

# Resistance to Mining

Enabling Factors and control of knowledge in uranium mining conflicts in Africa

PhD Thesis

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Doctorate programme in  
Environmental Sciences  
(ICTA-UAB)

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## Abstract

Resistance to mining is not new and nonetheless, resource extraction has been expanding materially and geographically during the last 50 years, reaching new frontiers, moving bigger quantities of soil and water and impacting more communities. The resistances that are emerging are becoming more relevant in shaping the commodity frontier and are an important factor in the political economy of mineral expansion. Thus, it has become crucial to understand why is resistance to mining emerging and how is it evolving.

Bringing attention to uranium, this often forgotten source of nuclear power, this thesis studies the industrial dynamics of uranium mining, its impacts and health implications, and the resistance at the uranium mining frontier in Africa. Namibia and Niger, the main producers of uranium in Africa, stand at the forefront of what was a global uranium rush partially slowed down by the Tepco-Fukushima accident.

This thesis proposes three enabling factors that help to explain the emergence and intensity of resistance by local communities to uranium mining: the ecology and geography of the resource; the degree and type of political and economic marginalisation of the community; and crucially, the creation of extra-local alliances that connect and integrate local concerns with broader social movements and global demands. I show how these three attributes play out differently in five Namibian communities that have been, or stand to be, affected by uranium mining, and explain how local ecologies of resistance shape, or fail to shape, the global uranium frontier.

The cases presented deal with Low Level Radiation caused by uranium mining affecting workers' health and those of people living in nearby communities. With people impacted claiming causal links that are still not scientifically sustained, the burden of proof is left to the communities. Through extra-local contacts local grassroots organisations in Niger and Namibia are engaging with scientists to produce new knowledge to learn how to protect themselves from the impacts and confront the manufactured uncertainty and other information produced by the mining companies. Using the co-production framework of Science and Technology Studies I argue that local and scientific knowledge is being co-produced through an activism which mobilises science. Locally driven, this 'Activism Mobilizing Science' process gives activists visibility and legitimacy to become new political actors and form part of an 'extended peer review' community (in Post Normal science language).

A second objective of this thesis aims at uncovering how resistance to mining has evolved. Whilst strikes, protest and demands linked to labour issues have dominated mining conflicts through history, we have seen how in the last two decades communities living in the surrounding areas of mining projects are increasingly opposing them on environmental grounds and objecting their lack of representation and participation in decisions concerning their development path. These groups are innovatively combining local narratives and alternatives with global discourses on rights (to clean water, to take decisions, indigenous rights) and environmental justice. Cross-scalar alliances have allowed local groups to increase their knowledge

about the projects, give them visibility and comprehend and act against their weak position in the global commodity chain. These alliances have also contributed to the emergence of a diverse set of resistance strategies such as legal court cases, activist-scientist collaborations or "consultas" at community level to reject mining projects. The response of the state and the mining companies to resistance is also explored.

The thesis concludes that whilst the resource and geography of a mining project are key determinants in a socio-environmental conflict, the community's strive for participation and recognition drive the connection and integration of local concerns with broader political demands and the control or production of new knowledge, key paths in the formation and success of resistance movements to mining.

## Resumen

La resistencia a la minería no es una novedad y sin embargo, la extracción de recursos se ha ido expandiendo material y geográficamente durante los últimos 150 años, llegando a nuevas fronteras, moviendo cantidades más grandes de tierra y agua e impactando a más comunidades. Las resistencias que han surgido son cada vez más relevantes, contribuyendo a la forma de la frontera de extracción y siendo a su vez un factor importante en la política económica de la expansión minera. Así pues, es cada vez más crucial entender porque surge resistencia social a la minería y como está evolucionando.

Esta tesis focaliza la atención en el uranio, la generalmente olvidada fuente de la energía nuclear, a través del estudio de las dinámicas industriales de la minería de uranio, los impactos e implicaciones a la salud, y la resistencia en la frontera de extracción del uranio en África. Namibia y Níger, los principales productores de uranio en África, están a la cabeza de lo que ha sido una fuerte demanda global de uranio parcialmente ralentizada por el accidente Tepco-Fukushima.

Esta tesis propone tres factores que pueden ayudar a explicar el surgimiento e intensidad de la resistencia de comunidades locales a la minería de uranio: la ecología y la geografía del recurso, el grado y tipo de marginalización política y económica de la comunidad, y crucialmente, la creación de alianzas externas que conecten e integren las inquietudes locales con movimientos sociales más amplios y demandas globales. Muestro como estos tres atributos juegan un papel diferente en cinco comunidades en Namibia que están o estarán afectadas por la minería de uranio, y explico como las ecologías locales de resistencia dan forma, o no, a la frontera global del uranio.

Los casos presentados tratan sobre radiación de bajo nivel causada por la minería de uranio que afecta la salud de los trabajadores y la de las comunidades cercanas a la mina. Con personas impactadas reclamando relaciones causales que no están probadas científicamente, el peso de probar su impacto queda relegado a las comunidades. A través de contactos externos, grupos de organización de base en Níger y Namibia están aliándose con científicos y produciendo nuevo conocimiento para protegerse de los impactos de la minería y confrontar la manufacturación de incertidumbre y otra información producida por las compañías mineras. Utilizando el marco de la co-producción en los Estudios en Ciencia y Tecnología (STS en inglés) yo argumento, que el conocimiento local y científico está siendo co-producido a través de un activismo que moviliza conocimiento científico. Impulsado localmente, este proceso de 'Activismo Movilizando Ciencia' (AMS en inglés) da a los activistas visibilidad y legitimidad para transformarse en nuevos actores políticos y formar parte de una "comunidad extendida de iguales" (siguiendo el lenguaje de la ciencia post normal).

Un segundo objetivo de esta tesis es descubrir como la resistencia a la minería ha evolucionado. Mientras huelgas, protestas y demandas relacionadas con temas laborales han dominado conflictos mineros a través de la historia, estamos viendo como en las últimas dos décadas comunidades que viven en las zonas aledañas a los proyectos mineros están oponiéndose cada vez más a los proyectos mineros por



temas ambientales y objetando su falta de representación y participación en las decisiones que conciernen su desarrollo. Estos grupos están innovando con una combinación de narrativas locales y alternativas con discursos globales de derechos (agua limpia, toma de decisiones, derechos indígenas) y justicia ambiental. Las alianzas entre escalas han permitido a grupos locales incrementar su conocimiento sobre los proyectos, darles visibilidad y comprender y actuar en contra de su débil posición en la cadena de producción. Estas alianzas han contribuido también a la emergencia de diversas estrategias como juicios legales, colaboraciones científico-activistas o consultas a nivel comunitario para rechazar proyectos mineros. La respuesta del estado y de las compañías mineras a esta resistencia también se explora.

La tesis concluye, que si bien los recursos y la geografía de un proyecto minero son factores determinantes en un conflicto socio-ambiental, el esfuerzo de una comunidad por adquirir reconocimiento y participar conduce a la conexión e integración de preocupaciones locales con exigencias políticas más amplias o a la producción de nuevo conocimiento, trayectos clave para la formación y éxito de movimientos de resistencia a la minería.

## Resum

La resistència a la mineria no és una novetat i no obstant això, l'extracció de recursos s'ha anat expandint material i geogràficament durant els últims 150 anys, arribant a noves fronteres, movent quantitats més grans de terra i aigua i impactant a més comunitats. Les resistències que han sorgit són cada vegada més rellevants, contribuint a la forma de la frontera d'extracció i sent alhora un factor important en la política econòmica de l'expansió minera. Així doncs, és cada vegada més crucial entendre perquè sorgeix resistència social a la mineria i com està evolucionant.

Aquesta tesi focalitza l'atenció en l'urani, la generalment oblidada font de l'energia nuclear, a través de l'estudi de les dinàmiques industrials de la mineria d'urani, els impactes i implicacions a la salut, i la resistència a la frontera d'extracció de l'urani a Àfrica. Namíbia i Níger, els principals productors d'urani a Àfrica, estan al capdavant del que ha estat una forta demanda global d'urani parcialment reduïda per l'accident Tepco-Fukushima.

Aquesta tesi proposa tres factors que poden ajudar a explicar el sorgiment i intensitat de la resistència de comunitats locals a la mineria d'urani: l'ecologia i la geografia del recurs, el grau i tipus de marginació política i econòmica de la comunitat, i crucialment, la creació d'aliances externes que connectin i integrin les inquietuds locals amb moviments socials més amplis i demandes globals. Mostro com aquests tres atributs juguen un paper diferent en cinc comunitats a Namíbia que estan o estaran afectades per la mineria d'urani, i explico com les ecologies locals de resistència donen formen, o no, a la frontera global de l'urani.

Els casos presentats tracten sobre radiació de baix nivell causada per la mineria d'urani que afecta la salut dels treballadors i la de les comunitats properes a la mina. Amb persones impactades reclamant relacions causals que no estan provades científicament, el pes de provar el seu impacte queda relegat a les comunitats. A través de contactes externs, grups d'organització de base a Níger i Namíbia estan aliant-se amb científics i produint nou coneixement per protegir-se dels impactes de la mineria i confrontar la 'fabricació' d'incertesa i altra informació produïda per les companyies mineres. Utilitzant el marc de la co-producció dels Estudis en Ciència i Tecnologia (STS en anglès) jo argumento que el coneixement local i científic està sent co-produït a través d'un activisme que mobilitza coneixement científic. Impulsat localment, aquest procés de 'Activisme Mobilitzant Ciència' (AMS en anglès) dóna als activistes visibilitat i legitimitat per transformar-se en nous actors polítics i formar part d'una "comunitat estesa d'iguals" (seguint el llenguatge de la ciència post normal).

Un segon objectiu d'aquesta tesi és descobrir com la resistència a la mineria ha evolucionat. Mentre vagues, protestes i demandes relacionades amb temes laborals han dominat conflictes miners a través de la història, estem veient com en les últimes dues dècades comunitats que viuen a les zones limítrofes als projectes miners estan oposant-se cada vegada més als projectes miners per temes ambientals i objectant la seva falta de representació i participació en les decisions que concerneixen el seu desenvolupament. Aquests grups estan innovant amb una combinació de narratives

locals i alternatives amb discursos globals de drets (a aigua neta, presa de decisions, drets indígenes) i justícia ambiental. Les aliances entre escales han permès a grups locals incrementar el seu coneixement sobre els projectes, donar-los visibilitat i comprendre i actuar en contra de la seva feble posició en la cadena de producció. Aquestes aliances han contribuït també a l'emergència de diverses estratègies com a judicis legals, col·laboracions científic-activistes o consultes a nivell comunitari per rebutjar projectes miners. La resposta de l'estat i de les companyies mineres a aquesta resistència també s'explora.

La tesi conclou, que si ben els recursos i la geografia d'un projecte miner són factors determinants en un conflicte soci-ambiental, l'esforç d'una comunitat per adquirir reconeixement i participar condueix a la connexió i integració de preocupacions locals amb exigències polítiques més àmplies o a la producció de nou coneixement, trajectes clau per a la formació i èxit de moviments de resistència a la mineria.

## Preface

In 2007 I lived for eight months in Cajamarca, Peru, working with GRUFIDES, a local organisation that supports resistance groups confronting the huge gold mining project of Yanacocha -as well as other mining projects emerging in the area-. This experience pushed me to study and understand the situation I encountered; community intra and inter divisions, little communication between the mining company and the numerous communities, water pollution claims with contradicting scientific reports, a two tier economy in Cajamarca, different layers of the state divided over which actions to take and increasing levels of violence. On my return to Barcelona I met Joan Martinez Alier who encouraged me to undertake the Masters in Environmental Science with a special focus on Ecological Economics at ICTA and carry on with a PhD. I decided not to study Yanacocha's mining conflict for several reasons; it had been widely studied by other scholars (e.g. Anthony Bebbington) and two colleagues at ICTA were already researching gold mining conflicts in South America. I wanted to explore instead an understudied mineral and geographical area; uranium mining in Africa.

During my PhD I collaborated in the coordination of two research projects. The Spanish Ministry funded project CSO2010 21979, which paid my salary, has been supporting 22 researchers looking at the links between social metabolism and socio-environmental conflicts. I also coordinated the work-package on nuclear energy of the EJOLT EU FP7 funded project and collaborated in several reports and workshops. Through my research I brought in and collaborated with three partners in EJOLT; with CRIIRAD we uncovered radioactive pollution on soil and water in the river nearby Rössing Uranium mine. With Earthlife Namibia (another partner) we collected further evidence on the health situation of mineworkers. We made a public presentation of these results (together with the London Mining Network) in May 2014 in London that caught the attention of The Guardian and several other newspapers who published our findings. These were also presented at the Annual General Meeting of Rio Tinto few days after and we got assurance by its CEO that workers have -and will have- access to their medical files.

My first article, in collaboration with my tutor Giorgos Kallis, was published in *Global Environmental Change* in 2012. I had a 6-month gap that same year due to maternity leave and resumed work in 2013 working on my second article that was accepted in *Ecological Economics* in February 2014. My third article is a literature review on 'resistance to mining' that was rejected by *Geoforum* (with two reviewers accepting it for publication subject to revisions and two of them rejecting it). After taking into account all the comments, it has been re-submitted and accepted in *Ecological Economics*.

During these years I have participated in several conferences on Ecological Economics (Bremen in 2010, Istanbul in 2011, Rio de Janeiro on 2012), the AAG geographers conference in 2012 and the Political Ecology DOPE conference in Kentucky University in 2014. I also participated in the World Social Forum in Dakar in 2011 and the People's Summit in Rio in 2012 giving several presentations and connecting with different organisations of interest for my research. I have helped

organise two summer courses on environmental conflicts and political ecology in ICTA and attended the last two summer courses in Barcelona and Greece. Last year I was assistant professor in Political Ecology in the Masters imparted by ICTA. I also recorded and directed a documentary film on uranium mining conflicts in Namibia.

I am also a member of Research & Degrowth with whom I participate in reading groups and collaborated in the organisation of the 2012 Conference in Barcelona. I have co-written with Mariana Walter a chapter on 'Commodity Frontiers' for the book 'Degrowth. Vocabulary for a New Era' recently published by Routledge. It is with this framework in mind that I carry out my research; resistance to mining movements (many times without knowing it) are rebelling against economic growth that is pushing the frontiers of extraction into their land.

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Giorgos Kallis has been an accurate, brilliant, patient and constant tutor. My main regret for finishing my PhD is that he will not be my tutor any longer!

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Mis amigos me han escuchado pacientemente hablar de mi tesis, y me han permitido olvidarla y permanecer cuerda. Gracias por nuestras charlas, chistes y buenos ratos.

Mis padres, me habéis empujado siempre a aprender y conocer mundo, gracias. Mis hermanas Cecilia e Isabel, habéis sido un gran apoyo todos estos años. Gracias por todo.

Cameron, this would not have been possible without you. Thank you for your constant support in allowing me to pursue this career; listening to my jabbering about mining conflicts, uranium, for taking care of our kids when I went to conferences or meetings, for giving me more time in the final stages to write up the thesis, for revising all my work. It has all been noticed. Thank you.



## Introduction

One of the first people I met in Namibia was Petrus Haobeb. He was my contact in Arandis, the town next to Rössing, the biggest uranium mine in the country. We met at the entrance of the town hall, now an empty huge carcass. He came over to greet me limping slowly. Walking back together to his home he started talking to me about the town; I should have seen it in its 'golden time' back in the 80s, all services were provided by the mine who usually also organised functions in the town hall and sport events with free food, drinks and presents. "But look now, not so good anymore" he sighed. The town suffered through the low uranium price and the bust of the 1990s. At the time of my visit, people were hoping for a new mining boom, a short-lived boom that seems to have come to an end after the Tepco-Fukushima disaster.

Stepping into Petrus' house -all houses are the same standard square building with a sandy entrance- his wife greets me with a faint smile. As I learn after, I am not the first foreign researcher or visitor that has come to see Petrus asking questions and leaving with no results, nobody there to really help them.



Petrus (on the left) and a friend also ex-worker at Rössing (source: author)

Petrus, like many other workers living in Arandis, started working in the mine when it started in 1976. Initially workers slept in barracks next to the mine and later moved to this purpose-built town. The main demands of workers during the 1970s and 1980s focused on labour conditions and salaries, with race discrimination being at the core of their demands. It was only in the 1990s that workers such as Petrus started to experience health problems. Petrus' story has perhaps transcended more



than that of other workers because -as he states- he has proof that he was radiated while working as a laboratory technician. Having to crush samples for analyses created a lot of dust and he often had to pipet samples that sometimes reached his mouth. Rössing's doctors generally denied any radioactive-related health impact but a visit to South Africa confirmed he had been radiated. In 2000 he couldn't work anymore and was diagnosed with severe anaemia, a radiation-related disease. After being very sick for four years he started recovering in the late 2000s.

Petrus has continuously written to Rössing management asking for compensation for sick workers like himself. For years he asked to receive at least 100% of his salary (he was obtaining 75%) and access to Medical Aid. When finally in 2011 he was given 100% of his salary, in Petrus' mind this meant the mine acknowledged he had an occupational related health problem. After all these years Petrus wanted an apology so he persisted in writing letters and giving interviews to researchers or journalists. But Rössing had no intention of acknowledging any wrongdoing and in 2012 they reversed its position and asked Petrus to go back to work. Petrus was distraught, he didn't feel fit to work again but couldn't get access to any 'independent' medical doctor other than the mine's doctors who were claiming that he could work. He didn't go back to work so he was retrenched and is now receiving nothing from Rössing.

Petrus' case is different from other cases at Rössing because has medical files that state he was exposed to radiation and has managed to survive to tell his story. His testimony represents that of many silenced cases; workers that started working when the mine opened when safety regulations weren't as strict, and are dying in silence. No information on the actual numbers has been provided, but testimonies talk of many, many workers.

What motivated me to come to Namibia was the story of Rössing and its workers and the 'uranium rush' that Namibia was experiencing. After a price hike in 2007 the government handed out 166 exploration licenses and there were talks of five to ten mines opening in the near future, all nearby or inside a national park. This expansion gave rise to different types of responses from the communities living nearby these projects. Whilst some communities, albeit with internal divisions, opposed this expansion; others were happily welcoming an investment near their community. Analysing and trying to understand these different responses has been a main undertaking of this thesis. I was motivated by a quest to understand why some workers and some communities, despite the risks and impacts of low level radiation (as the case of Petrus illustrates), welcome the mines while others don't. Secondly, I wanted to understand much better the complex politics of science behind cases such as Petrus' and the ways those like Petrus manage to wield the powers necessary to make a case, including in scientific terms. To elucidate this, I compared the experience from Namibia with a second case study in Niger, researching the science-based strategies pursued by activists in their fights against uranium mines. These case studies were combined with an extensive literature review to uncover, more generally, the motivations, strategies and changes of resistance to mining.

Uranium is the focus of this thesis. It is mostly used as fuel for nuclear power and has very particular characteristics not only because of the risks that its extraction entails

but also due to its demand and production patterns. When compared with other minerals, radioactivity is an added albeit invisible factor. Over the years knowledge about its impacts has been increasing together with the protection methods required. But uranium shares many commonalities with other minerals. It too has to be mined, removing and processing huge quantities of ore with several common environmental impacts; acid mine drainage, the risk of collapse of the waste dams, high water consumption, accidents in the transport of toxic products. Other social and cultural problems common in mining communities include internal community divisions, increased alcoholism and prostitution, incompatibility and conflict with other land uses such as agriculture and the creation of a two tier economy with the arrival of external workers (Pegg, 2006). In response to these impacts, another common trait is the spread of resistance to these projects, albeit with different degrees of organisation and violence, narratives and strategies.

In order to analyse resistance to mining this thesis is bridging political ecology and ecological economics together with literature on environmental justice, social movements, Science and Technology Studies (STS) and participation. The analysis of social metabolism provides a good framework to understand the expansive drive of capitalism and the havoc created at the commodity frontiers. Whilst ecological economics helps us understand why this expansion is happening, political ecology explains how this process is taking place. The materiality of this expansion is pushed by consumption centres and linked through a commodity chain of extraction and transformation that causes impacts in each step of its chain. This thesis focuses on the impacts and resistance at the first step, namely extraction. Political ecology helps uncover not only the social and economic inequalities of this commodity chain but also the power differences and how these shape and reinforce these inequalities.

This thesis contributes moreover to the already well-explored link between power and knowledge. Using STS and participatory literature I innovatively explore a process whereby power structures are being challenged through knowledge creation. I also draw into social movement literature to develop an understanding of how resistance to mining can emerge and evolve also comparing it to the New Social Movement (NSM) paradigm.

Following this introduction, I explain next the key questions and objectives guiding this research. Even though each chapter has its own theoretical framing, in section 2 I encompass and expand the main literature used. The methodology is presented in section 3. The following three chapters are the results of my research and the main contribution of this thesis. The first two chapters are already published whilst the third has been accepted for publication. In the conclusions I pull together the various threads of my thesis synthesising my contribution and linking them to the current situation in my case studies. I finalise by sketching out three future research proposals emerging from this thesis.

## **1. Aims and Research Questions**

Resource extraction and conflicts have occurred throughout history, however during the last 50 years it has been expanding materially and geographically reaching new frontiers (Bridge, 2004a; Krausmann et al., 2009), moving ever greater quantities of soil and water (Prior et al., 2012) and impacting more communities (Martinez Alier,

2003). Encompassed by a communications revolution that is connecting and making more visible all these fights (Della Porta and Tarrow, 2005; Castells, 2013), the emerging resistances are becoming more relevant in shaping the commodity frontier and are an important actor and factor in the political economy of mineral expansion. Thus, it has become crucial to understand the circumstances that allow for resistance to mining to emerge:

Why does resistance to mining emerge? Why do some communities react to mining whilst others do not?

Using grounded research theory I have analysed the expansion of uranium mining in Namibia uncovering what factors allow for resistance to mining to emerge. Namibia is the second largest producer of uranium in Africa and fifth largest in the world, which helps understand how resistance (or the lack of it) can shape the advancement of the uranium frontier in Africa and elsewhere:

How is resistance shaping uranium mining expansion?

In order to research how this resistance is taking place on the ground I studied the micro-politics of knowledge control and how they can shape resistance and conflicts. Scientific knowledge has traditionally been seen as supporting hegemonic political forces such as mining companies. Through the role of expertise assumed by scientists, science and technology act as political agents in the relations between the state, mining companies and local groups. But scientific knowledge doesn't always favour strong corporate actors and has been used or constructed by grassroots organisations in mining conflicts:

What is the role of scientific knowledge in a mining conflict? How is it contested? Why are grassroots organisations engaging in knowledge production?

An activist strategy involving scientific knowledge production was identified and explored also using uranium mining in Africa (Niger and Namibia) as case studies. Beyond Africa and uranium I also investigated the role played by experts in these alliances through the figure of Robert Moran.

Resistance to mining is not new; strikes, protest and demands mostly linked to labour issues have dominated mining conflicts through history. Although environmental complaints against mining are not new, this thesis explores a hypothesis whereby a shift from labour to environmental complaints has been occurring. Uncovering this shift, I analyse how resistance to mining has evolved during the last two decades. Aims, motivations, narratives and strategies of the resistance movements to mining -as well as the mining industry- play an important role in shaping the commodity frontier.

Is resistance to mining changing? Which strategies are being used by community groups? What are their discourses? How is the extractive industry responding?

Through a literature review I have analysed different authors' views on the main demands, discourses and strategies used by communities resisting mining as well as corporate and state responses.

## **2. Literature overview**

In order to outline and describe this thesis' contribution to the literature I explore below in depth the main academic fields that frame my research. The study of social metabolism in ecological economics is crucial to identify geographically the social and ecological pressures of consumption chains. Ecological distribution conflicts are not new; they are in fact part of the history of capitalism's accumulation process as I show below using mining cases. To understand how this unequal distribution takes place I draw on the analysis of power and knowledge through political ecology and science and activism literature. In the last section I introduce what uranium is, its main characteristics and risks as well as justify why I chose this particular mineral as a focus for my study.

### **2.1 Social Metabolism and Ecological Distribution Conflicts**

Ecological economics views society as part of wider environmental dynamics, from where we extract materials and energy and return them in the form of waste. In order to explore these dynamics, the study of social metabolism looks at the physical throughput of flows of material and energy between human societies and the environment. Several methodological tools like Human Appropriation of Net Primary Production (HANPP), Virtual Water or Material and Energy Flow Accounting (MEFA) have been developed to analyse this material and energy exchange (Haberl et al., 2007; Fischer Kowalski, 1998). One of the most commonly used indicators in MEFA is Domestic Extraction (DE) as a measure of natural stocks depletion. Whilst on a global scale all resources extracted are consumed, on a country level trade is taken into account looking at Domestic Material Consumption ( $DMC = DE + \text{imports} - \text{exports}$ ). These studies look at biomass, fossil fuels, construction minerals and crucially for this thesis metal and industrial mineral ores (Schandl and Eisenmenger, 2006; Krausmann et al., 2009; Schaffartzik et al., 2014). Whilst biomass products have low specific impact per tonne and are generally extracted in large amounts, inorganic resources such as minerals have high impacts and are extracted in smaller quantities. Some minerals such as gold, diamonds or uranium exist at such low concentrations that the impacts per unit of extraction are even higher (Schandl and Eisenmenger, 2006).

Comparisons between countries and regions and across time have been growing with more databases being compiled using the standardised methodology proposed by Eurostat (2001, 2007). Thanks to these tools relevant data has been compiled to ascertain and characterise the rise and geographical expansion of material demand. One of the best examples is the global analysis carried out by Krausmann et al. (2009) using data ranging from 1900 to 2005. They show how from 1900 to 1950 the share of biomass declined from roughly 75% to less than 50% whilst the share of ores and industrial minerals increased rapidly. In fact, by the end of the century, non-renewable resources accounted for more than 70% of total material use. During this period, extraction worldwide increased an average 3.4% per year (Schaffartzik et al., 2014). The rise of extraction of non-renewable minerals is linked to an increase in

per capita use of materials. Population, a usual culprit due to its link to human nutrition and in turn to biomass production, in fact increased at a lower rate than non-renewable mineral extraction.

One of the highest metabolic changes (in the last century) was found between the end of WWII and the first oil price shock when the amount of materials and energy used per capita more than doubled (Krausmann et al., 2009). The shift in the resource base from biomass to non-renewable resources is typical of economies that have undergone a process of industrialisation (Schandl and Schulz, 2002; Krausmann et al., 2008). During this shift, material and energy extraction is not appropriated by all in an equal fashion. Wallerstein (1974) introduced the concepts of core and periphery to show how the shift from feudalism to capitalism accumulated wealth in core countries with high capital-intensive production (some European cities in the 16<sup>th</sup> and 17<sup>th</sup> C.) whilst the European and non-European periphery provided low-skill labour and raw materials.

This shift started to occur after the 14<sup>th</sup> C. feudal crisis. Extraction in Europe was becoming increasingly prohibitive due to the decimation of forests and forest enclosures that was causing steep rises in the cost of fuel for extracting silver. The New World offered rich deposits and accessible labour power that is exemplified by the “silver mining complex” in Peru (Moore, 2003). Potosí became a fertile ground for the extraction of silver commencing a process of unequal ecological exchange between American peripheries and the European cores. The ecological transformation was vast; silver smelting caused massive forest clearance that was partially halted with the use of the amalgamation technique. This however was accompanied by massive disruptive hydraulic infrastructure and the need to extract mercury. The Huancavelica mine also in Peru was used for this purpose creating socio-ecological impacts of its own with mercury poisoning adding to standard occupational hazards. In terms of labour, the initial self-organised Indian mineworkers were substituted by the ‘mita’, a rotating annual labour draft that conscripted one in seven male adults to work (mostly) in the mines (Dore, 2000). It was accompanied by a “large scale reorganisation of space” (Moore, 2003) that resettled native population into Spanish-style towns known as ‘reducciones’, transforming common and community land into a new common-field system that combined farming and herding maximising productivity with less labour; the workforce that was needed in the mines. Miners worked strenuous shifts in hazardous conditions as mines went deeper in search of more minerals becoming increasingly unsafe.

By early 17<sup>th</sup> C. Potosí’s riches declined and Zacatecas in Mexico was already becoming the new frontier of extraction (Moore, 2003). The ecological exhaustion (and environmental destruction) occurring at peripheral extractive areas was pushing expansion to fresh land. Further expansion is possible as long as there remains un-commodified land, products and relations (Moore, 2000). The expansion of the commodity frontier meant that more areas were included in the capitalist system.

With the introduction of fossil fuels, the industrialisation process of previously peripheral areas intensified during the 18<sup>th</sup> and 19<sup>th</sup> C. spreading to more countries

in Europe and North America, becoming themselves core and semi-peripheral countries. Due to increasing internal country divisions of labour and resource exploitation, a core and periphery was also developed within each country. This occurred mainly through the displacement of small-scale agriculture by factory production; many peasants became disconnected from their land and their social metabolism through a process known as metabolic rift (Marx, 1976). This shift also implied that flows of products (and nutrients) were transported from the countryside to the cities causing degradation at points of extraction and pollution at points of consumption (Moore, 2003).

The transition to capitalism from an agrarian to an industrial society and metabolism is still underway. Several regions have been increasing their metabolic profiles during recent decades. China, India, Mexico and Brazil are on the industrialisation path with people moving from agriculture into urban-industrial centres (Krausmann et al. 2008, 2009). Regions and cities of these developing countries are making their way up towards a material intensive standard of living (see for Asia as a whole Schandl and West, 2010; Muradian et al., 2012, and Singh et al., 2012 for India). New frontiers in Latin America and Africa are being explored and exploited becoming new peripheries for the extraction and supply of natural resources to new industrial cores and at the same time beginning the transition towards an industrial type social metabolism (Schaffartzik et al., 2014).

