers, who cultivate, either full or part-time are not significantly different for the three sites DS Tikaré, Zomkalga and Tiba (Exact Fisher=1.337,  $p=.534$ ,  $n=128$ ). This finding reinforced the idea to analyse the three sites Tikaré, Zomkalga and Tiba as one case study. As numbers of part-time cultivators are small, the analysis steps back and looks only at the binary information, whether someone cultivates or not.

The two groups are called Cultivating ASGM worker and Permanent ASGM worker. The term ASGM worker reminds us that everyone earning his money at the mine site, independent of his activity is concerned. This graph has informed the reader that 81% of ASGM workers active on a Descending Site are cultivating and are thereafter called Cultivating ASGM worker (CW). At the Permanent Site Alga, the part of people who are cultivating is significantly smaller: Only 40 % are active in the grain fields and therefore CW. The other 60 % are called Permanent ASGM worker (PW). Analytically there are four distinct groups now DS-CW, DS-PW, PS-CW and PS-PW. Differences between the groups support a characterisation of the group of people and even though a very descriptive information, this deepens our understanding of the labour investment decisions. The information helps to understand who cultivates and who does not. It seeks to find structural social information, apart from personal priorities and one's specific context.

For nominal variables, the four groups differ significantly for the matrimonial status (Exact Fisher: 15.48,  $p=.006$ ,  $n=237$ ), the origin at the local village (Exact Fisher: 33.65,  $p=.000$ ,  $n=237$ ) and the last activity before working at the ASGM site (Exact Fisher: 15.57,  $p=.001$ ,  $n=237$ ). No significant difference was found for gender or the educational level. The contingency test was applied to look for differences between permanent and cultivating ASGM workers at the two types of sites. The results can be found in the Appendix in Table 18. At DS married men and women tend to cultivate during the wet season. At the PS on the other hand, it is the single men that are more frequently cultivating than the married co-workers and this is not a question of age. Furthermore, the result for localness is surprising. At the PS locals are more likely to keep working on the ASGM site during the wet period than their non-local co-workers. This is different for the DS, where the grand majority of people is local, whether cultivating or not. But, the ones that are local might be more likely to cultivate than their foreign co-workers. It must be remembered though that the number of surveyed people is small in this group. More insights can be gained from



Figure 12 that informs the reader on the origin of the ASGM workers and their mobility behaviour.

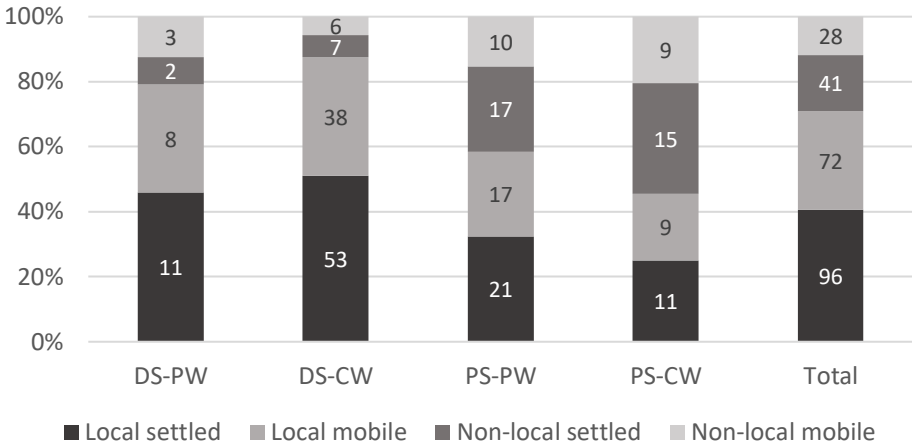


Figure 12: Mobility behaviour and localness of respondents. Source: Survey data, 2017.

Figure 12 shows that while the localness differs between PS and DS, the mobility does not. DS as well as PS, have the same share of people that have worked on other sites before. Many locals have gained work experience on other sites. Further, people, who indicated their very last activity before ASGM was agriculture are more frequent in the ‘Cultivating ASGM worker’s group and they return to agriculture during the wet period with a majority of 73 %.

Figure 13 gives more detail on the respondent’s past activities and reveals that the last activity before starting one’s work on the ASGM site is significantly different between the four groups. Even though all the respondents have a familial agricultural background, some of them diversified their activity well before starting their work at the ASGM site. They are more frequent in the PW group for both types of site. Ex-students are frequent in the group PW. They make up 30 % of that group at DS. This raised frequency of ex-students is the only difference between the lifecycle stages of mines. As the number of respondents is small for this group, it is doubtful that it characterises a difference for the stage of a mine.

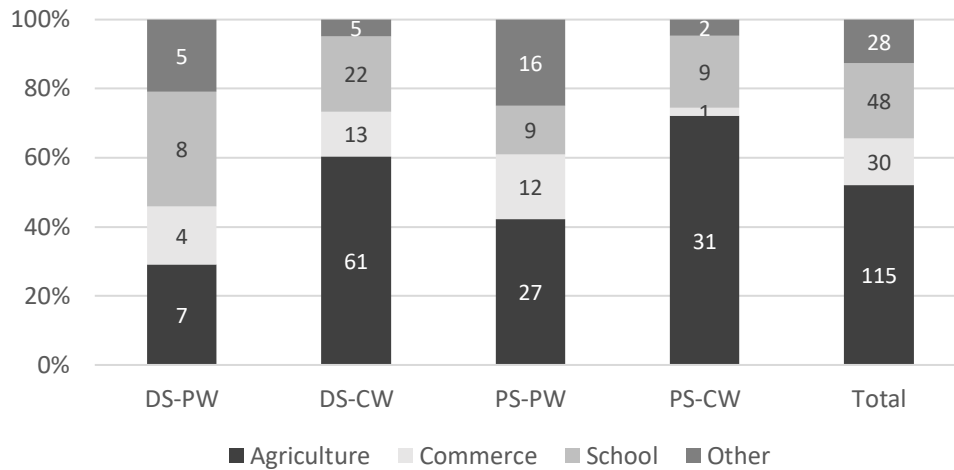


Figure 13: Distribution of activities of the respondents before starting to work at the ASGM site. Source: Survey Data, 2017.

Regarding the dry season type of work on ASGM site and the wet season activity cultivation more insights can be gained from Figure 14. The two type of sites DS and PS should not be compared, due to the sampling strategy that is linked to the kind of work on site. A comparison between DS-PW and DS-CW or PS-PW and PS-CW is possible. One can see that for the DS, there is no differentiation between CW and PW depending on the kind of work. All kind of jobs are continued throughout the year or intermitted by cultivation. This is different for the PS. Here, the physically demanding jobs (category A-E) are more often carried out by people, who cultivate during the rainy season. Those who do trade with food, drinks or gold are more likely to remain on site all year around.

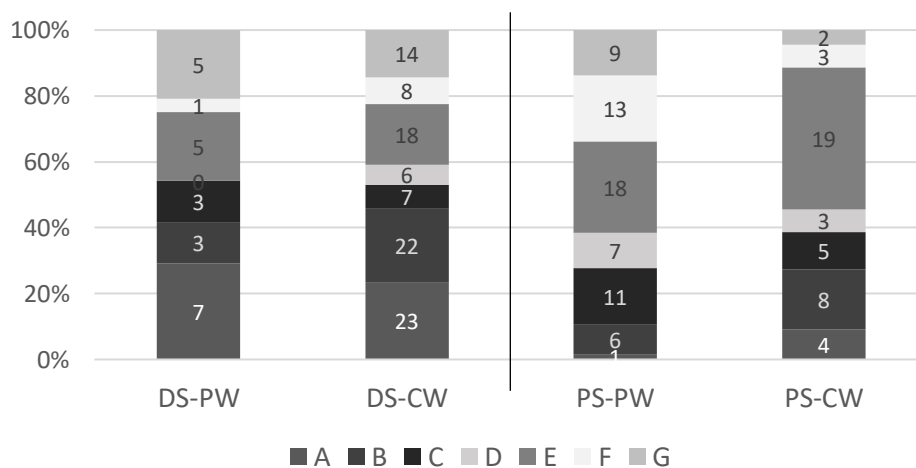


Figure 14: Distribution of activity during the dry season depending on the wet season activity. A: Digging, milling ore; B: Digging, milling and washing ore; C: Digging, milling, washing and cyanide treatment of ore; D: Washing or transport of ore; E: Cyanide treatment; F: Selling food/drinks; G: Business. Source: Survey data, 2017.

The results in the form of a table for the analysis for the metric variables can be found in the Appendix in Table 19. Three variables are significantly different between the four groups: the number of siblings, the ratio of siblings working in agriculture and the ratio of siblings working in ASGM. No significant difference between the four groups was found for the number of siblings from the same father, neither for age, age to start working on site or years of work experience in ASGM or on the site nor for the number of sites worked on.

The mean value of the respondents’ generational ratio working at the ASGM site of 40.5 % indicates the immense economic importance of ASGM in the region. The mean age of the respondents is 29.25 years, with the average person starting to work on site at the age of 22.55 years. Even though the difference between PW and CW is insignificant for the number of years work experience in their respective ASGM activity CW tend to be more experienced. But the trend goes towards a higher number of sites for the PW group, without significance. The ratio of siblings working in ASGM, as well as in agriculture is higher for the CW, than for the PW. This is true for both kind of sites DS and PS. Looking at the absolute number of siblings working in agriculture in the four analytical groups, the result is surprisingly homogenous. Figure 15 reveals that it is generally four of the siblings working in agriculture and there is no difference between the four groups nor between the type of ASGM site.

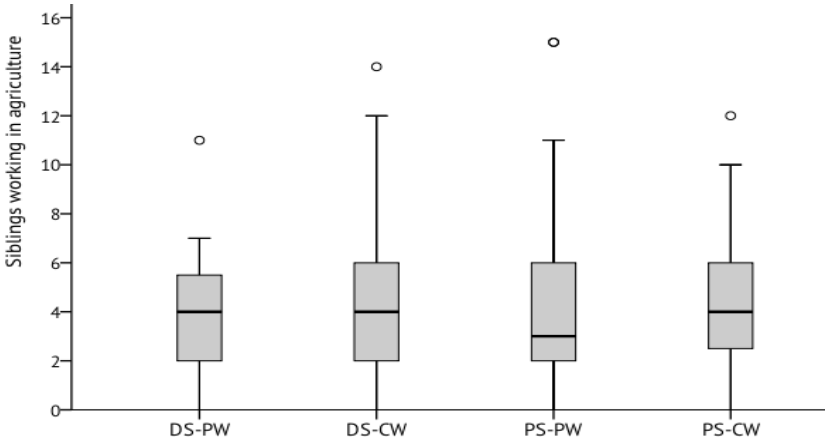


Figure 15: Number of siblings, who are working in agriculture compared for the four groups. More than 16 siblings are not displayed. Source: Survey data, 2017.

Interestingly, the number of children diverges between the four groups tested for. CW working on a DS have on average 3 children, one child more than the other three groups. It is specifically the age class 26-40 years old with an elevated number of children in this group. On the PS, the number of children are different, here it is the Permanent ASGM workers who have more children, than the Cultivating ASGM workers.

## 5.2 Discussion: Comparison along the ASGM Lifecycle Stages

In order to answer the research questions the above presented results of the statistical analysis are interpreted and discussed. The sub-chapter describes the profile of the cultivating ASGM worker (CW) at the two different types of site (DS and PS) and draws the conclusion of the differences between the Descending and the Permanent Site.

The **Cultivating ASGM worker** at the **Descending Site** (DS-CW) is characterised by the following traits: The person is married (77%) and local (86%), originating from the village next to the site. The other 14% are dominated by people from surrounding villages, very close to the Descending Site. The site does not attract migrants. Most cultivating ASGM workers, have not completed their primary school education (85%), half of those have not attended school at all, this is different for the PW on the DS. A majority (59%) has only been active in agriculture, before starting to work on the ASGM site. The ASGM work keeps him busy during the agricultural low-season, rather than replacing another activity. The cultivating worker can be found in any activity on the ASGM site, like the non-cultivating ASGM worker. The only difference is that people who wash or transport ore always cultivate. If compared to the PW co-labourer, the cultivating ASGM worker has a high ratio of siblings also working in ASGM, as well as a rather high ratio of siblings also working in agriculture, but they tend to have less siblings than their non-cultivating co-labourers. With an average of 3 children he has more children, but is not older than the non-cultivator. He has been working in ASGM on their current site, as well as in ASGM in general for many years (on average 8 years), this is longer than his non-cultivating colleague.

The **Cultivating ASGM worker** at the **Permanent Site** (PS-CW) is characterised by the following traits: The person is relatively often single (36%) compared to his non-cultivating co-labourers (29%). He is often not from the village next to the site but rather from Further, away (54%), but he is not very mobile, most likely he has been on one or maximum two sites (93%). The Permanent Site attracts many migrants. His educational level is low, but no different to the PW co-labourers. Remarkable homogenous in this group is the activity, the labourers did just before starting to work on the site. A person in this group is very likely to have worked in agriculture only (71%). Therefore, the ASGM work keeps him busy during times, when agriculture does not need labour. He is likely to work with the ore directly, in digging, washing or treating it with cyanide (89%). People who sell drinks or food or who do business do not cultivate. Further, what distinguishes the farming ASGM worker from his non-farming co-labourer is the relatively low number of children (mean 1.7 children) and siblings. The part of the siblings working in ASGM and in agriculture is high compared to his PW colleague.

Also, he tends to have started working on site earlier (mean age 21.5 years) than the non-cultivator (24.6 years).

The typology of miners for the different mine lifecycle stages by Hilson (2010) can be supported. The ‘gold-rush miner’, who is highly mobile, always at the site that is currently giving a high yield and accumulation motivated was found at the PS, but was in a minority. At the PS, most match the description of the ‘permanent miner’, working and entrepreneur on the ASGM site all year around and remaining after the gold-boom has receded. This corresponds well to what I called ‘Permanent ASGM worker’. The ‘seasonal miner’, looking for cash to supplement basic needs, who are poverty motivated and conduct mining during the season that they cannot cultivate was the kind of miner found at the DS. Equally this corresponds well with my category the ‘Cultivating ASGM worker’. Comparing the two different stages of sites, one can see that the typical Cultivating ASGM workers need to be characterised differently, but also have some traits in common. Figure 16 displays the comparison, along with the distribution of cultivators and non-cultivators at the two types of site.

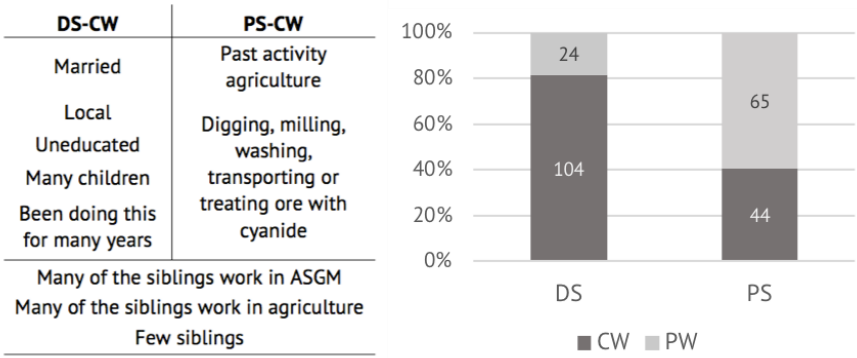


Figure 16: Comparison of DS and PS. Summary of differences and commonalities of the Cultivating ASGM worker at the two sites. Right visualization of typology distribution. Source: Survey, data 2017

One can see that at the Permanent Site the Cultivating ASGM workers are in a minority. Only those that work in the most physical demanding occupations and used to work during the wet season mainly, as they were active in agriculture before, still return home to cultivate. At the Descending Site, the Cultivating ASGM workers are in the majority. Those who are married with many children, living in the closest village, are uneducated, but have been working in ASGM for some years return to their fields, when the wet season comes. All Cultivating ASGM workers are from families with fewer children, forcing them to go home to support their parents in cultivation. Half of their siblings pursue the same activities as the surveyed individuals throughout the year.

### 5.3 Conclusion: ASGM Workers’ Labour Investment in Agriculture

The chapter answers the question: **Whom** and **what part** of the ASGM workers invest their time and work force in agriculture at a **permanent** ASGM site compared to **descending ASGM sites**? The findings to the three aspects of the questions are summarised in Table 5.

Table 5: Summary for the findings of Chapter 5.