Regions in Europe and North America that are in more advanced stages of industrialisation are net importers of materials from peripheral countries (Giljum and Eisenmenger, 2004). Relative dematerialisation (an increase in material use efficiency) is becoming standard in this type of advanced industrial economies. It is however not accompanied by lower material consumption overall supporting the Jevons paradox thesis or rebound effect argument which claims that technology and eco-efficiency alternatives lead in fact to a decrease in the actual cost of production therefore increasing demand (Polimeni, 2008). Contrary to its objective of reducing environmental damage, resource use efficiency can contribute to further environmental burden through increased extraction and production arising from increased demand. Haas et al. (2015) point out that in 2005 the EU-27 had an average material use per capita of 15.8 t/cap/yr, 64% above the global average, being also a material net importer amounting roughly to 20% of its Domestic Material Consumption (DMC). These economies have incorporated agriculture into the industrial regime and have shifted to the service sector whilst labour and intensive activities like mining are outsourced (Krausmann et al. 2008). Bruckner et al. (2012) point to a decline in domestic extraction of materials in industrialised core countries that has been substituted by imports from peripheral countries, shifting at the same time the environmental burdens and the socio-environmental conflicts associated. This has also been motivated by the neoliberal reforms and structural adjustment plans put forward in many countries under the auspices of multilateral organisations like the World Bank (Gordon and Webber, 2008; Campbell, 2009). In the extractive sector this translated into changes in mining legislation and tax holidays that resulted in a rapid increase in mineral production, especially in South America (Bridge, 2004a). Several studies have linked the change of the metabolic profile of peripheral countries like Ecuador, Colombia and Argentina that

increasingly rely on extraction for export, with an increase in socio-environmental conflicts (Vallejo, 2010; Vallejo et al., 2011; Walter et al., 2013).

Although mining techniques have changed since the Potosí silver complex, the present ecological implications of mining are vast; topsoil vegetation is removed, generally implying deforestation and huge biodiversity loss that is into smaller areas. Water is extracted and used in large quantities, generally competing with local uses, affecting its availability and quality. In the periphery we find poor and marginalised communities who have direct reliance on natural resources to sustain their livelihoods. These communities at the extraction frontiers bear the burdens of pollution obtaining sometimes little or nothing in return, setting the stage for resistance movements.

Presently resistance to mining is articulated mostly around environmental and health issues. In the past, with welcome exceptions (Dore, 2000; Perez Cebada, 1999), labour and wage issues seem to have been much more important concerns and the main demands of resistance movements. Bebbington et al. (2008a) identified these changing dynamics however drawing almost exclusively from literature of the past decade. In order to make an argument about a change from one era of extraction to another, there was a need to review comparable literature from the previous era as well; something I have attempted to do in this thesis.

During the last two decades of ecological distribution conflicts, not all groups or communities reacted in the same way to an extractive project landing in their territory. Different types of environmentalism have emerged to confront all these impacts. Core regions -like most of the US and Western Europe- that are at a post-industrialisation stage have seen the emergence of a New Social Movement based on post-material lifestyles that want to protect the environment for its aesthetic or leisure value (Inglehart, 1990). What Guha and Martinez Alier (1997) define as 'cult of wilderness' is closely linked to conservation efforts. Also conservationist, but for very different reasons, is the environmentalism posed by peripheral communities at the commodity frontiers. These communities often protect the environment because it provides them with the materials that support their livelihoods, or because it is interlinked with essential features of their culture and worldview. The environmentalism of the poor is a movement born from the resistance against the disproportionate use of environmental resources and services by the rich and powerful (Martinez Alier, 2003). However, one also finds that communities might actually want the development proposals of the industry engaging in negotiations and CSR programs. In reality, internal community divisions are common with different individual visions at play of what the project will entail. Although, as explored in Chapter 1, some scholars (Peet and Watts, 1996; De Echave et al., 2009) have made attempts to understand these varied responses, there is more scope in the literature to explore why resistance to mining emerges and what factors can determine its rise and development.

Also important in the study of ecological distribution conflicts (under the ecological economics discipline) are valuation techniques and the post normal science framework. The industry has traditionally used cost-benefit analysis and Environmental Impact Assessments to calculate or trade off the gains and losses of

environmental change caused by mining projects. Monetary valuation is the standard currently dominant utilitarian approach (Martinez Alier et al., 2010). Several authors have pointed out that these methods don't provide adequate descriptions of the environmental values people actually hold (Spash, 2000; Söderholm, 2001; Temper and Martinez Alier, 2013). Values such as sacredness, livelihood, participation, or biodiversity are difficult to reduce to a price. Prices imply the use of power by the capitalist society that imposes its own standard of valuation allowing an unfair trade-off of socio-environmental externalities for economic benefits. In ecological economics, methods such as participatory multi-criteria evaluation and deliberative evaluation (Zografos and Howarth, 2008; Munda, 2008) have been developed that acknowledge the 'incommensurability of values' (Martinez Alier et al., 1998) and allow for the use of multiple criteria in the evaluation of projects in order to overcome cost-benefit analyses. Rather than use this tool to "solve" socio-environmental conflicts (Wittmer et al., 2006), Larrea et al. (2014) suggest that due to strong power inequalities these tools should serve as a "dynamic process of appraisal and learning" aimed at structuring and nurturing on-going deliberations and decision making processes.

On many occasions however, uncertainties over related risks, costs or even benefits of a project make it very difficult to ascertain its viability. High uncertainty and risk are inherent due to, for example, the impacts of acid mine drainage, the use of cyanide in gold production or radioactivity in the extraction of uranium. In order to prove an impact and put a price on it or remediate it, science has traditionally looked for objective methodologies and empirical testing (Bidwell, 2009). In the case of health impacts epidemiological tests require high probability assurances that are very difficult to achieve when samples are small or complex (Brown, 1992). Scientific doubt is thus used to justify inaction (Bidwell, 2009).

Funtowicz and Ravetz (1995) wanted to bridge the gap between scientific experts and concerned citizens by proposing a normative framework where an extended peer community could address different concerns around (for example) a mining project. A peer community could include interest groups, politicians, lay citizens and scientists in order to exchange not only technical information but also values, history and personal experiences (Bidwell, 2009). There has been no attempt to date to identify and analyse actual cases of local actors that claim and make themselves part of an extended peer community. In Chapter 2 I analyse how activist groups are trying to open up a conventional scientific process and turn it into a 'post-normal' one positioning themselves as an extended peer review community with a stake in the decision.

## **2.2 Political Ecology**

Political ecology further explores the use of different valuation languages, not only analysing the demands, narratives and issues in dispute, but also understanding how the exercise of power can influence and impose certain discourses. Who has the power to impose certain valuation languages (such as monetary)? Who has the power to impose the procedure to reach decisions on resource extraction, land use, pollution levels, or development paths? (Martinez-Alier, 2001a, 2001b, 2003; Robbins, 2004).



Political ecology understands that the costs and benefits in ecological distribution conflicts are for the most part distributed unequally among different actors, reinforcing existing social and economic disparities (Bryant and Bailey, 1997). It aims at uncovering the winners and losers, the differential power and the hidden costs that produces social and environmental outcomes (Robbins, 2004).

A political ecology perspective is based on the premise that ecology is political; that ecological arguments are never socially neutral and conversely that all political projects have ecological implications (Harvey 1993). Political ecologists are therefore keen to “understand the dynamics and properties of a ‘politicised environment’” (Robbins, 2004). In fact, the emergence of political ecology was a response to different apolitical accounts of environmental changes such as purely ‘natural’ explanations of disasters and ‘hazards’ that didn't take into account political economic structures affecting the vulnerability and resilience of different groups (Bryant and Bailey, 1997; Peet and Watts, 1996). Bryant (1998) traces the origins of political ecology to radical geographers that rejected simplistic neo-Malthusian explanations of ecological changes such as land degradation (Blaikie and Brookfield, 1987). Focusing on local case studies, cultural and anthropological approaches later influenced this work identifying cultural patterns as an explanation of environmental-human relations. In this sense, Vayda and Rappaport (1968) argued anthropological research should encompass the ecosystem in which humans are embedded instead of looking at cultures in isolation. Rappaport's brilliant account of the agricultural ecological energetics and the religion of the Tsemgaba Maring tribe in Papua New Guinea showed how pig killing rituals served as “adaptive structures” to control pig population. When the energy cost of keeping the pigs became too high, religion tended to recommend ritual killing (and eating) of the pigs. These studies have been criticised for being narrowly local, neglecting the broader political economic forces within which communities make decisions and lacking historical perspectives (Peet and Watts, 1996). In order to allow for wider political economic considerations some authors turned to neo-Marxism, linking environmental degradation with social oppression and wider socio-economic structures. Bunker (1985) did an excellent analysis of the enclave extractive economy in the Brazilian Amazon where manganese, tin and bauxite mining were not creating any forward or backward economic linkages. At the same time land deforestation, the substitution of small-scale staple-crop agriculture and short boom mining cycles were creating social havoc and allowing for foreign interests to accelerate exploitation and degradation. Through direct investment or subsidies to private enterprise Brazil's central government advanced into the Amazonia trying to secure and control vast areas of land, as well as paving the way for the increasing commercial agriculture and industrial development in order to supply their core urban population. In contrast, the Amazon extractive peripheries maintained simplified low energy institutions and society. These studies have been criticised for over-determining the outcomes through established socio-economic structures, downplaying the role of weaker or local actors and their capacity to confront unequal power structures. They do however provide a plausible analysis of how “the subordination of extractive economies to productive economies in a world economic system” result in an uneven development of regions within and outside Brazil (Bunker, 1985; 13). Bunker had much influence in the development of the theory of ecologically unequal exchange. He wrote a (posthumous) chapter in the book edited by Hornborg, McNeill and

Martinez-Alier (2007) that brought together for the first time the studies of social metabolism with the perspective of world system history.

The apparent dichotomy between cultural vs. productive explanations for change was solved in later works during the 1990s as authors started to encompass concepts from different fields. These included ethnic and gender studies (Agarwal, 1992; ; Jones and Painter, 1995; Rocheleau et al., 1996; Schroeder, 1993), cross-scalar analyses of conflicts (Bassett, 1988) that take into account institutional and development processes (Peet and Watts, 1996; Zimmerer et al., 1996), and crucially for this thesis an increasing interest in the power of grassroots actors in social movements and conflicts over resource control (Guha and Martinez Alier, 1997). In this line, conflicts over colonial legacies were particularly explored as they uncovered how the wealthy and political elites had accumulated power, being able to impose organisational systems as well as discourses. Both Guha in India (1989) and Peluso in Indonesia (1992) analyse the forestry policies imposed by forest officers and the reactions of peasants against them. Studying the Chipko movement against deforestation in India, Guha (1989) argued that peasants in Garwhal and Kumaun in the Himalaya had historically defended their traditional systems of livelihood (based on oak production and use) against colonial pine plantations (for the railways) and other post-colonial commercial use of the tree plantations. Using social metabolism language, Guha's work discussed who (the colonial power, the commercial interests, or the local peasants for their own subsistence) was taking the human appropriation of biomass (HANPP). Rangan (2000) later on argued that local peasants were in fact immersed in the global market economy and only reacted against the industrial contracts taking the flow of income from their hands (Robbins, 2004). Political ecology ultimately uncovers the underlying factors that trigger conflict and resistance, trying to avoid romanticised or preconceived ideas.

The reasons why resistance movements in extractive conflicts emerge are therefore varied ranging from cultural and social to purely economic. This thesis identifies the need to systematise, under a political ecology perspective, not only the factors that allow for a resistance movement to emerge but also how resistance occurs uncovering the strategies and discourses used.

### **2.3 Power, knowledge and activism**

Political ecology has also been merged with post-structural ideas looking at the links between knowledge and power and how these shape cultural discourses, different knowledges and development ideas (Castree and Braun, 1998; Escobar, 1996; Peet and Watts, 1996). A post-structuralist approach focuses on the historical and cultural evolution of concepts that describe environmental change and degradation. It explores how political forces (and power) along these changes have influenced our understanding of environmental and social issues and uncovers the epistemology of resource use; who has the right to speak, what information or knowledge is useful, who decides whether a project goes forward or not (Forsyth, 2002).

Through history, knowledge has been a contested political tool generally appropriated by strong actors such as colonisers (Neumann, 1996; Peluso, 1993) or the state (Sletto, 2008) to serve their own purposes. In socio-environmental conflicts knowledge has traditionally been seen as supporting hegemonic political forces and

actors. Through the invisible role of expertise assumed by scientists and academic institutions, science and technology act as political agents in the relations between the state, big corporations and local groups.

But scientific knowledge doesn't always favour strong corporate actors. It can also be used or constructed by lay people; practitioners, NGOs or local groups to expose wrongdoings or improve practices and knowledge. Lay people are becoming activists that can either use existing scientific knowledge for their own purposes or produce new knowledge. Martinez Alier et al. (2011; 2014) explore the knowledge exchange between activists, academia and policy circles: from science to activism, and from activism to science. They describe how grassroots organisations or NGOs in socio-environmental conflicts are using scientific research developed by academia. An example is the use of the EROI (Energy Return On energy Input) by indigenous organisations in Canada against the extraction of oil sands. They denounce the huge amount of energy needed to extract each unit of oil. Activists also are continuously producing new knowledge that in some cases is adopted by scholarly and political spheres. Some examples are ecological debt, biopiracy or food sovereignty (Martinez Alier et al., 2014).

This knowledge is produced by activists either by becoming scientists themselves or in co-operation with scientists giving way to multiple activist-scientific liaisons. Under the counter-expertise umbrella (Topçu, 2008) we can find scientist-advocates (Brown, 2006), civic expertise (Bäckstrand, 2004), activist scholarship (Hale, 2008), expert-activists (Allen, 2003; Frickel, 2011), citizen-experts (Tesh, 2000; Fischer, 2000) and grassroots tech groups (Hintz and Milan, 2010) among others. One of the first and best-researched fields is AIDS and health related activism (Epstein, 1996; Robbins, 2004) whilst recently these liaisons are appearing more prominently in pollution and waste environmental justice conflicts, especially in the US (Allen 2003; Corburn, 2005). Scientific activism is studied by different fields including Science and Technology Studies (STS) (Woodhouse et al., 2002), risk communication (Tesh, 1999), risk assessment and through the role of citizen and local knowledge in public policy (Corburn, 2005).

These activist-scientific alliances are crossing borders and scales with activists engaging in knowledge creation in order to challenge the knowledge produced by companies in ecological distribution conflicts. Far less explored by the literature are the micro-processes of knowledge creation and exchange and how these alliances play out in developing countries where education, research tools and institutional and policy arenas are much less developed. Some exceptions include the work of Delgado (2009) that analyses the role of trust in expertise in the 'Movimento Sem Terra' in Brazil or local activists challenging REDD+ accounts (Gupta et al., 2012). There is still however scope in the literature to study how knowledge is created and articulated in environmental justice or ecological distribution conflicts, an endeavour of this thesis. As explored below, environmental justice conflicts place emphasis on distributional aspects between core and periphery, including how knowledge is traditionally produced and circulated.

## 2.4 Environmental Justice

Power relations and asymmetrical distribution of goods and bads is being challenged in numerous ways by alternative discourses that emerge from social movements. These discourses are becoming global as they represent and capture local struggles all over the world. This has been the case of the Environmental Justice (EJ) discourse. Closely linked in the US to environmental racism, it emerged after the realisation that Afro-American communities were unequally over-exposed to toxic waste and hazardous conditions. Distributional aspects have been a core theme in this movement. Analysts in the United States have been using spatial maps combining data of environmental hazards, race and income to identify disproportionate siting of industrial hazards in poor and minority communities.

The EJ discourse has been adopted by both activists and academics across the globe. Walker (2009) lists no fewer than 37 countries in which the environmental justice frame has been used, including resistance movements in mining conflicts. However, differing from the US, clear correlations between race or poverty and environmental risk do not typically appear in many developing countries where mining investment is flowing. In Latin America Carruthers (2008) points out how industrial hazards are distributed widely throughout metropolitan zones and outskirts with lower-class or working-class urban residents facing the same risks as middle-class or upper-middle-class residents. In the mining conflict of Cajamarca with Yanacocha gold mine, middle-class urban residents joined protests against the expansion of the mine to Mount Quilish in 2004 due to a shared perception of the pollution risk to their watershed.

Whilst in the US the unfair distribution of environmental hazards is generally due to deliberate policy decisions (Pellow 2000), in Latin America and other developing countries, the distributional aspect is related to the ecological unequal exchange between the consumer core and resource-producing peripheries -as well as internal colonialism and class relations (Kay, 2010)-. A general argument behind resistance is that foreign mining companies export most of their profits abroad in exchange for taxes, royalties and development packages that benefit a few but leave behind lasting environmental impacts.

As Schlosberg (2007) remarks, justice is not only about securing a fair distribution of goods and bads. Treating others justly also involves recognising their membership in the moral and political community. Communities desire the recognition of their individual rights as well as collective identities and needs, concerns and livelihoods (Urkidi and Walter, 2011). Another dimension of EJ links the marginalisation of communities to the need to promote their capabilities for their functioning and flourishing. In ensuring this, you facilitate their inclusion in political decision-making. All these aspects, Schlosberg (2007) argues, are interwoven and interdependent; one cannot pursue participation without certain capabilities, in the same way that to express a voice you need to be recognised as an agent. In order to understand the distributional aspect you need certain capacities and to claim your rights you need to participate. One cannot pursue one dimension of justice in isolation. Communities want to be recognised as agents capable of taking decisions about their lands and future, as well as participate in all levels of decision-making.

These aspects of EJ not only emerged as the discourse expanded globally. As pointed out by Cole and Foster (2001), EJ movements in the US such as tribal or labour movements already included other aspects apart from the distributional. An important movement especially relevant for this thesis and the origin of the EJ movement in the US is the quest of the Navajo people for recognition and compensation for the impacts they suffered –and continue to suffer- due to uranium mining. From World War II until 1971, uranium was mined in four south-western states of the US drawing many Native American as workers in the mines and mills. The US government was the sole purchaser of this uranium. Despite a well-developed understanding of the risks this activity entailed due to radioactivity, few protections were provided for mineworkers before 1962 resulting in high rates of illness among miners. After a long struggle for recognition, in 1990 was passed the Radiation Exposure Compensation Act. From an estimated 10000 uranium workers about a quarter were Navajo. In 2001, 40% had applied for compensation (Brugge and Goble, 2002).

Several aspects of environmental justice such as recognition, participation and demands of remediation and compensation are interwoven in the struggles of resistance movements to mining. An analysis of the literature of how the environmental justice frame has been used and instrumentalised in resistance to mining cases (in the literature) will shed light into what aspects are more relevant and how is the term evolving in this context.

## **2.5 Why uranium mining? Why Africa?**

One of the metabolic chains that has intensified extraction in the global periphery to fuel growth at the industrial core is that of nuclear energy. Despite supplying 11% of the world's electricity, nuclear energy has several commonly known criticisms, namely security, nuclear proliferation, waste and cost. This thesis wants to bring attention to another not-so-well-known risk in the nuclear energy complex; uranium mining and milling. The extraction and processing of uranium ores encompasses all the impacts associated with mining production such as high water consumption or acid mine drainage with the added hazard of radiation. Uranium mining has been less studied than other commodities such as gold, copper or coal. Although coal is used in energy production generating carbon emissions and contributing to climate change, uranium and nuclear energy spread radiation creating numerous under-explored effects on our environment and health. The issue of radiation accentuates scientific uncertainty, making it ideal to study how activists organise to contest scientific claims, one of the objectives of this thesis.

A quick introduction into the hazards of uranium mining will help contextualise this thesis.

All natural uranium isotopes (uranium 238, uranium 234 and uranium 235) are radioactive, meaning that their nucleus is unstable. These atoms naturally decay transforming into new atoms commonly known as daughter products. For example in the case of uranium 238 the decay process entails the creation of 13 radioactive daughter products, ultimately creating lead. In each decaying step ionising radiation in the form of alpha and beta particles and gamma rays is emitted. Gamma emissions are very penetrating and can travel tens of meters through the air. Alpha radiation is

less penetrating and can be totally stopped by a sheet of paper or a plastic bag. It is however particularly dangerous if its ingested or inhaled (through water, food or dust). Most of the gamma emissions from the uranium-238 decay chain come from the decay of radon 222, the only gas in the decay chain.

Uranium-238, uranium-235 and their daughter products are present in the soil, water, air, flora and fauna. The radiation emitted by these radionuclides is called natural background radiation. When uranium ore is buried underground, the radiation levels at the surface of the soil remain usually low. However when this uranium is mined and surfaced, uranium nuclides can contaminate water bodies as well as travel through the atmosphere due to dust or gas radon (radon 222)-emanating emissions as it decays.

The impacts of uranium mining therefore begin in the exploration phase. In order to ascertain the quality of the ores, trenches and deep holes are dig that can severely alter the hydrogeology of the underground water system. Once the mining operations start with the extraction and crushing of ore, as well as through the milling process to produce yellow cake, there is a continuous transfer of radionuclides into the biosphere. But yellow cake is not the only outcome of mining; radioactive waste is produced in many different forms. The biggest impacts come from waste rock (uranium ore of low quality and therefore not processed) and tailings (waste product of uranium milling operations). Tailings contain all the radioactive metals of the uranium decay chain which have not been extracted in the mill, especially thorium-230 and radium-226 whose half-lives are 75,000 years and 1,600 years respectively.

The workers of uranium mines and the local population living on the vicinity of the mine are exposed to low doses of radiation, increasing the risk of cancer and other pathologies. Cancer may occur from a few years to decades after exposure to radiation. Is extremely difficult to prove if a cancer case is linked to exposure to ionising radiation, needing huge cohorts and large epidemiology studies.

Uranium - like many commodities although for different reasons explored in Chapter 1- has experienced patterns of investment and disinvestment that have greatly affected the mining frontier. Already mentioned, the southwest of the US where the Navajo live has experienced two boom and busts with thousands of people being employed and retrenched and whole towns built and almost wiped out (Amundson, 2002). Another boom occurred in 2007 provoking a 'uranium rush' this time in Africa. Hundreds of exploration licenses have been conceded in 35 African countries (wise uranium, 2015). With little or no information on uranium reserves, mineral abundance is not the main driver for mining companies in Africa. According to World Economic Forum data the environmental regulation and enforcement is 27 and 30% worse in Africa and Latin America than in developed economies (WEF, 2015).<sup>1</sup>

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<sup>1</sup> Rates are from 1 to 7. Stringency of environmental regulation is 3.86 in Africa and 3.89 in Latin America

Coupled with high levels of corruption, these countries are attractive for mining companies who want lower production costs.

Namibia and Niger, the two case studies of this thesis, have had uranium mining for more than 30 years. They are the biggest producers in Africa and 4th and 5th in the world with 8% each of global output in 2012 (OECD, 2013). With operating mines and well-known resources, they became a prime target for mining companies during the uranium rush.

Despite having had uranium mining for several decades, research on the environmental and social impacts on these two countries have received close to no academic attention to date. It is perhaps due to the uranium rush that more attention is now being placed not only on Namibia but on other countries like Tanzania or Mali that also stand at the commodity frontier.

### **3 Methodology**

This section explains the research strategies and techniques used to gather the data and derive the findings of this thesis. This research aims at responding why resistance to mining emerges, how it's carried out and what is the role of newly acquired scientific knowledge in ecological distribution conflicts. In the first part I used grounded research theory and field data collected through semi-structured interviews and document collection. In order to respond how resistance to mining is being carried out I employed different methodologies. A single and multiple-case study approach was used in Chapter 1 and Chapter 2. In Chapter 2 and its appendix, the context of the conflict (uranium mining or other types of mining) is not as important as the specific process of knowledge creation analysed. For this reason in-depth interviews with key actors as well as relevant data collection sufficed and no field data was gathered. In order to ascertain the strategies, demands and discourses of resistance to mining, a literature review was carried out (Chapter 3).

#### **3. 1 Research strategies**

##### **Grounded research theory**

Once I decided to focus my research on uranium mining in Africa, Namibia became an obvious case-study. Although its the second producer in Africa and has a history of mining resistance, almost no academic literature had covered it. A welcome exception is Gabrielle Hecht's accurate research on Rössing's union strategies during the 80s and 90s and an activist report on the impacts of Rössing on the environment and workers written by foreign activists acting as testimony of early resistance (Dropkin and Clark, 1992). Information however on present resistance was covered only by newspaper articles. They described a community (Topnaar) opposing uranium mining in their territory and two NGOs that had organised a conference in 2008 to raise awareness. I became enthralled by the case; historical gaps in resistance, local actors acting in isolation, different layers of knowledge and discourse. What was the relation between these different types of resistance? Why resistance seemed so disentangled? Newspapers also showed that several new uranium mines were being planned. Where they provoking further resistance not covered by the newspapers? I decided to uncover and understand past and present resistance in Namibia.

Without any preconceived theoretical framework or ideas of what I was going to find, I went to Namibia in 2009. After some initial interviews with these two NGOs I soon realised that uranium expansion was affecting different and distinct socio-economic and racial groups not allowing me to fit what I was going to find with a pre-set theory (e.g. the environmentalism of the poor thesis didn't seem to fit with the Topnaar). I decided to approach my research using grounded research theory; the objective became to construct theory from the systematic analysis of data (Glaser and Strauss, 1967).

Data was obtained through semi-structured interviews to all relevant actors. The choice of interviewees was not reduced to workers and community members but also to mining companies, NGOs, consultants, journalists and different tiers and ministries of the public administration in order to understand the political and socio-economic implications of the uranium rush.

All interviews were manually coded in order to find their perception of the mining projects and the motivations behind their actions (or in-actions). The analysis allowed me to establish some initial hypotheses that were run through the data obtained, comparing the different communities. After this first analysis I carried out a literature review of social movement and political ecology previous relevant works. This literature was combined to develop a final set of enabling factors for resistance to mining to emerge (explained in Chapter 1). As acknowledged by Glaser and Strauss (1967); “the source of certain ideas, or even models, can come from sources other than data”. So whilst all the concepts are constructed from the data collected, some can also be found in previous work, further corroborating this thesis (Charmaz, 2006).

### **Case study research**

In Namibia I wanted to discover if resistance to uranium mining was emerging and why, as well as the strategies or narratives being used by the different social groups (Chapter 1). Case study research was the method chosen because, as pointed by Yin (2011), it aims at acquiring an “in-depth understanding of a single or small number of cases set in real-world contexts”. The need to understand the context and other underlying conditions is crucial and resulted in the study of numerous sources of evidence such as academic and grey data (combined with semi-structured interviews). As an alternative research strategy, surveys would also provide me with contextual data but would only attend a few set of variables, limiting explanatory power. I needed an in-depth account of the communities’ feelings towards the mining expansion, details that could be traced overtime, discourses, opinions and motivations. This information could best be acquired through a case study research.

The mining projects proposed were nearby several communities that were reacting in diverse ways. These disparities intrigued me, motivating me to study four of them as sub-units of analysis, turning the research into an embedded case study. Whilst the uranium mining expansion in Namibia is the frame of a single case design, the reactions of the different communities act as sub-units of analysis. I spent an average of 15 days with each community carrying out semi-structured interviews. The



similarities and differences between the three communities allowed me to develop and corroborate the findings of this research.

Analysed in Chapter 2 is an activism-science liaison that was formed (through the EU funded EJOLT project) between one of the NGOs I initially contacted in Namibia (Earthlife Namibia) and an expert organisation in radiation issues in France (CRIIRAD). After an initial interview I realised a more established, similar and evolved liaison had been created with a local organisation in Niger (also contesting radiation knowledge). I decided to study and compare both cases using a multiple-case design in order to find out similar or different traits, the implications given the different contexts as well as observe how these liaisons can evolve in time through the Niger case. Despite some differences, it emerged that both cases had similar characteristics in terms of knowledge creation. I therefore carried out a multiple case study using literal replication; meaning; both processes predicted similar results. Multiple case literal replication research gives more robustness to the findings by avoiding putting “all eggs in one basket” (Yin, 2003, p.53). Moreover, given that the context of both cases are different this expands the generalizability of the findings (Yin, 2003).

Given these cases were also studied with no preconceived ideas or theories following grounded research, the cases at hand can be considered paradigmatic cases because they “transcend any sort of rule-based criteria” (Flyvberg, 2006) setting the standard for other cases. Whether the cases presented are “central cases for human learning” (Flyvberg, 2006) remains to be seen as more cases are studied and the characteristics proposed are compared and contested.

### **Action Research**

“The institutions of normal science and academia, which have created a monopoly on the knowledge making process, place a primary value on pure research, the creation of knowledge unencumbered by practical questions. In contrast the primary purpose of action research is not to produce academic theories based on action; nor is it to produce theories about action; nor is it to produce theoretical or empirical knowledge that can be applied in action; it is to liberate the human body, mind and spirit in the search for a better, freer world” (Reason and Bradbury, 2001; p.2)

One of the objectives of this research has been to support local organisations to produce practical knowledge that is useful for them and to develop the abilities that would allow them to create more knowledge, two of the basic premises of action research (Reason and Bradbury, 2001).

On my return from Namibia I got in contact with Bruno Chareyron, the head of CRIIRAD and wrote a project in order to look for funds to bring him to Namibia after discovering his activities in a documentary (Uranium, is this a country?). I thought his expertise would be useful for the local activist organisations in Namibia. The proposal was later included in the EJOLT project that started on 2011 and has recently finished. I became the Nuclear Work Package coordinator of EJOLT, which included organisations from Slovenia, Bulgaria and Malawi also dealing with nuclear

and uranium mining issues. The project aimed at developing alliances between Environmental Justice organisations (EJOs), think tanks and research centres.

As part of the project I travelled together with Bruno Chareyron to Namibia to take samples of soil, water and air in the vicinity of the uranium mines, as well as recording material for a documentary (Conde, 2014b). A report with the results denouncing contamination in the vicinity of the mines was published (Chareyron, 2014). Also as part of the project several workshops took place in Barcelona (that I helped organise), Rio de Janeiro and Rome aimed at capacity-building and promoting exchanges between the different partners. One of these collaborations between FIOCRUZ, a public health institute in Brazil, and Earthlife Namibia resulted in a study on the health impacts on workers (Kohrs and Kapuka, 2014). In parallel, the EJO Citizens for Justice (CFJ) in Malawi that I introduced in EJOLT because of their involvement in the African Uranium Alliance, had been a strong voice of opposition against the Kayalakeru uranium mine. They also received a visit from Bruno Chareyron (CRIIRAD) that together with CFJ denounced water contamination and a high risk disposal of tailings (Chareyron, 2015).

An aim of my thesis has been to challenge -through the Activism Mobilising Science process that I set in motion in Namibia- traditional ways of producing science, taking into account and introducing in the construction of knowledge those people engaged in the conflict, including not only the local organisation and communities, but also me. Although my position here is mainly as facilitator; I helped plan and participated in the sampling trip, drafted and revised the reports and encouraged all the outcomes of these collaborations. I have also made these results public (as I explain in the preface) in the Annual General meeting of Rio Tinto and at a conference in London, reaching newspapers like The Guardian (The Guardian, 15 April 2014). As a result Rio Tinto is now carrying their own 'epidemiological study' using 'independent doctors' but only using past medical files, no new medical tests will be carried out. This raises doubts about the credibility of these future findings.

My involvement in the process I am studying raises epistemological issues in social research; how the relationship between the researcher and the researched is influenced due to the connection between facts and values. An ontological and positivist frame suggests the phenomena being researched should be independent and unaffected by the behaviour of the researcher. An alternative constructivist view, which I adhere to, supports the believe that the relationship between the researcher and social phenomena is interactive, thus the researcher cannot be neutral (Ritchie et al., 2013; Brydon-Miller et al., 2003). In this thesis however two precautions have been taken to develop a more robust study; my involvement has been explicitly acknowledged and identified as part of the process and a triangulation of data was carried out (Flick, 2004; Yin, 2003). Data from interviews was extensive so having numerous interviews from each group allowed me to have a coherent and wide understanding of each community's context and perception. The data obtained through interviews was combined and compared with community observation and grey data (newspapers and reports).

In political ecology the idea that the researcher can be objective has been rejected by several authors since the inception of this field (Forsyth, 2008; Peet and Watts,

1996). The construction of meaning and knowledge of reality and environmental problems is always biased by our experience-stock. Blaikie (1985: 1) wrote in his seminal book of political ecology: “[this] is not a neutral book. It takes sides and argues a position because soil erosion *is* a political-economic issue, and even a position of so-called neutrality rests upon partisan assumptions” (emphasis in original).

Leaving epistemological issues aside and advancing into action research in political ecology, Bebbington and Bebbington (2012) calls for the practice of underground political ecology linking “activism, technocracy and scholarly endeavour”. Referring specifically to the governance of extractive industries he claims that “if contemporary capitalism is made possible by the bundling of the subsoil with specific networks of power, knowledge and technology, then any alternative way of governing the subsoil and its relationships to life above the surface, will be brought into being through different networks of power, knowledge and technology. That is the project of a political ecology of the underground and it is one whose challenge far exceeds the possibilities of academic political ecologists working alone” (Bebbington and Bebbington, 2012).

As proposed by Bebbington, my aim with this thesis and as an academic political ecologist has been to challenge the knowledge and power networks in place in the governance of the uranium mining industry in Namibia and elsewhere, acting in collaboration with local groups, NGOs and scientific experts.

### **Literature review methodology**

I carried out an integrative literature review aiming at summarising all related themes of social resistance to mining (Cooper, 1988). Following Creswell’s (1994) methodology I undertook a process “of reading, analysing, evaluating, and summarising scholarly materials about my topic”. I embarked on an extensive search using the Web of Knowledge, Google Scholar and Google employing different combinations of relevant keywords. For example I combined resistance, social movement, conflict, protest, collective action and strikes together with mining, resources, extractive industries, governance, development, CSR, etc. A second search was carried out using snowball methodology from the bibliography obtained in the first search. For the literature on the history of resistance most of the 19<sup>th</sup> C. resistance is extracted from Godoy’s (1985) review ‘Mining: anthropological perspectives’. The review has also benefited from six peer reviews that have suggested additional literature. After a screen of more than 300 works, several were discarded with 292 articles and books finally included. A literature map helped me organise and decide how to group the articles and structure my work. Summaries of all the articles started to feed into the outline of the review, responding to my research questions.

## **3. 2 Sources of evidence**

### **Semi-structured interviews**

I used semi-structured interviews to gather field data because they allow the interviewee to expand and express their own ideas but are bounded to the open-ended questions. As Leech (2002) explains, “semi-structured interviews allow

respondents the chance to be the experts and to inform the research". Interviews had a defined introduction presenting the interviewer and explaining the general objectives of the interview. The predefined questionnaire was structured to obtain initially a general understanding of the individual and the community's socio-economic situation. A second section was designed to understand their perception and knowledge about the mining industry, as well as their relation and reactions (if any) to it. In the field trip in Namibia I undertook 166 interviews. Except for few contextual interviews, most of them lasted around 90 minutes.

Government officials (from the Ministries of Mines and Energy, and Agriculture and Water Affairs such as hydro-geologists or monitoring technicians) provided me with an understanding of their conflicting role as promoters and watchdogs of the mining industry and the weak enforcement of government regulations. In order to understand the viewpoint of the mining companies I met with technical representatives of both Rössing and Langer Heinrich mines and with several consultants working for them. One of these consultants was carrying out a 'consultation' for the Social and Environmental Impact Assessment for AREVA's Trekkopje mine in the protected area of the Spitzkoppe community. Because this community is located in a remote area, I asked to go along with her to visit it. Although I carried out the interviews independently from her activities and I always told the community I was an independent-university researcher, no-doubt their responses were biased hoping to obtain something from us.

Several 'conservationist' NGOs in Namibia work also as consultants for the mining companies being totally aware of their conflictive standpoint. One of these organisations has a research centre in the desert (Gobabeb) next to the Topnaar community and kindly supported my research there. Through them I acquired a translator (that I later changed) and got in contact with the head of the Topnaar community, with whom I had to talk first to ask for official permission to carry out interviews with members of his community. Because the community is divided into different factions I tried to interview different members of all of the factions.

The two only independent (from the mine) NGOs that were active in uranium mining issues were LaRRI and Earthlife Namibia, with whom I developed a closer relationship. They put me in contact with Petrus Hoabeb in Arandis (whose story is explained in the introduction). Once in Arandis I allowed Petrus to select the people with whom I should talk. I tried to interview members of different age groups, some working for the mines and some not, sick ex-workers as well as retired. I also interviewed a local priest, the local teacher and nurse and the head of the municipality of Arandis.

In Swakopmund, the biggest town next to Rössing I also met with government representatives of the regional Health department, the Swakopmund municipality and the head of the Erongo County Council (regional government). I also carried out interviews with other relevant stakeholders of the tourism and hospitality business; meeting with restaurant, hotel and tour agency managers. I was trying to understand the advantages and negative consequences of the mining sector was bringing for them and the town.

For Chapter 2 the research carried out was based on several interviews for each of the three key actors in the process analysed. The structure of the interview differs from that of the previous chapter; after some contextual and general questions, much more specific questions were asked that addressed chronologically the different steps of the knowledge co-production process under study. Some interviews were carried out in person (in EJOLT meetings) and other follow-ups over the phone. Given that the information required was so specific, a visit to Niger was not warranted. All interviews with Almoustapha Alhacen from Niger were carried out over the phone and recorded. A colleague assisted during the interview for translation and were later transcribed and translated into English.

### **Grey data**

A press review of one of the main newspapers in Namibia (The Namibian) was carried out to obtain contextual information on uranium mining expansion, the government's and other societal actors official response. The task was facilitated by the search engine in the newspaper's website. Apart from the Internet, documentation was collected from the main library in Windhoek to better contextualise the history of the communities analysed.

For Chapter 2 a press review was also conducted to ascertain the impact of the process analysed as well as a revision of all relevant reports available from the mining companies.

The research presented in this thesis explores resistance to mining. The first chapter uncovers enabling factors for resistance. A better understanding of resistance movements as well as the role played by demand and production patterns in the global uranium market are combined to comprehend their effect on the global frontier of extraction. This chapter was published in the journal of Global Environmental Change. Chapter 2 does a detailed analysis of a strategy based on knowledge creation used by activists resisting uranium mining in Niger and Namibia. Grassroots organisations have engaged in the what I have named Activism Mobilising science. This chapter has been published as an article in Ecological Economics. This chapter has an appendix that explores and expands Activism Mobilising Science through the role of the expert. Chapter 3 emerged as a need of the first two; the multiple strategies, discourses and motivations behind resistance to mining that I encountered motivated me to carry out a literature review on resistance to mining.



# **Chapter 1**

## **The global uranium rush and its Africa frontier**

### **Effects, reactions and social movements in Namibia**

#### **Abstract**

Uranium mines are the often forgotten source of nuclear power. The promotion of nuclear energy as a clean alternative and the projected increase of electricity demand in countries such as China and India, led to a global uranium rush unseen since the peak of the Cold War. This article studies impacts and social movements at a uranium mining frontier looking at the interaction between the global social metabolism, industrial dynamics and local ecologies of resistance. Namibia, the world's fourth largest producer of uranium, stands at the vanguard of the global uranium rush with 66 recently granted prospecting licenses and two operating mines. We focus on three generic attributes that help to explain the emergence and intensity of resistance by local communities to uranium mining: the ecology and geography of the resource; the degree and type of political and economic marginalisation of the community; and crucially, the connection and integration of local concerns with broader social movements and political demands. We show with the use of empirical material how these factors play out differently in five Namibian communities that have been, or stand to be, affected by uranium mining, and explain how local ecologies of resistance shape, or fail to shape, the global uranium rush. Our work offers an example of an integrative approach for the analysis of the global-local dynamics of environmental change in relation to the extraction and flow of the essential materials that fuel industrial economies.

Keywords: Uranium; nuclear power; mining; commodity chains; social movements; Africa.



## 1. Introduction

In January 2012 President Obama introduced a 20 year ban on one million acres of land around the Grand Canyon. This comes after the Pew Environment Group and other U.S. environmental groups denounced the threat to America's most important natural heritage sites through thousands of mining claims, many in search of uranium, surrounding the Grand Canyon, Mount Rushmore, Joshua Tree and Yosemite national parks (Pew Environment Group, 2011). One year earlier in the town of Arlit in the Sahara desert of Niger, seven employees of the French construction company Vinci and the French nuclear energy firm Areva were kidnapped by Al-Qaida (BBC, 16 September 2010) leading to a temporary stop of construction in the mega uranium mine at Imouraren. An anxious Minister of Mines and Energy assured the international community that Niger will "maintain output and not be discouraged by these dramatic events" (The Guardian, 15 October 2010). What connects such disparate events in distant - geographically and socio-economically - parts of the world is the global uranium rush (MME, 2010; Pew Environment Group, 2011). This is the subject of this article.

Uranium mining is the often forgotten first step in the production chain of nuclear power. Its risks on health and biodiversity are not as grave as those of radiation leakage from a melting nuclear reactor, but they too can be dramatic (Brugge, 2005; IEER, 2006; ECR, 2003; Kuletz, 1998). Given the low concentration of uranium in natural ore, considerable quantities of residues are produced during extraction and processing, including heavy metals and radioactive decayed elements. Such residues, contained in ponds or dams near the mill, can leach to underground and surface water sources. Worse still, they can escape to the environment if dams break, as happened in New Mexico in 1979 when over 1,000t of radioactive mill waste were released into the Puerco River, a radiation release greater than the Three Mile Island disaster (Kuletz, 1998). Most of the radiation typically emitted in a mining site is considered low level radiation (<100 millisieverts-mSv). Regarded as harmless or even beneficial by some scientists (Sanders, 2009), others such as the International Commission for Radiological Protection (ICRP), which sets the radiological limits adopted by the International Atomic Energy Agency (IAEA) contend that "it is scientifically plausible to assume that the incidence of cancer or hereditary disorders will rise in direct proportion to an increase in the equivalent dose in the relevant organs and tissues, below about 100 mSv" (Wrixon, 2008). And the National Research Council in the US (IEER, 2006) reminds that although cancer risk is expected to decline along with declining dose rates, "it is unlikely that there is a threshold below which cancers are not induced". External radiation (alpha, beta and gamma) as well as internal radiation received through radon gas, dust and water constitute major hazards in uranium mines. Many epidemiological studies carried out, among others in the Navajo population in the U.S. and former workers of the Wismut mine that operated until 1990 in Germany, have shown links between exposure and diseases such as bronchial and lung cancer (see among others, Gilliland et al., 2000 for the US and Kreuzer et al., 2010 for Germany).

Social reaction and stricter environmental regulation of uranium mining in countries such as Australia and the U.S., coincide with a shift of mining activities to poorer countries with less restrictive legislation (Campbell, 2009; MMSD, 2002; Otto, 1998).

In the context of a pre-Fukushima global boom in uranium prospecting driven by the re-emergence of nuclear power as the energy option of choice, Africa quickly became a global uranium frontier (Financial Times, 1 May 2009; OECD, 2009). Namibia is the world's fourth largest producer of uranium, accounting for 8% of global supply and about 5% of estimated global reserves (WNA 2011b; OECD, 2009). Since 2005, 66 exploration licenses have been granted and three to four new mines are likely to open (MME, 2010). Drawing from the concrete reality of Namibia this article seeks to understand how global patterns and local – natural and social – ecologies combine to shape the expansion of the uranium frontier. Our aim is analytical, we focus on explaining a contemporary socio-environmental phenomenon, i.e. uranium rush, the territorial forms it takes, and the actual or potential rise of social resistance and in turn, its effects to the global patterns of expansion.

## 2. Theory and Method

Our research is positioned within a growing literature at the interface of ecological economics and political ecology, concerned with the expansion of the global social metabolism of material and energy flows and the impacts and reactions this creates in territories and communities at so-called extraction or commodity frontier (Moore, 2000). This is a relatively new line of inter-interdisciplinary research (Martinez-Alier et al, 2010). It is of relevance to global environmental studies since it offers an integrative, multi-scalar (often called glocal) approach to the analysis of resource changes and related socio-environmental impacts. Whereas global environmental studies have advanced understanding of climate change, natural hazards, regional and local vulnerabilities and adaptation options, they have paid less attention to material flows and the social impacts and implications of intensifying extraction in the global periphery to fuel growth at the industrial core or at consumption centres. This is a gap addressed by the present article.

Ecological economics has shed light on the role of ecological limits and material throughput in the functioning of the economy. Analysing the patterns of expansion of material flows to new territorial frontiers and their socio-environmental impacts, political ecology has developed a better understanding of how uneven power relations within late capitalism affect differential access to resources and sinks along lines of class, race, ethnicity or gender, shaping the changing social metabolism and the distribution of its costs and benefits. The two together offer a more complete view of the drivers of change of complex socio-environmental systems.

Figure 1 illustrates in a simplifying graph an integrative ecological economic – political ecology analytical approach to the study of a resource frontier, in our case uranium. Rather than focussing only at the local level and the impacts or grievances there, we position and explain local issues within the broader global commodity chain of extraction-transport-production-consumption and disposal of the materials at stake, itself driven by consumption and geo-political and geo-economic market forces within a globalizing, capitalist world. This allows us to understand local problems in their global and political context, illuminating both the causes and the possible political interventions needed at broader scales beyond the territories of extraction. For example by shifting interest from managerial or regulatory interventions at the extraction side alone to the role of faraway consumers and

advertising, global geo-economics and trade relations or to the corporations dominating the commodity or product market. Vice versa, global changes and their territorial manifestations are themselves the outcome of myriad local specificities and struggles. A successful social movement in a particular territory may shift mining activity elsewhere or make it so expensive as to delay or even stop it. Note that our focus in this article is on extraction in relation to global dynamics, but our general approach could be extended to studying impacts, conflicts and movements at the production, transport, consumption or disposal stages (see Martinez-Alier et al, 2010). Understanding historical, social and power relations at the local level and the ways in which these shape resistance and conflict is vital for understanding the particular shape a frontier takes, and for speculating about its future evolution. We therefore argue that the geographical pattern of global material flows is shaped by the social dynamics of resistance at the local level. In this article we try to probe this relationship between global material flows and social dynamics of local resistance.

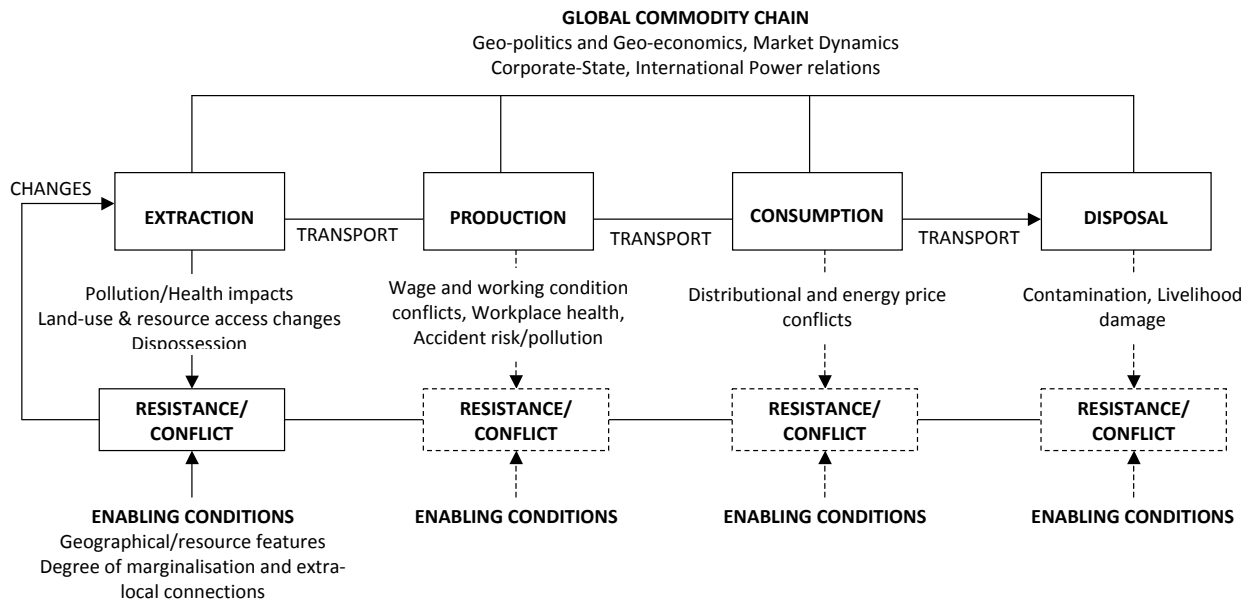


Figure 1: The global commodity chain and resistance and conflict at the extraction frontier

For this latter task of explaining the conditions under which effective resistance against a commodity resource frontier emerges — or does not emerge — and the forms it takes, we draw and expand upon social movement theory. During the 1970s social movement scholars focused on resource mobilisation theory analysing how organisations and networks interact and mobilise (McCarthy and Zald, 1977). In the 1980s, with the study of New Social Movements (NSM) the focus of theory turned to why new social actors emerge (Crossley, 2002). Different currents of social movement scholarship (Cohen, 1985) have converged over time to form a more holistic explanation (Melucci, 1999 quoted by De Echave et al., 2009; Dwivedi, 2001). NSMs have been attributed to new grievances marked by a shift from economic to cultural identities, in comparison to the old class-based politics of the labour movement (Melucci, 1989). According to Bebbington et al. (2008a), historically the strongest movements around extraction conflicts emerged to address issues of exploitation such as miners’ working conditions and health claims. However, as technology advanced, the number of workers diminished and the environmental

footprint of the mines increased, creating conflict over dispossession of land, water and other resources and loss of way of life. From an ecological economic perspective there is a direct link between the increase of such conflicts and the vast increase in the tonnage of minerals extracted, transported and used around the world (Martinez-Alier, 2002).

The causes for the emergence of social movements has been addressed by Habermas (well summarised by Crossley, 2002) as a reaction to threatened forms of life and social organisation (lifeworlds), and by Escobar (1995) who, closer to third world movements, argued social movements emerge as a reaction to the inequality and abuse caused by adverse social relationships and capital accumulation. Compared to first world environmental movements, often driven by a cult of wilderness (Martinez-Alier, 2003), third world movements have distinct causality and concerns; actors often react against the encroachment and degradation of environmental resources such as land and water that constitute the basis for their livelihoods (Redclift, 1987; Guha and Martinez-Alier, 1997) in what has been called an environmentalism of the poor and the indigenous, whose actors are often not self-conscious environmentalists (Martinez-Alier, 2002).

Social reaction and resistance to uranium extraction by indigenous environmentalists is not new. Australian aboriginal communities such as the Mirrar have been fighting the Ranger and Jabiluka uranium mining projects (Fagan, 2002) and so have, for decades, aboriginal Canadian communities in Saskatchewan (Harding, 1988). The Tuareg rebels have reacted against French Areva's mines in Niger (Kennan, 2008), the 'Jharkandi Organization Against Radiation' formed in Jharkhand, India (Ramana, 2012) and there is the more publicised fight of the Navajo in the US (Eichstaedt, 1994; Shuey, 2001). However, for each uranium mining project that created resistance and made it to the news, there are several others that passed unnoticed, without open reaction and conflict, or with oppression and silencing. Which are the factors that make some groups resist against resource frontier expansion, and others not?

Some authors have already pointed out some enabling conditions for the emergence of resistance movements. Peet and Watts (1996) highlight the importance of the perception and interpretation of an adverse situation, the sense of collective identity and the linkages between different social movements. Similarly, De Echave et al. (2009) link perceptions of impacts and of effects on identities and pre-existing practices with the capacity to organise in a collective way. Social Movement theory has highlighted how group size and the distribution of costs, benefits and transaction costs determine the feasibility of collective action; marginalisation of certain disadvantaged groups in this sense, is seen as a deterrent for effective collective action, though this often depends upon the perception of the gravity of the concern. Our interest however here is also on the interaction of socio-political, bio-physical and geographical factors, the last two seldom looked upon in the social movement literature which is dominated by sociologists. For instance, the combination of very low population density in a large, resource-scarce and hence uninhabited territory linked to very strong state repression might leave conflicts in a latent state for a very long time or indeed forever.

In our analysis and drawing from the social movement literature informed by an ecological-economics understanding of mining frontiers and material flows we propose three decisive enabling conditions. The first concerns the particular 'spatial ecology' of the mining resource at stake and the surrounding human and livelihood resource landscape. This includes factors such as the form and nature of impacts (visible vs. non-visible, immediate vs. slow-onset, future risk vs. acute health impact) and the location of the mine with respect to settlements and alternative livelihood resource uses that may be affected by mining activities. The perceived degree of threat to livelihoods is related to the speed and strength of the reaction (Peet and Watts, 1996). Unless there are mechanisms to understand that there is a threat, there is no possibility of reaction to it (Blaikie and Brookfield, 1987). We hypothesise that the more direct, visible and immediate the impacts on health or livelihoods are, the more likely mobilisation is. Visibility is of course socially constructed. Nuclear radiation is not visible to the naked eye, one needs instruments to detect it. But one could argue that the risks from cyanide in the leaching of gold ore are also invisible to the untrained eye. Technical risks are always subject to a process of social training.

The second condition concerns the marginalisation of the community affected and its relationship with the territory (Robbins, 2004). We focus on marginalisation to minimise the association with purely economic deprivation, emphasising marginalisation as a process where communities are excluded from the mainstream of interests and power (Jeysens, 2006). These communities lack the time and resources to participate, and the capacities to make their voices heard in the debates and arguments that lead to the formation of movement discourses (Bebbington, 2007; Blaikie and Brookfield, 1987). At one extreme one finds politically disenfranchised communities which are supposed to be 'too poor to be green' and at the other, strong, politically organised communities with broader historical-political demands. Attachment to the place and the existence of a material or symbolic economy relying on local resources are important variables in this respect (Escobar, 1995; Martinez-Alier, 2002).

Internal divisions in affected communities may produce finer lines of marginalisation. Those at the top of the power of hierarchy can be bought off whilst those further down the structure are further marginalised. The special interests of community chiefs and Union or government representatives to gain more power, alliances, contracts and money can create internal divisions and stop the flow of information to the more disenfranchised community members and particularly to women, undermining the emergence of a movement.

The third set of enabling conditions concerns connections between local inhabitants and extra-local actors, generally national or international NGOs. These often play an important role in bringing knowledge to the local level, making connections to movements elsewhere, mobilizing extra-local resources for local action, and acting at different scales, turning local conflicts into glocal conflicts (Bebbington et al., 2008a; Keck and Sikkink, 1998; Urkidi, 2010; Swyngedouw, 1997). Such extra-local actors are vital in forging links and exchanging knowledge among participants in conflicts at different stages of the commodity chain (hence the broken horizontal line of figure

1), and generate a broader awareness about the position of the particular problem or conflict within the broader commodity chain and market-geopolitical dynamic.

Our main case study is the uranium rush in Namibia, and within it we look at five sub-case-studies of projects/territories to enrich understanding of how different communities react to uranium mining. The communities examined represent different socio-economic, environmental and historical uranium mining landscapes emerging in Namibia. Note that the three aforementioned theoretical propositions did not formally precede the empirical research; we adhere instead to a grounded theory approach, whereby theory is continuously reworked as a result of empirical observation. In this sense, the three propositions identified above are the distilled outcome of our research which started with a less clear and different set of propositions and which evolved into the three propositions drawing on pre-existing social movement and political ecology theory. It rests upon further cross-comparative, and possible large-N statistical research, to test the general relevance of our propositions.

Empirical research was conducted in a period of two years, including participation in meetings, internet discussion lists, exchange of information with NGOs and other researchers. The main part of the research was carried out during three months of field work in Namibia (May-July 2009). Conde visited the capital Windhoek, and the communities analysed in this article conducting 161 semi structured interviews and two informal focus groups with different stakeholders such as community members, mine, government and union representatives, consultants to the mining industry and journalists. In interviews with policy makers and corporations we discussed the regulatory framework, the monitoring of impacts and technical aspects of mining planning and regulation. Interviews and focus groups with individuals and workers from the affected communities focused on livelihoods, perceptions and knowledge of the mining industry and reactions. Some interviewees wish to remain anonymous so interviews have been numbered for reference. A second three-week visit to Namibia in September 2011 allowed Conde to update the research, carrying out interviews with new and old contacts. Collaborative research with local NGOs was been carried out over this two year period.

The paper is structured as follows. Section 3 looks at the commodity chain of uranium, focusing on exploration, extraction, consumption and market patterns and explaining how these interact with regulatory forces that shift the extraction frontier to Africa. Trends before and after the Fukushima accidents in 2011 have been taken into account. Section 4 presents the body of the empirical research at the national and local levels. First, we explain the geographical and political-economic context of Namibia and the governance vacuum that the uranium mining industry takes advantage of. Next, we document the history of the most emblematic uranium mining community in Namibia, Rössing, developed by Rio Tinto at the end of the 1970s and to this day one of the world's largest uranium mines. Next, we move to the recent rush and analyse the plans for four new uranium mines in different geo-political settings, presenting the perceptions and reactions of the communities that stand to be affected. Section 5 pulls together the various threads of this research, global and local, historical and contemporary, environmental and social, to assess and theorise the resource extraction conflicts at the uranium mining frontier.

### **3. The global metabolism of uranium**

#### **3.1 The commodity chain**

The global metabolism of a material resource can be conceptualised in terms of a commodity chain starting with exploration and extraction and ending up with consumption and disposal. U235, the isotope required for the production of a fission chain reaction, constitutes less than 1% of natural uranium (IAEA, 2009). The first step for obtaining U235 is the mining of economically viable ores. Traditionally this has been done with either open-pits or under-ground mines. The ore extracted is crushed, ground and leached with sulphuric acid, undergoing a process of ion exchange before being dried at high temperatures to obtain yellow cake powder that is finally packed in steel drums. This process is generally done in a uranium mill. The yellow cake is then transported via truck, train or ship to a processing facility, where it is transformed into Uranium Hexafluoride and enriched to increase the proportion of U235. It is then turned into a hard ceramic oxide (UO<sub>2</sub>) for assembly into rods specifically designed for each type of reactor. The rest of the yellow cake, mostly U238, is considered depleted uranium, and can be used with reprocessed plutonium extracted from nuclear waste to produce MOX, which is an alternative nuclear fuel. Enrichment facilities are only found in 11 countries, Iran being the latest addition, as countries are discouraged from developing them to avoid nuclear military proliferation. Uranium fuel rods are then transported to the various nuclear power plants (WNA, 2011a; IAEA, 2009).

The consumption and production of a resource coevolves, regulated by market forces and propelled by capital flows and the actions of corporations and investors. For the remainder of this section we look in turn at the demand, production and market forces of the uranium chain.

#### **3.2 Demand patterns**

Figure 2 shows the evolution from 1945 to 2005 of uranium consumption and the shift from military to civilian electricity uses. The global distribution of uranium consumption largely corresponds to nuclear energy production, with the US being the largest consumer with 104 reactors, followed by France with 58 reactors and Japan with 54 reactors operating before the Fukushima accident (WNA, 2011c).