<b>Who works in agriculture?</b>	<ul style="list-style-type: none"> <li>○ People whose last major activity before ASGM was agriculture.</li> <li>○ People who have been combing the two activities ASGM and cultivation for a while.</li> <li>○ People from families with few children.</li> <li>○ People whose siblings conduct the same activities as them.</li> </ul>
<b>What part cultivates?</b>	<ul style="list-style-type: none"> <li>○ 80% of ASGM workers at the Descending Site.</li> <li>○ 40% of ASGM workers at the Permanent Site.</li> </ul>
<b>Depending on lifecycle stage?</b>	<ul style="list-style-type: none"> <li>○ Yes, the part of Cultivating ASGM workers depends on the lifecycle stage of the ASGM.</li> <li>○ Some characteristics for the Cultivating ASGM workers varies, depending on the lifecycle stage.</li> <li>○ The familial conditions are similar for all Cultivating ASGM workers, independent of the lifecycle stage.</li> </ul>

The next chapter, Chapter 6, informs the reader about the financial investments that ASGM workers have done in the agricultural sector and for the context in other sectors. The argumentation for their decisions are presented in Chapter 7.

## 6. Capital Investment in Agriculture

The semi-structured interviews gave an insight of the various ways ASGM workers use their gain. Apart from basic resolving familial social issues and supporting the family is important for the interview partners. It follows an assessment of the remittances the ASGM workers contribute to the family compound budget, based on the survey data. The remittance income is often invested in agriculture and is therefore an approximation of the financial flow between ASGM and agriculture and certainly a good measure between ASGM and the livelihood income of a household. Only in combination with the qualitative data, where it is indicated what was realised with the cash income, a conclusion to the second sub-research question can be drawn:

**How and to what extent do ASGM workers invest their financial gain in agriculture at a permanent ASGM site compared to descending ASGM sites?**

It follows the analysis of remittances and thereafter the semi-structured interview data is presented in order to understand the various other ways to use their gain.

### 6.1 ASGM Worker's Remittance to the Familial Compound

Three out of four people working on the ASGM site support their families financially on a regular basis. Financial familial support means that they contribute to the budget of familial compound, where their parents, sometimes grand-parents and siblings with children live. The size of the family compound is highly variable. Generally, the money is given to the oldest man, who manages the family compound's needs. The grain production is traditionally under his control, but everyone labours. The women additionally look after some smaller fields, where they cultivate the most important ingredients for the sauce, such as ladyfinger and peanut. ASGM is immensely important in the region with an estimation of 40%<sup>7</sup> of the generation that is currently of the working age, earning their cash income in 'orpaillage'. Meaning that the relative number of people actually earning their income on the ASGM site is even bigger than this, as people that sell food or drinks are not included in the saying 'working in orpaillage'. The rural household's budget is therefore largely based on the ASGM income. This is why it is important to get a better understanding of the amount of remittances that the ASGM workers send their families in the region at the two lifecycle stages of ASGM mines.

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<sup>7</sup> Estimation is based on the two survey questions: How many siblings of the same father do you have? How many siblings work in 'Orpaillage'?

The group of people not supporting their family financially (n=56, 23.6%) can be described as follows: 18 of them are women. Of the 38 men not supporting their family, 25 (65.8%) are cultivating ASGM miners, 27 (71.1%) of them have never worked on another site and 13 (34.4 %) have less than a year experience of working on site. Only 7 men, not supporting their family, match the common characterization of mobile, foreign, possibly income optimising miners. During the semi-structured interviews, some have stated that they were not able to support their family, as the money was just enough to stay afloat themselves. I think that a No in the question after the support is not a free choice, but rather mirroring one's income that does not allow to send remittances to the family.

Without being able to proof the covariance of income and support to the family, I assume that the support to the family can be interpreted as proxy to understand relative income differences in the ASGM community. This claim is supported the immense and significant (Mann-Whitney U Test  $p=.000$ ,  $n=153$ ) difference of financial support the ASGM workers can make to their families depending on the stage of mine or put simply, depending on how much gold is currently extracted. At the DS ASGM workers remit on average 25'282 XOF/month (sd=19'816 XOF/month) and at the PS the amount is on average more than doubled. ASGM worker on PS remit on average 55'132 XOF/month (sd=54'395 XOF/month). There is no significant difference for the share of people supporting their family between DS (78.1 %) and PS (73.4 %). During the semi-structured interviews the ASGM workers expressed that they contribute at very diverse levels, illustrated by the three following quotes:

*"Everything I gain I share with my family. I am the only son and want to support them."*  
(ID 310, 23 ans/m, from Bane, 06.05.17, at Alga).

*"Whenever we have a financially difficult situation in the family, my oldest brother calls a reunion and we distribute the needed money equally. If one cannot pay, he will owe the money to the one that paid his share."*  
(ID323, 23yr/m, from Tikaré, 25.04.17, at Tikaré)

Therefore, the part of the income forwarded to the familial compound varies from these irregular sums that do not follow a specific rule and where the relative share remains unclear to individuals with a fixed share for example:

*"I give half of my earnings to my family."* (ID325, 20yrs/m, from Séguénéga, 03.05.17, at Zomkalga) or *"When I earn 10'000 XOF, I give 7'500 XOF to my parents and keep 2'500 XOF for my small needs."*  
(ID319, 16yrs/m, from Alga village, 09.05.17, at Alga)

The contribution is either on a regular basis, on an irregular or on demand. The means of transmission influences the regularity. Some use the mobile service Orange Money, whose use has highly increased in the region since its launch a couple of years ago. Others give the money in person,



once they gain an opportunity to travel home or they use the services of their friends, commissioning money with them on their trips home. The amount per month was estimated by discussing the sum with the interviewee and calculating an average per month. The following quote illustrates the variability and that this detailed questioning was needed to get a good estimation:

*“The amount I give to my parents varies depending on how much gold I can extract. The maximum is 25'000 XOF per month, the minimum 10'000 XOF per month.”*  
(ID304, 20 yrs/m, from Ouagadougou, 01.05.17, at Zomkalga)

Some families only demand their children for contribution in case of a specific need or social problem - following the principle of need. In some families, the brothers decide to contribute equally, in case that one of the siblings can currently not support the family, he will be in debt. They follow the principle of equity. Other families decide on a contribution by financial capacity and each gives what he can – following the principle of efficiency.

Women are generally not asked to contribute, but can, if they feel able to. Only 10 out of the 28 women surveyed, support their family financially and the amount is generally low, on average 9'813 XOF/month (sd=16'729 XOF/month). Another significant difference (Kruskal-Wallis Test, n=153, p=.000) for the amount of money can be explained by the different sites and therefore depends directly on the extractability of ore bearing rock. The site Tikaré brings most likely the lowest income with the average remittance amount of 18'328 XOF/month (sd=12'480 XOF/month). At Zomkalga and Tiba the people are able to remit more, on average 28'617 XOF/month (sd=23'463 XOF/month) and 29'192 XOF/month (sd=20'519 XOF/month).

Significant differences (Kruskal-Wallis Test p=.013, n=153) can also be found between the various groups being local or non-local and being mobile or non-mobile. It seems like the group non-local settled, having never moved site, can contribute the least to their family's budget, on average only 22'131 XOF/month (sd=17'473 XOF/month). This is the group ASGM worker in the most difficult financial situations. Much better off are the non-locals who are mobile (mean=56'429 XOF/month, sd=46'675 XOF/month). A big and significant difference (Mann-Whitney U p=.001, n=153) was observed between CW and PW. The cultivating ASGM workers contribute significantly less to the familial budget compared to the permanent ASGM workers. But this is due to the distribution of CW and PW to the DS and PS that was revealed by the more detailed analysis. Figure 17 shows that there is no difference in the median amount of monthly financial support depending on the choice of wet season activity, but the amount is much more variable for the PW, than for the CW.

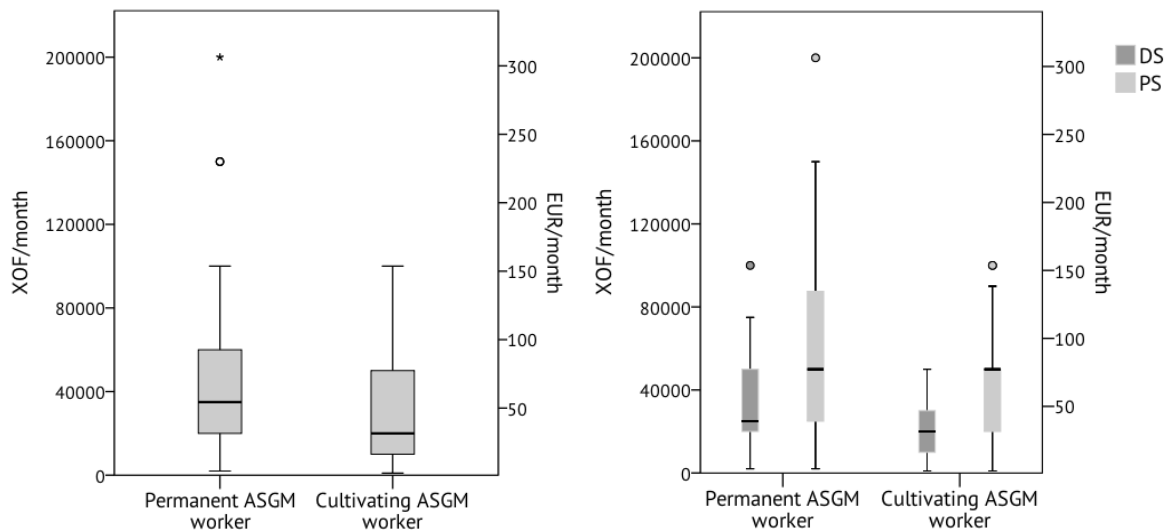


Figure 17: Differences in monthly financial support for family depending on wet season activity. The left image separates additionally depending on the mine lifecycle stage, the right does not separate for this.

No significant difference neither for the ratio of people supporting the family nor for the amount was found for the nominal factors matrimonial status, education, origin, activity during the dry season on the ASGM site and the past activity. The detailed statistical data can be found in the Appendix in Table 20. Further, no significant difference or correlation was found for the metric factors: Years working on current site or in ASGM in general and part of the siblings working in ASGM. The detailed statistical data can equally be found in the Appendix - in Table 21.

People supporting their family financially are significantly younger, than their non-supporting co-workers ( $p=.000$  mean=27.57 years,  $sd=8.85$  vs. mean=34.82 years,  $sd=11.42$ ) and have fewer children ( $p=.000$ ; mean=1.85,  $sd=2.5$  vs. mean=3.8,  $sd=3.82$ ). Further, they were significantly younger when they started to work on the ASGM site ( $p=.000$ ; mean=20.62 years,  $sd=7.57$  vs. mean=28.82 years,  $sd=11.55$ ), worked at more sites ( $p=.002$ ; mean=1.75,  $sd=1.06$  vs. mean=1.38,  $sd=0.7$ ) and are from families with more children ( $p=.007$ ; mean=7.39,  $sd=4.59$  vs. mean=5.68,  $sd=4.17$ ) than those not supporting their family. Age and with it having founded a family of their own or not influences the possibility to support the familial compound significantly. The amount of the support is positively correlated with the number of sites (Spearman-Rho=.198  $p=.014$ ) and negatively correlated with the part of siblings that work in agriculture (Spearman-Rho=-.189  $p=.019$ ). Families with little help in the field, get more financial support from their children.

The number of sites, as well as the migration behaviour seem to influence the money available to familial contribution strongly. Figure 18 shows that the most mobile group of people, those that are flexible in moving from site to site can financially contribute the most to their families' budget. Non-

locals who have never moved elsewhere contribute significantly less than the other three groups of people.

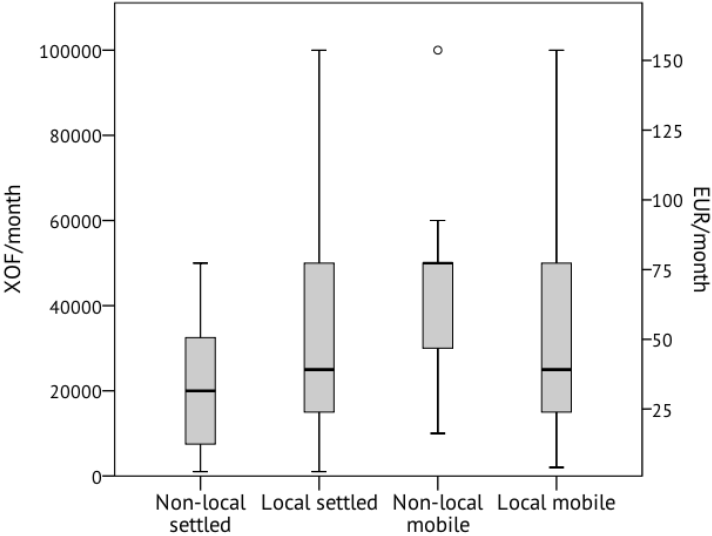


Figure 18: Monthly financial support for family and work migration Values above 100'000 XOF / month are not displayed. Source: Survey data, 2017.

Figure 19 gives more insight into the contribution to the familial budget regarding the different activities on site. Comparing the activities, A to C one remarks that the more vertically integrated the value chain the higher the contribution the individual worker can make to his familial compound. Further, activity E - the cyanide can contribute a high gain compared to the others. Remarkably low is the activity F, selling food and drinks, mostly conducted by female: The median value is 0 XOF / month for this group of people.

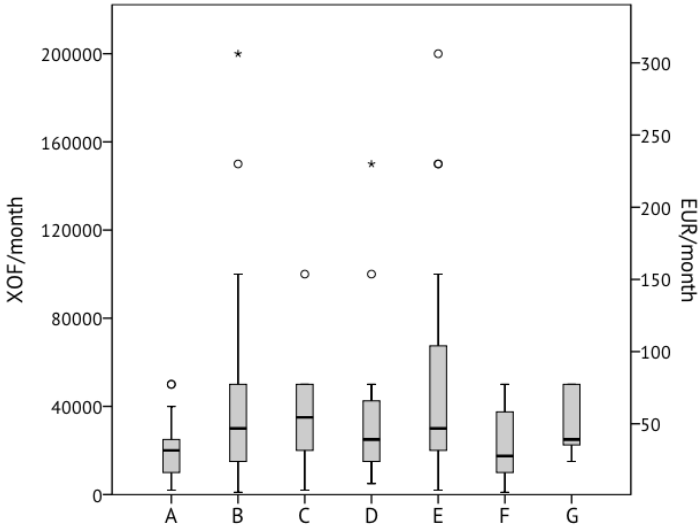


Figure 19: Boxplot of financial support towards the family of origin separated by activity on the ASGM site. A: Digging, milling ore; B: Digging, milling and washing ore; C: Digging, milling, washing and cyanide treatment of

ore; D: Washing or transport of ore; E: Cyanide treatment; F: Selling food/drinks; G: Business. Values higher than 200'000 XOF / month are not displayed. Source: Survey data, 2017.

In summary, one can state that whether an ASGM supports his family or not, is a question of gender, having founded a family, the size of the family to be supported and the flexibility to move for gain maximization. Out of those supporting the family financially, the highest values are forwarded by those men, who work on PS, work all year around in ASGM (PW) and move site regularly. Other than forwarding the money to the familial compound, the ASGM worker also invest a part of their money directly. The next sub-chapter gives more insight into the acquisition and capital investment decisions by the ASGM workers.