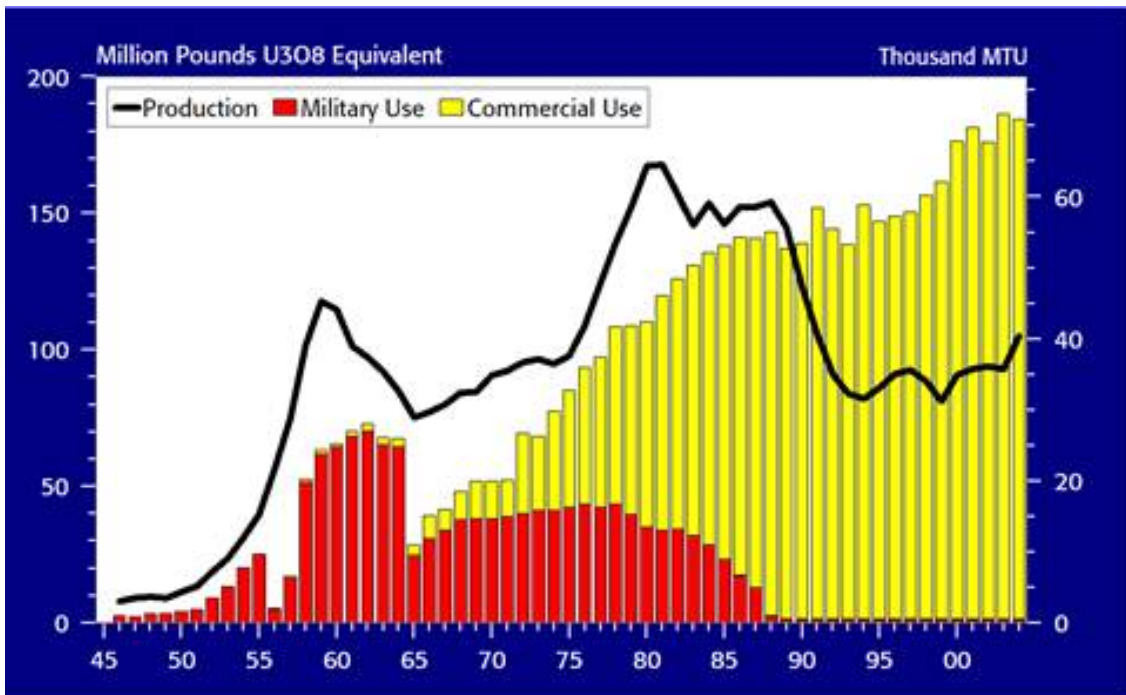


Figure 2. Production of uranium from uranium mines. Source: Klingbiel (2005)

The metabolism of uranium is driven today by an inexorably growing demand for electricity, expected to increase at an annual rate of 2.2% globally to 2035. Most of this increase in demand is expected to come from Asian countries such as China and India (IEA, 2010). Rising electricity demands coupled with international commitments to mitigate carbon dioxide emissions and climate change have been taken up by the nuclear lobby, which has successfully remarketed nuclear energy as a clean alternative (Combs, 2010; OECD/NEA, 2009; IEA, 2010). Nuclear energy is benefiting from a price rise since 2003, complemented by the possible extraction peak of other energy sources such as oil and later gas (OECD, 2009) and the geopolitical instability in Northern Africa and the Middle East. Prominent intergovernmental organisations such as the OECD and the International Energy Agency see nuclear energy together with renewables as an essential component of future energy portfolios (IEA 2010; OECD, 2009). In his 2010 State of the Union address President Obama called for “a new generation of safe, clean nuclear plants” (CRS, 2010), while even some environmentalists have joined the chorus (Lovelock, 2007; Monbiot, 2011).

With 57 new reactors under construction and 210 more on order or planned (WNA, 2011c), before Fukushima an estimated 44 countries intended to introduce new nuclear power facilities or expand existing ones in the foreseeable future. The Nuclear Energy Agency (an OECD organ) predicted an increase by a factor of 1.5 to 3.8 by 2050 from 441 units in operation today (OECD/NEA, 2008). The nuclear lobby claimed a “nuclear renaissance” was underway (WNA, 2011d). However partly as a result of financial difficulties and construction delays, it has proven difficult to increase or even maintain the existing number of nuclear power plants (The Economist, 14 October 2010 and 10 March 2012; Bradford, 2010, Schneider et al., 2011). The Fukushima accident further altered the course of nuclear energy expansion, with Germany being the first country to halt construction of new nuclear



plants, and Japan closing down almost all (undamaged) nuclear plants for testing. Other countries with ageing reactor fleets such as the UK and France are also facing increased civil opposition (Schneider et al., 2011). After Fukushima, Russia, China, South Korea and India might slow down the rate of construction of new plants, though their nuclear plans are still underway.

Even so, this somewhat limited “nuclear renaissance” did translate into increased uranium exploration efforts, which soared between 2003 and 2009, with 400 exploration companies forming or changing their orientation to raise US\$ 2 billion for uranium exploration (MEG, 2010). , Pre-Fukushima predictions expected global uranium consumption to increase by 54% by 2030 (WNA, 2010). Even with much lower rates of growth, one can expect the expansion of the commodity frontiers of uranium extraction.

### 3.3 Production

Some 53,663t of uranium were produced globally in 2010 from uranium mines, accounting for 78% of global consumption. Secondary sources such as civil stockpiles, decommissioned nuclear weapons, reprocessed natural and enriched uranium and re-enriched depleted uranium tailings, account for the remaining 22%. Kazakhstan is presently the leading producer of mined uranium, followed by Canada, Australia and Namibia (WNA, 2011b). Figure 3 shows the distribution of total mine production and reserves between different countries. Production is very concentrated: the largest five uranium mines in the world - McArthur River in Canada, Ranger and Olympic Dam in Australia, Rössing in Namibia and Kraznokamensk in Kazakhstan - account for 43% of world uranium production (WNA, 2011b). Reserves are also concentrated with Australia, Kazakhstan and Canada holding 51% of reserves (OECD, 2009).

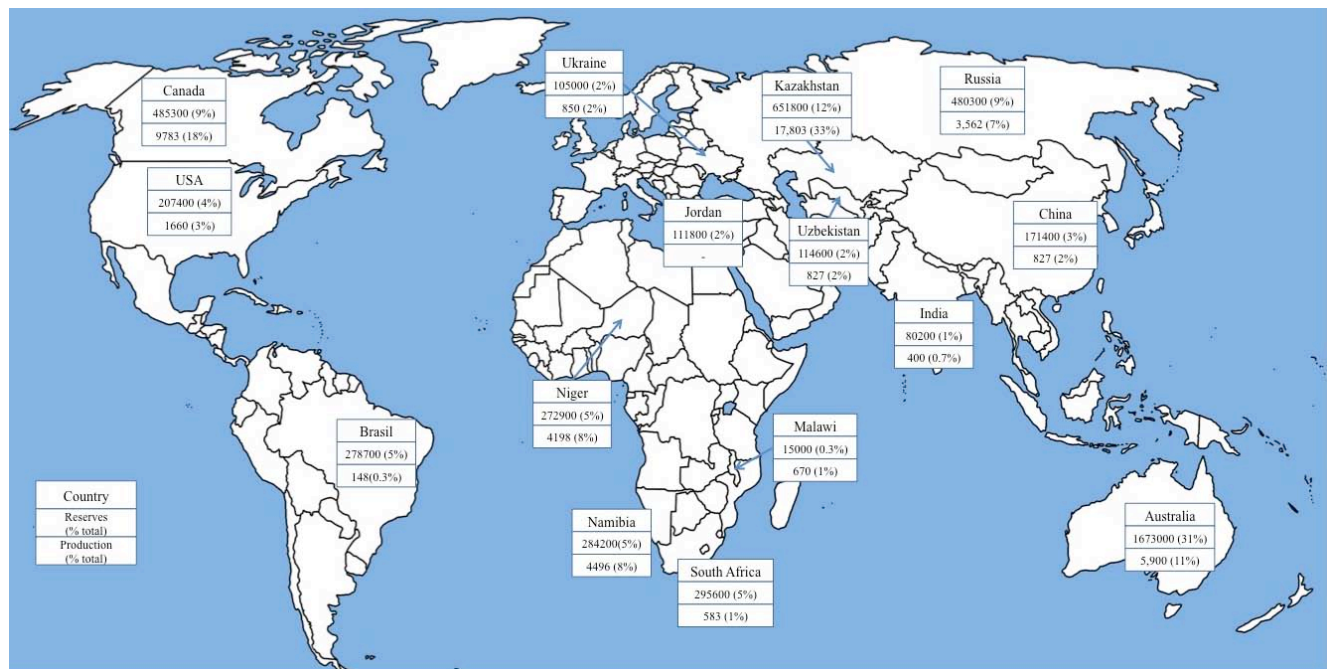


Figure 3. Major uranium producers and major world reserves of uranium (cost of extraction at less than US\$130/kgU). Source: WNA 2011b; OECD, 2009

Countries such as Canada and Australia not only have larger identified reserves than Africa, but their uranium is also of better quality and economically less costly to extract. Uranium concentration in the ores generally varies between 0.1 to 0.5 per cent (IAEA, 2009), with high concentrations of average 1.1% found in Canada at the rich Athabasca basin (Mudd and Diesendorf, 2008), compared with concentrations as low as 0.01% found in Namibia's deposits (WNA, 2010). Such ores require the use of more water and energy (Mudd and Diesendorf, 2008) and the use of alternative techniques such as heap leaching, where sulphuric acid is sprayed over piled-up-crushed ore and the solution with uranium oxide is collected below. This process allows more cost-effective extraction of uranium from lower grade ores (IAEA, 2005). However its environmental impact is greater as the piles not only take up more land but also create a bigger hazard, releasing dust, radon gas and leaching liquid seepage (Wise uranium, 2010). The method that is becoming most dominant is In Situ-Leaching (ISL), which injects sulphuric acid solution into underground deposits to dissolve uranium, which is then pumped up and processed in the mill. This technique avoids the creation of open-pits, but there is a risk of contaminating groundwater (Mudd, 2001).

There has been a notable shift in mine investment from countries in the developed world, such as Australia and Canada, to Kazakhstan and Africa, despite the fact that the former hold most of the high quality reserves (E&MJ, 2006, 2009; MEG, 2010; Combs, 2010; Financial Times, 1 May 2009). Australia, which holds 31% of known recoverable uranium reserves followed since 1984 a 'Three Mines only Policy', in effect a moratorium on all new uranium mines (Panter, 1991). The moratorium was accompanied by strong anti-nuclear and aboriginal movements demanding land rights (Adamson, 1999). Although legislation in countries such as Canada or Australia is not necessarily prohibitive, environmental regulation and enforcement are much tougher than in other parts of the world. The combination of this regulatory effort with effective social resistance and lengthy legal challenges can slow down the opening of a mine considerably, and make investments in Africa advantageous. As noted by John Borshoff, head of an Australian uranium mining company called Paladin Energy Ltd: "Australia and Canada have become overly sophisticated. (...) there has been a sort of overcompensation in terms of thinking about environmental issues, social issues, way beyond what is necessary to achieve good practice" (abc, 2 April 2006). As a result, several Australian mining companies such as Paladin have displaced their uranium production to places like Namibia and Malawi (OECD, 2009; RCR, 2011). Globally, of the 31 mines that were planned to open from 2009 to 2012 only five were located in Australia, the US and Canada (OECD, 2009). Thirty-four countries in Africa have already granted exploration licenses (Wise uranium, 2011) with Niger issuing more than 100 exploration permits in two years and Botswana issuing 138 (MME, 2010). During the period 2009–2012, uranium production was expected to increase 118% in Niger, Namibia, Malawi and South Africa (Kate and Wilde-Ramsing, 2011).

### **3.4 Industry and the market**

The uranium mining industry is heavily concentrated, ten companies accounting for 87% of the world's uranium production in 2010. The French state nuclear giant Areva, the Canadian Cameco, Anglo-Australian Rio Tinto, and the Kazakhstan state

company, KazAtomProm (WNA, 2011b) are the main players in this cartel-type industry. These corporate players are rooted in the major consuming countries — France, Russia, USA — or in developed countries such as Australia and Canada with considerable reserves that fed much of the early demand (Amundson, 2002; Combs, 2010; OCDE, 2007). Some of these companies, such as Areva and Rosatom, are active in the whole uranium commodity chain, being major players in mining, enrichment and nuclear plant construction and operation.

While all mining commodities are susceptible to market fluctuations and concomitant booms and busts in production and investment, uranium has the exceptional feature of a very constrained range of uses and users. This makes the uranium market stable in the short-term, and extremely unstable in the longer-term. Unlike gold for example, whose prices depend on a variety of economic factors and the tastes of millions of people; or copper, which is used in a variety of industrial applications, uranium is basically used for two purposes: bombs, to a decreasing extent, and power stations, both dependent on political circumstances and vulnerable to inherently unknown events, such as a referendum or a nuclear accident. It was the Three Mile Island accident in 1979 for example that led to the spectacular bust of the 1970s boom that stopped the commissioning of nuclear plants in the US. The price plummeted to \$10/lb, a level at which it stayed until the early 2000s. Figure 4 shows the fluctuations in prices and the links to key political and industry events.

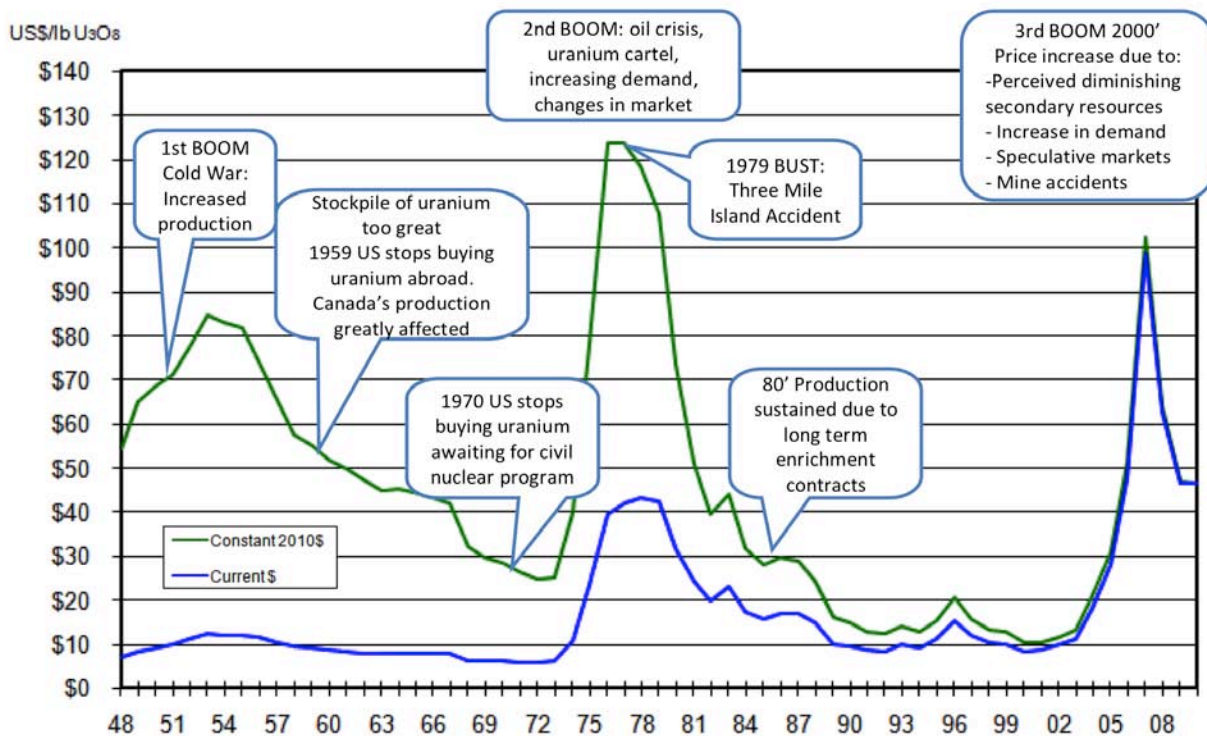


Figure 4. Evolution of uranium price (annual average). Price sources: 48-68 US/AEC, 69-86 Nuexco EV, 87-Present Ux U3O8 Price. Info provided by The Ux Consulting Company, LLC. History sources: Amundson (2002), Combs (2010), Radeztki (1981)

The uranium market works on the basis of bilaterally negotiated contracts between uranium producers and buyers, i.e. nuclear utilities, with a number of intermediaries

including traders and hedge funds. The vast majority of contracts are transacted under long-term, typically 3 to 15 year contracts directly between a mine and a nuclear plant (WNA, 2010). The remainder are traded through spot trading, up to 12 month delivery, accounting for less than 20% of supply (WNA, 2010). Two features are important: first, since it takes considerable time to expand production at existing mines or through development of new mines, prices can increase for an extended period of time before production can grow to satisfy demand. Vice versa, the long-term nature of contracts means that production may continue at some level, even as prices fall, i.e. there is a time lag between price and production, though price and prospecting are more closely correlated. The cost structure of nuclear power generation, with high capital and low fuel costs, means that once power generators are in place, demand is relatively predictable, more so than for other mineral commodities.

In the 2000s, uranium price trends followed those of other commodities with a spectacular price increase up until the economic crisis of 2007/08, from just \$7 a pound in 2003 to \$140 in June 2007 (figure 4 shows yearly prices). This was provoked partly by two mine accidents lowering production, the entry in the market of hedge and investment funds and the growing perception of diminishing secondary resources, with the end in 2013 of the “megatons for megawatts” program between Russia and the US, whereby the US supplied 50% of its requirements buying military stockpiles from Russia. This was reinforced by the 2007 edition of the Red Book, the authoritative publication of the International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency, published annually since the 1960s about uranium supply and demand: “given the long lead time typically required to bring new resources into production, uranium supply shortfalls could develop if production facilities are not implemented in a timely manner” (OECD, 2007). However, after a spectacular rise, the price fell down to \$40-50 per pound and was on a recovery path reaching \$73, just before the Fukushima accident, when it fell again to \$55 per pound (UxC, 2011). It has stabilised at that range (\$51 in March 2012), a very high level compared to the 1990s and early 2000s.

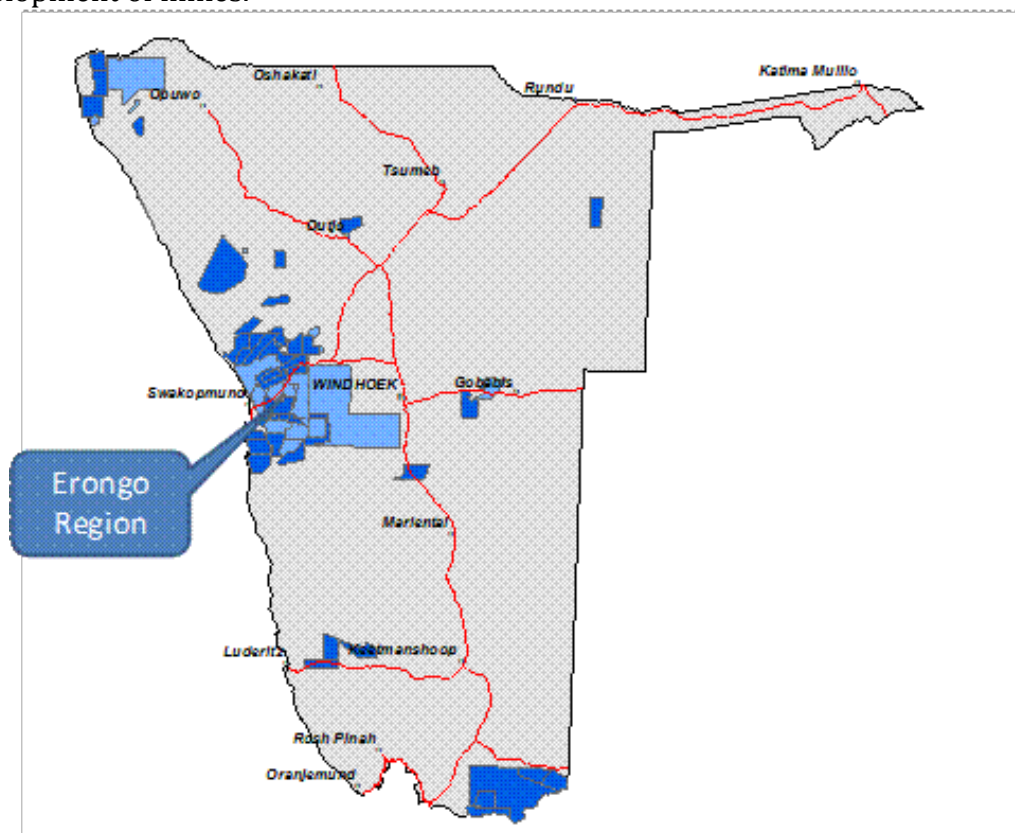
Despite the high costs of nuclear power in a context of stressed public finances and the reduction of electricity demand in countries hit by the crisis, some analysts maintained that by 2020 there would remain a substantial imbalance (of approximately 80 million pounds) between supply and demand requiring high prices to give incentives to new mining (Financial Times, 20 April 2010).

## **4. The effects of the global uranium rush in Namibia**

### **4.1 Namibia’s uranium rush**

Why a uranium rush in Namibia? Namibia has considerable reserves, some 284,000t, about enough to supply four years of the world’s demand at 2010 levels, but they are of low-concentration and therefore expensive. Namibia’s attractiveness is a function of geographical, political and social factors. Namibia has a large territory. 2.2 million people share 824,292 sq km. This results in a low population density of 2.77 people/km<sup>2</sup> (World Bank, 2010). Most of central and southern Namibia is suitable only for cattle herding or small-scale horticulture and is inhabited by white big-farm

owners and scattered, small ethnic tribes. It is in central Namibia, in the Erongo region that uranium prospecting is concentrated (see map 1). The low population density diminishes both health concerns and possible resistance that may delay the development of mines.



Map 1. Map of Namibia with the 66 exclusive prospective licenses (blue boxes in the map).

Namibia offers a good stable “business environment”. The World Bank praises Namibia as a “success case” with income growth of 4.5% per year since 1990 and a middle-class average income very unequally distributed (see Table 1). Politically Namibia is stable, governed since independence from the South African apartheid regime in 1990 by the liberation party, South West Africa People’s Organisation (SWAPO), which has won all five free parliamentary elections. SWAPO quickly abandoned plans for the nationalisation of foreign corporations, opting for market-oriented policies and an investor-friendly tax regime, more accommodating than even that of neighbouring South Africa (Rakner, 2001). The royalty for uranium is currently set at 3% of revenue, a low rate by international standards (MME, 2010). Companies can apply for deferment or reduction of royalty payment; as a result uranium royalties account for only 0.08% of total government revenue in 2008 (US\$2.5m compared to the desired US\$43.7m; MME, 2010). The corporate tax rate for mining is 37.5% of profits, but several exemptions are often taken advantage of by corporations (MME, 2010), including ‘Export Processing Zones’, such as the one offered to Areva’s Trekkopje uranium mine, free from corporate, import or sales taxes, in exchange for “technology transfer, capital inflow, skills development and job creation” (MME, 2010: 7-109).

Another attraction for investors is the lack of restrictive environmental regulation. Apart from a binding constitutional clause for ecosystem maintenance, the only other

concrete body of law is the 1992 Minerals Act (currently under revision), which asks for a cursory Environmental Impact Analysis, and lacks important provisions such as mining closure and rehabilitation requirements. An Environmental Act with requirements for an EIA applicable to all mining projects was approved in 2007 but so far has not been implemented, hampered by a weak administration. Indicatively, in the Ministry of Environment, there is only one person in charge of revising all EIAs for the whole country (Interview#138, 166); in the Ministry of Water only five people monitor the water quality of all 13 regions of the country (Interview#165). Approved uranium mining EIAs have been widely criticised by local and international NGOs (Schmidt and Diehl, 2005; Wise uranium, 2011; Interview#1). Environmental management is largely left to voluntary industry self-regulation such as ISO and corporate responsibility standards or to the Namibian Chamber of Mines program, that is neither legally binding nor independently monitored.

Corruption in Namibia is relatively low (61<sup>st</sup> out of 180 countries in the global Corruption Perception Index), however according to the Afrobarometer (IPPR, 2008), 49% of respondents inside Namibia felt officials were corrupt. Critics contend that there is an emerging black elite based around SWAPO's control of the growing public sector (Melber, 2003; Bauer, 2001), which gives work to 22% of the employed population, and spends more than 30% of GDP, (Sherbourne, 2009) channelling public funds to privileged interests in defence, paramilitary security and intelligence (Mbai and Sherbourne 2004 cited by Melber, 2007). Mineral exploration licences are protected by a secrecy clause in the 1992 Minerals Act and the Minister has much leverage for the terms of agreement with foreign corporations, with no public oversight (IPPR, 2010).

Namibia's low education quality (see Table 1) reflects the legacy of a two-tiered apartheid education system (Cohen, 1993). Spending in crucial sectors like health and education has declined since the mid-1990s (Sherbourne, 2009). There is a marked discrepancy in the position of the country in the global ranking of income per capita at PPP compared to its position in the Human Development Index (Table 1). This reflects a level of inequality amongst the highest in the world (Table 1).

<b>Indicator</b>	<b>Score</b>	<b>Source</b>
GNI per capita PPP (2010)	US\$ 6,420	World Bank, 2010
Human Development Index	120 <sup>th</sup> (out of 187)	UNDP, 2011
Inequality (Gini Coefficient)	0.73	HDR, 2007
Unemployment (2008)	50%	NFLS, 2009
Population living in poor conditions	27.6 %	NPC, 2008
Life Expectancy	51.2 years	OECD, 2008
Education for All Development Index	83 <sup>rd</sup> (out of 127)	UNESCO, 2011

Table 1. Some socioeconomic indicators in Namibia

The government maintains a focus on overall economic growth with mining at the forefront. Mining (including diamonds and other minerals) produced 10% of economic output in 2009 compared with 17% by tourism (NTB, 2008). Mining is responsible for 43.7% of export earnings (BoN, 2010) and uranium alone could in theory add 3-9% of total government revenue by 2015 (MME, 2010). There is much lip-service paid to mining as a source of employment, but the sector employs only 7,500 workers (0.02% of the employed population, Sherbourne, 2009), ten times less than tourism (NTB, 2008).

Namibia has relatively good infrastructure that facilitates material export with the mines connected to port facilities (map 2). However, isolation, aridity, and the use of water-intensive techniques to extract the low-quality ore require new water supplies for the mines and the government is in search of funds for a new desalination plant (interview#139). Mining also puts a strain on the electricity system, which faces periodic power shortages due to its dependency on South Africa (Sherbourne, 2009). Electricity demand by uranium mining alone may reach 200MW by 2015 (interview#160) compared to actual demand of 564MW in 2010 by the country as a whole (NAMPOWER, 2010); a 25MW emergency diesel generator has been constructed, with plans for a coal-fired power plant in Arandis and the development of the offshore Kudu gas project (Interview#162).



Map 2. Main uranium mines in the area (operating, under construction and planned) and town and communities most affected by the uranium expansion. Source: Authors with Google Earth map and data from MME, 2010 and Reptile Uranium.

In 2007 the government enacted a moratorium on new Exclusive Prospective Licenses (EPL) to allow environmental regulation and infrastructures to catch up. Nonetheless, at least 12 more mines are in the pipeline (map 2). In the remainder of this section we investigate the social responses, actual and potential, to the expansion of the uranium frontier. We start from Rössing, Namibia's first and the world's 3rd largest uranium mine, and then compare four diverse cases of prospective mines with different socio-environmental settings.

#### 4.2. The Rio Tinto mine in Arandis

The Rössing mine was founded by Rio Tinto in 1976. Rio Tinto is one of the biggest mining companies in the world with earnings of \$1.19bn for its energy (coal and uranium) segment in 2010 alone. Total production of uranium oxide from Rio Tinto's uranium mines in Australia and Namibia in 2010 was 16.6 million pounds (Rio Tinto, 2010). The Rössing mine is located in the middle of the Erongo Region, 60km from



the nearest town of Swakopmund (map 2). Rio Tinto built Arandis at a stroke in the middle of the desert to house workers. Most came from far away, often without their families: in 1977 only 550 of the 1,600 black workers were from the local Damara ethnicity, others coming from as far as South Africa or Malawi (Moody, 1992). After a long period of downscaled production, the mine in the last few years has again ramped up its production from 2,000t in 1993 to 4,150t in 2009 (Chamber of Mines, 2009). Furthermore, French Areva started building a new mine nearby Rössing and three to four new mines stand to open soon. How do locals perceive these developments? Our interviews suggest that many people in Arandis are welcoming this revival of mining activity. As interviewees stated, uranium mining means “more money into the country” (interview#98), reopening “a bank branch, a hospital and a petrol station” and turning the town hopefully into “an industrial hub” (interview#16) with “permanent jobs” (interview#120).

The lack of reaction against this expansion represents a change that contrasts with Arandis’ historic emblematic position internationally in social resistance against uranium mining (Hecht, 2010; Moody, 1992). The history of this resistance is worth recapping. The mine started during the 1970s global uranium boom, with a fixed contract between Rio Tinto and the British Government, which used uranium for military and civilian purposes (Avery Joyce, 1978; Roberts, 1980). By the early 1980s, the UK was importing nearly half its requirements from Rössing alone (Moody, 1991). The deal induced an international Campaign Against the Namibian Uranium Contract (CANUC), which brought together the Namibian independence movement, the anti-apartheid movement (the deal was in breach of UN decisions), and Partizans (People Against Rio Tinto Zinc and Subsidiaries), a London-based grassroots organisation. The movement held a number of direct actions and demonstrations in the U.K., Germany and Japan in the process mobilising students, anti-nuclear groups, campaigners and trade unions for nuclear disarmament. In 1984, the biggest contract between Rössing and a UK nuclear power plant wasn’t renewed, partly due to weakening demand and partly due to the activist pressure. Flows of uranium from Namibia to the UK continued, despite being delayed and rerouted on several occasions as during the Liverpool dockworkers’ strike in February 1988, who refused to handle 13 containers of uranium coming from Namibia (Dropkin and Clark, 1992).

The international campaign highlighted the appalling living, wage and worker rights’ conditions in Arandis (Dropkin and Clark, 1992; Roberts, 1980). Rössing’s workers also mobilised and held strikes in 1976 and 1978 (Hecht, 2010; Moody, 1992). The crackdown was fierce, as the Apartheid regime prohibited unionising and in 1980 closed the main workers’ Union of Namibia, imprisoning much of its leadership without trial. Still, the combination of local and international pressure partly paid off, as Rio Tinto in the early 1980s set up a special Foundation investing in improvements for the Arandis community. As one of the initial settlers recalls from those years: “We didn’t have to pay for housing, water or electricity, everything was provided for us, we even had a social centre and sports facilities” (Interview#97). Still, in 1989 half of Rössing’s workers lived in hostels without their families, while whites continued having the better jobs (Moody, 1992). In 1988, and with independence around the corner, workers formed Rössing’s Mining Workers Union and fought to end racism in the workplace, extending their demands on safety and

health issues (Hecht, 2010; interview#125). Hecht (2010) gives an excellent historical account of Rössing's workers' struggle for health rights and the micro-politics of science-and-technology involved. Local struggles were linked to the international movement, which after Namibian independence gave priority to health issues, with the publication in 1992 of 'Past Exposure' (Dropkin and Clark, 1992), a report that denounced the high levels of radiation and pollution in the mine, documenting a huge seepage of 780m gallons of radioactive tailings prior to 1980. Rössing invited experts of the IAEA for inspection, who concluded that the mine had an outstanding track record and that radiation was well below safety limits (Hecht, 2010). The Union and the international campaign hired a black Namibian medical student working in Germany to conduct a health assessment of Rössing's workers, who concluded that miners had increased risks of genetic damage and a worrisome reduction in testosterone levels (Zaire et al., 1996, 1997). Rio Tinto disputed his findings with two internationally recognised scientists who concluded that there was "no chromosoma aberration" (Lloyd et al., 2001). The campaign came to a peak and then receded after 1998, when an ex-mineworker with cancer won the right to bring his US\$650,000 compensation case in the UK (the Connelly case), but his case was dismissed because the time limit had expired (Meeran, 2011; Hecht, 2010).

What happened to this struggle? We hypothesise that the disappearance of resistance relates to the three enabling conditions mentioned in the introduction to this article; the natural and social ecology of Arandis, the deepening process of economic marginalisation of the community, and the weakening of the multi-scalar ties between workers and the international movement that mobilised resistance in the 1970s and up until the 1990s. First, the workers, settled in the middle of a desert, have no alternative source of livelihood other than working in the mines. Declining profitability in the 1980s and 1990s strengthened Rio Tinto in its negotiations with SWAPO, which gave up its initial plans to nationalise the mine. Rio Tinto stayed but began operating the mine in sleep mode, diverting money from a future restoration fund to keep mining operations, and cutting down on community expenses, handing the responsibility for the town to the government in 1992. Almost 70% of the workforce was fired in the 1990s (Chamber of Mines, 2009). Since Rössing was the only employer and there were no alternative employment opportunities, many people fled the town. Arandis lost many of its facilities, including the bank, the petrol station and the hospital, which was reduced to a clinic. Residents found themselves having to pay for services such as electricity, water, schooling and housing. The local authority was stripped of its revenue base, while facing increasing demands from an impoverished population (Interview #16). While marginalisation deepened, the international movement against Rössing waned. Pro-independence groups had achieved their purpose and the anti-nuclear movement subsided with the retreat of nuclear energy in the 1990s. As for Partizans, we can speculate they abandoned activities in Namibia due to internal changes, an already debilitated Rössing and the disappointing result of the Connelly case (Rössing however never ceased to appear in the black list of the group's publications).

Presently Arandis houses some 4,500 people, Rössing remaining the largest and almost only formal employer providing work to 494 people in 2008. Six to eight people are dependent on each mineworker in Arandis (Hoadley et al., 2005). Although Rössing's salaries are relatively good for Namibia (they start from

US\$1,000/year), 88% of Rössing's mine workers in 2008 were subcontracted to companies that do not offer benefits or labour security.

The revival of mining appears therefore as the only hope for the town's residents and its local authority. Yet the first signs of a renewed local-international campaign may be found in the awareness activities carried out since 2008 by Earthlife Namibia and the Labour Resources and Research Institute (LaRRI), who disseminated interviews with sick ex-workers of Rössing who link their health problems to the mine. The health impacts to workers are becoming more acute now, with many of the old workers becoming sick (interviews#96,98,99,109,110). Assessing the full-scale of such claims is nearly impossible, as many ex-workers die unregistered at their places of origin, whereas Rössing refuses to make public any data related to the health condition of its workers not only to us but also thus far to the health authorities (Interview#11).

### **4.3. Snapshots from Namibia's current uranium rush**

Whereas the community of Arandis lived through the typical boom and bust cycle of the uranium industry, the following four cases have not had previous contact with uranium.

1. The Spitzkoppe community is located in the northern part of the Erongo region, 50km from the site where Areva obtained a mining license in 2009 to build a mine (see map 2) and inside a conservation area. 2. The resident Topnaar community belongs to the Nama ethnic group, and live along the Kuiseb river, where two Australian corporations, Reptile and Toro Uranium, are undertaking exploration (see map 2: Aussinanis and Ripnes). 3. In the Valencia farm area, five white land-owners have bought land as a second residence; this is the site of a new mine owned by the Canadian Forsys Metals. 4. Finally, Swakopmund is a coastal town with 29,000 inhabitants living mainly from tourism where several mines are in the process of obtaining a license in the nearby National Park. Compared to Swakopmund, Spitzkoppe and Topnaar are much smaller communities with around 1,600 and 1,000 people each.

Table 2 compares the four cases and Arandis. Differing levels of perception and reaction towards uranium mining are observed. In Spitzkoppe where we talked to 22 people, nobody was aware what radiation means or of the potential impacts of uranium mining. People were very enthusiastic about the arrival of mines, a woman commenting: "[The opening of the mine] it's my dream, our people must be given a job, training, we must change our living standards" (Interview#40). The headman of the community stated: "228 applications have been presented [to the mining company] and I think most of them will get a job," however due to low education levels few in fact will be able to work in the mines. Areva fuelled expectations of development by drilling a village borehole for potable water in 2008. "If they have power to bring us water, they can also develop the community," an interviewee told us enthusiastically (Interview#22).

With the Topnaar, the situation is different. While a large part of the community, especially elders, are ignorant of the nearby mining explorations and their potential

impacts and many express similar sentiments as in Spitzkoppe about jobs and development, a significant proportion of the population, particularly those more educated and further up in the hierarchy of the community, are aware and concerned with impacts. Many seem to hold views similar to those voiced by interviewee 69: “I don’t mind the mines, but not here, not in the Kuiseb. They can be located there (points out), in the gravel plains, away from us” because “they will impact on our grazing areas, they create too much dust and noise and the [wild] animals will go” (Interviews#47 and 73). Others, complaining about the arrival of mines told us “I like our way of living, here is peace and quiet” (Interview#66). “I will never die of hunger here, I can kill a goat if I am hungry, there will always be something to eat” (Interview#63). The Topnaar community is the only community in Namibia that has publicly expressed its concern about the mining expansion. Statements by their Chief Seth Kooitjie appeared in a national newspaper (New Era, 13 October 2008). Yet, the Chief sounded more pragmatic to us than in public: “We have no power to stop the mines, nobody asks us, nobody has ever asked us permission for anything” but added that “at least they should give us something, we want jobs and development” (Interview#46).

Table 2. Comparison of cases based on data from the mines and the communities near them, including economic, social and environmental characteristics as well as absence or not of conflict. Source: author's interviews, mining companies' websites and Chamber of Mines (2009b)

Case studied (community)	Arandis	Topnaar	Spitzkoppe	Swakopmund	Valencia				
Mine(s) associated	Rössing	Aussanis	Ripnes	Trekopje	Marenica	Etago	Omahola	Langer Heinrich	Valencia
	Rio Tinto	Reptile Uranium	Toro Energy Limited	AREVA	West Australian Metals/ Hanglong Energy Limited	Bannermans	Reptile Uranium	Paladin Energy	Forsys Metals
Main owner of the mine	Australia/UK	Australia	Australia	France	Australia/China	Australia	Australia	Australia	Canada
Owner nationality	1978	exploration phase	exploration phase	2010	exploration phase	2013	2014	2007	2012
Start of Project (expected)	12 years	na	na	11	na	16 years	12 years	15 years	17 years
Duration of project/closure date	5km	5km (aprox)	30km (aprox)	50km	55km	36km (aprox)	45km (aprox)	82km	5 km (aprox)
Location (Distance from the mine)	Khan river	Kuiseb River	Kuiseb River	No	Omaruru River	Swakop river	Swakop river	Swakop river	Khan river and aquifers
Location (Near river)	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Location (National Park, Conservancy Area)	Resource quantity (tons U)	113.4	8203	na	103000	na	23043	74500	38100
Estimated mine output/year (tonsU)	4500	na	na	3200	1000	2300-3200	1000	1700	1600
	Senior	Junior	Junior	Senior	Junior	Junior	Junior	Junior	Junior
Type of company (junior/senior)	2384	na	na	na	na	na	na	852	na
Nº employees	969(88%)	na	na	na	na	na	na	637 (75%)	na
Subcontracted (% total employees)	Rössing Foundation	none	none	CSR by AREVA	none	Influx of people and business	Influx of people and business	planned	none
Economic advantages	Tourism	yes (two camp sites)	yes (two camp sites)	yes (one camp site)	yes (one camp site)	Yes	Yes	Yes	planned
	Indigenous community	No	Yes	No	No	No	No	No	No
	Sacred value	No	Yes	No	No	No	No	No	No
	Prior information consent	No	No	No	No (Areva consultation through Env&Social Impact Assessment)	No	No	No	No
	Historically marginalised	No	Yes	No	Yes	No	No	No	No
	Perceived health risk	Yes	Yes	No	No	Mixed	No	No	No
	Health impacts	Yes	No	No	No	No	No	No	No
	Powerful chief	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Water issues (present & potential)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Water scarcity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Impacts on environment (present & potential)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Environmental</b>	Type of environmentalism (Martinez Alier, 2002)	Too dependent to be green	Environmentalism of the poor	Too poor to be green	Too poor to be green	Cult of wilderness	Cult of wilderness	Cult of wilderness	Cult of wilderness
	Closure Plan/Closure Fund	Yes/Yes	na	na	Yes/No info	na	na	Yes/No info	na
	Voiced discontent	Yes	Yes	Yes	No	Few	Few	Yes	Yes
	Legal challenge	Yes	No	No	No	No	No	Yes	Yes
	Demonstrations	No	No	No	No	No	No	No	No
<b>Conflict</b>									

In the city of Swakopmund in turn, there is awareness that the uranium mines are going to damage the tourism industry, either due to the visual impact of the mines and the associated infrastructure, the blocking of routes and access to often visited places in the National Park, or the influx of migrant workers that could increase insecurity (Interview#144b) and the nearby development of a new chemical industry complex that would fabricate reagents for the mines (MME, 2010). The tourism industry is controlled by whites; and although most of them realise the importance of conserving the park (Interviews#130,129,129b), few have ventured to voice their complaints outwardly and more hope for sustainable, mutually satisfactory solutions through the information sessions that are held with the mining companies. Few complaints about uranium mining have reached national newspapers (The Namibian, 12 August 2010; 31 October 2008). However in 2011, some Swakopmund residents, mostly white, realising the chemical industrial complex would be located right at their doorstep, raised their voices and created a strong opposition (The Namibian, 2 October 2011). However government officials believe that mining and tourism can co-exist (interview#142, 138), since many areas of visitors' interest will remain unaffected by the infrastructure. The tourist operators hope the same.

Interestingly, the only effective legal challenge to the national uranium rush comes from a white land-owner holding a vacation farm near Valencia uranium mine (see map 2). The complaints there were motivated out of nature appreciation and the beauty of wilderness. In the words of a farmer: "look at the view and [you] see what it was like years ago; no paths, no telephone, we want to keep it like this for those after us" (Interview#157). Valencia farm-owners perceive that the mine "will have an impact not only on the water, but on the animals, on the air, on the landscape, (...) people will come to the area to work, it will stop being the way it is now" (Interview#157). One owner among those who shared this view, challenged in court the groundwater permit that was given to the mine for its construction phase (Court Case, 2008). The case is still in the courts, but in the meantime the water permit to the mine has been on hold. Together with the fall in uranium prices and the low uranium ore concentration in the area, this has slowed down the plans of Forsys to develop the mine in Valencia.

How can we make sense of these differences in perception and in the strength, or absence, of opposition? Looking first at the spatial geographical context, all projects are located in the remote arid territory of Erongo, yet there are different degrees of conflict with alternative uses of the territory. Whereas the Spitzkoppe barely subsist and do not use extensively the local environment, the Topnaars rely on herding and the melons that grow on the riverbed, with their survival intimately linked to the river. For Swakopmund, the mines are something happening far away, even though it will visually impact a considerable part of the territory that provides them with wealth through the tourism industry. These are still tentative links, and there is hope that given the vastness of the area, tourism can continue unimpeded in other areas of the national park. More worrisome are the changes that might take place in the city itself given the possible inflow of workers, but these are also uncertain and not immediate. It is only when residents perceived the impacts of a future chemical plant will be closer to them that they reacted. In the Valencia farms, the conflict is more

direct: between the leisure use of the area by the white land-owners, which is evidently incompatible with the mining of a radioactive substance.

Secondly, these communities have different degrees of power to challenge mining development. Spitzkoppe belongs to the Damara ethnic group who were used as slaves by the Nama and Herero for centuries and as a result did not experience the process of ethnic self-definition and coherence of other tribes (Henschel and Wenning, 2009). As part of South African colonial policies of dispossession, the Damara, along with other tribes in Namibia, were dispossessed of their land 40 years ago, which passed to whites for farming, and they were confined to native reserves in marginal, semi-deserted lands. Their community remains economically marginalised even by Namibian standards, with an average annual income per person of US\$150 - US\$300 with more than 75% being unemployed or living of selling gemstones obtained by small-scale mining. The literacy rate is considerably lower than the average for the region with over 50% not completing primary education (Areva, 2008).

Although education levels and incomes are also low in the Topnaar community, they are a much more ethnically cohesive and politically empowered community with a strong attachment to their land in the vicinity of the mouth of the Kuiseb River, where they have lived for centuries. Although the area was declared a Game Reserve in 1907 by the Germans and a National Park in 1979 by the South Africans, the Topnaars resisted repeated plans for their eviction and were eventually granted semi-permanent communal land tenure rights in 1979 (Henschel and Wenning, 2009). In later years many Topnaars migrated to the coastal cities, succumbing to government harassment and in search of jobs, but those who remain maintain a subsistence-based living relying on local resources and a strong communal structure, controlled hierarchically by the Chief and his family.

The Valencia land-owners and the Swakopmund tourist operators live a world apart from the Topnaars and Spitzkoppe. They form part of the educated white elite of Namibia. This explains why the former have been the only one who have successfully accessed the Courts and managed to stop, at least temporarily, a mine. During SWAPO rule, the white community maintained most of the economic privileges; they control still great part of the land and the economy. They have however lost political influence. Many of them are hesitant to confront the SWAPO government and its development plans, preferring to stay on their own turf. This might partly explain why in the case of Swakopmund, the tourist operators are less willing to challenge head-on the mining plans and why they retain a more fatalistic, 'wait and see' approach. Similarly, in the Valencia court case, this might explain why the demand was put forward by only one land-owner, others hesitating to join the legal process.

Thirdly, links with external actors also influence the differing levels of reaction. While Spitzkoppe has remained largely isolated and people there have heard nothing about uranium mining or nuclear energy, awareness by the Topnaars owes a lot to a tour presentation in 2008 by two foreign environmentalists who gave several public talks on nuclear energy and uranium mining and showed dramatic pictures of health impacts of radioactivity elsewhere. Many of our interviewees remembered the presentation and although they did not fully comprehend the nature of the impacts,

they understood that uranium mining would pose a health threat and decided to oppose it. In the Valencia case also, the success of the plaintiff would have been difficult without the collaboration with the Legal Assistance Centre, an independent legal NGO based in the capital, which takes on legal challenges against human rights abuses.

If we were to predict the prospects of resistance, we would state that Namibia as a whole is a country of least resistance, given its geography, low population density and social structure, and this explains the ease with which the global uranium rush has expanded in the territory, displaced from traditional source countries despite their larger and higher quality reserves. True, uranium mining is not something that one would easily recommend to any country. There are real costs in terms of (scarce) water and energy. We have also emphasised that damages to health from radiation are not unknown in the country because of Rössing mine. Nevertheless, save for the Valencia farms, where a strong white individual with the help of an NGO managed to mount a legal challenge to a uranium mine, the only other case where resistance may challenge the expansion of the uranium frontier is with the Topnaars. Their dependence on local resources that stand to be impacted by uranium suggests a potential for a resistance stemming from an environmentalism of the poor and the indigenous. Internal community power dynamics will be important in the Topnaars' case. The chief of the Topnaar community has already met with mine representatives, having decided to collaborate with them in exchange for money and development for his community. Since everything will be channelled through him, he is likely to favour the mines to earn more power and money. Some Topnaars interviewed questioned the honesty of the chief, claiming that he "is in favour of the mines because he receives money from them" given that he let the companies drill for prospecting (Interviews #77,78,84 and 85). The attitude of the chief will most likely deter resistance within the community. However, the Chief's rule is disputed by contender King Khaxab, who opposes the mine expansion. He is not alone in thinking that the mines will destroy their traditional way of life. This internal division in the community might be the initial step in a process of resistance that could rely on King Khaxab, who coincidentally has already developed international connections, such as with the foreign couple of experts who made the uranium tour at his request.

In the Swakopmund case, the opposition has so far focused on the industrial chemical complex and not on the mines themselves. However, given the importance of the tourist economy, we can speculate that if the first mining activities in the Park start having an impact on the sector, this might slow down subsequent ones. Another limiting factor for the expansion of the uranium frontier in Namibia is the sheer amount of infrastructure, especially water, that needs to be mobilised, the cost of which is prohibitive for most private operators, and difficult for the State to take up. The financial crisis and the Fukushima disaster, coupled with the declining price of uranium, may do more to halt the uranium frontier than local resistance, though they may at some point coalesce, making some investments too expensive to undertake.



## 5. Conclusions

The world's growing social metabolism in terms of energy and materials is producing new geographies of extraction, production, consumption and waste disposal and resistance in different parts of the world. This article investigated the expansive extractive geographies of an important energy resource for powering modern society, uranium, and the forms of resistance it meets in a specific territory, Namibia. Our task was both empirical and theoretical: empirical in terms of collecting information about the trends of the uranium mining industry and in documenting the forms and consequences of its expansion in a specific place; theoretical in terms of formalising and using accumulated knowledge from previous ecological economics, social movement and political ecology studies to understand the initial and subsequent conditions under which resistance is likely to emerge in this extraction frontier. We also looked at the forms such resistance can take in terms of social class, ethnicity, and scale, and the ways that this may in turn shape the frontier and the territory.

What is the main contribution of our research? Firstly, the rush for uranium mining and its socio-environmental impacts is too little known and often ignored in the debates about nuclear energy. We claim that problems and concerns with nuclear energy start from the point of extraction. Not only production and disposal should be considered when evaluating the socio- environmental life-cycle costs and benefits of this source of power.

Second, we analysed a broader phenomenon, i.e. impacts and conflicts at the extraction frontiers of global material flows. This is of obvious relevance to the understanding of global environmental change. Yet it has received relatively less attention than natural/climatic hazards and regional/local vulnerabilities. Global environmental studies at their best offer integrative conceptual frameworks combining qualitative, grounded case-study analysis with quantitative data. We developed and applied an integrated framework for the study of our topic, using elements from ecological economics, political ecology and social movement theory. Our approach depicted in Figure 1 is open, yet also general enough to be applied elsewhere offering a set of analytical entry points for studying frontier expansion and resistance/conflict at the various stages of a material/commodity chain.

Third, we extended environmental social movement theory enriching sociological analyses which look only at the limits posed by marginalisation in collective action. We shifted attention to the geographical and bio-physical specificities of the resource and territory at stake, and cross-scalar links between local and international actors. Communities are neither 'too poor to be green' nor do they automatically resist State or corporate projects in their territory. It is the interdependent set of socio-economic, biophysical, geographical factors that determine where resistance emerges and where not. We have not offered an (impossible?) general theory of environmental social movements in the third world. We have demonstrated however how the above three – among many possible – factors provide a good explanation for reaction/movement formation within Namibia. We welcome research to test the importance of these factors in different settings, ideally through cross-comparative research.

Our analysis does not offer easy predictions or prescriptions about what will or should happen with uranium mining in Namibia, much less elsewhere. It does however offer the basis for an informed debate of possible developments. It is through the changing dialectics of expansion and resistance that the new uranium landscape in Namibia and the rest of the world will be determined. In 2006, the Navajo hosted the first Indigenous World Uranium Summit with indigenous delegates participating from around the world. They called for a ban on uranium mining in native territories. Participants form a coalition of anti-mining, anti-nuclear and indigenous movements in North America and Australia. Their activism, coupled with strengthening environmental regulations, has resulted in delays of uranium mining projects in these countries. In contrast, given its geographical, socio-economic and governance conditions, Namibia thus seems to present itself as a path of least resistance and one may expect it to be at the vanguard of the expanding global uranium frontier.

There is however no pre-determined trajectory. The nuclear disaster in Fukushima in 2011 changed once again the dynamics of the nuclear industry, and by extension its source commodity, uranium. Even if the effect on uranium production expansion and prices were not to be as dramatic as in the preceding Chernobyl and Three Mile Island accidents, the uranium rush is likely to slow down despite plans for many more nuclear power stations in China, India and other countries. The most expensive, more problematic, or locally more resisted projects are likely to be trimmed down, such as the Valencia mine. An important related development is the reawakening of the anti-nuclear movement and the strengthening of alliance-building between movements along the uranium chain. An expression of this is the recently created African Uranium Alliance. This brings together several African NGOs denouncing the impacts of uranium mining. Earthlife and LaRRI from Namibia, members of this Alliance, staged a renewed campaign denouncing Rössing's impacts on the environment and the health of workers. The Uranium Alliance is reinvigorating ties with anti-mining movements elsewhere as well as nuclear energy campaigners like the International Physicians for the Prevention of Nuclear War. It remains to be seen whether white activists and environmental NGOs will build effective bridges with discontented workers, and indigenous marginalised communities, to challenge the industry and re-shape the uranium frontier in Namibia.



## Chapter 2

### Activism mobilising science

#### Abstract

The article sheds light on a process where unequal power relations are contested through the co-production of scientific and local knowledge. I argue that lay citizens, communities and local grassroots organisations immersed in socio-environmental conflicts are engaging with professional scientists to understand the impacts a polluting project is causing on their environment and themselves. Together with scientists they co-produce new and alternative knowledge that gives the local organisations visibility and legitimacy, information on how to protect from the impacts and allows them to engage in practical activism, challenging the manufactured uncertainty and other information produced by the state or companies running the projects. This process is what I term Activism Mobilising Science (AMS). It is locally driven by activists who have built related capacities and is generally based on voluntary work. AMS is compared to other participatory processes and gives clues into how grassroots organisations can avoid co-optation. The analysis is based on two uranium mining conflicts in Niger and Namibia where two local organisations are trying to confront the manufactured uncertainty of the nuclear industry through an AMS process.

Keywords: activism; knowledge co-production; political ecology; uranium mining; participatory processes; resistance

## 1. Introduction

“We had no knowledge that radon could travel, we thought that you had to be in contact with uranium, otherwise radioactivity would not impact you” (A. Alhacen, Pers.Comm., 1 February 2013).

In Niger, Almoustapha Alhacen is the head of Aghir in’man, a local NGO in Arlit, located next to the uranium mines of Areva, the French state nuclear giant. After working for more than 20 years in the uranium mines he saw several of his colleagues getting sick from diseases they did not understand. He wanted to know more; understand why that happened, and take measures to protect himself and others.

In a similar way, Bertchen Kohrs and Hilma Shindondola-Mote, heads of two NGOs in Namibia (Earthlife Namibia and the Labour Resource and Research Institute, LaRRI) had been trying to gain more knowledge about the impacts of radioactivity. In 2008 they carried out an investigation and campaign revealing that an unknown number of mineworkers of Rio Tinto’s Rössing uranium mine had been getting sick and some of them dying. The workers believed their diseases were connected to their work in the mine. They had heard about radioactivity but didn’t know how it could impact them. By highlighting and exploiting the uncertainty over radiation related occupational health diseases (Hecht, 2012), mining companies have impeded workers from claiming compensation. Moreover, the nuclear industry has also manufactured this uncertainty (Michaels and Monforton, 2005) by for example producing studies denying the impacts of radiation (Hecht, 2012). The manufacture of uncertainty has been used with great success by polluters and manufacturers of dangerous products (best known examples are the tobacco and asbestos industries) by questioning the validity of scientific evidence on which regulation prohibiting those products is based (Michaels and Monforton, 2005). I differentiate between knowledge *produced* by the mining companies that is based on their own measurements or monitoring of impacts and *manufactured* knowledge that aims at covering or increasing uncertainty about an impact. The two Namibian NGOs wanted to challenge this uncertainty by learning more about radiation and its impacts. As a result, both Aghir in’man from Niger and Earthlife from Namibia contacted CRIIRAD, a French independent laboratory specialised in radiation. CRIIRAD visited the two countries marking the start of an on-going collaboration, allowing these organisations to learn more about radiation and challenge the knowledge created by the mining companies.

These alliances emerge as a result of the increasing pressure for extraction driven by the increasing social metabolism, a decline in the quality of minerals and reserves and an increasing competition among land uses. This is driving the commodity frontier into more ecologically and socially vulnerable areas, with higher environmental impacts (Moore, 2000). These areas are often inhabited by indigenous people or historically disadvantaged social groups, whose livelihoods are highly dependent on their land (Guha and Martinez Alier, 1997). These phenomena set the conditions for the emergence of resource extraction conflicts (Martinez Alier et al., 2010). The expansion of the commodity frontier or the increasing impacts in these areas after many years of extraction is causing local communities to react and

confront these operations. This is coupled with an increasing capacity by local organisations to make extra-local contacts (Keck and Sikkink, 1998), in this case with scientists.

In political ecology literature several authors have examined how mining companies have access to and control over resources, land, water, energy, minerals (Bebbington et al., 2010; Bryant and Bailey, 1997; Martinez Alier, 2003). However, to date the literature does not sufficiently explore how knowledge is co-produced, manufactured and controlled by these companies in order to create discourses and truths.

Knowledge production and control does appear in the literature when looking at how historically, knowledge has been appropriated by colonial officials (Bryant, 1996; Peluso, 1993; Robbins, 2004), conservationist NGOs (Bryant 2002) or institutional narratives (Fairhead and Leach, 1995; Sletto, 2008), imposing their discourses and 'truths' on grassroots organisations. Although examples where grassroots organisations contest these different narratives through relevant science-based knowledge are explored (Bebbington, 1996; Forsyth, 1998; Peet and Watts, 1996), little attention has been placed on the dynamics and processes of how this happens (see for example Peluso, 1995). In this article I explore one such mechanism of resistance, looking at how the interactions and processes of power can be reversed. Knowledge, be it local or scientific or newly co-produced (Jasanoff, 2004), becomes a political tool that can express and exercise power.

I argue that with a process which I hereby call 'Activism Mobilising Science' (AMS), lay citizens, communities, and local grassroots organisations are engaging with professional scientists to learn from them the tools and the scientific language they need to produce a new and alternative knowledge with which they can challenge dominant discourses and engage in practical activism.

Through AMS, activists become visible actors in the governance of extractive industries and environmental health, engaging politically and influencing environmental actions and outcomes together with the state and the companies (Lemos and Agrawal, 2006). For instance, urban neighbourhood organisations might call for expertise from environmental chemists who can teach them how to measure dioxins when confronting a new incinerator (GAIA, 2003), or peasant groups might ask a sympathetic hydro-geologist to instruct them on how to take water quality measurements when trying to challenge an open cast gold mine (FPIF, 2012).

The aim of this article is to build the definition of AMS by understanding **how** and **why** is activism mobilising, using and co-producing, science. The next section introduces the case studies' context; the manufactured uncertainty and opacity the nuclear industry often uses, which the AMS processes presented are challenging. The theoretical background and methods are explained in section 3 and 4. Section 5 explains how and why two grassroots organisations engage in an AMS process to confront uranium mining whilst section 6 gives clues into how these organisations have avoided co-optation. Section 7 situates and compares AMS in the literature on participatory processes and section 8 draws some conclusions.

## 2. Uranium mining and the manufacture of uncertainty

The cases presented in this article deal with Low Level Radiation, radiation under 100mSv, caused by uranium mining and affecting workers' health and communities living nearby. Despite half a century of intensive research in the field of radiation and human health, uncertainty is still prevalent as science has yet to find a way to clearly connect an individual's exposure to low doses of radiation to subsequent health problems or fatal diseases. Only with large groups such as the Wismut and Navajo cases<sup>2</sup> have large epidemiological studies with lifetime follow-up been able to detect a significant increase in cancer mortality (Brenner et al., 2003; Land 1980). Science cannot yet prove causation in particular cases (Connor, 1997; Brenner et al., 2003; EEA, 2001; Hecht, 2012). Given the difficulty to carry out these studies, the radiation protection community has been using since the 1970s the linear no-threshold model that assumes that the biological damage caused by ionising radiation is directly proportional to the dose (Kathren, 1996). In other words, there is no safe radiation dose. However, responding to pressures by the industry, the International Commission for Radiological Protection (ICRP), which sets the radiological limits adopted by the International Atomic Energy Agency, proposed the ALARA principle in 1977 (ICRP, 1977) by which all exposures should be kept As Low As Reasonably Achievable. According to Hecht (2012), this move tried to remove the exceptionalism of nuclear risk by comparing it to other industrial risks. It set a permissible threshold below which a reduction in exposure is not worth the investment. This caused a major debate in the nuclear industry, with the ICRP modifying the threshold downwards twice since then. With people impacted by Low Level Radiation claiming causal links that are still not scientifically proved and safe limits being modified as new research appears, it is safe to say that the impacts of Low Level Radiation are shrouded with uncertainty (Hecht, 2012; Kuletz, 1998).