## 6.2 Individual or Familial Capital Investment Strategies

Some ASGM workers revealed a detailed plan, how they plan to improve their financial conditions over the course of their lifetime, using ASGM as a first income source. For example, this interviewee told me:

*“I have been working here as a gold washer for about six months after returning from my couturier apprenticeship in the Ivory Coast. With the money I earn here, I have bought a cow, soon I can buy a second one. I want to raise cattle in the future, creating a job for a young lad by taking care of them. Once I can sell my first few calves and some meat, I will buy the material for my couturier business, return to my village and start sewing.”*  
(ID 328, 23m, from Rollo, 25.04.17, Tikaré)

This was the interviewee with the clearest vision of his future. He was aware of the investment possibilities he has, even with the small amount of money he earns in ASGM. Even though his long-term goal is a non-agricultural activity, the interviewee wants to invest in agriculture, more specific in livestock herding, in order to reach his goal, but also in order to keep being active in agriculture and making use of the land. Not all the interviewees had a detailed vision of their future, nor the awareness for being able to make some active decisions for their occupational future. An old merchant, whom I interviewed at the Alga site market told me the following:

*„Some have invested well. Those can now live a good life without gold. A good investment is for example building houses and renting them out or merchandize. These people thought about tomorrow. Bad investments were done by the people that did not think ahead and had no plan. They have spent their money on food, women and to show off. Out of 10 people 4 invested well and 6 invested badly. At the moment it is the young that are not well investing. They want to get experiences and do not look ahead. This was different when we were young. We had other visions... We used to be satisfied with what we won. You planned your life with what you had. Today the young want to make as much money as possible.“*  
(ID301, 70m, from Momone, 10.05.17, Alga)

Interestingly, the old man does not mention an agricultural activity as mean to invest and earn more in the future. One could think that he, being a merchant mainly, does no longer have a strong

relationship to agriculture. This is not true, as he says that he has been cultivating every single season and personally has invested quite a bit in cultivation by renting a tractor, hiring people and buying ingredients. Further on in the interview, I asked him what he thinks people would be doing here, if there was no gold and he revealed, what he thinks the problem with agriculture is: „Without orpaillage everyone would be working in agriculture, only that this is no longer productive.“ To understand how and to what extent the ASGM workers invest their money in agriculture, one has to look at the other options for rural household’s spendings to get a sense for the overall expenditures.

Some mainly buy things for their families with the money, others use it for their own needs and plans. In cases that the interview partner revealed passing on almost his entire salary on to his parents, we talked about the familial compound’s spending. I wanted to learn about animals, materials and consumer goods that have been paid with ASGM money. These areas of investments are presented in the following Figure 20. The lower rectangle represents who spends the money and how, the higher rectangle shows what the money is invested in.

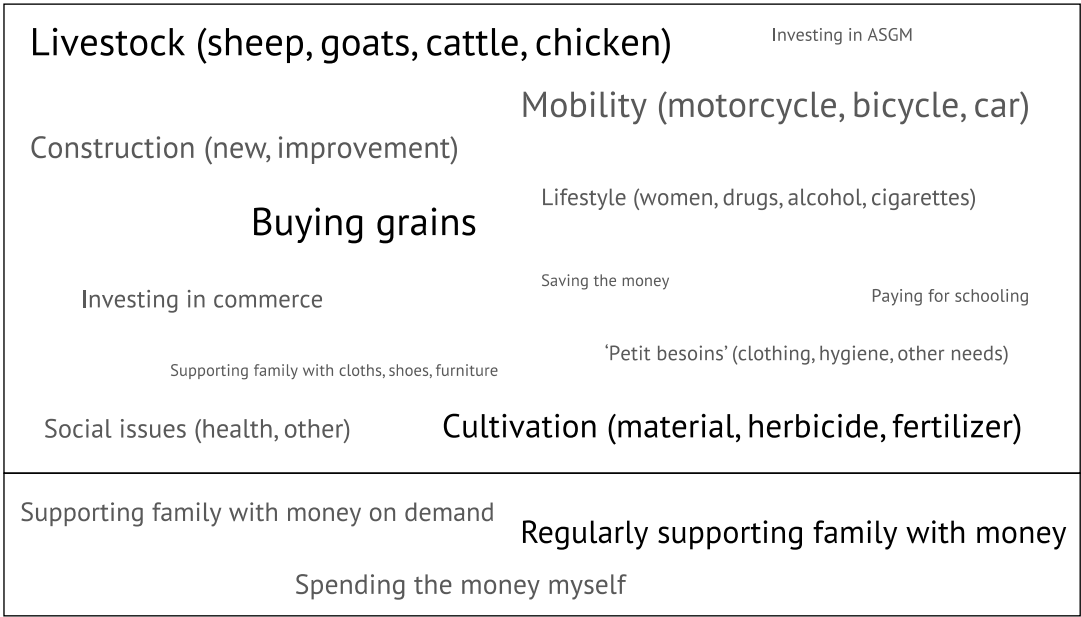


Figure 20: Word cloud for the answers to the question “What do you do with your money?”. The size represents the frequency of an answer, the bigger the more frequent. In black are all answers that are directly related to agriculture. Source: Interview data, 2017.

Figure 20 shows that investments in livestock, mobility, grains, construction and cultivation are the most mentioned expenditures. Most often the money is passed on to the family on a regular basis and the head of the family decides about the investments. Investing in ASGM as a business, paying for school, saving money without a specific purpose and giving goods to the family, like clothes, shoes and furniture were only rarely mentioned. Some spend a small part of their money themselves

and give a part of it regularly to their family. Others mainly spend the money themselves and have developed independent investment ideas and only give money to their families in case of a specific demand. A few indicated that they save the money for a later emergency.

The subject of saving money came up regularly. The interviewees revealed that they invest in livestock, when they want to save the money for later use, just like the first quote of this sub-chapter revealed. "Buying grains" was mentioned by almost every ASGM interview partner. Out of the 28 interviewed ASGM workers only 5 said that their harvest was sufficient for the year, in the past few seasons. The majority of people expressed that they had a lean season. The last months before the new harvest cannot be covered with their own grains, but they need to buy additional grains. Another subject that was frequently mentioned is cultivation. People buy tools to facilitate labour - such as a plough, they invest in artificial fertilizer, manure, other ingredients - that were mostly not further specified, in labour-intensive cultivation techniques-like demi-lune and zai for which they hire people or they rent a tractor. The following quote explains the agricultural situation well:

*„Once I have made enough money in ASGM I would like to buy animals, charretts, ingredients, manure and employ people on our farm. If we could employ people, we could intensify our production on the fields. We cannot extend our fields, because there are no free fields in my village. My family has already bought animals, a charrette and fertilizer with the ASGM money. This has improved our harvest, but we need to improve even more.“*  
(ID314, 23m, from Bourzanga, Alga, 08.05.17)

There is a lack of agricultural material inhibiting an efficient use of the land, meaning that small changes like easing work by buying a charrette and adding fertilizer can improve the harvest in some cases. Further, the quote talks indirectly about the demographic pressure that makes plots smaller and eaters more numerous, needing an intensive rather than extensive production for self-sufficiency. The motorcycle was mostly mentioned in relation to independence and lifestyle, but also in the agricultural context. It allows people to get to their fields faster and transport things easily.

Figure 21 represents future plans that came up during the interviews. It is remarkable how much emphasize was put on the activity commerce. Giving more money to the family was rarely a theme and only with young men that have not been able to contribute to their familial compound so far. A new theme was emigration. Investing in construction remained important, but people added that they will construct to rent out the house, in order to have a steady income. Investing into agriculture was a present theme, but not dominant.

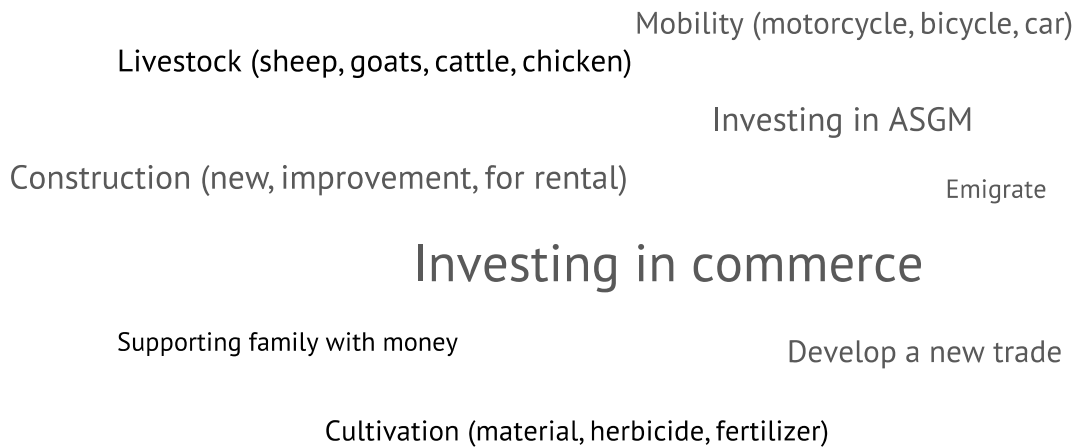


Figure 21: Word cloud for the answers to the question “What do you want to do with your money in the future?”. The size represents the frequency of an answer, the bigger the more frequent. In black are all answers that are directly related to agriculture. Source: Interview data, 2017.

### 6.3 Discussion: Comparison along the ASGM Lifecycle Stages

In order to answer the research sub-question – How and to what extent do ASGM workers invest their financial gain in agriculture at a permanent ASGM site compared to descending ASGM sites? – I have presented the findings to the first part of the question, how and to what extent the ASGM workers invest their financial means in the agricultural activity. It follows now a comparison along the ASGM lifecycle stage, with more detailed findings presentation to visualize differences, as well as an embedded first discussion of the results.

ASGM workers remit to the familial compound independent of the ASGM lifecycle stage they work on (Contingency Analysis= 1.65, n=237, p=.443). The workers contribute with a frequency of 73.1% on the PS and with a frequency of 78.1% on the DS. The independence of the lifecycle stage on the other hand is not given for the amount (Mann-Whitney U Test n=153, p=.000), the PS workers remit significantly more (mean= 55'132 XOF/ month), than the DS workers (mean=25'282 XOF/ month).

In order to understand the difference in financial investments between the two ASGM lifecycle stages, the amount of monthly familial support depending on various socio-demographic and work history variables was analysed separately for the two ASGM lifecycle stages. At the DS, none of the analysed variables produced differentiating results for the amount of support for the family<sup>8</sup>. The amount is neither explicable with socio-demographic nor work related factors, but varies according to factors that have not been examined. The analysis of the PS gave some interesting insights detailing the findings of Chapter 6.1.

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<sup>8</sup> See Annex .. for more detail.

A difference in the amount of money forwarded to the family can be discovered by looking at the type of activity. Interestingly, there is only a significant difference for the PS (Kruskal-Wallis Test, n=68, p=.009) but not for the DS (n=87, p=.927) nor for the overall data (n=151, p=.058), even though this almost reached a significant result.

Figure 22 visualises that the DS and the PS are different regarding this aspect. A similar observation can be made, when examining the migration behaviour related to work and the money forwarded to the familial compound. The fact that someone is local or not and has moved to several mines or not plays a role at the Permanent Site, not so on the DS, though.

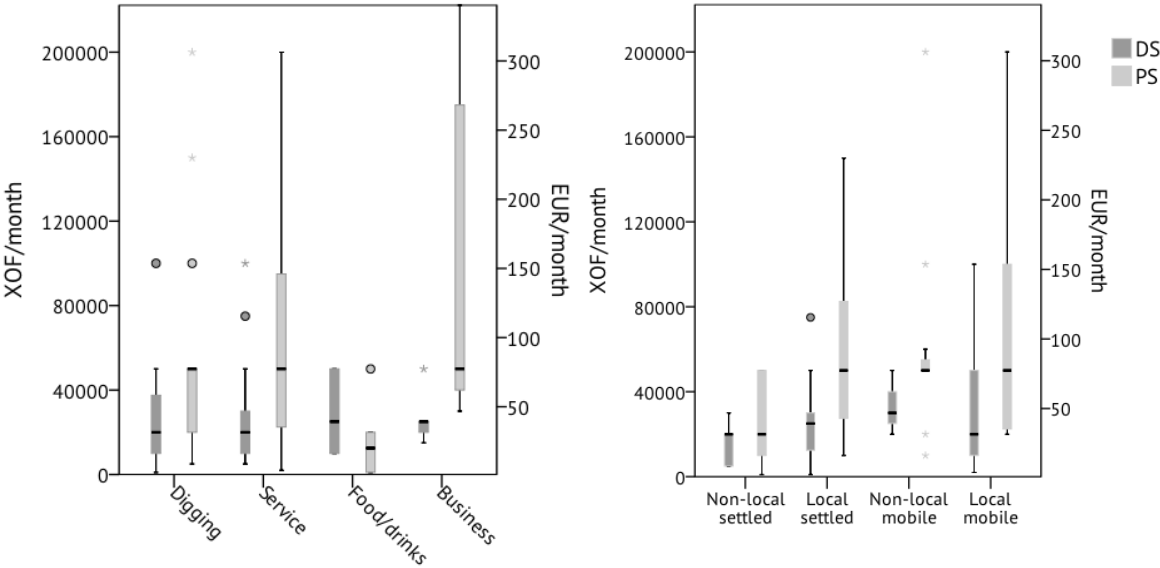


Figure 22: Differences in remittances depending on the mine lifecycle stage and the ASGM activity to the left and depending on the ASGM lifecycle stage and the migration behaviour to the right. Source: Survey data, 2017.

The Permanent Site shows very variable amounts of money forwarded to the familial compound, partly depending on the occupation and therefore highly likely depending on the individual gain, which seems to be distributed highly unequal. At the DS on the other hand, this is different. The amount is the same, independent of the occupation. There are two possible explanations for this. Firstly, on the DS, the gain is small, but more equally distributed and therefore the amount forwarded is also not so variable. Secondly, the people on the DS forward the minimum sum that is demanded by the family head, but are not able to forward more money, if they would earn more, the variance would possibly similar to the Permanent Site distribution.

Being local is a clear advantage on the PS, but not so much on the DS. The pattern is similar, the Non-local settled are the ones with the most difficulty to forward money and the other three groups are



about equally successful, but only for the PS and the total data set this difference reaches significance. Again, two explanations are likely. The DS miners all make just a very small gain and the gain is quite equally distributed. This allows them to forward a socially required minimum, but they cannot give more, as they are all close to the existential minimum.

The difference in themes that came up during the interviews for investment of gain was not very different for the Permanent Site, as compared to the Descending Sites. Only three themes can be mentioned as tending to be different. DS interviewees stressed investments into construction more than the other interviewees. Workers on the Permanent Site on the other hand, stressed that they want to use their money for their lifestyle and for the development of a commerce. All the other themes came up regularly at both types of ASGM. Therefore, also regarding agricultural themes the made investments are similar for the two ASGM lifecycle stages.

### 6.4 Conclusion: ASGM Worker’s Capital Investment in Agriculture

This chapter seeks to answer the question: **How** and **to what extent** do ASGM workers invest their financial gain in agriculture at a **permanent** ASGM site **compared to descending** ASGM sites? The findings to the three aspects of the questions are summarised in Table 6.

Table 6: Summary of the findings for chapter 6

<b>How in agriculture?</b>	<ul style="list-style-type: none"> <li>○ Buying grains for 2-8 months to complement the harvest.</li> <li>○ Buying livestock, as a mean to save money for emergencies an otherwise for herding.</li> <li>○ Investing in cultivation material and non-familial labour force.</li> <li>○ Bought individually by ASGM worker or bought with the familial compound's budget to which they contribute on a regular basis.</li> </ul>
<b>How much?</b>	<ul style="list-style-type: none"> <li>○ Half of the quotes about financial investments were directly related to agriculture.</li> <li>○ Mean contribution by ASGM worker to familial compound 38'549 XOF / month.</li> <li>○ 76 % of ASGM workers contribute to the familial compound's budget.</li> </ul>
<b>Depending on lifecycle stage?</b>	<ul style="list-style-type: none"> <li>○ Part of ASGM worker who contribute to familial budget is not dependent on lifecycle stage.</li> <li>○ Amount of money remitted at the PS is more than the doubled amount of the DS. (Mean = 55'132 vs. 25'282 XOF / month)</li> <li>○ Areas of investment do not differ regarding agriculture in qualitative analysis.</li> </ul>

The realisation the ASGM workers make with the money from gold is in both lifecycle stages very similar. How they rationalise and explain their decisions will be discussed in the next chapter, where the reader can see whether I have found a context-specific difference in the interviewees’ argumentation.

## 7. Explanation of Investment Decision

This chapter gives answers to the second of the three research questions:

**How do ASGM workers reason their investment decision at a permanent ASGM site compared to descending ASGM sites?**

### 7.1 Reasoning for Labour Investment in Agriculture

The semi-structured interview helped me to understand that cultivating does not mean cultivating the entire season for many men. Talking to the village women revealed that the husbands quite often state that they are working in the fields even though, their main activity remains the ASGM work during the wet period. Some women complained that their husbands spend their days looking for gold instead of contributing their force in the sorghum, millet or corn fields. At the same time though, the complaining women stated that their economic situation has improved and they accept the changes in the agricultural activity. I started to ask for details, when and how long they work in the fields and whether they support their wife during the harvest or not, as well as asking for the reasons behind their decisions. It seemed to be difficult for the interviewees in the interview situation to state that they no longer work in cultivation. This was less of an issue in the survey data collection. As this data was collected together with health data, people were careful to state all their activities during the wet, as well as the dry season. Further, they were asked for each activity separately, with multiple answers possible rather than having to come up with an answer themselves, as in the semi-structured interview.