The industry didn't only exploit this uncertainty but in many occasions manufactured it. Hecht (2012) points in her book to numerous accounts where mining officials contested the findings of the ICRP in order to defer regulation. She dubs the scientists behind this manufacturing as the "merchants of doubt" (Hecht, 2012:209). As with tobacco or asbestos cases, it has been argued that "the cause-and-effect relationships have not been established in any way; that statistical data do not provide answers; and that much more research is needed" (extracted from Michaels and Monforton, 2005). The established radiation limits (under 20mSv per year for workers) and the ALARA principle, allows the uranium mining companies to comply with the regulations, thus liberating them from any responsibility over sick workers. As with the lead industry case, the blame was shifted "from the lead itself and the manufacturing process, and claimed that the workers had sloppy habits and were

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<sup>2</sup>After WWII uranium mining expanded in the Wismut province in East Germany and in several states of the South West of the US, drawing (in the second) Navajo People to work in their mines. Numerous epidemiological studies have proven occupational related cancers (see among others, Kreuzer et al., 2010 for Germany and Gilliland et al., 2000 for the US). In the US led to the passage of the Radiation Exposure Compensation Act.

careless” (extracted from Michaels and Monforton, 2005). In Niger’s and Namibia’s uranium mines the responses are similar, “the diseases are caused by the eating and social habits of the workers, who don’t exercise (...) and in many cases smoke” (Rössing Manager, Pers.Comm., 21 June 2009).

As a result, the burden of proof of the impacts of Low Level Radiation is left to the communities. They however lack the technical expertise required by orthodox science to claim they are being impacted. The State and the companies value the formal and quantitative information the communities lack. They privilege evidence produced by experts trained in scientific disciplines. On top of this, communities face also the opacity of the uranium industry that made “invisible” black African miners (Hecht, 2012), Indian Nations in the US (Kuletz, 1998) and communities in Jharkhand, India (Ramana, 2012), bypassing for decades radiological safety regulations and not informing miners of the deadly hazards they were exposed to. To bridge this gap, it has been argued that these problems can no longer be viewed as purely technical and left exclusively to professionals. Due to high uncertainty, the urgency to solve this issue by those workers who are still alive and sick and the high stakes involved, the study and evaluation of Low Level Radiation in the nuclear industry could be considered a case of Post Normal Science. According to Funtowicz and Ravetz (2003) these problems must be managed by extended peer groups that should include lay knowledgeable people with stakes in the issue. Relevant knowledge “may include community knowledge of places, anecdotal evidence... [where actors] can create their own knowledge” (Funtowicz and Ravetz, 2003). These processes give legitimacy and visibility to actors through a combination of local and scientific knowledge as I describe below. Presently though, local knowledge such as the workers own accounts of health problems generated by grassroots organisations tend to be ridiculed or neglected, motivating some activists to engage in AMS processes. I argue that by instituting processes of AMS, workers and communities produce Post-Normal Science on the ground.

### **3. Theory**

Below I present two bodies of theory to help understand the process of AMS. The first one introduces how AMS challenges power relations through knowledge co-production. Then I frame AMS within other participatory or collaborative processes.

#### **Knowledge co-production and power**

Power is “a disciplining force dispersed through society” (Jasanoff, 2004). Power is located in the interactions and processes that build social relations and is shaped by the asymmetrical distributions of resources and risks (Hornborg, 2001; Paulson et al., 2003). The burden of environmental impacts in a socio-environmental conflict is a consequence of these power relations (Bryant, 1998; Peluso, 1992). Weaker actors are not only marginalised by the unequal distribution of the environmental burdens but by the predominant discourses that exercise and consolidate -in themselves- power (Bryant, 1998; Foucault, 1980; Peet and Watts, 1996). Such dominant discourses are embodied in environmental and social impact studies as well as Corporate Social Responsibility programs that propose development projects for local communities. These development discourses consolidate the mining companies’ domination over land and water (Escobar, 1995). They are accompanied by scientific



methods and language that are used to produce knowledge about the impacts of projects, increasing in some cases the uncertainty about these impacts.

Power is not static, it circulates, is continually “reinscribing itself in our communities, institutions, practices, discourses and scientific products” (Jasanoff, 2004). As such, strong actors such as mining companies rarely have overwhelming power, and weaker actors can challenge their legitimacy (Bryant and Bailey, 1997; Foucault, 1980). The literature on resistance emphasises the use of local environmental knowledge to subvert the activities of powerful actors (Guha, 1989; Peluso, 1992). It has long been argued that local knowledge should be included to reframe environmental policy towards more locally relevant needs (Chambers, 1997; Hecht and Cockburn, 1989), in environmental decision making processes (Peluso, 1992; Corburn, 2005; Fiorino, 1990) and in the management of natural resources (Agrawal et al., 2008; Gadgil et al., 1993; Toledo et al., 2003). This could signify a democratisation of science (Brown, 1998; McCormick, 2009) through the emergence of alternative networks that may exist in parallel, or outside the formal boundaries of scientific institutions (Forsyth, 2002).

Scientific knowledge has traditionally been seen as supporting hegemonic political forces and actors. However, like all knowledge, scientific knowledge is partly socially constructed (Foucault, 1971). Science depends on observation, measurements and testing of the natural world, but is also subject to its social history as well as the interests and stakes in place (Barnes, 1977); the social practices, material resources and institutions that contribute and disseminate this scientific knowledge (Corburn, 2005; Jasanoff, 2004). Scientific knowledge doesn't inherently favour strong actors such as mining companies or the State. Murdoch and Clark (1994) proposed a 'hybridity' of scientific and indigenous knowledge in projects to achieve sustainable development. It can also be used (and constructed) to expose and measure the impacts of polluting industries on local populations or communities. To this end, there has increasingly been more cases that combine the best of local and scientific knowledge through a co-production framework.

Taken from Science and Technology Studies (STS), the concept of co-production entails the “dynamic co-evolution of knowledge and social change” (Forsyth, 2002). It refers to processes where knowledge, scientific as well as local knowledge, is “framed, collected and disseminated through social interaction” (Jasanoff, 2004). Under this framework, science and values are negotiated, their objectivity and subjectivity is challenged and rethought. The knowledge produced by the mining companies, immersed in their own values and subjectivities, is contested by activists. These in turn co-produce their own knowledge, with their own biographies, explanations and applications. STS stresses that the making of science cannot be seen as an autonomous independent process and it's in fact political (Jasanoff, 2004). AMS has the political aim of altering power structures by challenging 'taken for granted' or manufactured knowledge.

Jasanoff (2004) describes co-production as more of a “bricolage” than an idealized scientific method, “opening conversations with other approaches of social and political enquiry”. My take on STS is on the process of co-production itself, on how different kinds knowledges are blended in the context of a socio-environmental

conflict. Corburn (2005) in his book on Street Science took on this challenge, albeit situated in a more urban and more policy oriented context.

In a socio-environmental conflict, a co-production framework should include all those “with a desire of participating in the issue” through an extended peer community (Funtowicz and Ravetz, 1993). The empowering aspect is not whether local or indigenous or scientific knowledge is used and co-produced, but it is about ‘knowledge’ itself. The same knowledge can be classified in one way or another “depending on the interests it serves, the purposes for which it is harnessed, or the manner in which it is generated” (Agrawal, 1995).

### **Participatory Processes**

The use of local knowledge and the promotion of participation of communities is not new. Indeed starting with Participatory Rural Appraisals (Chambers, 1983), the field of participatory development emerged in the 1980s with the objective of making development projects legitimate, making sure they encompass all the issues relevant for local actors (Hickey and Mohan, 2004; Reed, 2008).

Participation has also become relevant in other disciplines such as policymaking and research, evolving into other forms of participatory processes. At its roots is the rejection of the ‘deficit model’ that assumes lay people lack sufficient understanding and knowledge, and need education in order to participate in policymaking and scientific undertakings (Sturgis and Allum, 2004).

The degree of participation of grassroots organisations and the power asymmetries between these and the institutions are controversial factors that differentiate different collaborative and participatory methods. Action and Participatory Action Research (PAR) highlight the importance of local and bottom-up approaches to research and decision-making (Minkler, 1997; Reason and Bradbury, 2001). With a higher degree of participation and acknowledgment of local knowledge, in Community Based Participatory Research (CBPR), community partners are involved in all phases of the research from its inception, research questions and study design, to the collection of the data and interpretation of results (Minkler and Wallerstein, 2003; Shepard, 2002). However CBPR is generally started by the researcher, who brings into the community the history of the research institution and of the researchers themselves. Scientists can be reluctant to have their credibility challenged whilst activists face the possibility of being co-opted by participatory mechanisms that allow their superficial involvement but do not give them decision-making power (McCormick, 2009; McGrath et al., 2009; Montoya and Kent, 2011). These participatory processes are a step forward from the deficit model, but embrace instead a ‘complementary model’. In it, the communities are given a voice and invited to give political considerations but they still don't engage in technical issues (Wynne, 1991; Corburn, 2005). Following Corburn (2005) I argue that when local knowledge is acknowledged, incorporated and used to develop scientific knowledge, a co-production framework is adopted.

The participatory paradigm also comprises different forms of participation in the production of science. Civil, citizen, civic, stakeholder and democratic science all embrace the idea that science and science policy have political and social

implications and that citizens must “have a stake at the science-politics interface” (Bäckstrand, 2003). Civic science aims at enhancing public understanding of science, increase and diversify participation and promote the democratisation of science (Bäckstrand, 2003). The democratisation of science (McCormick, 2009; Nowotny, 2003) criticises and contests expert knowledge for being biased and politically driven and aims to give legitimacy to lay knowledge in science. It aspires to transform the institutions of science including more democratic principles and reframing research and scientific objectivity. It goes beyond representation and participation and to heart of scientific enquiry (Bäckstrand, 2003; McCormick, 2009).

Closer to what I call AMS is citizen science where lay citizens who are not trained as conventional scientists participate and enact science, they collect and process data as part of a scientific enquiry. It differs however from AMS in that nowadays most citizen scientists participate in research projects that are designed and adapted to them. We see this especially on the fields of ecology and environmental sciences where citizen scientists record for example sightings of bird species (Silvertown, 2009).

Another way of linking experts and lay citizens are science shops. Largely in urban settings, science shops act as “brokers” between community groups or NGOs and university researchers on themes defined by the NGOs (Barr and Birke, 1998; Dickson, 1984). Also in urban contexts but challenging the conventional use of science, Corburn (2005) proposes the framework of Street Science. Using four case studies in Brooklyn, New York, he describes how grassroots organisations use local knowledge to engage in environmental health issues affecting their communities. He argues these organisations challenge the “dominant system” by “deconstructing professional ideas as inadequate representations of reality”, contesting conventional ways of framing problems and employing methods. Street Science also embraces a co-production framework, placing great emphasis on the role of local knowledge. Also based in industrialised economies, the counter-expertise model describes a specific type of activist-scientist relation whereby laypersons liaise with scientists to produce alternative knowledge in a context of high uncertainty and risk such as nuclear energy. As I will analyse in the discussion, AMS is close to Street Science and the counter-expertise model but differs from them in some elements.

Although grassroots organisations are not always aware of it, all these collaborations between traditionally historically marginalised communities and professionals can be classified as part of the environmental justice movement, as they demand an end to social and economic policies that subject excluded and poor communities to environmental hazards affecting their health (Bullard, 1990; Cole and Foster, 2001). Although centres of environmental justice as well as science shops can be defined as Community Based Participatory Research (O’Fallon and Dearry, 2002; Shepard, 2002), the way the research is defined and used will depend on the power structures of each case.

#### **4. Methods**

The case studies in this paper were chosen as paradigmatic case studies (Flyvbjerg, 2006) to understand the emergence of a coalition between scientists and

activists that has been emerging with the rising number of environmental conflicts, especially in the global South (Martinez Alier, 2003). Although these coalitions are indeed happening with other environmental conflicts, such as gold mining (FPIF, 2012) or GMOs (Saunders and Ho, 2012), uranium mining is an excellent example of what AMS is trying to confront with knowledge creation: the opacity of the nuclear industry and the uncertainty of Low Level Radiation. The cases of Niger and Namibia are very illustrative because mining has been taking place there for more than 30 years in colonial and post-colonial contexts with deeply embedded power relations that only recently are starting to be challenged. One such mechanism of contestation is AMS.

The empirical research is based on the thematic analysis of 11 interviews carried out in person or via skype or telephone during 2012-2013 with key activists and scientists in the two AMS processes. A newspaper search was carried out as well as a survey of relevant documentation of the grassroots organisations, CRIIRAD, of Areva's subsidiaries Cominak and Somaïr and Rio Tinto's mine Rössing. The paper also benefited from two field trips in Namibia carried out in 2009 and 2012 and the participation in the EU funded project EJOLT (Environmental Justice Organisations, Liabilities and Trade), which provided the funds for CRIIRAD's visits to Namibia.

## **5. Uranium mining in Niger and Namibia**

The towns of Arlit and Akokan, in Niger, were built by Areva (then Cogema) in 1968 to house the workers of its two uranium mines: Somaïr and Cominak. Of the 100,000 inhabitants that currently inhabit the area (Areva, 2011), only those working for the mines and the town officials have running water, electricity and health services. The rest, around 60,000 residents, live in houses built out of mud, corrugated iron and scrap metal (Greenpeace, 2010; The Guardian, 1 February 2009). Water is polluted and access to it is inadequate (Chareyron, 2003; 2008). Areva has already used 20% of the local aquifer's capacity (Areva, 2009). Marginalisation and dependence is acute, with nearly all inhabitants connected in some way to Areva's mines (Areva, 2009). Areva remains the biggest private employer and exporter in Niger (Reuters, 5 February 2014) giving leeway to their activities. This context has placed Areva in an extremely powerful position vis a vis the workers and inhabitants of Arlit and Akokan. With colonial ties that have consolidated since the mine's opening and limited independent oversight that only in the last decade is starting to break, local communities and workers are in a clearly marginalised position.

One of the biggest concerns for the workers and residents near the mines is the impact of Low Level Radiation on their health. This can be external radiation (beta and gamma) emitted by uranium and its decay chain, as well as internal radiation fixed inside the body when breathing radon gas, inhaling dust or drinking and eating polluted water and food. One of the biggest hazards emitting Low Level Radiation are the tailings dams and the waste rock piles, where all the mining waste is deposited, radionuclides can be transported by air and seep into underground waters. Tailings contain 85% of the original radioactivity and will remain radioactive for hundreds of thousands of years (Chareyron, 2008). Both mines have created since their opening in 1968 more than 30 million tonnes of tailings (Areva, 2011). In underground mines such as Cominak, radon gas is a major hazard both for its workers and for the residents living near the ventilation shafts (Chareyron, 2008).

Areva has manufactured uncertainty about the hazards the local population faces. A case in hand occurred when the IRSN (the French Institute of radioprotection and nuclear security) visited the mines at Areva's request in 2004 placing numerous recommendations. Although they were mostly followed (Areva, 2005) an exception was the high exposure in front of the police station in Akokan, which Areva denied and no remediation was undertaken (Areva, 2011).

Almoustapha Alhacen has been denouncing the impacts of the mines on the environment and the health of the communities because "Areva doesn't have a structure to inform people. Areva says nothing, not an ounce, to inform them about the dangers of radioactivity" (A.Alhacen Pers.Comm., 1 February 2013). Since he founded the NGO Aghir in'man in 2002, he has been informing local residents and workers about the impacts and risks of radiation, engaging with the press, the chiefs and other political actors and co-producing new knowledge that contradicts Areva's manufactured uncertainty through an AMS process, as I will analyse in section 5.3.

In Namibia, the town of Arandis was built to house the workers of Rössing uranium mine, a Rio Tinto mine that has been operating since 1976. Rio Tinto is the fourth largest publicly listed mining company in the world with mines in over 40 countries (Rio Tinto, 2014). During the 1990s coinciding with low uranium prices, Rössing retrenched 70% of its workforce, causing many people to flee the town. In 1992, Rössing handed the administration of the town to the government, forcing residents to pay for the first time for electricity, water, schooling and housing, further marginalising the town (Chapter 1: Conde and Kallis, 2012). Like in Niger, residents and workers depend fully on the mine. Of main concern is the impact that Rössing has caused (and continues to be causing) on the environment and the health of workers. Like Areva's subsidiaries in Niger, Rössing has not declared a single occupational health disease related to radiation (Dr. Swiegers, Pers.Comm., July 2009). Moreover, the mine has never been open to release or collaborate with investigations connected to radiation related diseases. During the 90s the Mine Workers Union in alliance with anti-nuclear movements took action to uncover health impacts on workers through a study that was carried out by Dr.Zaire, a young Namibian doctor. Through government connections the company managed to revoke Dr.Zaire's research permission. The study was carried out in secret but its findings were rejected by Rössing (see Conde and Kallis, 2012; Hecht, 2010).

As a recent report carried out by Earthlife and LaRRI shows (Kohrs and Kapuka, 2014), this opacity is prevalent with Rössing's workers not given access to their medical records with some of them dying of diseases they don't comprehend. This opacity pushed Earthlife to start an AMS process.

### **5.1 How is AMS carried out?**

AMS is a locally-driven process that gives visibility to local activists. By local is meant community or grassroots organisations from the areas where the impact or activism is taking place. AMS is generally driven by one or two individuals that have built related capacities and is largely voluntary. AMS follows a co-production model where local as well as scientific knowledge is combined to produce new knowledge. The

relationship between the scientific expert and the activist is of continuous collaboration and inter-dependence.

### **Locally driven**

Since 1999, Alhacen and other co-workers at Somair partnered with Areva to carry out some workshops on how to efficiently use water and electricity. Although their knowledge on radiation issues was close to nil, they had long suspected of a link between uranium mining and occupational illnesses, warning against excessive road dust or taking working clothes home. But it was not until three colleagues that worked in uranium concentration sections died, that Alhacen decided to cut the association with Areva and form Aghir in'Man; "we wanted to understand what radiation was and how to measure it" (A. Alhacen Pers.Comm, 1 February 2013). They contacted Greenpeace and CRIIRAD, only the latter answered. Soon after, radiation measuring devices were sent to Aghir in'man so that they could take some initial samples and measurements. This sampling convinced CRIIRAD to make a field trip to Arlit in 2003. After the visit, CRIIRAD published the results through a press release and several reports confirming there was radioactive contamination in the water, air and in the scrap metal sold at markets. They also pointed out the problem of radioactive tailings stored in the open air (Chareyron, 2003; CRIIRAD, 2005). To share these results, Aghir in'man organised and carried out workshops with women, local journalists and chiefs of different tribes. They organised sampling trips with local counsellors and journalists to take measurements in the polluted areas.

In Gabon, where Areva has also been mining for 30 years and the impacts are very great (see Hecht, 2012 and CRIIRAD, 2009), Bruno Chareyron, CRIIRAD's laboratory director explains that no strong local organisation was driving the process locally: "in the case of Mounana (Gabon), if those people were to ask CRIIRAD [to come to Gabon], we would have made it a priority. We tried to do something [sending them a Geiger counter] ... but both sides have to do something". In contrast, in Niger, Aghir in'man is leading the process; they take out samples, organise workshops, participate in public meetings, give interviews to journalists and locate funds to acquire new equipment.

Earthlife Namibia followed a different path. Since its creation in 1990, Earthlife has been denouncing the impacts on the environment of industrialisation and mass tourism, sometimes being the only source of dissent in the country. Major campaigns were the fight to stop the construction of an hydroelectric power plant at the Epupa falls (1996-1999) and the construction and operation of RAMATEX textile factory, that quit the country in 2008 leaving behind huge quantities of salty and toxic waste water on the outskirts of the capital (The Namibian, 7 October 2003). Although Earthlife tried to confront Rössing -Rio Tinto's uranium mine- right after independence in 1990, the opacity of the industry made it impossible for them to obtain any information about its possible impacts (B. Kohrs, Pers.Comm., 9 February 2013). It was not until 2005, when Paladin, an Australian company presented an EIA to open a uranium mine (Langer Heinrich) in a National Park, that Earthlife started to get involved actively in nuclear issues. The EIA was sent by Earthlife to a German research institute to revise it, who found it had many deficiencies (Öko-Institut e.V., 2005). In 2008, Earthlife together with LaRRI carried out a campaign denouncing the expansion of uranium mining in the country (Kohrs, 2008) and the impact on the health of workers (Shindondola-Mote, 2008). Interviews with workers and ex-

workers of Rössing were carried out revealing that many of them were sick and didn't trust the opinion of the medical personnel at Rössing. In a country with almost 40% unemployment, a worker told LaRRI: "We keep the job as a security measure; your heart is telling you to work but your mind is telling you to go" (Shindondola-Mote, 2008). Rössing denied the accusations of Earthlife and LaRRI as un-scientific and emotional (Namib Times, 19 June, 2012). This set the foundation for an AMS process.

Earthlife entered in contact with CRIIRAD through the EJOLT FP7 EU funded project (Environmental Justice Organisations, Liabilities and Trade, coordinated by ICTA UAB) that aims at bridging EJOs and research centres or think tanks pursuing environmental justice. I invited Earthlife to participate as a partner in EJOLT. I was working in the project and knew Earthlife from when I had carried out fieldwork in Namibia in 2009. Since the start of the project in 2011, Earthlife has been driving the AMS process, with EJOLT's coordinators and myself acting as facilitators. Earthlife planned and organised the trip that CRIIRAD did to take samples in September 2011. And once the results were obtained, Earthlife asked CRIIRAD to pay a second visit to Namibia in order to share and explain the results.

Earthlife is also carrying out other activities that indicate they are leading the AMS process; after CRIIRAD's second visit, Earthlife has a more fluent contact with Rössing and is demanding more information from them. They have enquired the Mining Commissioner about a uranium mining license given to a Chinese company. They approached the Atomic Regulator enquiring about the Atomic Energy Act draft and submitted a proposal as part of the regulations of the Act. As part of EJOLT, Earthlife is presently evaluating Namibia's nuclear legislation and developing proper regulations on rehabilitation after mine decommissioning and together with LaRRI, a study on the health impacts on workers and ex-workers has been carried out (Kohrs and Kapuka, 2014). With funds from a German foundation they are also training 10 Namibians on nuclear, energy and environmental issues. All these activities were not part of EJOLT's initial workplan but have largely benefited from the legitimacy acquired through the knowledge co-produced between CRIIRAD and Earthlife.

### **Knowledge co-production**

In Niger as well as in Namibia, the scientific knowledge of CRIIRAD on radiation and uranium mining is of utmost importance for the local activists in order to understand and analyse the impacts on the environment. However, experts don't know the local complexity of the area; they know what to look for and different measuring techniques and measuring devices, but in order to apply or use them, they need the local knowledge provided by grassroots organisations. Local knowledge is not limited to oral stories of the community. Certainly, the local geography (rivers, polluted areas) and how to access them (evading sometimes the company and state security guards), whom to interview, the social knowledge of health impacts (how many people are sick, who are they), socioeconomic aspects (marginalisation, water supply), is also local knowledge. This knowledge is vital to the application of scientific tools.

As Chareyron of CRIIRAD explains:

“We don’t know the area and we spent only 2.5 days (in Arlit); where do we sample the water? What kind of water? Where is the scrap sold on the market? We had no maps, we need the people to understand where things are” (B. Chareyron, Pers.Comm., 15 June 2013).

Importantly, the interpretation of the results also depends on this local knowledge; high radioactivity measurements are dangerous in relation to the local population activities and movements, the accessibility to polluted sites. Do people live near the ventilation shafts? Which boreholes are being used? How is scrap metal being used? Do tourists have access to the waste rock dump? Are pastoralists more at risk than other community members? Who is at risk if the tailings dam broke? Do workers and residents have enough knowledge of the impacts of radiation? This knowledge has been crucial to interpret and communicate the newly co-produced knowledge.

The AMS process is not limited to the visit of the expert organisation. In fact, the new tools and scientific language acquired are crucial for the local community and groups in order to keep producing more knowledge. Both Earthlife and Aghir in’man have been doing, often in coordination with CRIIRAD, more sampling, placing demands and contrasting information provided by the mining companies or other institutions. In Niger, back in 2003, contaminated scrap metal was detected in a local market by CRIIRAD. Through the years Aghir in’man has been denouncing this fact and carrying out more tests warning the community against the use of this scrap metal. Only recently Areva has admitted: “1,000 tonnes of this radioactive scrap metal had been found at a scrap metal dealer's” whilst another 600 were unaccounted for. They have now “immediately stopped the removal of all scrap from the sites” (AFP, 17 January, 2013).

### **Ability of grassroots actors to participate in politics**

In order to be able to co-produce new knowledge and use it in their activism, one or few members of the grassroots organisations need to have the ability to participate in politics, in the mechanisms of power. In our case studies, both Kohrs and Alhacen have been able to develop capacities despite the high level of inequality and marginalisation in their countries<sup>3</sup>. When analysing their personal stories, we observe that both had developed abilities to talk in public, deal with the press or government officials, language skills and the capacity to develop extra-local contacts. They also had acquired a special sensibility regarding social and environmental issues.

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<sup>3</sup> Niger has the lowest (measured) HDI in the world (position 186) (UNDP, 2013) whilst Namibia has one of the highest Gini coefficients in the world (0,73) (HDR, 2007)



Alhacen didn't receive a formal education. When he was 16 years old he worked for a French NGO who taught him not only how to read and speak French but also to deal with the press and engage with other organisations. He was sent to Germany and France, where he recalls: "was like having your head under the water and then coming to the surface" (A.Alhacen, Pers.Comm., 1 February 2013). He started working in Somaïr in 1978 when he was 21 years old and became an active union member in 1992. This position again trained him to deal with human rights and labour issues paving the way to many of his present activities. Kohrs grew up in a poor family in Germany in the aftermath of WWII; "we had to live off the land ... we had to use everything that was there, that shaped my respect towards nature... my parents put that seed in me" (B.Kohrs, Pers.Comm., 9 August 2013). After acquiring college education and working, she moved to Namibia in 1973. She recalls: "when I stepped in [I told myself] this is your country, and from that time I was addicted". She was one of the founders of Earthlife right after independence and became the head of the organisation in 1992. Being of German origin she made most of the links with research groups and experts in Germany.

### **Grassroots actors are few and volunteers**

Following social movement theory, it is argued that AMS processes are durable and sustainable into the future because they are largely voluntary (Mc Carthy and Zald, 1977). Aghir in'man has managed to maintain the AMS process since 2002 and Earthlife's activities seem to follow a similar path. Although the organisations might at some point have used external funds, the activists are volunteers. Alhacen (from Aghir in'man) still keeps a job in the mine and Kohrs (from Earthlife) is currently working part-time for a German organisation in a biodiversity conservation project. The funds the organisations have managed to secure are used to buy new equipment, organise talks or sampling trips. AMS activists will be found in grassroots organisations or small NGOs, big NGOs will probably use other processes to liaise with scientific experts.

Kohrs and Alhacen have been the main drivers of the AMS processes described here. Being driven by one or few members can be a potential source of weakness of AMS processes. They take the lead on most of the initiatives and the rest of the members relay heavily on them. This makes these processes potentially vulnerable if one of these key members was to disappear, leave or get co-opted. However, key to their durability, both leaders are delegating to newer or existing members and both organisations have created alliances with other local organisations; Aghir in'man is part of CSC (Coordination des organisations de la Société Civile d'Arlit) and GOSCRAZ (Groupement des Organisations de la Société Civile de la Région d'Agadez), groups of civil society organisations in Arlit and the region of Agadez. Earthlife is working with LaRRI, the Goethe Institute and several conservation and educational groups in Namibia.

## **5.2 Why AMS?**

Did Aghir in'man and Earthlife need to learn about the impacts of radioactivity? Did they need to understand what a Sievert is or how to use radiation-measuring devices? In learning this, it could be argued that local organisations enter in the framing of the mining companies who can lure these organisations into complex EIA

processes or information exchanges, neutralising their activist focus (Suryanata and Umemoto, 2005; Thompson, 2005).

Three reasons are outlined below as to why scientific knowledge needs to be acquired and reproduced by these grassroots organisations: i) to acquire visibility and legitimacy, ii) to learn about and protect themselves from the impacts, iii) to refute the produced information and manufactured uncertainty of the companies.

### **To acquire visibility and legitimacy**

“Before we were afraid of the police, afraid of everything, of Areva, of the military... now I can speak to the military, I go freely wherever I want.” (A. Alhacen, Pers.Comm., 15 March 2013).

“Thanks to CRIIRAD we now have the equipment and the knowledge to go to a place and detect radioactive material. We feel free to write and address whoever we want” (A. Alhacen, Pers.Comm., 15 March 2013).

Through the creation of new co-produced knowledge, grassroots organisations engage in politics, in the mechanisms through which power circulates and is negotiated (Paulson et al., 2003). As this occurs, local actors acquire visibility by becoming new political actors. The fact that this new knowledge is a co-production between scientific and local knowledge gives local actors a legitimacy that would have otherwise been denied.

“Many newspapers, politicians ask our opinion ... people talk to us, we have an extremely important audience. We have been very sought out. We are the bridge with civil society because we speak about everything... Nowadays we have a lot more visibility and that is very important” (A. Alhacen, Pers.Comm., 15 March 2013).

Alhacen has gradually become a public figure. He is presently the president of the ‘Commission environnementale du développement rural’ of the ‘commune’ of Arlit making decisions ranging from water schemes to road construction and is in close contact with other local councillors, tribe leaders and the president of the ‘commune’.

They have been asked to participate in public meetings of future mines, like the massive project in Imouraren (A. Alhacen, Pers.Comm., 15 March 2013) as well as being behind the organisation of three marches. The first one took place in May 2006 to denounce dust pollution. Areva paved 12km of road leading to the mine after the march (A. Alhacen, Pers.Comm., 15 March 2013). Their appearances in national and international newspapers have been increasing, as well as their public appearances. In 2008 Areva was given the ‘Public Eye Award’ as the worst company in the world and Alhacen went to Davos to present the situation in Arlit. In 2010 Alhacen was also invited to present the impacts of uranium mining in Niger at the 8th Session of the UN Commission for Sustainable Development in New York. The visibility Alhacen acquired prevented Areva from firing him. Instead they ‘punished’ him by moving him to a lower responsibility job.

Although Areva (2011) has continuously denied all the accusations, they have gradually been improving security in the mine, providing better information to workers on radiation issues, more dosimeters (personal devices to measure gamma radiation) were given to workers, facilities were installed so that clothes weren't taken home (A. Alhacen, Pers.Comm., 15 March 2013). Around the mines, Areva invested to improve the water facilities (Air Info, 29 June 2011) and is organising the "plan compteur" in Arlit monitoring the town for radiation (A. Alhacen, Pers.Comm., 15 March 2013).

Although Earthlife was already in the public sphere before their contact with CRIIRAD, a major boost to Earthlife's credibility was achieved with CRIIRAD's second trip to Namibia in 2012 when they presented the new co-produced knowledge (Press release, 11 April 2012). A press conference that was attended by all the major newspapers in the country (Namibian Sun, 24 April 2012; Republikien, 26 April 2012; The Namibian, 13 April 2012; New Era, 12 April 2012). Several meetings were organised with government bodies, regional councils and mining companies to present the results. After these meetings Kohrs stated:

"Although the findings of CRIIRAD were downplayed by the management of the mining companies and the experts involved in the mining industry, they seem to be alerted. Several meetings were called and the press releases [of the mining companies] featured in local papers stating how harmless uranium mining is.... in general we created huge interest. We created awareness". (B. Kohrs, Pers.Comm., 9 February 2013).

As well as Alhacen, Kohrs has become a public figure:

"Shopping, or walking on the streets, I get approached". Moreover "now without being asked, Earthlife appears in the papers. If one paper writes about uranium mines, and they can't get hold of me, they quote something I have said before. I get quoted without realising or knowing"(B. Kohrs, Pers.Comm., 9 February 2013).

One could question if this newly acquired legitimacy and visibility is due to the liaison with CRIIRAD or if it is due to other activities carried out by Aghir in'man or Earthlife. However, before the liaison with CRIIRAD took place, neither organisation had the basic scientific knowledge required to co-produce new knowledge, which has been a crucial aspect to gain legitimacy:

"Before the arrival of CRIIRAD we had zero knowledge. We didn't have materials or knowledge about radioactivity... Bruno [Chareyron] allowed us to realise that the scrap metal was contaminated so we could make the local population aware" (A. Alhacen, Pers.Comm., 15 March 2013).

"...and for Earthlife it was a good change in a way that 'aha' it's not only emotional what I bring, I come with scientific facts, and we are taken more seriously. Especially by the experts in the companies, there is a different approach. It is evident that scientific data provided

by CRIIRAD have a much greater impact than many years of Earthlife's activities providing general information on the impacts of uranium mining" (B. Kohrs, Pers.Comm., 9 February 2013).

### **To protect from impacts**

In situations where knowledge and 'facts' has been produced and sometimes 'manufactured' by companies with no external scrutiny, local communities have no clue as to what they are confronting. They want to learn and understand what is impacting them and how to protect themselves. As Alhacen explains, before engaging in this AMS process:

"People had no notion about uranium or radioactivity, the municipality, the tribes' leaders, there is a lot of ignorance and poverty" (A. Alhacen, Pers.Comm., 2 February 2013).

Alhacen is now able to tell the community, in the numerous workshops Aghir in'man has organised, not to buy scrap metal in the market or not to consume water from certain boreholes. He can demand better protection for mineworkers or advise them to take seriously their radiological protection in the mine (A. Alhacen, Pers.Comm., 5 March 2013).

Rössing has admitted that their workers' knowledge of radiation issues needs to improve (Rössing Bulletin, 22 May 2009). As an example, yellow cake has been stolen on several occasions by workers and taken to their homes in the hope of selling it (The Namibian, 8 September 2009 and 6 September 2011). Earthlife and LaRRI want the workers to be fully aware of the impacts they are facing. As Shindondola-Mote argues:

"I am against the ignorance of people being exploited for profit ... if people were given the chance to make an informed decision of whether they want to work in a dangerous environment or not, then I would really have no problem. Because even if they (Rössing) come out and openly declare that these are dangerous zones, people will still work, because they need their jobs, as long as people know they are not going to die today, [and] because they don't have any other option, they will still work for the mines, but at least they have made an informed decision" (H. Shindondola-Mote in Conde (2014b) - 'Namibia's Uranium Rush' Documentary)

### **To refute manufactured uncertainty and other information produced by the mining companies**

Areva in Niger and Rössing in Namibia have been producing information and magnifying uncertainty, always denying radiation related occupational health problems (see section 5). The sampling and measurements carried out during and after CRIIRAD's visit allowed for the creation of new data, new knowledge, that directly challenged the knowledge that had been created by the mining companies. As an example, according to Areva's report (2011) "the results of these [water] analyses are compared to the World Health Organization (WHO) recommended

limits and show that Nigerien and international drinkability norms are being met". However the measurements taken by CRIIRAD and Aghir in'man show that water is polluted above WHO limits (Press release, 18 December 2003; Chareyron, 2008). Areva denied these accusations but closed two of the water boreholes that are mostly affected.

When accused of high death rates due to respiratory infection - the town of Arlit (16.19%) has twice the national average (8.54%) (Chareyron, 2008; Greenpeace, 2010) - Areva's response is to say that these "allergic disorders" are "caused by the aggressive impacts of sand on the eyes and lungs, and not by mining activity" (Areva, 2011). In the same report Areva (2011) states that "the environmental radiological monitoring network does not indicate massive dispersal of radioactive dust and confirms the absence of contamination within the towns". However, a field trip carried by Aghir in'man and CRIIRAD collaborators denounced that the radiation in front of the Cominak hospital reached values 100 times higher than normal (CRIIRAD, 2007; Press release, 15 May 2007). On the impacts of radon gas, annual average for all sites are provided by Areva making it impossible to identify radiation hotspots (Areva, 2011). However, as pointed by Aghir in'man collaborators the level of gamma radiation 1m above ground near the barbed wire of one of the ventilation mouths was 16 times higher than normal (CRIIRAD, 2008).

In Namibia, the abnormally high radiation measurements found in the Khan River downstream from Rössing were claimed to be natural by Rössing management (Rössing manager and G.Ellis, Pers. Comm., July, 2009). After the measurements carried out in their 2012 trip, CRIIRAD and Earthlife have been able to contradict this manufactured uncertainty: "The highest impact [on the Khan River] concerns the uranium concentration that increased by a factor of 2155, from 0.2 µg/l upstream to 431 µg/l downstream. WHO recommendation for uranium concentration limit in drinkable water is now 30 µg/l" (Chareyron, 2014).

As Bertchen Kohrs states:

"Before we always said 'it could be that..., there is a danger..., it has happened in other countries'. But now [after CRIIRAD's results] we had facts and that was really worrying for the mines, and for the journalist was good food... If it means we are taken seriously, the more we can prove that we can understand what is going on, it's better" (B. Kohrs, Pers.Comm.,9 February 2013).

## **6. Avoiding co-optation**

Alliances of different actors can imply compromise and power struggles between partners leading to the co-optation of weaker actors and resulting in some powerful groups "speaking on behalf of others" (Forsyth, 2002). Co-optation is a process whereby a stronger group subsumes or assimilates a smaller or weaker group generally changing its original discourse or demands. This is a major risk in scientists-activists coalitions. Co-optation can take many forms and it can be an unintended consequence of these alliances. Local knowledges and discourses can get co-opted or disregarded by scientists with different research agendas (McCormick, 2009; McGrath et al., 2009; Michaels, and Monforton, 2005; Cooke and Kothari,

2001), by bigger NGOs (Bob, 2005) or by corporate and the state 'sustainability' discourses (Bridge and McManus, 2000; Utting, 2005).

The AMS case studies described in this article have avoided (so far) co-optation. An analysis of the case studies from this perspective has surfaced three clues into how grassroots organisations can avoid co-optation in science-activist alliances: i) the scientific experts as well as the activists are independent both financially and institutionally, ii) the new co-produced technical knowledge does not become their only activist tool, claim or discourse and iii) grassroots actors avoid using technical language. I do not argue that AMS always avoids co-optation, but I point to factors that can help to prevent it.

i) Scientists can be hired by companies to carry out studies to challenge attacks on the industry, resulting in a conflict of interests (Michaels and Monforton, 2005). In an AMS process the scientific experts that assist the local organisations (CRIIRAD in our case studies) have no links to any industry, research center or institution. This allows them to engage in the co-production of knowledge only with the agenda and objectives of their own organisation. Moreover, as pointed by Cooke (in Hickey and Mohan, 2004), it is important that the consultants work at local rates or for free. In the case of CRIIRAD funding is coming from French citizens, allowing them to oppose strong corporations such as Areva. In the case of AMS activists, as observed before, they generally work on a voluntary basis allowing them to have certain independence. ii) Co-optation can occur in different forms, there can be a co-optation of the discourse (their argumentation), the activities carried out, the language used, the objectives set, etc. As Bob (2005) points in his analysis of Nigeria's Ogoni movement, their original demands for political autonomy were transformed to environmental and human rights issues because of their interest in creating global alliances with large NGOs. Also Bridge and McManus (2000) point to how activists fighting gold mining in the US had their sustainability and 'appropriate technology' discourse co-opted by the industry. In the case studies analysed the new co-produced knowledge has not become their only discourse co-opting their argumentations, neither has it become the focus of their activities or only objective.

On top of radiological issues, Earthlife also raises concerns about the potential loss of tourism or the fact that mining investment is driven to their countries because of weak environmental legislation and lower taxes (Kohrs public presentation, 3 October 2009). Moreover, the study recently published on the health impacts on workers is exclusively based on local knowledge of workers and ex-workers of Rössing (Kohrs and Kapuka, 2014).

Aghir in'man in coordination with other organisations places many other demands that are not related to radiological contamination; company pay increases, government decentralization (Air Info, 6 December 2011), payment and distribution of mining taxes and plundering of mineral resources (CSC, 10 October 2011; Air Info, 25 January 2013), demands for the electrification of the town of Arlit (Press release, 24 March 2013), growing insecurity in the region, the improvement of the route between Arlit and Agadez, the capital of the region (Air Info, 3 February 2011; Air Info, 6 December 2011; GOSCRAZ, 2013) or the lack of respect to labour regulations

or social security in the new Chinese mines of Azelic (GOSCRAZ, 2013; Air Info, 25 January 2013).

iii) The use of scientific language can be an important aspect of the co-optation process. Local activists can get carried away by the dominant-techno-scientific language; not being able to refute the industry's knowledge using technical language (Cooke and Kothari, 2001; Yearley, 1992). This can happen for example when grassroots organisations try to challenge the EIA produced by a company. However, it has also been argued that technical language can become a useful tool for activists, as with the AIDS case (Epstein, 1996; Forsyth, 2002), or when combating Monsanto's GMO seeds (Lepage, 2012; Saunders and Ho, 2012). AMS activists don't contest the tools or language of science, neither do they change or adapt scientific language to their needs. They do challenge the use and control of science, and in doing so, they need to learn the language for two main reasons; on one hand they want to carry out their own measurements and on the other, they need to be able to defend this new co-produced knowledge.

The local organisations in the case studies have however avoided their whole discourse becoming too scientific; they adapt their presentations to their audiences. Thanks to the continuous collaboration with the expert organisation, they don't need to understand every scientific detail because they can contact them if something they don't understand comes up. They want to learn enough to understand the impact. As Kohrs and Alhacen explain:

“I did not go into understanding the chemical impact too well, it's very complicated, but the radiation part I think I understand”. For instance, presently “to produce the final report we need Rössing data to compare [our results]. Then Bruno [Chareyron] can say if the radiation is man made or original (natural)” (B. Kohrs, Pers.Comm., 9 February 2013; 9 August 2013).

“We feel independent from CRIIRAD. Although we still need them, they are not indispensable but they are very necessary” (A. Alhacen, Pers.Comm., 15 March 2013).

## **7. AMS and participatory processes**

AMS can be viewed as part of an existing body of scholarship on participatory processes like Community Based Participatory Research (CBPR) where community organisations are given a central role in the research (Minkler and Wallerstein, 2003). A main difference however is that with AMS experts co-produce science with lay people that engage in technical issues and are not limited to a political role. Moreover, with Activism Mobilising Science (AMS) the expert assists the activist not with the objective of carrying out research; hence AMS does not have the word 'research' in it. Moreover, although co-optation can be avoided in CBPR (Minkler et al., 2010; Cohen et al., 2012), with AMS as with Street Science, these inequalities or structural preconditions are generally sidestepped because the process is driven by the local organisations themselves. The divide between the scientific and the local actors that could end in co-optation is in fact acknowledged and valued in AMS.

There is no need to define or reach an agreement on the type of research as in each case the experts are contacted by the organisations themselves because of their specific technical expertise, be it dioxins, water quality or radiation. In Niger experts were contacted by the local organisation and in Namibia through an EU funded project, but with the same objective in mind; to learn about radiological impacts of uranium mining.

Models very close to AMS are Street Science and 'counter-expertise'. With Street Science communities use local knowledge to challenge the conventional use of science (Corburn, 2005). Two important traits make AMS differ from Street Science; i) although local knowledge is important with both processes, in AMS is the co-production with scientific knowledge -not the questioning of science- that is crucial. ii) Street Science is rooted in urban and western contexts. It seeks to transform professional views about what is happening in the communities with the aim of changing policy. Conversely AMS processes occur generally, though not always, in developing countries and rural contexts. The objective with AMS is to gain knowledge and visibility in order to challenge the knowledge produced or manufactured by the companies. Policy-making is not excluded but is not as crucial as with Street Science because the structures and institutions that would allow community engagement in policymaking are not yet in place and have not been developed as a consequence of AMS. The counter-expertise model (Topçu, 2008) tolerates a blurry frontier in the activist-scientist nexus, with activist becoming themselves scientists and vice-versa. Like Street Science, the counter-expertise model is also situated in the industrial North; the activists can have scientific skills that have been able to acquire through high education. CRIIRAD itself comes from a counter-expertise model (Topçu, 2008). However, with AMS the roles are very clearly defined and don't change; the local organisation doesn't have scientific capacity having to mobilise external capacity.

From an ecological economics perspective, Street Science, the counter-expertise model or AMS can be seen as the first stage of a PNS process, where local stakeholders that previously had no say in the issues at stake are given visibility and legitimacy to start engaging in an extended peer review process. Key to these processes is the co-production of scientific and local knowledge that is becoming an activist tool in order to challenge the dominant discourse.

## **8. Conclusions**

The world's growing social metabolism has been pushing the extraction frontier to feed its energy and material consumption in areas sometimes very far from where it is consumed. This extraction has been causing numerous socio-environmental conflicts as communities react to the impacts suffered. The uneven distribution of impacts and risk is a consequence of the unequal power relations. This article has investigated a particular form of confrontation to the expansion of the frontier of extraction and the impacts it causes, it describes a process that contributes to a shift in power relations, thus alleviating of the risks and impacts associated.

My task was both empirical and theoretical; empirical in terms of analysing and characterising this particular process, looking at its main characteristics and the



reasons why activists engage in this particular way. Theoretical, in terms of understanding this process as part of the knowledge-power interaction whereby the co-production of local and scientific knowledge can challenge unequal power structures.

What is the main contribution of this research? First, the article has drawn attention to the opacity of the nuclear industry and their manufacture of uncertainty. Mechanisms like the ALARA principle - widely used in the industry - that relies on economic aspects of “how much a person is worth the investment in security” (Hecht, 2012), or the lack of statistical certainty to correlate radiation exposure with single case diseases, give the nuclear industry a huge leeway. Key issues such as setting radiation limits, deciding which radiation security measures are obligatory or accepting radiation related occupational health diseases, should not be exclusively decided by experts. Instead, an extended peer community that includes also those actors who are bearing the costs and the impacts of radiation should engage in a Post Normal Science (PNS) process. Through AMS these actors are gaining visibility and legitimacy and can now engage in wider circles of power contestation.

Second, the paper contributes to two different theoretical frameworks; STS and political ecology. On one hand I have extended the co-production framework of STS shifting attention to the specificities of the co-production of knowledge itself, how can local and scientific knowledge can be combined, the results it can produce and how it can be mobilised in a socio-environmental conflict. The term co-production allows to go beyond the deficit and complementary models used in several participatory processes allowing for an open engagement between science and the communities’ local knowledges. This framework is valuable because it entails the acknowledgement that all knowledges (including scientific knowledge) are in part socially constructed and can therefore be challenged by other co-produced knowledges. Political ecology has helped me to point to the power and knowledge unequal structures embedded in socio-environmental conflicts that AMS is trying to challenge. It highlights the importance of local knowledge and the “promising idea” (Bryant, 1998) of combining it with scientific knowledge that AMS is doing using a co-production framework.

This article examines what I have termed Activism Mobilising Science (AMS), a process where power is contested by local organisations immersed in socio-environmental conflicts. Grassroots organisations liaise with scientific experts to learn from them the tools and scientific language they need to protect themselves from the impacts of radioactivity (in my case studies). They also want to gain visibility and legitimacy to be able to refute the produced information and manufactured uncertainty of these companies. These processes are locally driven, based on voluntary work by activists who have built related capacities, and engage in a co-production framework with the expert.

The legitimacy acquired by the grassroots organisations has allowed them to challenge the companies and government behind environmental health burdens. These organisations not only co-produce new knowledge but they also transfer it to the local population, thus becoming agents for environmental justice. This in turn has pushed companies (in our case studies uranium mining companies) to change and

improve their practices. Even more relevant, is that companies (as well as the state or other elites) have to be more open about the impacts they cause if they are being more skilfully scrutinised, opening a dialogue between local grassroots organisations, the state and the companies about topics that were previously ignored or hidden.

Furthermore, I claim that what has happened in the cases presented can also happen in other places. A case in hand is the work of Bob Moran, a consultant who used to work for mining companies carrying out EIAs. Although it is difficult to ascertain the power balance of these liaisons, he is now being hired by grassroots organisations to critically examine the EIAs produced by the mines. His expertise is sought not only for his technical knowledge but also for the authority and publicity that his work draws upon the cases he reviews (FPIF, 2012; Moran, 2013).

What I offer is a set of generalizable analytical entry points to study activist-scientific relations in the context of socio-environmental conflicts. In this sense, the theoretical framework I offer is more of a heuristic and less of a formal theory and can inform case-study research elsewhere. It could then become theorised as a type of activism as part of social movement theory, participatory or PNS processes.

# Appendix

## A testimony from the scientific side

### Summary

In order to expand, characterise and acquire a better definition of Activism Mobilising Science, I have compared scientific-activist alliances through the lens of a scientific expert. Through in-depth interviews I have studied the role of Robert Moran, an expert hydrogeologist that acts as consultant for activist organisations. The analysis highlights the importance of the expert's visit to the site in order to co-produce new knowledge and give further credibility to his own opinion. Moreover, the expert's visit maximises politically the impact the results. Other highlighted aspects are the importance of securing funding and the vital role of background education and the ability to participate in politics.

### 1. Introduction

In the previous chapter I claim that Activism Mobilising Science (AMS) is a strategy used by local groups immersed in socio-environmental conflicts. Grassroots organisations liaise with scientific experts to learn from them the tools and scientific language they need to protect themselves from the impacts and gain visibility and legitimacy. The processes analysed in Chapter 2 are locally driven, based on voluntary work by few activists who have developed certain abilities to engage in politics. Together with the expert, local activists co-produce new knowledge in order to challenge the knowledge produced by the mining companies.

To support this thesis and the proposed traits of AMS I explore in this appendix the process through the figure of the scientific expert. The comparison of different scientific-activist alliances through the lens of a scientific expert has allowed me to test AMS's characterisation, set boundaries and acquire a better definition.

As explored in the theoretical framework of the thesis, there are different types of scientific-activist liaisons. Activists can either adopt existing scientific knowledge and data in their own arguments or produce new scientific knowledge either by becoming scientists themselves or in co-operation with experts. Scientists, in turn, can engage in activist activities becoming 'expert activists' (permanently or on a case-by-case basis) as well as act as external consultants but not becoming involved in the politics of the conflict. The boundary between experts and activism is increasingly blurry. Some experts base their activities through NGOs like Bruno Chareyron from CRIIRAD whilst others like Robert Moran, the subject of this chapter, act as consultants of local groups and governments in mining conflicts. Other 'expert activists' include university-based experts that can become activists for a specific case if they are requested to do so by local groups because of their expertise or offer their services through science shops. Other more permanent 'expert activists' are based in Environmental Justice Centres (mostly in the US) actively seeking to engage with local groups in environmental justice conflicts.

Robert Moran is a good case to analyse the scientific role in these liaisons. An expert hydrogeologist with 43 years of professional experience, he has been working for 18 years with local groups and NGOs immersed in water resource, mining and nuclear conflicts. My colleague Mariana Walter and I contacted him through the EJOLT project and he kindly accepted to conduct with us several interviews. Four two-hour long semi-structured interviews were carried out from January to May of 2015 revising in chronological order his entire career. His detailed CV helped us elaborate the questionnaire. We aimed at uncovering his personal motivations, his understanding of the power dynamics in these conflicts as well as the characteristics of his interactions with the local organisations.

In the last interview I focused on four cases and asked procedural questions regarding the specific process of knowledge production and exchange. Unless stated otherwise, all the quotes in this commentary belong to Moran. Some members of local organisations were also contacted through email and Skype in order to clarify some aspects of their involvement.

The cases chosen are 1) Kumtor gold mine in Kyrgyzstan owned by Centerra Gold, a Canadian company. Although the mine is situated in a remote and high altitude area (over 4000m) it has sparked opposition almost since it started in 1997 due to fears of contamination of the glacial meltwater that flows to the valleys below. 2) The Conga mine project proposed in Cajamarca, Peru, is an extension of Yanacocha gold mine majority owned by US-based Newmont Corporation. 3) Rosia Montana is an ancient underground mine intended to become an open-pit gold and silver mine, it's owned by the Canadian Gabriel Resources and has sparked the largest socio-environmental movement in Romania blocking the mine for 14 years. 4) Dewey Burdock is a proposed *In Situ* Leaching uranium operation in South Dakota, USA. Its located at the margins of the Black Hills which was "taken" from the Lakota Sioux by the U.S. government in the 19th century (once gold was discovered), making it an extremely "controversial area". This region is also famous in the US for its "pressured" water (water flows to the surface without use of pump). An alliance of citizen and tribal groups have combined effort to oppose this project. All these cases reflect different characteristics of AMS processes, allowing comparisons and adding relevance to certain recurring aspects.

In the next short section I introduce the figure of Robert Moran and include a table with some selected cases of his career. In Section 3 I analyse the four case studies through the lens of an AMS process as described in the previous chapter; I analyse each of the relevant characteristics to see whether Robert Moran engages in AMS processes. The main differences with the AMS process described in Chapter 2 are identified in Section 4 and Section 5 concludes.

## **2. Moran's background**

Robert Moran grew up in San Francisco, which became the main California city in the late 19th and early 20th centuries, after gold and silver were discovered in the Sierra Nevada Mountains. It was the source of the miner's supplies and where the early wealthy mining promoters lived. California was where Moran first saw the impacts of mining. With a first degree in zoology and chemistry and a PhD in water

geochemistry from U. of Texas, Austin, he started working for the US Geological Survey (USGS) in 1972 and later moved to the private sector. He became acutely aware of the secrecy of the industry and how little information on industry impacts is made public. As he became more senior, he became more involved in disputes involving mining companies, governments and citizen groups: “I gradually started to see how unfair the balance of power was in most of these disputes and how poor the results were in terms of public-interest outcomes. Most importantly, the industry was the source of all the technical information on the mines, their workings, environmental chemistry, water used, accidents, etc.” He saw these details while working for industry lawyers but the public and government were not aware of these issues, as this information was only selectively made public.

At that time, most civil society groups lacked the training to understand the technical details and consequences of mining. As Moran states: “[What] I found was that they are technically and politically naive. For me that was part of the problem. You couldn't have a public dialog about information if the other side was unable to understand the technical details or was not allowed to see them. Also, generally, no competent technical consultants would work for civil society because they knew this would destroy their chances of ever working for the industry again.”

His career shift occurred in 1996: “In one project I was asked to do some things that were pretty dishonest about hiding information. I did not do it”. Instead he started offering technical support to grassroots organisations, civil society or citizen groups, and writing papers for general audiences on cyanide in the environment and the “politics” of acid drainage predictions. “Civil society and regulators were not looking at these issues realistically. They simply accepted the optimistic predictions that were being made by the industry. Also, they avoided considering the political uses of these predictions to obtain operating permits.”

Since then Moran has been working with a plethora of organisations as well as governments in the US and all over the world giving advice and training on technical issues around water resources, mining (metals, coal, uranium).

Table 1. Selected cases of Robert Moran’s post-1996 career\*

Date	Country & Region	Case	Client	Main Activities
2015	Haiti	Haiti training	New York University Law School, Global Justice Clinic	Training in water quality and project development in areas impacted by mining activities
2009-2014	US, South Dakota	Proposed Dewey Burdock in-situ uranium mine	Oglala Sioux Tribe and various other citizen’s groups (Consolidated Interveners)	Expert opinions and testimony before the U.S. Nuclear Regulatory Commission’s Atomic Safety and Licensing Board

Date	Country & Region	Case	Client	Main Activities
2013-14	US, South Dakota	Proposed Dewey Burdock in-situ uranium mine	Black Hills Wild Horse Sanctuary, and Bangs, McCullen	Expert opinion submitted to State regulatory agencies
2011-2014	Colombia, Bogota	Training Colombian Contraloria	Contraloría General de la República & IKV Pax Christi	Assistance and training to the independent auditing arm of the Colombian government
2012	Cajamarca, Peru	Conga Mine	Environmental Defender Law Center & GRUFIDES	Review of environmental documents; site visit
2011	Bishkek, Kyrgyzstan	Kumtor Mine	"Tree of Life" & Bankwatch	Review of operations
2011	Krumovgrad, Bulgaria	Krumovgrad	Za Zemiata & Autonomous University of Barcelona	Review of the EIS for a proposed gold mine; municipal / public meeting presentations
2007 - ongoing	Alaska, US	Proposal for Pebble Mine [above largest stockeye salmon fishery in the world]	Trustees for Alaska**	Technical evaluation of impacts; public presentations and opinions for litigation; court testimony
2009	Bolivia	San Cristobal Mine	Commission for the Integrated Management of Bolivian Waters & Regional Farmers Federation of the Southern Altiplano	Review of present mining activities and documents; site visit; meetings with regulators.
2009	Tolima, Colombia	Proposed La Colosa gold mine	IKV Pax Christi, Netherlands	Technical review of proposed project; meetings with regulators & universities; site visit; public presentations;
2006-7	Romania	Proposed gold mine Rosia Montana	Alburnus Maior	Evaluation of EIA and preparation of summary report; site visits; meetings with regulators & university
2005	El Salvador	El Dorado Mine	Asociación de Desarrollo Social Santa Marta	Evaluate EIA and related documents; site visit; meetings with company & regulators

Date	Country & Region	Case	Client	Main Activities
2005	Guatemala	Marlin Mine	Colectivo Madre Selva	Review of EIA; attendance at national and indigenous mining forums; water quality training; review of CAO and IFC documents; site visits
2003	Esquel, Argentina	Proposed Esquel Mine	Greenpeace Argentina & Mineral Policy Center	Review of EIA (water, environ. issues) and conditions; site visit; public presentations
2001	Santa Rosa de Copan, Honduras	San Andres Mine	Asociación de Organismos No Gubernamentales	Independent review of water and environmental issues; site visit; meetings with local regulators
2003	Tambogrande, Peru	Proposed Tambogrande mine	Oxfam America & Mineral Policy Center & Environmental Mining Council B.C.	Review of mining water and environmental issues; public presentations; testimony in Peruvian Congress
2000	Sydney, Australia	Proposed cyanide-leach gold mine	Malerah-Wahlabul Native Title Claimants & Friends of the Earth	Review of water quality issues and testimony at Land and Environment Court

\*These cases are extracted from Moran's CV. The selection is based on the cases Moran highlighted through the interviews.

\*\* The Nature Conservancy, Trout Unlimited, Alaska Conservation Foundation, Trustees for Alaska and Renewable Resources Coalition, Alaska. Wild Salmon Center, Portland.

### 3. Is Moran part of an 'Activism Mobilising Science' process?

Following the analysis of AMS in Chapter 2, is Moran engaging in a knowledge co-production process driven locally by few actors? To avoid co-optation, is Moran independent from the mine and are the local groups using different strategies and languages? Are Moran's and the local groups findings refuting the information produced by the mining companies or is it being used to protect themselves from the impacts?

#### Locally driven and independent

As in the case of Earthlife Namibia and CRIIRAD (Chapter 2), most of the cases analysed in this chapter are initiated by external actors (who generally also secure funding to pay the expert). However, in all the cases observed, the local groups take the lead of the process, not only planning the expert's visit but also learning and using the knowledge created.

The case of Rosia Montana is representative; Moran was asked to review the EIA of the mine by Stephanie Roth, a Goldman Prize-winning activist that had moved to

Rosia and was orchestrating a fierce opposition campaign together with local groups. Alburnus Maior, a local NGO working closely with Roth, together with other local NGOs, had heard of Moran's activities and reputation through Roth and their networks.

Moran initially reviewed copies of the EIA at his home in the US, later (in August 2006) he carried out a month-long field visit organised mostly by Alburnus Maior and Roth: "Alburnus Maior took me on secondary visits to towns that would be impacted, and introduced me to officials and academics." Alburnus Maior and Roth managed to secure funds from the Staples Trust, U.K. and the Open Society Foundation in Romania. Moran explains that external funds, even if small, are generally secured to pay for his work and travelling expenses, assuring his independence from the mine. He in fact often doesn't ask his clients (local organisations) where the funds are coming from in order to maintain their (and his) financial independence, and to minimise public discussions about funding.