There is a significant difference in the share of cultivating ASGM workers between the two data sets. This might be due to the small number of people semi-structurally interviewed and therefore not be representative. I interpret it differently though, I think that the difference represents a social taboo in a society where spending the rainy season in cultivation is the norm. Figure 23 visualises the difference between the data sets but must be interpreted with care, due to the low number semi-structured interviews. Not all of the semi-structured interviews with ASGM workers were assignable to the three categories.

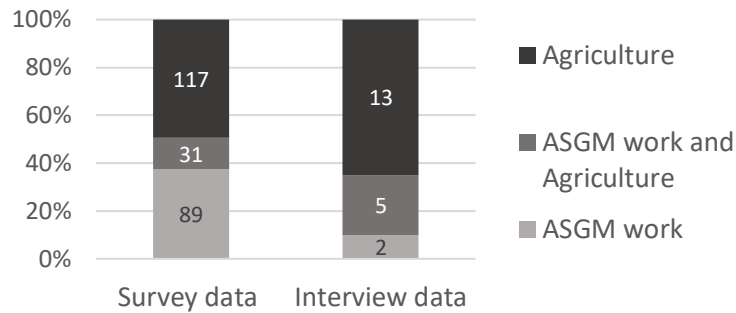


Figure 23: Difference of indicated wet season activity between the survey data and the semi-structured interview data. Source: Field work, 2017.

As expected, explanations as to why people get involved in agriculture or not were diverse. Some interviewees struggled to explain why they were cultivating, expressing that it was somehow normal to them, what they have always done and know. The group of people that cultivate the entire season usually expressed their strong emotional connection to agriculture. On the other hand, those that cultivate a part of the season see cultivation as something they still do, but it is not their priority. When earning opportunities are there they will take them on risking to neglect their cultivation duties. The group of PW stress that the reason for their choice is the higher profit possibilities in ASGM, as compared to any other occupation open to them. It was the higher profit in ASGM that authorities also see as the reason why people get involved in ASGM and cultivate less:

*„It is especially the young adults that are attracted to work there. Each year the harvest may vary and earnings from agriculture are ten times as small as those from orpillage [...] The young people do not think agriculture is important. In this region agriculture is only practiced as sustenance farming. This cannot feed everyone. It discourages the young. They also have other needs that need at least a bit of money.“*  
 “ (28.04.17, Kongoussi)

The ASGM workers themselves gave me a number of reasons why they keep cultivating all the same but it is not priority or why they chose for themselves to stop cultivating during the wet season. A part of the interviewees explained their decision in the same way as the authority but this explanation is only one of many, as one can see in Table 7.

Table 7: Citations of explanations for the wet season activity. The diversity of explanations is presented for each activity. Interview statements made at the Permanent Site are shaded in grey.

Cultivating ASGM worker		Permanent ASGM worker
Entire season	Part of the season	
I <b>support my family</b> , during the wet season. I stay at home until we bring the last grain in.	The <b>men</b> sometimes support the women only over lunch for a <b>couple of hours per day</b> and go then back to their orpaillage activity.	Some <b>patrons say you have to stay</b> on site all year. If a production has not been productive they ask you to stay longer before you can go home after the set.
The other brothers have left already to do the zai. Once they seed, I will join them until harvest. During the wet season, I <b>will always keep cultivating</b> .	One <b>stays here with our material</b> , the <b>others go home to help</b> with cultivation and then we swop. All of us do max 2-3 months in cultivation.	
I help my brother in agriculture, during the wet season. My brother looks after the farm all year around and I <b>contribute cash to buy what we cannot produce</b> .	My activities are chef du trou, commerce and agriculture during the wet period. If you <b>stop cultivating</b> , it is nearly <b>impossible to restart</b> .	Whenever the family can <b>make enough money in orpaillage</b> , we <b>rent out our fields</b> for the season and do not cultivate
During 4 months of the year I cultivate. I <b>prefer the wet season</b> , it is <b>not as strenuous</b> as orpaillage. But orpaillage is financially much more attractive.	I cultivate, during the wet season. I prefer supporting them the entire season, but if there is a <b>chance of earning some money</b> , I would possibly take it on.	I can make <b>more profit here than in agriculture</b> , gardening or the selling of seedlings. My family do subsistence agriculture. I work here to send money home.
I prefer cultivation to orpaillage, because it is cultivation that <b>nurtures us</b> .	I stay <b>three months</b> in cultivation then I leave, even if the harvest is not all in.	I <b>do not like cultivation</b> , because I just love orpaillage. You constantly need to have hope, I like this.

## 7.2 Reasoning for Capital Investment in Agriculture and other Sectors

The ASGM workers use their financial gain in various ways, as we have seen in Chapter 6.2. This sub-chapter gives the reader an overview of how people explain their financial investments. Local civilians not involved in ASGM like the police, gendarmes, teachers expressed their view on how the people spend their ASGM gain in the following ways:

*„It is the beautiful life they start enjoying at first. They buy themselves a good motorcycle and spend their time in maquis. At this point they invest in their houses and in women...when all theses needs have been satisfied they possibly invest in other things.“*  
(04.05.17, Séguénéga)

*„They mainly use the money for festivities like wedding, burial and baptism and the consumption of dolo [the local beer]. For this one needs cash. The families get often rich through orpaillage.“*  
(26.04.17, Tikaré)

*„Many women could buy themselves bicycles, plates and cloths. Many men invested in a motorcycle, in a house or in a first or second woman.“*

All locals, who are not involved in ASGM focused on the lifestyle investment and the motorcycle, when asked what the ASGM workers use their gain for. Talking to the ASGM workers, showed a bigger diversity of investments and broad explanations to invest or not to invest in a specific sector. For the lifestyle investments, it was difficult to get testimonies from the ASGM workers themselves, as this is something that most Burkinabe would not openly admit and talk about. Table 8 shows explanation patterns for the six most mentioned investment choices. Horizontally the citations have been ordered depending on the overall estimation of the persons orientation, whether the interview partner was talking mainly about his ASGM activity or rather about the agricultural activity. For each theme, the diversity of explanations is presented. It is apparent that explanations oriented towards ASGM were mostly expressed at the permanent ASGM site, shaded in grey. Explanations by people oriented towards the agricultural activity were more often expressed by ASGM workers on the Descending Sites.

Table 8: Explanations for the financial investment choices. Selected interview citations are categorised depending on the investment choice and ordered from left to right from a rather agriculture oriented interview partner, to an ASGM oriented interview partner. Interview statements from the permanent ASGM site are shaded in grey. Permanent ASGM worker's statement are cursive.

	Agriculture oriented		ASGM oriented	
Buying grains	The harvest gets worse due to <b>lack of rain</b> in the past years.	We harvest much less, but we can <b>buy what is missing and even more</b> . Our meals are more varied now.	The people <b>do not want to cultivate</b> any more [...] there are much less working hands then there used to be 10 years ago.	<i>If you are successful in orpaillage you can buy grains. If you only do agriculture you cannot be <b>certain</b> whether you can <b>feed your family well</b>.</i>
Livestock	Keeping livestock is <b>profitable</b> .	The people here can buy <b>bigger animals</b> now and the number of animals rose in the village.	I can eat <b>meat</b> every now and then or I can <b>solve a problem</b> at home by selling or butchering an animal.	I cannot invest in livestock, because I do <b>not have enough to feed</b> them.
Mobility	We were able to buy bicycles, now we can <b>get water much more easily</b> .	Many orpailleurs say because they took the risk, all the money should be for themselves. They <b>always buy a motorcycle first</b> .	I can <b>easily get somewhere</b> with the motorcycle, e.g. if someone is ill. At the moment I am <b>borrowing</b> , this <b>makes me dependent</b> .	<i>I bought a motorcycle first, in order to <b>reach new sites quicker</b>.</i>

<b>Cultivation</b>	We add <b>fertilizers</b> and have been able to rent a <b>plough and an ox</b> . Our <b>harvest has doubled</b> .	We bought a little wagon and <b>wheelbarrow to transport the compost</b> .	I <b>employ people</b> to dig zai for me, <b>buy ingredients</b> and manure with the ASGM money.	I <b>rent a tractor</b> and buy fertilizer with the ASGM money. With good rain, I <b>did not have to buy any grains anymore</b> .	<i>I send them fertilizer.</i>
<b>Construction</b>	Everyone who has a bad house nowadays has not been <b>lucky</b> enough as an orpailleur.	Young men have built many houses. The <b>quality has improved</b> . They are more stable and many have a tin roof.	I have built a house here on site, where I would like to <b>open a little shop</b> .		
<b>Lifestyle</b>	<b>What I do not use</b> to solve social problems and a motorcycle I will use for a good life e.g. my wedding.	They <b>blow the money with women</b> . Especially the young spend their money quickly.	They spend money <b>unnecessarily with cigarettes, alcohol</b> , while they do not even have the money to wash themselves.		

### 7.3 Discussion: Comparison along the ASGM Lifecycle Stages

The rationality for cultivating or not during the wet season differs between a Permanent Site and a Descending Site. At the DS, the explanations were superficial and people struggled to give arguments for their decision. This was very different at the PS, where the argumentations were detailed and considered well. It seems like, the “normal thing to do” - cultivation at the DS and ASGM at the PS does not need to be defended and explained. If one does another activity than the majority of his co-labourers during the wet season, arguments are constructed and easily expressed.

Table 9: Paraphrased explanations of time and force investment during the wet season. Comparison of the Descending Site with the Permanent Site situation.

	Cultivating ASGM worker		Permanent ASGM worker
	Entire season	Part of the season	
Descending Site	Preferring cultivation to ASGM Food security, it nurtures us No work on the cyanide site	Can combine it each day	I do not like cultivating.  The fields are rented out
Permanent Site	Supporting the family, taking on responsibility  It is our tradition, we have always cultivated.	Staying to guard infrastructure in turns, wanting to cultivate Combining to keep agriculture going on a low level, because it is impossible to restart  Cultivating but leaving, if there is a chance for cash Cultivating when site is officially closed	Patron makes me stay  More profit here, want to send money home

By carefully reading the explanation of investment choices, one can see that the general categories are the same at the two sites, but the standard of living seems to be remarkably higher at the PS compared to the DS. Explanations are diverse and more or less detailed and comprehensible, but this is not dependent on the type of site, as Table 10 shows.

Table 10: Paraphrased explanations of the six most mentioned investments of ASGM gains: Comparison of the DS with the PS situation. Citations from PW are written cursively, in grey was expressed on a DS.

	Descending Site		Permanent Site		
<b>Buying grains</b>	Bad pluviometry	Can buy now	Not liking cultivation	<i>Same work time smaller risk for food security</i>	
<b>Livestock</b>	Profit	More animals	For meat and emergency	Not enough to feed animals	
<b>Mobility</b>	Ease everyday life	Trend	Being independent <i>Optimise ASGM gain</i>		
<b>Cultivation</b>	Fertilizer, rent plough/ox, more yield	Wheelbarrow for compost	Employ people, improve yield with ingredients	Improve yield with hired workers and tractor	<i>To send fertilizer home</i>
<b>Construction</b>	Show luck	Improve quality	For another business		
<b>Lifestyle</b>	What is leftover		Blowing money	Choices not clever	

## 7.4 Conclusion: Explanation of Investment Decision

This chapter seeks to answer the question: **How** do ASGM workers **reason their investment decisions** at a **permanent** ASGM site **compared to descending** ASGM sites? The findings to the three aspects of the questions are summarised in Table 11.

Table 11: Summary of the findings of chapter 7.

Explanation time investment?	<ul style="list-style-type: none"> <li>○ Spending the wet season in cultivation is the traditional way, needing no rational explanation, where the majority of people does so (CW). It is explained in more details, where the minority of people does so (PS).</li> <li>○ Spending the wet season at the site needs rational justification at both type of sites. It is explained by referring to the higher profit, they can make on site even during the wet season.</li> </ul>
Explanation finance investment?	<ul style="list-style-type: none"> <li>○ Investing in cultivation can increase the yield.</li> <li>○ Investing in livestock can serve as a mean to save the money for later profit.</li> </ul>
Depending on lifecycle stage?	<ul style="list-style-type: none"> <li>○ Explaining why one spends the wet season cultivating is told differently at the two sites, see above.</li> <li>○ Explaining why one invests financially in agriculture does not depend on the ASGM lifecycle stage.</li> </ul>

The explanation of their decision regarding labour investment differs at the two types of mines. Not so does the explanation for the financial investment differ. How the interviewees estimate the effect of their decision on their agriculture is explain next chapter, where the reader can see whether I have found a context-specific difference in the interviewees' agricultural production.



## 8. Perception of Effects on Agriculture

This chapter takes a leap to a more abstract level of understanding one's environment. It asks:

**How do ASGM workers understand and judge the effects of their investment decision on their familial agriculture at a permanent ASGM site compared to descending ASGM sites?**

The answer to this question gives more insight on the local perception of the development in their region. Rather than a descriptive kind of answer the interview partner were asked to analyse what is happening in their familial agriculture and in their surroundings. The answers give insight to the local discourse of cause and effect for change. This part of the study is based on the semi-structured interviews with the ASGM workers, as well as on complementing interviews with the local authorities.

### 8.1 Quantity and Quality Effects on Harvest

The effects on the quality and especially on the quantity of harvest were described either solely positively or negatively. None of the ASGM interviewees mentioned both positive and negative effects, before concluding. The number of people who estimated that their harvest has decreased was nearly the same number of people as the number of people that estimated that the harvest had increased. The main reason given for an augmented amount of grains was that the money from ASGM allowed to invest in improved agricultural material and new techniques. The reasons for a decreased harvest were manifold and only rarely linked to ASGM, but covering worsening environmental conditions and demographic effects. An interviewee, member of the municipal office in Séguénéga compared the negative with the positive effects and came to the following conclusion:

*"I think that orpaillage leads to a decreased production, because the surface that is being cultivated is reduced. I believe that the investments in agriculture cannot keep up with the loss of surface cultivated."*  
(04.05.17, Séguénéga)

His argument for the estimated negative effect was repeated by two interviewees, whose land was affected. They felt that the loss of land was bearable, as long as a part of the family profited as well and if they are being compensated with some ore for their loss. The ASGM worker's opinions on the matter are summarised in Table 12.

Table 12: The effects of ASGM on the quality and especially on the quantity of the harvest in the area. The diversity of argumentation and reasons are displayed. Citations made at the Permanent Site are shaded in grey. There are no citations from Permanent ASGM workers.

Decreased (n=8)	Increased (n=11)
There are <b>too many children</b> now. The <b>plots have become smaller</b> and they keep getting smaller. This is then the reason why people leave.	My parents' harvest was just for them and not even sufficient. With the <b>new techniques</b> , we can also <b>cultivate bad fields</b> and can sell a part of the harvest.
It is a very <b>tiring</b> task and we are <b>lacking the force</b> to cultivate every square meter we could cultivate. During the harvest season can we hardly harvest everything because we lack the work force, but all our children are helping.	We used to cultivate without <b>compost</b> , but now with compost we produce the same amount on a smaller area. The compost allows us to produce the <b>same amount but with less work</b> .
Some <b>fields are degraded</b> . We decided to let them go wild. They are not even good enough to keep the animals on it.	We succeed in cultivating all our fields. We add <b>fertilizers</b> and for a few years we have been able to rent a <b>plough and an ox</b> since then our harvest has doubled.
A third of my fields is <b>occupied by orpillage</b> . It is bearable because my family is also involved. It is painful, but as soon as they have found some gold, it is ok for me.	
Some digging <b>husbands only</b> support their families a <b>couple of days</b> . This diminishes the harvest	Ever since we have been able to <b>invest</b> in our farming, we <b>produce more and of better quality</b> .
We used to be able to fill 5 granaries. Now the <b>rain is not good</b> anymore we only fill 2-3 granaries.	

The narrative for a decreased harvest is on one hand linked to factors that are not under the interviewees control, such as *“it is the lack of rain”*, *“the plots are too small”*, *“the fields are degraded”*, *“we are not enough people”* and on the other hand to ASGM *“fields are occupied by orpillage”* and *“the men are not helping enough”*. Overall the reasons for a decrease are externalized. The reasons for the success on the other hand, is seen to be closely linked with their success in ASGM and the success is claimed for themselves. It becomes also clear that not everyone who can increase the harvest with new technique aims to do so to produce for the market. Rather, it is to increase the meals per day or to minimize the needed work hours, while being subsistent. The interviewees not only mentioned the effects on the quantity of harvest, but talked about other factors that have changed in their agricultural activity.

## 8.2 Other Effects on Agriculture

The change caused by ASGM has not only influenced the quality and quantity of harvest but has caused changes in work distribution, in market opportunities, cultivation techniques as well as livestock keeping. The information the ASGM workers gave me about the developments were very diverse and again, rather than taking the information as the truth about the local conditions, I interpret them in order to understand how the change is perceived locally. The question after who cultivates gave an interesting insight in a conflict between the younger and the older generation, illustrated here with the saying of a policeman and an extract of an interview with two elderly men and their sons and I asked who was cultivating the fields.

*“The orpailleurs bought their parents improved material for their agricultural activity [...] But the young people themselves stay on site during the wet season. They leave the women and elderly behind for cultivation. They will never go back to cultivation.”*  
(15.05.17, Bourzanga)

*„The orpailleurs are cultivating“ [says one of the sons]. „The orpailleurs are no longer cultivating, they just stay on their gold site all year around“ [old man]. [Son says] „The agriculture does not feed the people as well as orpillage does. If you are successful in orpillage you can buy grains. If you only do agriculture you cannot be certain whether you can feed your family well. At a certain point you have to leave the family and look for more.“*  
(12.05.17, Alga)

The opportunity to earn money in ASGM, led some families to focus on this and rely on the market for their grains. This, as well as the rising number of inhabitants attracted to ASGM has increased the demand and therefore prices. While some profit from this situation selling a part of their harvest, others keep cultivating, but need to add up aliments for six months or more. The price of beans is most strongly influenced by ASGM:

*„The price of beans has varied very much lately. 2015 the price used to be at 400-500 XOF. In 2016 the price rose to 600-700 XOF. The production was bad, this is one reason, but the price also rises wherever orpillage is going well.“*  
(04.05.17, Séguénéga).

Other prices fluctuate as well. Interviewees mentioned that the prices for sorghum has risen up to 180 % of the former price. This is a big expenditure, especially during periods where the mobile ASGM workers are in the area, because gold is extracted in high amounts. Table 13 summarises some of the effects of ASGM on agriculture.

Table 13: The effects of ASGM on other factors influencing agriculture. The citations are ordered horizontally along the continuum of being more agriculture or more ASGM oriented. This was judged by looking at the entire interview. Citations made at the Permanent Site are shaded in grey. Citations from Permanent ASGM workers are cursive.

	Agriculture oriented			ASGM oriented	
<b>Who cultivates</b>	The <b>whole family</b> supports the parents in field work, everyone works in the fields during the wet season.	It is the <b>men</b> that are cultivating more than the women. There has not been a change.	Those with money <b>hire young men</b> . It is important that the people here keep cultivating. One cannot count on gold to pay for food.	<b>Women and children</b> work more in the fields than men. The men are responsible for the grains. Therefore, they have to work in orpaillage, in order to be able to buy the grains for the family.	<i>Whenever my family can make enough money in orpaillage <b>we rent out our fields</b> for the season and do not cultivate. This was possible for the last three years.</i>
<b>Product sale</b>	Nowadays <b>we can even buy a bicycle, moto with the sale</b> of the products.	With the gold, the commerce flourished and <b>prices were high</b> . Especially <b>beans</b> were a good business.	If a family focuses too much on orpaillage they have <b>not enough to eat</b> the year after. <b>Another family can sell their harvest</b> to them in order to make money.	Normally we do not sell any harvest, <b>but if we have an emergency</b> we do.	My cultivation <b>does not suffice</b> to sell agricultural products.
<b>Cultivation technique</b>	<b>Newer technologies</b> like plough and ox <b>need money</b> . We do not have this money and therefore keep cultivating with the hoe.	We cultivate with <b>zai and with plough and ox</b> .	In my village, everyone uses the <b>tractor</b> , but not in other villages. We can rent the tractor from a person that made a fortune in orpaillage. This was a good investment.	We have <b>hired people</b> , used a <b>tractor</b> twice in the past. But I <b>cannot replace my orpailleur children totally</b> , too expensive. I use plough/ox this is cheaper. We do zai, compost and add fertilizer to maximise the harvest. Earlier I did everything by hand.	
<b>Livestock</b>	Thanks to the orpaillage activity some families could buy <b>small ruminants</b> and <b>before</b> they had <b>only some chickens</b> or no animals at all.	We <b>invested our gain</b> mainly in livestock, <b>goats and sheep</b> . We prefer the small ruminants, they are sedentary.	There are many <b>more animals of all kind in my village</b> now. My family has doubled the number of cattle.	<b>We sold many animals</b> . There were difficult situations and we needed the money.	Now the children do orpaillage. We have <b>no one who can look after the animals</b> . Also, there are <b>not enough areas</b> for the animals, because there is no forest left.

Some ASGM workers have used their gain to invest in their familial agriculture and have changed their cultivation techniques, intensifying and seldom extensifying their production to varying degrees mostly capital led. Some hire labour, but all state that they could not replace the children that do not work in the fields entirely. Therefore, there is no labour led intensification. The agricultural activity is

also diversified, as the many statement about livestock herding and the observation of a policeman in Bourzanga explains:

*“I observed that more people are doing vegetable gardening. There are even orpailleurs that actively invest in this by buying fertilizer, ingredients and land close to the water in order to get people to cultivate it for them during the dry season.”*  
(15.05.17, Bourzanga)

The change in livestock is mostly explained with regard to risk. Having animals to sell in a case of an emergency or investing in animals before making another bigger investment is explained similar to the functioning of a bank account with interest. It allows to keep the value or even improve slightly by selling offspring. Wanting to develop a big livestock activity is denied. They explain that meadowlands are restricted in the area and investments to develop livestock herding on a big scale are too big. Further, livestock herding is traditionally the Peule’s activity, an ethnos who move with their animals through the Sahel region. The Peule people are only rarely involved in the ASGM activity.

### 8.3 Discussion: Comparison along the ASGM Lifecycle Stages

The perception of how the quantity of harvest has changed does not differ between the two different stages of a mine site. At both type of sites, there were people arguing that their harvest has increased with the help of ASGM or decreased during the years of activity in ASGM. What was differing though, was the explanations of the perceived development. This is summarised in Table 14. At the Descending Site, it was more stressed that it was the lacking work force of men in agriculture that led to a decreasing harvest. At the Permanent Site on the other hand, it was argued that it is changing environmental conditions that are causing a smaller harvest. This forces the ASGM workers to look for alternatives. Those that used to cultivate on the ASGM site, also mentioned the lost fields, as a factor for their harvest getting smaller and smaller. There was no difference in the reasons presented for an increasing harvest.

Table 14: The perceived change of harvest quantity through the impact of ASGM and other recent developments at PS and DS. Citations were paraphrased. Differences are shaded in grey.

	Decreased	Increased
<b>Descending Site</b>	Lacking the workforce, too tired, not enough children	Compost gives higher yields, we cultivate a smaller area with less hands
	Demographic pressure diminues plot size	Investments allowed to improve quality and quantity
	Men doing ASGM instead of cultivation	
<b>Permanent Site</b>	Demographic pressure diminues plot size	New techniques allow to cultivate bad fields
	Fields are degraded	Fertilizer and plough/ox increases yield, cultivating the same surface
	Fields occupied by orpailleurs	
	Lacking the workforce, too tired	
	Bad pluviometry	

There is a difference for other factors perceived to have changed in agriculture between DS and PS. The summary can be found in Table 15. People working on the PS stated that it was mostly women, elderly and children or hired workers that do the bulk of cultivation work, this was not stressed in the same way for the DS. Another clear difference is apparent in the cultivation technique. While those working on the PS can invest capital led mainly, those on the DS have invested in material improvements that still demand a high labour input. This difference is not clear cut, but tendencies are represented here. The changes in livestock is not clearly dependent on the stage of the site, but rather due to the individual orientation.

Table 15: The perceived changes in agriculture due to ASGM displayed along the continuum of being agriculture or ASGM oriented. The citations were paraphrased. Statements at the PS are shaded in grey.

	Agriculture oriented		ASGM oriented		
<b>Who cultivates</b>	Everybody cultivates		Hired people	Women, elderly and children	<i>Other families</i>
<b>Product sale</b>	We can sell products now	The prices are high	Some families need to buy food from other families.	Selling in case of emergency	Not enough to sell
<b>Cultivation technique</b>	New techniques: zai, compost, plough/ox		Renting tractor	Hiring people, new techniques, still lacking workforce	
<b>Livestock</b>	Bought many small ruminants		More animals of all kind	Sold animals and did not invest in livestock	No one for animals, forest

### 8.4 Conclusion: Perception of Effects on Agriculture

This chapter seeks to answer the question: **How** do ASGM workers understand and **judge the effects** of their investment **decisions** at a **permanent** ASGM site **compared to descending** ASGM sites? The findings to the three aspects of the questions are summarised in Table 16.

Table 16: Summary of chapter 8.

Quantity effects?	<ul style="list-style-type: none"> <li>○ The harvest has increased, thanks to the new technologies that we financed through ASGM.</li> <li>○ The harvest has decreased, because there are not enough working hands, the plots have become too small and the environmental conditions have worsened.</li> </ul>
Other effects?	<ul style="list-style-type: none"> <li>○ Who cultivates depends on the individual orientation versus ASGM (hired people, women, children, elderly or agriculture (everyone). The cultivation techniques have become more work efficient and intensive.</li> <li>○ Generally, the changes were capital led, some also labour led, when labour can be hired.</li> </ul>
Depending on lifecycle stage?	<ul style="list-style-type: none"> <li>○ At both lifecycle stages, there were people who argued that their harvest has increased and others that stated it had decreased.</li> <li>○ The reasoning for a decreased harvest differed. At the DS people argued that it was the lack of workforce. At the PS people argued it was due to external reasons like the bad pluviometry.</li> <li>○ Who cultivates differs between DS (everyone) to PS (hired people, women, children, elderly). The cultivation technical changes were more expensive for PS than DS. The livestock changes do not depend on the lifecycle stage.</li> </ul>

The harvest has partially increased and decreased near both kind of mines. It is likely that this difference in harvest development is due to different livelihood strategies. The next chapter goes back to the overall research question and discusses it with the help of the findings in the four empirical chapters.

## 9. Mining and Farming over the Lifecycle of an ASGM

This chapter discusses the overall research question: **How is farming and mining combined by ASGM-workers at a permanent ASGM site compared to descending ASGM sites** in Centre-North/North of Burkina Faso? Further, it discusses the methodological approach as well as implications to further research.

The overall research question has two components: First, how the activities mining and farming are combined and second, how this differs between two lifecycle stages of an ASGM. The livelihood strategy concept and related writings that were referred to in chapter 2.1 supports the understanding of the empirical findings. The first component of the question will be treated on multiple analytical scales, each in a separate chapter. The chapter refer back to the lifecycle stages, but do not focus on them. The micro-level looks at the motivation to combine the two activities at the household level, the meso-level looks at combination strategies in four categories and the macro-level discusses the combination of ASGM and agriculture at the macro level.

The chapter starts with the second component of the question. Rather than discussing the listed differences and similarities, as I have done in the empirical chapters, the discussion here will describe the relationship of farming and mining chronologically along the lifecycle of an ASGM. In this way, the answers to the sub-questions that served to get a grasp on the topic, will complement each other to get an overall impression on what goes on in the different zones. The discussion starts, after the rush for gold has levelled off and the professional and very mobile miners have moved on. It is unclear how the mine will develop, either it turns into a Descending Site and the ASGM sector continuously loses importance or the gold remains abundant at a site, every now and then, small veins are stroke by the diggers. Veins that are rewarding, but do not attract another major in-migration. This kind of site is called Permanent Site (PS) in this study.

### 9.1 Differences between a Permanent and a Descending Site

How do people near a Permanent Site make their living? As stated in chapter 2.1. this is the basic question behind a livelihood analysis. It is certain that the livelihood portfolio of a rural household near a PS nearly always includes ASGM related work.<sup>9</sup> Out of ten siblings of the same generation roughly four will work in ASGM. Some watch the animals or support household work. Other occupations are primarily commerce, construction and artisanal work such as metal work, tailoring,

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<sup>9</sup> In the interviews I asked them if they knew a family nearby where nobody works in ASGM. The answer was without exception: No.



pottery or wood work. An occupation that hopefully improves the family's livelihood in the future is attending school, roughly four out of ten siblings in a generation are in school (Asmado, 2013). All the activities in the secondary and third economic sector are highly dependent on the success of the ASGM sector. It is the gold price, along with the extraction rate of gold that influence the microeconomic climate.

At a PS, the market can be described as mostly dynamic, as compared to nearby towns and villages. More than half of the ASGM workers (60%) choose to remain working in ASGM during the wet season. Those, who return to work on their fields are from families with fewer children, had no other major activity apart from agriculture before joining ASGM and have been doing this combination of ASGM work and agriculture for a while, as have their siblings. Three out four ASGM workers make remittances of on average 55'000 XOF per month to the familial compound, but the amount varies largely. The money given as remittances and personal money are mainly spent on grains, livestock, motorcycles, cultivation techniques and on familial needs. Spending the wet season in ASGM is actively chosen over agriculture at PS. Hired people, women, elderly and children farm the land, leading to diminished harvests for some as the most efficient workers are not supporting the farm work. The diminished harvest is explained without blaming the ASGM workers, it is the bad pluviometry and the unfavourable environmental conditions that have led to the decrease. Others state that through investment in cultivation techniques, their harvest has increased lately.

How do people near a Descending Site make their living? Not all the livelihood portfolios of the families near the ASGM sites include ASGM related work, but even at Descending Sites it is difficult to find a family where no one is involved in ASGM. Just as at the PS, out of ten siblings of the same generation roughly four will work in ASGM, although it is unclear, whether they work at the nearby site or elsewhere. The other kind of activities open to the local population is similar to the PS, but the market climate is different. Sales and orders are stagnating for traders and craftspeople. People make no bigger acquisitions and live partly off their savings.

The big majority of ASGM workers (80%) return to support their family in cultivation during the wet period. Those, who return to work in cultivation are mostly married and have founded a family of their own. The majority of them has not been doing another activity outside of agriculture before joining the ASGM workers and have been doing this combination of ASGM work and agriculture for a while, as have their siblings. Three out four ASGM workers make remittances of on average 25'000 XOF per month to the familial compound, but the amount varies. The money given as remittances and personal money are mainly spent on grains, livestock, motorcycles, cultivation techniques and on familial needs. Spending the wet season in agriculture is the normal thing to do at DS and is not

questioned much. Everyone farms the land, but because some individuals decide to work in ASGM or elsewhere during the wet season, the harvest has diminished for some due to the lack of work force. Others state that through the small investments in cultivation techniques, their harvest has increased lately.

## 9.2 Livelihood Strategies

### **The Micro-Level: The Household's Decision and Individual Motivation**

Now the analysis zooms in to the household's decisions near an ASGM over the gold extraction trajectory of the mine. Like Ellis (2000) I argue that discussing whether it is choice or necessity leading to diversifying in the ASGM sector is misleading concerning the range of experiences the concept assigns to just two processes. Other concepts and models are more helpful to understand the decision of getting involved in ASGM at the household or individual level. The simple economic household model suggests that people act rationally, "diversification as a function of on-farm returns to labour time compared to off-farm earning opportunities" (Ellis, 2000, 292). Simply spoken, if one's labour force brings more return in ASGM, he will choose this activity over agriculture. Once that the gold is not as readily found as before, he will go back to cultivation, as there are not many other non-farm activities in the region. Ellis (2000) proposes extending this simplistic model with six components for an entry point of analysis: seasonality, risk, labour markets, credit markets, asset strategies and coping behaviour, all mediated through social relations and institutions.

Regarding ASGM, all components are worth to be discussed additionally. Seasonality is an important component for the Centre-North of Burkina Faso, where the bulk of cultivation work is restricted to five to six months a year, leaving farmers without diversified activities economically inactive for the rest of the year. While earlier seasonal migration not only primarily served to provide labour in the off season, it also diminished consumption in times of shortages. Many young men of the area used to emigrate to the Ivory Coast, where they worked as seasonal labourers in plantations. Others occupied themselves with crafting during the agricultural off-season. Crafts that are mainly based on the processing of cotton, like spinning, weaving and dyeing, as well as pottery and metal work. Further, the people living in this region are not new to the search for gold. Superficial gold extraction or rather gold prospecting is an ancient practice in the region, conducted by men and women. It is the underground extraction that is new, as well as the immense attraction. Neither the crafts nor the emigration are preferred alternatives for the agricultural off-season. It is ASGM that now attracts the majority of young labour forces during the dry season. If the gold goes well, even the agricultural occupation loses attraction, as work continues throughout the wet season. This is different, if it is unsure, whether the gold will give enough or not. At DS people mostly stick to their cultivation

season and ASGM is only a viable occupation for agricultural off-seasons. Agriculture remains the first choice of activity, as soon as the gold boom is over. The gold has not changed people's livelihood and possibilities in the long run, where the gold has not been extracted over generations.

Risk and shocks are another component that explains the decision to diversify into ASGM at the household level. In ASGM people need to deal with several risks, regarding their health and success. The households deal with risk by conducting different activities, rather than getting all involved in ASGM and agriculture, as both bear risks of income failure. Spending one's time in cultivation is only risky with reoccurring long periods of drought resulting in crop failure. Investing the entire labour force available to one family in cultivation is perceived as a great risk by some ASGM workers. In some families, the eldest brothers work at several different ASGM sites, while the younger siblings attend school. Different sites are chosen to distribute the risk of a burying event, as well as the chance to be there, when a gold vein is discovered. The younger siblings attend school, with the hope that once the elder brother's physical force is gone, they will be supported by the better educated siblings. This immense diversification within the families can also be seen by looking at the ratio of activities within a generation. On average only 41% of the siblings work at an ASGM site and only 71% cultivate during the wet period. Therefore, one sees that people adhere to one principle "in the means of survival do not put all the eggs into one basket" (Ellis, 2000, 294).

Ellis (2000) states that in rural regions labour- and credit-markets are weakly developed. This is not true for the Centre-North of Burkina Faso. ASGM offers an informal labour opportunity that is relatively equally accessible to all rural dwellers, especially if they are male. Boys, who neither attend school, nor pursue another activity during the dry season are offered jobs at the ASGM site by "scouts" looking for work force for an ASGM investor or by friends and siblings. This is tempting for the young lads and requires less initiation than other off-farm jobs do. The ASGM is a sector that causes rural off-farm diversification. Further, the ASGM sector offers credit opportunities for ASGM undertakings, but not for agriculture. ASGM gain is used, as many citations have shown in the foregone chapter, as a cash possibility for agricultural undertakings.

Another component to enrich the simplistic economic household model is to understand diversification as an asset strategy. This means that households diversify in off-farm activities in order to improve their livelihood in the future and not necessarily to improve living conditions in the short term. This is an important motivation for the ASGM workers. Nearly every interviewee stated that his long-term goal is to develop another activity outside of ASGM and mostly outside agriculture. The workers do not get involved in ASGM with the intention to stick with this activity in the long run, but rather to use it as a trampoline for another activity. Clearly, some stick with ASGM

and never succeed in realising their further diversification dreams. This is true for the DS, where sometimes the income was insufficient to save for another activity and true for the PS, where some develop an ASGM type of identity, the 'Real miner's' identity, as described by Bryceson & Jønsson (2010) and no longer share their earlier values and dreams.

Another motivation to get involved in ASGM can be that one needs to cope with a difficult situation or period. This was mentioned by various interviewees. An incident, such as the death of one or both parents forced the elder children of the families to leave school or job that does not pay well to look for an income replacement. This was found in ASGM. The initial emergency activity was adopted in the livelihood portfolio. This motivation was found at both sites, the DS, as well as the PS.

We have seen the kind of decision a rural household has to take regarding its livelihood with the presence of ASGM. The simplistic economic household model, where individuals decide on their activity simply on the basis of what gives higher returns is useful, but needs to be enriched with the consideration and analysis of seasonality, risk, labour markets, credit markets, asset strategies and coping behaviour for understanding the decision at the household or individual level. We will now look at regional livelihood trends for the two different kinds of ASGM sites.

#### **The Meso-Level: Categorisation of Livelihood Aspirations**

In order to explain the empirical findings at a larger scale and to see the differences and heterogeneity of dealing with a very similar challenge, how to gain a living with the presence of ASGM, I reach back to Dorward et al. (2009) with his suggestion to understand livelihood aspiration in three categories: "Hanging in", "Stepping up" "Stepping out". The natural resource potential in the Centre-North of Burkina Faso can be described as low. The market situation at a Permanent Site is mostly dynamic. Relatively poor people follow the strategy "Hanging in" in farming and mining or "stepping up" in farming by improving cultivation techniques. This means that most of them will choose to invest their human asset, their work force in farming during the wet season. Their financial asset is remitted to the familial compound and invested in grains to supplement the harvest, livestock for worse times and familial needs.

Better off households are likely to aspire "Stepping out" of agriculture getting into a full-time ASGM occupation or they aspire to use ASGM to step out of the rural lifestyle entirely, using their newly acquired finances to start another business. This aspiration became very clear during the interviews, where most stated that they would eventually like to leave ASGM work and start a business in resale of consumer goods. Meanwhile, most of the better off families keep cultivating on a very low

productive level, just to keep the agricultural system running. Table 17 summarises this discussion in the style of the table has been presented in Chapter 2.1.

Table 17: Very simplified likely livelihood strategies (Dorward et al., 2009) of poor and middle class depending on market situation and natural resource potential. Table from Dorward et al., 2009 supplemented with my findings and adjustments in grey font for the low natural resource potential, marked in grey.

		Financial Status	Stagnant market → Descending Site	Dynamic market → Permanent Site
Natural-resource potential	Low	Poor	Muddling through or Hanging in	Hanging in or Stepping up
		Less Poor	Hanging in and try Stepping up	Stepping out (ASGM only or other) and Hanging in or Stepping up
	High		n.a.	n.a.

Like Mushongah & Scoones (2011) I argue that a fourth category of livelihood strategy is needed: ‘Muddling through’. It describes the situation where a rural household is losing assets, as they are under immense distress. This category is needed to take struggling households into account that are going through difficult times. Clearly, calling ‘muddling through’ a strategy or aspiration is overweening, it is rather a livelihood pathway. Inspired by the graphical display of the livelihood pathways in Pritchard et al. (2017), Figure 24 informs the visual reader on the differences in livelihood pathways of household at permanent and descending ASGM sites in comparison.

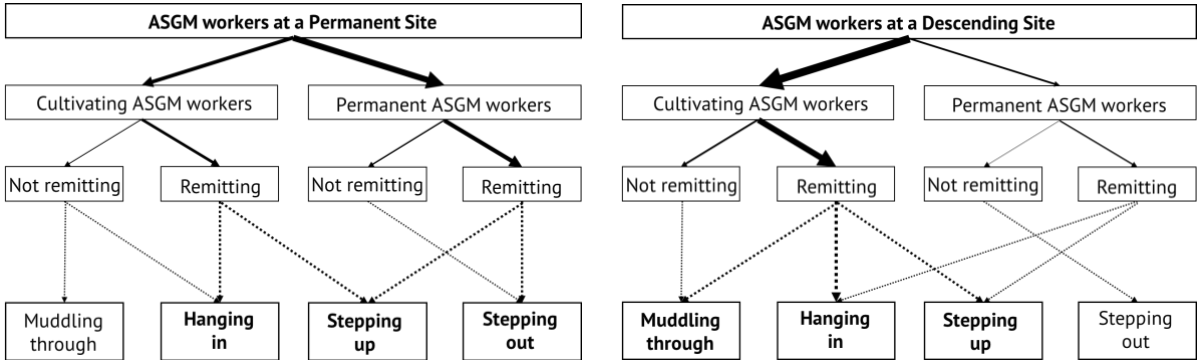


Figure 24: Livelihood pathways for Permanent and Descending Sites. The boldness of the solid arrows indicates the number of people surveyed belonging to each category. The pointed arrows are based on the interview data. Here, bold arrows signify the livelihood aspiration of the majority of people, but is not numerically accurate.

At a PS and in the area nearby, the majority of households follow a combination of ‘Stepping up’ and ‘Stepping out’ livelihood strategy. Some households are ‘hanging in’. At a DS, the situation is different and more diverse. The majority of households near a DS are ‘hanging in’. Some lose assets that they have gained during the success period of the mine and are ‘muddling through’. Other

households have invested in farm-based assets like livestock. They are now still profiting from the former gold boom and 'step up' in their agricultural production.

Mushongah & Scoones (2011, 1254) argue that Dorward's livelihood categorisation describe class formation and agrarian change. 'Stepping up' represents the formation of a class of petty commodity producers or in the case of Yatenga and Bam rather to a class of people who no longer need to rely on the market for a part of their subsistence. By producing enough food for themselves, some of them can sell a part of their harvest at the high market prices influenced by ASGM. Most of the people who 'step up' can diminish their relative expenditure on staple food leaving them budget for other expenditures. 'Stepping out' relates to off-farm activities. Those succeeding in this category as well as in the 'step up' category form the rural upper class. Those who are 'hanging in' achieve to hold their relative social position, as compared to the families who are not engaging in ASGM. Rising staple food prices weigh heavy on families in Bam and Yatenga, where most families need to invest in cereals to complement their harvest. Without the profit that can be made in ASGM, the social position of families without ASGM workers worsens.

A livelihood strategy is then sustainable, if it can recover from stresses and shocks by maintaining or enhancing its capabilities and assets while not undermining the resource base (Chambers and Conway, 1992 in Haug, 1999, 182). The livelihood strategies based on a combination of agriculture and ASGM allow to maintain or sometimes enhance assets even under stress, such as a diminishing return from gold. But can ASGM be conducted without undermining the resource base? Strictly spoken, no. Resource extraction is never a sustainable practice. If one accepts the weak sustainability concept, where the total assets within the three dimensions should remain stable, ASGM can be undertaken, if caring for the spheres on the surface at the same time: Avoiding negative impacts on the atmosphere, pedosphere, hydrosphere and biosphere. At the moment ASGM is not a sustainable activity, as it does not adhere to the standards in the environmental dimension. The next section will deal with the social and economic dimension of the ASGM activity in a rural society.

### **The Macro-Level: ASGM and De-Agrarianization**

How do the empirical findings of this research speak to broader macro-analytical questions regarding the rural and agrarian development? Can ASGM be understood as the mean that accelerates de-agrarianization processes in Yatenga and Bam? I argue that there is no de-agrarianization process in Yatenga and Bam.

The absolute number of people active in agriculture has only risen over the past twenty years, due to the continuously high population growth in rural areas. The relative number of people working in

agriculture has remained stable in Burkina Faso over the success years of ASGM (FAO, 2014). This is most likely not the case for Yatenga and Bam, where the relative share of people active in agriculture must have decreased in the ASGM success years. This indicates a weak de-agrarianization process. Certainly, one can see that farming has become a low status occupation that people want to avoid, especially in the younger generation. It remains open, whether this reflects a profound and permanent process of cultural change, where those despising farm work will not return to agriculture later on in their life. This would support Rigg's (2006) argument that livelihoods become more and more delinked from farm land and it is labour outside of agriculture that differentiates social classes.

The observed shift from a permanent to a descending site shows that the majority of households rely on agriculture as a backbone and security anchor in economically bad times. The ASGM workers are very much aware that the gold comes and goes and one should not rely on it too much. Some households and individuals have invested in farming activities, indicating a re-agrarianization movement. Many of those investing in agriculture, more specifically in livestock do so to save money for a later diversification step that succeeds only if the ASGM activity prospers over long periods. The meso-analysis has shown that the rural development and with it the rural population has become heterogeneous. The ASGM sector has integrated a large part of the population in Bam and Yatenga into the global capitalist economy. This integration of the rural population has caused class differentiation. A rural capitalist ASGM class has emerged and uses the labour force of weaker individuals for accumulation. I agree with Djurfeldt (2013) that this has led to a breakdown of the local social and cultural norms, but I argue other than Djurfeldt (2013) that this has not driven a mass de-agrarianization.

I argue along Rigg's (2006) ideas. Seeing a recent partial de-agrarianization in a rural area, where gold is currently mined successfully, is not automatically alarming. Rather it is an artefact of class differentiation among the rural population, caused by a sudden influx of money. Ascending households are those who invest labour resources in ASGM and intensify their cultivation capital-led or rent out their fields in times of successful ASGM production. Descending households are those, who oppose ASGM and are solely active in non-farm activities. Two factors though are to be kept in mind. The ASGM activity must not heavily degrade the worker's health status, as many studies have shown that households with unhealthy individuals struggle with poverty. This goes hand in hand with a responsible handling of chemicals and sediments to avoid degrading the environment. Secondly, the ASGM must not undermine schooling, as remittances of educated individuals are generally higher and will bring the family a more secure livelihood in the long term, than the remittance a very young ASGM worker can make to his family in the short term.

Agriculture becomes unimportant to the household's income, where ASGM is present. But can one really speak of de-agrarianization due to ASGM? Relatively spoken, the part of people continuously involved in agriculture has most likely declined in Bam and Yatenga, if we compare today with what it was like 20 to 30 years ago. In absolute numbers on the other hand, the people working in agriculture has almost certainly remained stable, if we remember how population has grown over the same period of time as it was shown in Figure 4. De-agrarianization is not the right term for what is happening in Centre-North and a part of the North of Burkina Faso. Rather the rural population undergoes an immense social restructuring with the establishment of a gold mining elite and livelihood trajectories are observable signs thereof.

### 9.3 Methodological Discussion

This chapter serves to assess the methodological procedure for the study question. It follows the quality framework for Mixed Methods Research by Tashakkori and Teddlie (O'Cathain, 2010, 541).

The chosen research design was overall found to have been appropriate, as the breadth and depth of the study could have been optimised with the given resources. Some small points could have markedly improved the quality of this mixed method study again. It would have been a useful interference of the data set, if the standardised questions from the survey were also collected after the semi-structured interview. This would have simplified the combination of the data sets and similarities as well as conflicts would have become more obvious. The data quality is found to be sufficient for the claims made. Two aspects would be changed if the study could be repeated. First, it would have been useful to collect interview data at the household level of the interview partners. Next time, I would ask the interviewees, whether I could interview the head of his family. This would provide interestingly coupled interviews, at the individual decision level, as well as on the group level - the household. Further under the condition, to have understood Mooré, it would have been useful to spend a day with the survey team, in order to be able to judge the survey results more critically.

The interpretation of the data was found to profit from the two independent data sets. Once both data was analysed individually the concurrent switch between the set of data allowed to understand the phenomena with different perspectives. Rather than a constructivists study, the interpretation of the qualitative data was conducted structurally, almost mechanically. This brings the benefit of making the interpretation transparent and comprehensible. Possibly engaging more hermeneutically with the data, could have brought other insights. This was considered, but found to be inappropriate, as the data was translated several times (Mooré-French, French-English) and therefore nuances in the language are no longer reliable in the English end version. The quantitative analysis would have



benefited if not conducted in a bulk, but rather engaging with the data intermittently. This would have made it easier to let go of details in the data and differ important from unimportant findings.

Overall the chosen paradigm and research design is fit to provide useful findings. Useful in the sense that the findings could inform real world decisions regarding policy. I found that the project with fieldwork in a team was highly beneficial for my research project. The resources were shared and gaining access to the sites was easier with a rather big team, also making it easier for an unexperienced researcher. Local authorities took their time to ensure that access was provided. Through talking to the team unpleasant experiences were easier ordered and overcome, providing an atmosphere in which I felt comfortable. All the same doing research in a group also complicated the logistics on site highly, so that every team could meet their goals within the given timeframe. I think I would have needed much more time for the same number of interviews, had I been alone. I would have used more time to reflect on the next choices of interview partners and would have taken days off, pre-analysing the interview data, possibly doing a week of fieldwork and a week of analysis intermittently.

The collaboration with the partner organisations of Action de Carême was certainly very helpful, as the partners knew, who had to be contacted in which order to gain access and also accompanied us there. Sometimes their private contacts and social position only made it possible that we could even go to the site and then move freely. Collaborating with a NGO brings the risk of awakening expectations in the local population. Within the context of gold and my visual appearance I found that beneficial overall. Locals have two kinds of people in mind, when they see Europeans. Either one is a NGO worker, coming to help them or one is prospecting gold. Being with the NGO made it clear that I was not there for gold. Expectations had to be managed, by carefully explaining why we were there and what we were doing. I feel that even without being with a local NGO these expectations would have been raised, therefore I was glad to profit from the advantages.

#### 9.4 Implications for Further Research

As any research, also this project raised almost more questions than it answered. This chapter should inform the interested reader on interesting aspects for research questions. The questions are clustered in three themes: demography and migration, agricultural practice and land use change and the family as unit of production and decision.

Regarding demography and migration, several interesting questions were triggered throughout the project. First of all, I have the hypothesis that the population growth in areas with gold has been absorbed by the ASGM sector, implicating a smaller migration flux from rural to urban areas or

abroad for gold bearing regions as compared to non-gold regions. Further this implicates also that the absolute number of people who cultivate a certain area has remained stable over the years. Also regarding work migration, I think it would be interesting to understand, where those who are currently hired to work in the fields are from. Indications were given that they are from further north, where the cultivation season is shorter, but what attracts them to work in the fields rather than also getting active in gold? These questions related to migration and demography would bring further insights into the economic importance of ASGM in Burkina Faso.

Further, questions were raised regarding the agricultural practice and with this about land use change, one could compare productivity rates and choice of crop in ASGM regions and non-ASGM regions. This would inform about overall trend of productivity, what has been assessed only qualitatively in this study. These kinds of studies are extensive. A possible approach could be to work with data that is collected and interpreted by organisations such as Fews Net, this could be linked to ASGM and its lifecycle stages. An interesting geostatistical project with indication of trends could emerge. Another project could evaluate the effects of material investments on familial agriculture. With the introduction of new cultivation techniques, one could learn about the implications for the division of labour and the change in productivity. It could be interesting to develop a method to estimate the spatial distribution of ASGM wealth that would bring insights on the rural economy. With a remote sensing project coupled to fieldwork, this could be successfully done with the development of a “tin roof index”. As we have seen through this research, constructing and improving housing is one of the first things, people invest once their financial situation has improved. Remote sensing technology and the possibilities in analysis can also aid to detect new areas of extraction as well as cyanide processing. If working with this data, it must be done critically and carefully, as the ASGM sector is still more being condemned than seen as a viable livelihood option.

The last theme of questions is related to the family as a unit of production and economical decision making. This could be a comparative ethnographic study, comparing the family life in an ASGM area with the family life of a non-ASGM area. As new opportunities become available for the young to gain their living and agriculture alone is no longer an option, decisions need to be made. Who and how are decisions on the family members activities taken, what kind of conflicts arise and is this a question of gender? These kinds of questions could bring further insights in understanding the transformation of the rural society in Burkina Faso. Further, my research has shown conflicting results regarding schooling of children. While some families are only able through the gains in ASGM to send their children to school, in other families the children leave school, apparently due to the alternative ASGM. Understanding this helps to see long-term effects of ASGM.

## 10. Wrapping-up Mining Farmers' Livelihood Strategies

### 10.1 Conclusion

This master thesis contributed to the debates on de-agrarianization and livelihood strategies. It focused specifically on the interlinkage of artisanal small-scale gold mining (ASGM) and agriculture concerning labour and capital, the reasoning behind livelihood decisions and the perceived effects on familial agriculture by combining a survey with semi-structured interviews in the provinces Bam and Yatenga in Burkina Faso. After a gold boom event, sites either turn into descending sites (DS) or rarely into permanent sites (PS). DS and PS were compared in order to understand the effects of ASGM on livelihood strategies.

The study found that 40 % of the ASGM workers cultivate at PS compared to 80 % at DS. ASGM workers invest a variable share of their gain in their familial agriculture by buying ingredients, tools and livestock. 75% of them remit to their family and the amount depends on the ASGM lifecycle stage. Thus, some households increased their harvest. After Dorward et al.'s (2009) livelihood strategy categorization they 'step up', improving their livelihood. Others have harvested less in recent years, but they can buy more cereals than they used to harvest. They 'step out', accumulating to start of a new activity providing higher or more stable returns. When the site turns into a DS most households are able to secure their new assets and 'hang in', while others whose investment choices were less sustainable lose a part, they 'muddle through' and some have invested the money they gained through the gold boom wisely and are 'stepping up'. Looking at farm and non-farm activities with an integrative approach allows to see household's and individual's middle-term developments.

Through ASGM the rural community is partially integrated into the globalised capitalist economy resulting in an immense social restructuring with the establishment of a ASGM elite. The livelihood trajectories, where some people are shifting their priorities from agriculture to ASGM are observable signs thereof. Land has lost its function to stratify society even though the land remains farmed and the absolute yield in the region has been stable. Farming and mining are complementing rather than competing activities, but farming has become just one out of many activities open to the rural population thanks to ASGM. The assumption that there is a de-agrarianization process happening in Bam and Yatenga is not supported. Most ASGM workers are indeed 'Mining Farmers'.

## 10.2 Policy Recommendations

Here, I formulate some recommendations based on my experiences and findings. I address institutions and organisations promoting rural development in areas with ASGM sites in Burkina Faso.

- Promote the safe conduct of ASGM activities as a diversification strategy of the rural poor motivated by insufficient farm returns. Support the households in successfully combining agricultural and ASGM activities throughout the seasons and within their families. Use a livelihood approach rather than a sectoral approach, focused on agriculture only to understand who currently struggles most with poverty.
- Promote the dialogue between the different actors claiming authority over the ASGM site in all communities in the area even those with no big ASGM sites so far. Agree on rules and taxing before a gold boom occurs.
- Invest resources in promoting health protection measures on site. This involves safer and informed handling of chemicals, general hygiene, sanitary improvements on sites as well as protection from fire during the night in the camp site areas.
- Invest resources in promoting an environmental safe conduct of ASGM as far as possible. The measures must especially protect air, water and soil quality. Cyanidation is a viable alternative to the use of mercury but must be applied with risk awareness. Loose sediment on the surface changes stream water ecosystems and increases wind dust transport, thus closing the holes after extraction is advisable. Deforestation is another major issue linked to ASGM, alternatives such as bamboo poles are an option.
- Strengthen the educational sector in the region, so that school offers an engaging occupational alternative to the children and adolescents in ASGM regions. Learning trades such as mechanic, smith and tailor are no longer attractive. Support the trade unions in reforming their offer of formations.
- Support the local households in developing long-term economic strategies for their families. Educate the head of the families, as well as the ASGM workers in making wise investment choices that provide higher or more stable returns. Promote activities in the secondary economic sector by enhancing values of primary products or interpersonal services, rather than commerce. Further, promote the acquisition of flexible material and tools, that can be used in agriculture as well as ASGM, for example tricycles.

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# Appendix

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## A. Statistical Tables

Table 18 shows some basic characteristics of the respondents, such as the distribution of sex or the level of education. Further, it displays the result of the statistical analysis conducted to check for significant differences between the four analytical groups.

Table 18: Mean values for several characteristics of the respondents with the results testing for significant differences between the four groups. Source: Survey data, 2017

Lifecycle stage	Wet season occupation	n	Men [%]	Single [%]	Local [%]	Primary school incomplete [%]	Last activity agriculture [%]				
Descending Site (DS)	Permanent ASGM worker (PW)	24	91.7	54.2	79.2	62.5	29.2				
	Cultivating ASGM worker (CW)	104	87.5	23.1	87.5	84.6	58.7				
Permanent Site (PS)	Permanent ASGM worker (PW)	65	84.6	29.2	58.5	83.1	41.5				
	Cultivating ASGM worker (CW)	44	93.2	36.4	45.5	86.4	70.5				
Total		237	88.2	30.4	70.9	82.3	54.3				
Contingency Analysis	Exact Fisher Test	1.938 p = .597		15.476 p = .006		33.651 p = .000		6.399 p = .089		15.567 p = .001	
	Significance	no		**		***		no		**	
	CC			.275 p = 0.002		.351 p = .000				.249 p = .001	
	Cramer-V			.203 p = 0.002		.375 p = .000				.257 p = .001	

Table 19: Mean values with standard derivation in brackets for several characteristics of the respondents with the results testing for significant differences between the four groups. Source: Survey data, 2017.

		Number of respondents	Siblings from same father [number]	Siblings working on a ASGM site [%]	Siblings working in agriculture [%]	Children [number]	Age	Age starting at mine site	Years of work experience	Years on current site	Sites [number]
Descending Site	Permanent ASGM worker	24	7.46 (4.16)	32.02 (23.83)	65.08 (29.89)	1.64 (2.44)	27.00 (9.54)	22.33 (9.04)	4.67 (5.59)	3.54 (5.50)	1.75 (1.03)
	Cultivating ASGM worker	104	6.36 (4.06)	43.19 (26.41)	75.47 (25.76)	2.99 (3.41)	29.68 (9.88)	21.78 (9.44)	7.9 (7.89)	6.13 (7.02)	1.59 (0.80)
Permanent Site	Permanent ASGM worker	65	8.08 (5.24)	34.70 (22.40)	64.13 (30.89)	2.09 (2.84)	30.2 (10.65)	24.58 (9.87)	5.62 (5.88)	3.48 (5.11)	1.83 (1.34)
	Cultivating ASGM worker	44	6.59 (4.48)	47.51 (29.08)	75.72 (27.31)	1.66 (2.25)	28.07 (9.48)	21.50 (8.11)	6.57 (9.21)	4.73 (7.97)	1.52 (0.76)
Total		237	6.98 (4.53)	40.51 (26.05)	71.34 (28.31)	2.33 (3.00)	29.25 (9.99)	22.55 (9.32)	6.70 (7.51)	4.88 (6.67)	1.66 (0.99)
Kruskal-Wallis Test			0.1	0.017	0.049	0.015	0.37	0.289	0.147	0.075	0.899
Independent Samples			no	*	*	*	no	no	no	no	no

Table 20: Mean values of respondents supporting their family financially and mean values of the amount with the standard derivation in brackets displayed independently for several characteristics. Source: Survey data, 2017.

	n	Percentage supporting family financially	Contingency Analysis			n	Financial support for family XOF/month	Kruskal-Wallis/ Mann-Whitney U	
			Exact Fisher	Sig.	CC			Indep. samples	Sig.
<b>Matrimonial status</b>	Married/ cohabiting	164	73.2	8.82 p = .109	no	96	40'438 (46'590)	.994	no
	Single	72	81.9			56	35'554 (32'376)		
<b>Sex</b>	Male	209	81.3	25.09 p = .000	*** .331 p = .000	145	40'135 (42'160)	.001	**
	Female	28	35.7			8	9'813 (16'729)		
<b>Education</b>	Primary complete	42	73.8	3.58 p = .235	no	26	46'731 (48'310)	.270	no
	Primary incomplete	195	76.4			127	36'874 (40'281)		
<b>Site</b>	Tikaré	41	80.5	3.62 p = .847	no	29	18'328 (12'480)	.000	***
	Zomkalga	39	82.1			30	28'617 (23'463)		
	Tiba	48	72.9			26	29'192 (20'519)		
	Alga	109	73.4			68	55'132 (54'395)		
<b>Origin</b>	local	168	78	1.96 p = .462	no	116	35'108 (35'463)	.790	no
	other	69	71			37	39'647 (43'642)		
<b>Migration</b>	local settled	96	69.8	12.59 p = .024	* .211 p = .073	59	35'076 (32'081)	.013	*
	non-local settled	41	68.3			23	22'131 (17'473)		
	local mobile	72	88.9			57	44'377 (52'921)		
	non-local mobile	28	75			14	56'429 (46'675)		
<b>Activity wet season</b>	Permanent ASGM worker	89	74.2	.939 p = .773	no	58	55'759 (57'778)	.001	**
	Cultivating ASGM worker	148	77			95	28'042 (22'346)		
<b>Activity dry season</b>	Digging/milling	100	82	10.11 p = .079	no	69	33'442 (32'426)	.058	no
	ASGM service	76	78.9			58	46'672 (43'172)		

	Selling food/drinks	25	64			13	20'538 (18'693)		
	Business	30	63.3			11	55'455 (82'142)		
<b>Past activity</b>	Agriculture	126	75.4	7.06 p = .311	no	85	34'988 (30'017)	.915	no
	Student	30	63.3			13	50'769 (61'976)		
	Commerce	48	85.4			35	38'571 (38'167)		
	Other	28	78.6			18	49'583 (71'395)		

Table 21: Mean values with standard derivation in brackets distinguishing the respondents along their answer to whether they support their family financially or not. Source: Survey data, 2017.

	Supporting family financially					Financial support for family XOF/month		
	n	Yes (n=180; 76%)	No (n=57; 24 %)	Independent samples	Mann-Whitney U Sig.	n	Coefficient	Sig.
<b>Age</b>	237	27.57 (8.85)	34.82 (11.42)	0	** *	153	-.010 p=.905	no
<b>Number of children</b>	223	1.85 (2.5)	3.8 (3.82)	0	** *	141	-.101 p=.233	no
<b>Years on current site</b>	237	5.12 (6.84)	4.18 (6.14)	0.464	no	153	.050 p=.541	no
<b>Years of work experience</b>	237	6.95 (7.43)	6 (7.83)	0.196	no	153	.130 p=.110	no
<b>Age starting work on site</b>	237	20.62 (7.57)	28.82 (11.55)	0	** *	153	-.068 p=.400	no
<b>Number of sites worked</b>	237	1.75 (1.06)	1.38 (0.7)	0.02	*	153	.198 p=.014	*
<b>Number of siblings</b>	237	7.39 (4.59)	5.68 (4.17)	0.007	**	153	.144 p=.076	no
<b>Part of siblings working ASGM</b>	235	40.91 (24.9 8)	39.71 (29.51)	0.265	no	152	.043 p=.599	no
<b>Part of siblings working agriculture</b>	237	69.61 (28.8 3)	77.81 (27.66)	0.066	no	153	-.189 p=.019	*

## B. Survey Questions

Start survey		Continuation	
English	French	English	French
Cyanide use in artisanal small-scale gold mining in Burkina Faso: health effects, environmental burden and societal dimensions	Usage du cyanure dans l'exploitation aurifère artisanale à petite échelle au Burkina Faso: effets sur la santé humaine, charge environnementale et dimensions sociales		
Health questionnaire	Questionnaire santé	Since when are you working here [on this particular ASGM-site]? Days	Depuis combien de temps travailliez-vous dans ce site minier artisanal ? Jours
Has the informed consent been obtained?	Le consentement éclairé a été obtenu?	Months	Mois
Interviewer name	Interviewer name	Years	Années
Interview date and start time	Date de l'entrevue et l'heure du début		
Site	Site		
Exposure group	Groupe d'exposition	Have you worked on other ASGM-sites before coming here? Where?	Aviez-vous travaillé dans d'autres sites miniers avant de venir ici? Ou?
ID	ID		
How old are you?	Quel âge avez-vous ?	In total, for how long have you worked on ASGM-sites? Days	Au total combien de temps aviez-vous travaillé dans les sites miniers artisanaux? Jours
If no age precision:	Si pas d'information sur l'age:	Months	Mois
Sex	Sexe	Years	Années
In with country were you born?	Dans quel pays etes-vous né(e)?		
Which other country?	Dans quel pays?	Le job que vous faites en moment c'est un job pour...	Le job que vous faites en moment c'est un job pour...
In with region were you born?	Dans quel région etes-vous né(e)?	What is your principal professional activity in the dry season? What work do you do most often in the dry season?	Quel est votre principal emploi / activité professionnelle dans la saison seche? Quel genre de travail faites-vous le plus souvent dans la saison seche?
In which community do you live?	Dans quelle communauté vivez-vous?	Which other activity?	Quelle autre activité?
Which other community?	Quel autre communauté?	What is your principal professional activity in the rainy season? What work do you do most often in the rainy season?	Quel est votre principal emploi / activité professionnelle dans la saison de pluie? Quel genre de travail faites-vous le plus souvent dans la saison de pluie?



		Which other activity? Qu'est-ce que vous avez fait principalement avant le travail sur le site d'orpaillage ? Quel autre travail?	Quelle autre activité? Qu'est-ce que vous avez fait principalement avant le travail sur le site d'orpaillage ? Quel autre travail?
For how long have you lived in this community?	For how long have you lived in this community?		
Days	Jours		
Months	Mois		
Years	Années		
		<b>[Survey continues with exposure questions not relevant for my study]</b>	
What is your current marital status?	Quel est votre statut matrimonial actuel?		
What is your level of education/schooling?	Quelle est votre niveau d'étude?		
What other level?	Quelle autre niveau?		
Combien des frères et sœurs du même père avez-vous?	Combien des frères et sœurs du même père avez-vous?		
Combien des frères et sœurs du même père travaillent dans l'orpaillage ?	Combien des frères et sœurs du même père travaillent dans l'orpaillage ?		
Combien des frères et sœurs du même père travaillent dans l'agriculture ?	Combien des frères et sœurs du même père travaillent dans l'agriculture ?		
<b>[further at top right]</b>			

## C. Interview Guide

Table 22: List of planned and conducted interviews. The crossed out people were not interviewed, the cursive interviewees were spontaneously added.

	<b>Custo- mary Authority</b>	<b>Gov. Authority</b>	<b>School Personal</b>	<b>ASGM Workers</b>	<b>Farmers</b>	<b>Other Civilians</b>
<b>Tikaré (Total 17)</b>	Naaba	<del>Préfét</del>	Teacher secondary (m)	young digger	kids ASGM	Sale
		CVD	Teacher secondary (f)	old digger	<del>no kids ASGM</del>	<i>tailor</i>
		<del>Gendarmerie</del>	Head of secondary	cyanide worker	<del>Young male</del>	<i>metal worker</i>
		Police	<i>Teacher primary (m)</i>	boss	Young female	President
		Major	<i>Teacher primary (f)</i> <i>Head of primary</i>	milller, washer vannage		
<b>Zomkalga/ Séguénéga (Total 18)</b>	Naaba	<del>Préfét</del>	Teacher secondary (m)	young digger	<del>kids ASGM</del>	<del>Sale</del>
		CVD	Teacher secondary (f)	old digger	<del>no kids ASGM</del>	<i>tailor</i>
		<del>Gendarmerie</del>	Head of secondary	cyanide worker	Young male	<i>metal worker</i>
		Police	<i>Teacher primary (m)</i>	boss	Young female	<i>pot maker</i>
		Major	<i>Teacher primary (f)</i> <i>Head of primary</i>	Miller, Washer milller, washer vannage <i>site chef</i>	<del>Well off</del> Struggling	<del>President</del>
<b>Bourzanga/A lga (Total 26)</b>	Naaba	<del>Préfét</del>	<del>Teacher secondary (m)</del>	young digger	<del>kids ASGM</del>	Sale
	<del>Tengsaba</del>	CVD	<del>Teacher secondary (f)</del>	old digger	<del>no kids ASGM</del>	<i>Land owner</i>
		<del>Gendarmerie</del>	Head of secondary	cyanide worker	Young male	President
		Police		boss	Young female	
		Major		milller, washer transporter vannage <i>site chef</i>	<del>Well off</del> Struggling	
<b>Kongoussi (Total 7)</b>		Agriculture Service				<i>School girl</i>
	<i>Canton Naaba</i>	<i>Environment Service</i>				<i>School boy</i>
		Livestock Service				
<b>Total conducted interviews</b>	<b>5</b>	<b>12</b>	<b>4</b>	<b>31</b>	<b>3</b>	<b>11</b>

It follows the interview guide for the semi-structured interview that I prepared before the first couple of interviews. The guide changed significantly after I had learned more and more. This is the very first version as it is the only version I had digitalised. After this I took notes in my field book, how I wanted to adapt the guide for the next interview. After about 10 interviews I no longer used the

guide at all, as I knew the questions and my goals by heart and I had changed and developed the guide. Therefore, this only serves as an information to see where I started off.

### **Introduction**

*Je m'appelle Jessica, je suis chercheuse et je viens de la Suisse. Elle s'appelle Natacha, elle est étudiante et elle va traduire les questions et les réponses que j'aimerais poser à vous.*

*Je voudrai vous poser une série de questions pour mieux comprendre comment la vie agricole a changé avec l'influence de l'orpaillage.*

- Si vous ne comprenez pas une question ou si vous souhaitez ajouter d'autres informations, vous pouvez m'interrompre à tout moment.
- Si une question vous semble inconfortable, vous n'avez pas l'obligation de répondre
- Si vous ne connaissez pas la réponse à la question, essayez de me donner votre meilleure estimation ou simplement dites-moi que vous ne savez pas.

*Les informations que vous nous fournirez seront traitées confidentiellement, rendra anonyme et ne seront utilisées que pour notre étude. Votre participation est volontaire.*

*Est-ce que vous êtes d'accord avec ça ? Si oui, je vous priez de signe ici ou donner un empreinte digitale. [Donner le feuille pour la signature]*

*Pour mieux rappeler ce que nous avons parlé, j'aimerais bien enregistrer cet entretien avec le dictaphone. Est-ce que vous êtes d'accord ?*

*C'est un type d'entretiens ou je préparé quelques questions mais j'aimerais bien que vous me racontez aussi des autres choses que vous trouvez importants dans la question du rapport entre la vie agricole et l'orpaillage. C'est vous qui venez parler beaucoup et nous vous écoutez plutôt.*

### **Entretien semi-guidé nombre x.x.x**

*Merci, pour votre aide et les informations. Avez-vous des questions à me poser ?*

*Pour me remercier pour l'entretiens j'aimerais bien vous donner une photo de vous. Est-ce que s'a vous intéressez ?*

### **Profs et enseignants**

*Qu'est-ce que vous pensez de l'orpaillage ?*

Est-ce que la vie dans la ville/le village a changé depuis le site d'orpaillage est devenu assez grand ? Comment ? Est-ce que vous pouvez me raconter une situation dans laquelle on peut comprendre comment la vie était avant ?

L'orpaillage a-t-il influencé la situation économique des gens dans la ville/le village ?

Comment est-ce que la vie scolaire est influencé par l'orpaillage ?

Est-ce qu'il y a des élèves qui ont quitté l'école pour l'orpaillage ? A quel âge ? Avez-vous des nombres précise ? Comment est-ce qu'on peut qualifier ces élèves ? Pourquoi est-ce que ces élèves quittent l'école ?

Est-ce qu'il y a des élèves qui travaille sur les sites d'orpaillage pendant les congés ou les vacances ? Quel est leur comportement à l'école ?

! Les données numériques ?

OÙ est-ce que je peux trouver les données numériques pour les provinces Bam et Yatenga ?  
Qui collecte ces données ? Est-ce que vous pouvez me donner les données pas agrégées ?

### ***Paysans/ villagois***

(Qu'est-ce que vous cultiver ? Comment est-ce que vous cultivez ? Qui est-ce que vous aidez à cultiver ?)

Qu'est-ce que vous pensez de l'orpaillage ?

Comment est-ce que le village a changé depuis que l'orpaillage est devenu plus important dans la région ? Est-ce qu'il y a des traces visibles de ce changement ici dans le village ? Est-ce que votre pratique cultural a changé depuis que l'orpaillage est devenu plus important dans la région ? Est-ce que vous avez des enfants qui travaillent sur le site d'orpaillage ?

Pourquoi est-ce que vos enfants (ne) travaillent (pas) sur le site d'orpaillage ?

Qu'est-ce que ça signifie pour votre famille ? Qu'est-ce que votre fils/fille fait avec l'argent ?  
Comment est-ce que votre fils/fille parle de l'agriculture ?

Est-ce que votre fils/fille vous vient à l'aide si vous avez des dépenses imprévues ou bien est-ce que vous venez à l'aide pour votre fils/fille s'ils ont besoin ?

Qu'est-ce que ça signifie pour vous ? Est-ce que vous pouvez me raconter comment est-ce que vous êtes venu à son/leur aide dans l'année passée ? Combien est-ce que vous avez prêté ? Combien par mois ? Combien par ans ? Combien par fois ? Quelles dépenses imprévues avez-vous ? Comment est-ce que vous avez donné/reçu l'argent ?

! J'aimerais bien avoir des données numériques !

### ***Autorité gouvernementale et organisations civil***

Qu'est-ce que vous pensez de l'orpaillage ?

Comment est-ce que l'orpaillage influence le développement dans ce département ? Est-ce que la vie dans la ville/le village a changé depuis que le site d'orpaillage est devenu assez grand ? Comment ? Est-ce que vous pouvez me raconter une situation dans laquelle on peut comprendre comment la vie était avant ?

L'orpaillage a-t-il influencé la situation économique des gens dans la ville/le village ?

Comment est-ce que l'orpaillage influence l'agriculture dans ce département ?

Est-ce que vous pouvez me raconter une situation que vous avez géré ? Quelle préoccupation est-ce que les paysans ont ? Est-ce qu'il y a des changements ou investissements agricoles visibles dans la région avec l'argent d'orpaillage ?

! Besoin de concrétiser les questions !

### ***Employé***

Pourquoi est-ce que vous avez décidé de travailler dans l'orpaillage ?

Est-ce que vous avez constaté un changement dans votre vie ? Qu'est-ce qui a changé dans votre vie quand vous avez commencé à travailler dans l'orpaillage ? Comment est-ce que vous avez trouvé cet occupation ?

L'agriculture qu'est-ce que ça signifie pour vous ?

Est-ce que vous travaillez encore dans l'agriculture ? Si on pouvait faire le même gain financier dans l'agriculture que dans l'orpaillage qu'est-ce que vous préférez ? Dans les années prochaines qu'est-ce que vous voulez faire comme travail ? Qu'est-ce qu'a changé pour votre

famille quand vous avez décidé à travailler ici ? Votre famille est-ce qu'ils sont d'accord avec votre décision ?

Comment est-ce que vous vous aidez dans la famille ?

Est-ce que vous participez aux dépenses imprévues de votre famille ou bien est-ce qu'ils vous viennent en aide ? L'année dernière est-ce que vous pourriez me raconter une situation où vous êtes venu en aide à votre famille ?

### ***Cadre***

Est-ce que vous pouvez m'expliquer comment le site est organisé ?

Pourquoi est-ce que vous avez décidé de travailler dans l'orpaillage ?

Qu'est-ce que dans votre vie a changé quand vous avez commencé à travailler dans l'orpaillage ? Comment est-ce que vous avez trouvé la première occupation dans l'orpaillage ? Comment est-ce que vous avez réussi à avoir cette position ?

Comment est-ce qu'on peut décrire « un bon orpailleur » ?

Quelles sont les caractéristiques ? Comment est-ce que vous choisissez les jeunes orpailleurs ? Comment est-ce que vous distribuez le profit ?

Qu'est-ce que vous pensez, du fait que les jeunes quittent l'agriculture pour travailler ici ?

Comment est-ce que les jeunes changent avec le travail ici ?

### ***Indépendants***

Pourquoi est-ce que vous avez décidé de travailler sur le site d'orpaillage ?

Qu'est-ce que vous faisiez avant ? Comment est-ce que vous avez réussi à avoir cette position ?

L'agriculture qu'est-ce que ça signifie pour vous ?

Est-ce que vous travaillez encore dans l'agriculture ? Si on pouvait faire le même gain dans l'agriculture que sur le site d'orpaillage, qu'est-ce que vous préférez ? Les années prochaines qu'est-ce que vous voulez faire comme travail ? Qu'est-ce qu'a changé pour votre famille quand vous avez décidé de travailler ici ?

Comment est-ce que vous vous aidez dans la famille ?

Est-ce que vous participez aux dépenses imprévues de votre famille ou bien est-ce qu'ils vous viennent en aide ? L'année dernière est-ce que vous pourriez me raconter une situation où vous êtes venu en aide à votre famille ?

## D. Statistical Tables for Independent DS and PS Analysis

Table 23: Permanent Site: Analysis of financial contribution to familial compound for nominal variables. Source: Survey data, 2017.

		n	Financial support for family XOF/month	Kruskal-Wallis/ Mann-Whitney U	
				Indep. samples	Sig.
<b>Matrimonial status</b>	Married/ cohabiting	43	57'837 (61'137)	.964	no
	Single	25	50'480 (41'028)		
<b>Sex</b>	Male	64	58'391 (54'427)	.000	***
	Female	4	3'000 (4'690)		
<b>Education</b>	Primary complete	7	96'429 (69'923)	.060	no
	Primary incomplete	61	50'393 (50'924)		
<b>Origin</b>	local	40	66'250 (60'857)	.040	*
	other	28	39'250 (39'344)		
<b>Migration</b>	local settled	20	56'500 (43'228)	.008	**
	non-local settled	17	24'059 (19'350)		
	local mobile	20	76'000 (74'385)		
	non-local mobile	11	62'727 (50'812)		
<b>Activity wet season</b>	Permanent ASGM worker	41	64'073 (64'442)	.230	no
	Cultivating ASGM worker	27	41'556 (30'304)		
<b>Activity dry season</b>	Digging/milling	22	50'455 (45'875)	.009	**
	ASGM service	35	60'343 (47'946)		
	Selling food/drinks	7	13'857 (17'715)		
	Business	4	107'500 (128'679)		
<b>Past activity</b>	Agriculture	38	45'105 (35'239)	.722	no
	Student	6	85'000 (79'687)		
	Commerce	13	58'461 (54'060)		
	Other	10	74'500 (88'927)		

Table 24: Descending Site: Analysis of financial contribution to familial compound for nominal variables. Source: Survey data, 2017.

		Financial support for family	Kruskal-Wallis/ Mann-Whitney U



		n	XOF/month	Indep. samples	Sig.
<b>Matrimonial status</b>	Married/ cohabiting	53	26'321 (22'206)	.955	no
	Single	31	23'516 (15'481)		
<b>Sex</b>	Male	81	25'710 (19'732)	.218	no
	Female	4	16'625 (22'522)		
<b>Education</b>	Primary complete	19	28'421 (17'244)	.226	no
	Primary incomplete	66	24'379 (20'528)		
<b>Origin</b>	local	9	22'222 (13'718)	.829	no
	other	76	25'645 (20'457)		
<b>Migration</b>	local settled	39	24'090 (16'464)	.537	no
	non-local settled	6	16'667 (9'832)		
	local mobile	37	27'284 (24'090)		
	non-local mobile	3	33'333 (15'275)		
<b>Activity wet season</b>	Orpailleur	17	35'706 (30'110)	.156	no
	Mining Peasant	68	22'676 (15'536)		
<b>Activity dry season</b>	Digging/milling	47	25'479 (19'756)	.927	no
	ASGM service	23	25'870 (22'945)		
	Selling food/drinks	6	28'333 (18'074)		
	Business	7	25'714 (11'339)		
<b>Past activity</b>	Agriculture	47	26'809 (22'217)	.526	no
	Student	7	21'429 (14'639)		
	Commerce	22	26'818 (17'289)		
	Other	8	18'438 (14'696)		

Table 25 Permanent Site: Analysis of financial contribution to familial compound for metric variables. Source: Survey data, 2017.

	<b>Financial support for family XOF/month</b>			
	Kendall-Tau-b		Spearman-Rho	
n	Coefficient	Sig.	Coefficient	Sig.

<b>Age</b>	68	.019 p=.829	no	.023 p=.853	no
<b>Number of children</b>	68	-.143 p=.138	no	-.174 p=.156	no
<b>Years on current site</b>	68	.092 p=.322	no	.119 p=.332	no
<b>Years work experience</b>	68	.153 p=.089	no	.209 P=.087	no
<b>Age starting work on site</b>	68	-.028 p=.751	no	-.049 p=.694	no
<b>Number of sites worked</b>	68	.236 p=.018	*	.289 p=.017	*
<b>Number of siblings</b>	68	.101 p=.265	no	.137 p=.264	no
<b>Part of siblings working ASGM</b>	68	-.033 p=.711	no	-.044 p=.724	no
<b>Part of siblings working agriculture</b>	68	-.143 p=.111	no	-.19 p=.121	no

Table 26: Descending Site: Analysis of financial contribution to familial compound for metric variables. Source: Survey data, 2017.

	<b>Financial support for family XOF/month</b>				
	<b>n</b>	<b>Kendall-Tau-b</b>		<b>Spearman-Rho</b>	
		<b>Coefficient</b>	<b>Sig.</b>	<b>Coefficient</b>	<b>Sig.</b>
<b>Age</b>	85	-.009 p=.914	no	-.009 p=.938	no
<b>Number of children</b>	73	.045 p=.625	no	.06 p=.615	no
<b>Years on current site</b>	85	.038 p=.637	no	.056 p=.609	no
<b>Years work experience</b>	85	.066 p=.41	no	.092 p=.404	no
<b>Age starting work on site</b>	85	-.102 p=.196	no	-.13 p=.237	no
<b>Number of sites worked</b>	85	.085 p=.34	no	.109 p=.322	no
<b>Number of siblings</b>	85	.097 p=.229	no	.143 p=.19	no
<b>Part of siblings working ASGM</b>	84	.047 p=.555	no	.057 p=.608	no
<b>Part of siblings working agriculture</b>	85	-.02 p=.808	no	-.025 p=.82	no