In the case of Newmont's Conga mine (Yanacocha's extension), Moran was contacted by 'The Environmental Defender Law Center', a non-profit law firm based in the US, and GRUFIDES, a local NGO who asked him to review Conga's EIA. As usual he also conducted a month-long site visit. Moran's objective with these site visits is to "both inform my opinions and to strengthen my credibility when opponents, the press, etc. began to ask questions, or if my report leads to some form of legal dispute".

When he travelled to Cajamarca, he was locally supported by GRUFIDES who already knew him from previous visits. This local influential organisation has been fighting Yanacocha since its creation in the early 1990s. On this occasion the situation was very tense after the death of two environmental defenders earlier in the year and the declaration of two states of emergency. Moran stayed at the house of a university professor, Nilton Desa and apart from internal GRUFIDES meetings, only two external meetings took place; one with the president and vice-president of the regional government and another one with a local activist group. GRUFIDES also organised a site visit near the mining project in order to evaluate baseline water quality conditions. Although they avoided the company's security, they were ultimately pushed out of the area.

In the case of Kumtor Mine in Kyrgyzstan, Moran was initially approached by Vlada Martsynkevych of Bankwatch, Kiev, on behalf of Kalia Moldogazieva, an activist and academic, working for the NGO 'Tree of Life' in Bishkek, Kyrgyzstan. Moran visited the area in 2011 with the objective of participating in a Kyrgyz-government-approved, independent mine audit of which he would be the only foreigner. While in Bishkek, Moran had technical meetings with the other members of the audit team and the participating government analytical laboratories. Despite being approved by the Kyrgyz government, the company, Centerra Gold, ultimately allowed the audit to proceed, but forbid Moran to enter the mine as part of the official audit team. Thus, over the next several days, Moran instructed Moldogazieva in what audit activities to pursue, so that she could take samples and make field measurements in his place.

Within days the activists arranged to have Moran and a documentary film-maker (Mirjam Leuze) transported near the margins of the Kumtor Mine property by the



former head of security for Kumtor. Local Kyrgyz provided horses so that the three of them could conduct a site visit around the margins of the mine, make field measurements and document the mine activities on film (Leuze, 2012).

Moran was supported locally mostly by the Kalia Moldogazieva and Vlada Martsynkevych, both female activists. They provided the necessary company documents and data, and introduced him to other local organisations and politicians. Both Moldogazieva and Martsynkevych could speak English and Russian facilitating the communication with Moran, translating when necessary.

This was not in fact Moran's first visit to Kyrgyzstan. In 1999 he made two trips to Bishkek in order to make technical presentations on cyanide to international scientists and to conduct water-related training to government regulators, university staff, and NGO representatives. Both visits were funded by the Soros Foundation. Also this time, he was denied permission to enter the mine.

The proposed Dewey Burdock in-situ uranium project in South Dakota (U.S.) is opposed by various citizens and native American tribal groups. Because uranium mining in the U.S. requires project review in both State and Federal government processes, two separate groups of citizen-tribal opponents and their lawyers asked Moran for technical-expert assistance. While technically separate, the two teams shared information between themselves and with Moran throughout the complicated legal interactions from 2009 through 2014.

The first to contact Moran was the manager of the Black Hills Wild Horse Sanctuary (BHWHS), owned by the well-known conservationist, Dayton Hyde. Moran was asked to review technical documents and provide expert opinions to the state regulatory agencies regarding the large-scale mining and water-use permits for the proposed Dewey-Burdock operations. In parallel, the Oglala Sioux Tribe together with their non-profit lawyers, Western Mining Action, also contacted Moran to revise the Environmental Impact Statement and to provide technical opinions (written and oral) to the Federal Nuclear Regulatory Agency.

Moran made numerous visits to the project region over the several years he was involved, usually accompanied by the some members of local groups and their lawyers. As with the Rosia Montana project, Moran carried out a one-day tour of the mine property lead by company representatives together with representatives of the citizens groups and their lawyers.

Unlike the previously discussed examples, Dewey-Burdock involved formal legal opposition, thus most of Moran's direct interaction was with the lawyers of the two teams. Dayton Hyde and members of local and regional groups as well as the Oglala Sioux Tribe provided the lawyers and Moran with much of the local and technical information they needed. However because the proposed project was not actually on tribal lands, Moran had little direct interaction with tribal representatives. Unlike all the other AMS processes analysed, the lawyers, not the local organisation, were in charge of the AMS process (contacting Moran and organising his visit) as well as having a major role in the conflict. I hypothesise this is due to the legalistic nature of the Dewey-Burdock conflict rather than a North-South difference (all other locally

driven cases are located in the South). Further case-study comparative research could corroborate this aspect.

### **3.2 Knowledge co-production**

All the cases engage in a knowledge co-production process; Moran learns from the local people and organisations about the area and about issues he had not previously realised. According to Moran, the local knowledge and inputs of the community are important tools needed to review the EIA. Also, site visits and discussions with the local people make his “arguments both technically and politically more powerful.”

In the Conga case, the GRUFIDES team supplied Moran with essential information on historical mining, water and land use, baseline sampling, spring locations. During the organised field visit to the proposed mining area, they pointed out the locations of the proposed mine facilities (open pits, waste rock piles, tailings, etc.). Together they made field water quality measurements (pH, conductivity and temperature) and made observations of springs, wells and fish. The interactions with them made Moran also realise the relevance of one crucial and constantly repeated argument: Conga’s closeness to Yanacocha (5kms) meant that “Yanacocha is in fact a 20-year laboratory of what would likely happen at Conga”. This was ignored in Conga’s EIA. “Instead the authors [of the EIA] attempted to substitute largely-ridiculous computer simulations to demonstrate that no negative impacts would occur”.

In the case of Rosia Montana he recalls the importance of local knowledge for his investigation: “I need to have their input. They know where the animals are, where the springs, and wells are, if the quality of the water has changed over the years. They (local people) also know that in modern times during the 50 and 60s, the Romanian State mining operations used cyanide to extract gold and silver—contrary to what the company claimed. The company (Gabriel Resources) said they didn't look for cyanide as it was not used, which was untrue. It is also useful to talk to local people to know what questions to ask”.

In Kyrgyzstan Moran was taken to the margins of the Kumtor Mine on horses. There he was able to observe the mining operations and their impacts to the glaciers, their tailings wastes and discharges, etc. He was also able to make field measurements (temperature, pH, conductivity) at numerous sites using his own equipment. These independent measurements were later used to refute allegations that the upstream “baseline” water quality was already contaminated prior to mining, and to compare with earlier company data. “Such complicated interventions, conducted in remote Central Asia, only about 40-50 km from the Chinese border, could only be arranged through the efforts of local citizens’ groups”.

Moran’s reports in fact don't only focus on technical issues such as heavy metal or cyanide contamination but highlight other aspects realised through his visits and knowledge shared with local people such as water depletion or diversion, fish depletion, waste disposal concerns, public consultations that are a “charade”, or lack of governmental capacity to monitor and enforce legislation. Importantly, Moran also points to gaps in the data or lack of preventive measures provided by the mining companies. For example Centerra Gold (operating Kumtor mine) did not collect appropriate baseline pre-operational water conditions and have failed to provide

adequate financial assurance funds (to the government) to remediate and maintain the mine after closure (Moran, 2011). In a similar way, Rosia Montana's EIA doesn't adequately expose pre-mining conditions of the water, including cyanide contamination (Moran, 2006). Thus, if the operating permits were approved, the company could likely avoid financial and legal liability for future impacts. According to Moran the mining company is also an important actor in his studies because their collaboration or lack of it (allowing him to visit a mine, sharing reports and data, etc.) will also reflect in the knowledge co-produced and the results of his report. According to Moran, a company that openly shares their data with the citizens and Moran is likely to have less serious water resource and general environmental impacts, and be more open to scrutiny by local groups.

### **Ability of grassroots actors**

As pointed in Chapter 2, the cases analysed confirm that in order to co-produce new knowledge in an AMS process some basic background knowledge is needed. As Moran points out: "I think that they (citizens groups) need to have some local or regional staff who are at least somewhat technically-educated. Its not likely that you can create a very successful oppositional group if its only 'campesinos' (peasants) for example. They need to have some local support from people with a bit more training and maybe those with connections to local universities, people who can help with alternative sources of information. (...) One nasty reality in such situations is that most governments tend not to respect the opinions of poor people, educated or not. Hence, it's politically-important to align these people with others who can raise their political influence."

In the case of GRUFIDES Moran points out that it "has by now become quite sophisticated; they have their own long-term funding, bought field equipment to make field measurements, and understood the overall political context". Most members have university degrees and several have good command of English. Laura Lucio, his main contact during his last visit, is a biologist, whilst Nilton Desa, who gave him accommodation, is a university professor. Lucio improved greatly her knowledge on hydrogeology with Moran's visit so with Moran's final report she wrote a 20 page 'easy-read' report and an article published in one of the largest national newspapers (La Republica). According to Lucio, the most impacting information revealed by Moran's EIA review is the large volumes of water that the mine would need to extract to operate. This technical data and other co-produced information was shared by GRUFIDES with several activists of local groups who have assimilated it in their argumentation and disseminated to local peasant organisations. This techno-scientific knowledge is important but it's not the main argumentation of the local communities. According to Lucio: "The role of Moran was to give a technical argument but the mine was stopped due to community's resistance. The technical argument helps; gives them legitimacy in the press, on the social networks. The communities though, with or without numbers, know all this through their own experience of 20 years of Yanacocha. They know where the waters are born and that a mining project located at the headwaters of a basin is going to affect them."

For GRUFIDES also, this co-produced scientific knowledge is not their only strategy. GRUFIDES is active in several other domains like community organisation, court case defence of peasant activists, challenge of government legislations, etc.

This was also the case of local activists in Rosia Montana who reinvented themselves as entrepreneurs, tourist guides, NGO activists and developed alternative development projects such as tourism through, for example, the yearly Hay Festival (Velicu, 2012). Alburnus Maior disseminated the results of the report at national level, translating it to Romanian and publicising it through their website as well as several national and local newspapers. Internationally, Roth helped disseminate the results through North American organisations like Earthworks and Mining Watch Canada. Like GRUFIDES, technical issues were not their only activist tool, they also had the capacity to take the company to court on several occasions, winning several rulings reflecting the local group's capacity to engage in the politics of power.

During Moran's visit to Bishkek (Kumtor mine case) he carried out some training with Kalia Moldogazieva, Mirjam Leuze and other members of the independent audit team. When the audit finally took place in October, Moran had already helped prepare the activists by developing the methodology, sampling sites, and choosing two certified laboratories and agreeing what was to be analysed—both while he was still in Bishkek and later from the US. Despite their experience (Moldogazieva had been investigating the impacts of Kumtor since 1998 and had already been in contact with other scientists in the past), he noticed their technical ability was limited when compared to the Conga or Rosia Montana cases. Moreover, the Kyrgyz State laboratories lacked adequate funding in water quality capabilities, and were subject to political pressures because this project could potentially impact the largest single source for revenue for the country, the Kumtor Mine. Thus, Moran had also to conduct some training interactions with the laboratory personnel.

The Kyrgyz sampling results showed contamination of both surface and underground waters and high use of cyanide (Moran, 2011). Kumtor activities were aggravating the recession and contamination of glaciers and Moran's report further supported the risks of flooding from a possible collapse of the dam at Lake Petrov. The NGOs made public these results after Moran's visit. He notes: "they were probably very limited in their ability in explaining the results, ideally I would have gone back but there was no funding". However, the report and results have been very important for Tree of Life and Bankwatch's advocacy. They pressured the European Bank of Reconstruction and Development to stop supporting financially Centerra, and at national level Martsynkevych notes: "this was the first ever analysis and criticism of water pollution by the mine". The company reacted by hiring a company to investigate Moran's claims whose independence was questioned. A second investigation by a different company corroborated serious impacts in the water balance downstream from the mine and gave strong recommendations on improving waste storage and preventing a collapse of the dam at Lake Petrov.

As in the other cases, scientific activism has not been their only tool. BankWatch has promoted governmental commissions to investigate other issues such as protection of natural reserves, legislation, land provision, shareholding and previous corruption cases.

In the case of Dewey Burdock, the local Dakota Sioux or even Dayton Hyde, weren't the main contacts of Moran during the conflict. Given the legalistic nature of conflicts in the US, where any new project has a long judicial process, and judicial processes are common routes to stop projects, the main actors in these conflicts are not generally the local citizens but instead their lawyers. Although lawyers may not have technical backgrounds, they understand enough to use technical issues and jargon to support their legal arguments.

It could also be observed that in much of the US, citizens may have higher formal education levels than in developing countries. However, such differences might not be that big because (as shown in Environmental Justice literature) modern mining in the US often occurs in economically-poor areas where the levels of education are generally poor (Bullard and Lewis, 1996; Pastor et al., 2001). This is also the case for the Dewey-Burdock case as the project is located in a poor and marginalised area.

As a comparison with these cases, Moran pointed out a recent visit to Haiti in May 2015. He was asked by the Global Justice Clinic of New York University Law School to carry out training of rural citizens and their staff. Haiti has presently no active metal mining but commonplace corruption and weak legislation enforcement, coupled with foreign pressure to weaken the mining legislation, is making this country a target for the mining industry. Moran pointed out that because "the educational level is so poor, it is often very hard to find people that read well; they have little or no technical training or mathematics. They don't understand what pH or conductivity are". He carried out basic training "for the local people, so that they can prepare for what is coming, and so that they can influence the expected weakening of the mining law. This involved mostly teaching them to collect baseline water data. (...) The training was quite successful if you limit your expectations. Most importantly, these citizens will be better prepared to understand and participate in the public meetings that will determine the future behaviour of their government and the mining companies in their areas".

Therefore, it is important that some members of the local groups have some formal education as a base to engage in AMS, but experience, liaisons, training and support by experts like Moran enhance their chances of success. "[When talking to the mining company] it would be best if they (the local group) had their own experts with them, but if there is no choice, their participation is greatly improved if they have been given some training and they know what questions to ask. They don't always have to know the answers, they have to know which questions to ask to put pressure on the company. Ideally however they will have their own experts with them".

I hypothesise that formal education is in fact just the first step towards acquiring the ability to participate in politics, the ability to use the new co-produced knowledge in a political context. As we have seen, all the groups Moran has liaised with seem to have this ability; placing court demands (all cases discussed), imagining and producing alternatives (Rosia Montana case), liaising with local and regional governments (Conga and Kumtor) and with other citizen's groups and academics (all cases discussed). Even though all participants weren't able to fully understand all the

technical implications of the new co-produced knowledge, they were able to mobilise it at different scales, legitimising and publicising their voices and demands.

### **Effectiveness**

Moran commented that effectiveness (understood as the local group's capacity to stop -or favourably modify- a project) depended on local groups being "well organised and coordinated" and "it also helps if they have good connections to the English-speaking world and to Europe. It sounds very self-centred but they receive a lot more support. Lets say I was talking with a Latin-American group, they can receive a lot of support from the English- speaking world if they have people on their team, somebody who has connections to English speaking NGOs and other international NGOs. That is a powerful group. The same is true for the US and Canada; 75% of all the mining companies in the world are incorporated in Canada; it's important if a Peruvian group, for example, has connections [there]". According to Moran these connections are important because "they (local groups) get more publicity in the international websites and reports and journals, and they have better access to other sources of funding. (...) Inevitably, the groups that have been most successful are those that manage to acquire external sources of funding in order to compete against such overwhelmingly-powerful and wealthy opponents."

### **What is not AMS?**

Although not his preferred option, in several occasions Moran has only revised the EIA and no fieldwork has been carried out. Generally this occurs due to limited funds. This was the case, for example, on projects for the Nacho Nyak Dun First Nation and the Nishnawbe Aski and other Ontario First Nation bands in Canada. In these cases knowledge exchange is limited to emails and phone calls. Here, his expertise and scientific knowledge is used as a strategy to gain visibility and refute the knowledge produced by mining companies, but the lack of contact with the local groups and their local knowledge limits the results of the report (limited to very technical aspects) and the training and knowledge exchange local groups and activists can gain.

Other activist-scientific alliances that don't entail knowledge co-production occur when, like in the case of Haiti, training is the main objective. This has occurred in several occasions. From 2011 through to 2014, he provided training to the independent auditing arm of the Colombian Government (Contraloria) on mining and environmental audits and legislation; in Guatemala, he was asked to carry out presentations on ecological aspects of resource legislation to Guatemalan government ministries, high-level officials and educational institutions.

## **4. Differences with AMS process in uranium mining in Africa**

1. We saw in the uranium mining cases of Chapter 2 that the local groups had created a **dependence** on CRIIRAD, they had an on-going close relationship where the local groups could contact Bruno Chareyron for different emerging issues. With Moran this is not usually the case, he states: "we must limit that (more consultations) because usually the agreement that we made initially is for a specific set of tasks, prepare a specific report, for a certain date. Ideally we can find additional funding to do additional tasks but often this is not possible. Ideally the local people will develop

some expertise so that some of the skills have actually transferred to them. But inevitably there is still some dependency and that is not a negative thing as long as we can apply for budget and restart the interaction, and as long as the citizens groups can stay organised for a period of time. But that is an exception, not many groups can stay organised for that long”

Funding is therefore a key aspect of AMS. Funds are not only necessary to be independent from the mine or the state but need to carry on in time if the AMS relation is to continue. But is this always the case? The case of CRIIRAD analysed in Chapter 2 exposes a different arrangement. Because CRIIRAD is supported by donations it has more leeway in the cases it chooses to engage with and support. The Niger mission was -and still is- in fact funded entirely by CRIIRAD. The Namibian case that was funded by the EU project EJOLT set the tone of their engagement: Kohrs is presently looking for funds to bring Chareyron back to Namibia. Chareyron, CRIIRAD’s expert, is however still supporting Earthlife Namibia when requested. Moran on the other hand is an independent consultant that needs to earn a living. Even though he operates at a very reduced rate (often only paid 10 % of his former commercial fees) and has on several occasions only been paid his trip expenses, the lack of funds limits the long-term engagement of AMS processes.

2. One of the main **motivations** for activists behind AMS processes in uranium mining in Niger and Namibia (Chapter 2) is their need to understand what uranium mining entails and how to protect themselves from its impacts. The activists in the cases analysed here are not as marginalised as the workers or local groups in Niger and Namibia. They are already aware of the impacts a mining project can entail either through education (Dewey Burdock), experience (Conga, Kumtor) or extra-local contacts (Rosia Montana, Dewey Burdock). They therefore seek an expert’s technical support to ratify and legitimate their claims.

Moreover, according to Moran, “one of the main reasons for conducting an expert visit is to enhance the legitimacy and credibility of the opinions written later, or if the expert must give opinions at a meeting or in court. It is much more powerful if one can say “I’ve seen this, at this site”, and these conclusions are similar to those I’ve made at many other similar sites.”

In most cases analysed, the visit of the expert is taken as an opportunity to carry out public presentations on water quality, legislation or other mining impacts. A final presentation towards the end of the visit can also be an opportunity to present the main findings and co-produced knowledge. In the case of Conga, given all the visit was carried out in secret (due to security issues), the only press conference to present the results took place in Lima after he had finished his stay in Cajamarca. He therefore did not participate in the dissemination of the results. Instead, the expertise and legitimacy already acquired by GRUFIDES allowed for a good dissemination of the results through local publications and newspapers articles.

3. The activists analysed in the uranium mining conflicts in Africa are **few and volunteer**, pointing to a possible weakness of these processes if this key person disappears. In the cases analysed in this appendix Moran engages with members of NGOs, lawyers and consultants, who are therefore employed and paid to do this job.

This points to a possible weakness too because if funds are not secured, the activist activities could also diminish or stop.

In the cases analysed Moran had contact mostly with one or two members of one local organisation that was driving locally the AMS process (Tree of Life in Kyrgyzstan, GRUFIDES in Peru, Alburnus Maior in Rosia, Western Mining Action in South Dakota). This points to another weakness already identified in Chapter 2; reliance on one activist. A clear example is the case of GRUFIDES. Moran collaborated closely with Laura Lucio who is in fact working for a Spanish NGO (Engineers Without Borders). Her contract therefore depends on the funding secured by this organisation. In fact Lucio has recently moved to a different town to work on another project. Despite still being in contact, her expertise is now lost for GRUFIDES. Luckily for GRUFIDES (and the opposition movement to the project), the project is now on hold.

## **5. Conclusions**

The cases analysed confirm AMS is driven by local groups that manage to secure independent funding in order to bring an expert to technically expose impacts they can perceive or suspect might occur. One of the main contributions of this appendix is that AMS requires the expert to visit the area not only to obtain samples or measurements from the site, or carry out training, but most importantly to enhance the credibility of the expert's opinion and to obtain local knowledge through exchanges with communities, grassroots organisations, government representatives and the mining company. Local knowledge includes past contamination, pre-mining conditions that might have been ignored in the EIA, depletion or diversion of water sources or biota, conflictive contamination points such as local fountains, social implications of impacts, etc. Such knowledge allows the expert to carry out a comprehensive study of the area, understanding all the implications of the mining project and the co-production of new knowledge. For example, the expert can take samples and make measurements of areas that local populations fear will be polluted or areas already contaminated to create an independent baseline study.

Another aspect highlighted by this appendix is that these liaisons are "powerful for the citizens because they can say that an outside expert has corroborated their opinions or suspicions." Even though the technical details are important, what gives value to AMS is the fact that an external technical expert corroborates the fears and risks of contamination and pollution generating (or giving further) voice and legitimacy to local groups in unequal power struggles with mining companies. Therefore the main value of AMS is political and only partly technical.

Other non-AMS activists-scientific liaisons such as on-site training or EIA revisions, specific technical assessments and other tools such as satellite mapping that don't require the expert's visit are still very valuable. However, what differentiates AMS from these processes is that it takes into account valuable local knowledge that would otherwise be ignored.





## Chapter 3

### Resistance to mining. A review

#### Abstract

Power relations in ecological distribution conflicts are increasingly challenged by movements resisting mining projects. Why and how do communities resist mining and how do their forms of resistance change over time? This academic review of 292 articles, books and reports sheds light on the changing strategies of resistance movements and the effects their actions have. The growing incidence of mining conflicts is causing local communities to react not only to perceived environmental impacts but also to object to their lack of representation and participation in decisions concerning their development path. They are innovatively combining local narratives and alternatives with global discourses on rights (to clean water, to take decisions, indigenous rights) and environmental justice. Cross-scalar alliances have allowed local groups to increase their knowledge about the projects, give them visibility, and comprehend and act against their weak position in the global commodity chain. These alliances have also contributed to the emergence of a diverse set of resistance strategies such as legal court cases, activist-scientist collaborations and local referendums or "consultas" at community level to reject mining projects. The review also explores the role of the state and the mining companies in these conflicts, exploring responses such as revenue distribution or Corporate Social Responsibility programs.

Keywords: Mining; resistance; social movements; socio-environmental conflicts; environmental justice; development; cross-scalar alliances; strategies; discourses; indigenous rights.

## 1. Introduction

Why and how do communities resist mining, and how do their forms of resistance change over time? Answering this question is important for studies of ecological distribution conflicts and of the changing nature of commodity frontiers. If we acknowledge the environmental and social limitations of our growth driven economy that is fuelled by a continuous extraction of resources, sustainability (for our and future generations) requires leaving some mineral resources un-mined under the ground. Local communities and organisations near mining projects are also demanding that these resources are not mined. This article sheds light on such actors, their changing strategies and the effects their actions have.

Socio-environmental conflicts are increasing due to the growing metabolism of society that is demanding more energy and material resources (Martinez Alier, 2003). Even a non-growing economy, if based on current technology, would need “fresh” inputs of fossil fuels and minerals. The commodity frontier in mining has been expanding especially to the global South due to mining law reforms, rising mineral prices from the mid-1990s to the mid-2010s (with a temporary drop in 2008), strong equity markets, and low domestic interest rates in core economies (Bridge, 2004a). Industry technological advances are also making reserves accessible that were previously not economically viable (Moore, 2000). Companies go deeper and farther, into more ecologically and sometimes socially vulnerable areas to extract the remaining resources. On many occasions these areas are inhabited by (indigenous and non-indigenous) communities who suffer the burdens of pollution and lack of access to basic resources due to the unequal distribution of power and income, and social inequalities of ethnicity, caste, social class and gender (Martinez Alier et al., 2014b).

There is a lot written on mining conflicts and resistance, but much of it is fragmented among different disciplines and is written with different questions in mind. This literature review attempts to provide a “meta” outlook on resistance to mining, from the perspective of a critical researcher interested in the drivers of ecological distribution conflicts and the social forces that might change unjust ecological distributions and move the economy towards sustainability. This review puts forward a hypothesis: there has been a shift in strategies and discourses used by resistance to mining in the last two decades. It points to alliances with extra-local actors as having played an important role in this shift; not only fostering movements to emerge, but also developing solidarity and political opportunities, and facilitating the acquisition or co-production of technical knowledge (Ali, 2009; Bebbington et al., 2010; Conde and Kallis, 2012; Foweraker, 2001; Keck and Sikkink, 1998)

Resistance also shapes and influences patterns of development. This review shows how many movements create, recover or re-affirm a development path that rejects mining, in the process proposing alternative development models, or “alternatives to development” (Escobar, 1995). In other cases communities adapt and accept the offers of the mining companies largely in the form of Corporate Social Responsibility programs and other ameliorations (Horowitz, 2012).

Resistance as a concept may refer to different political aims and forms of opposition and mobilisation. Hollander and Einwohner’s (2004) review of the term identifies

'action' whether it be "verbal, cognitive or physical" and 'opposition' to existing power relations as core elements of resistance. The issue of 'recognition' is more contested. Whilst some scholars suggest the term should be reserved for visible and collective acts (Rubin, 1996), a growing scholarship based on Scott's (2008) research draws attention to what he termed "everyday" resistance. Although his research is based on peasant studies, a parallel can be drawn with mineworkers that need to make a living out of the source that is causing their grief, compelling them to covert resistance and calculate their conformity. 'Everyday socio-environmental resistance' in mining is not well documented so most resistances covered by this manuscript are found to be visible and overt, where both the communities and the mining companies are aware of it taking place. The review does include works where communities resist as part of their negotiation strategy with the mining company. Moreover, resistances covered can be sporadic or even anecdotal or they can be sustained over time, based on organised collective actions and backed by a dense social network, turning into a social movement (Tarrow, 1994).

Extensively used in this manuscript is the word 'community'. It has been challenged on many occasions as ignoring the complexity of actors, different interests and the institutions that it entails (Agrawal and Gibson, 1999). In this review, 'community' describes groups of lay people that live in the surrounding area of mining projects. This can represent one or several groups, with different visions and understandings of the project, different ethnicity, gender, class and cast cleavages, and with different degrees of marginalisation. I acknowledge this simplification and try to specify where I can the differences in each case.

I have carried out an exhaustive review of the peer-reviewed literature concerning resistance to mining omitting significant literature on oil and gas. Although the patterns of resistance are similar -and in many cases the same movements are involved in both- the dynamics of each industry and the resistance that emerges can vary. Having said this, some of the literature revised analyses aspects of resistance to extractive industries that includes, but is not confined to, mining cases. A selection of relevant non-academic publications produced by NGOs, think tanks and research projects have also been included.

Given the numerous approaches or instances in which resistance to mining is encountered in the literature I have undertaken an extensive search using the Web of Knowledge, Google Scholar and Google employing different combinations of relevant keywords. A second search was carried out using snowball methodology from the bibliography obtained in the initial search. Several works were discarded for lacking relevance for the review, with 292 articles and books finally included.

In the following three sections I explore what I see as a shift from economic to ecologic distribution conflicts in mining and identify present drivers of resistance to mining. Section 5 explores the extra local alliances made by social movements and the main discourses adopted through these alliances, whilst section 6 points to three strategies also increasingly shared and used. The effectiveness of these strategies and in general of the movements themselves is explored in Section 7. Sections 8 and 9 introduce the role and responses of the state and the mining companies, especially looking at the evolution of Corporate Social Responsibility programs. The discussion

(section 10) explores three relevant debates in the literature and the last section concludes.

## **2. Historical analysis of mining conflicts**

Resistance to mining is not a novelty; labour and health issues have been the focus of resistance movements through history. Mining has occurred since prehistoric times, growing in size and impacts together with technology improvements. Agricola's masterpiece 'De re Metallica' published in 1556 mentions high concentrations of dust and diseases due to breathing problems, poor working conditions and accidents (Agricola and Hoover, 1912). Slavery in the mines was commonplace from Ancient Egypt and Ancient Greece all the way through to the Roman Empire (Klemm and Klemm, 2012). Semi-slavery conditions also became common in Spanish colonies such as Potosí in Bolivia during the 15<sup>th</sup> C. Self-organised Indian mineworkers were substituted by the 'mita' obliging one in seven male adults to work in the mine (Moore, 2003). Workers used passive forms of resistance mainly migrating to other areas (Cole, 1985). Much later, with the industrialisation of Western economies, several mining enclaves were opened in Africa and Latin America during the second half of the 19<sup>th</sup> C. to feed its growing factories (Krujit and Vellinga, 1977).

An early testimony of an environmental conflict is found in Huelva, Spain, where disputes between farmers and miners due to the impacts of acid rain and forest decimation caused by mining activities lead to the creation in 1535 of the "Ordenanzas de Zalamea la Real", a normative code that regulated the use of water, forests and several livelihood aspects (Ortiz Mateo, 2003). Also in Huelva during the 19<sup>th</sup> C. intensive forest exploitation and the emission of sulphurous smoke from the copper open-air smelters sparked protests of nearby landowners and peasants that managed to secure economic compensation. The situation culminated in 1888, under the management of Rio Tinto, when a joint protest of workers and peasants ended with 200 people killed by the army (Martinez Alier, 2003; Perez Cebada, 1999). After this event, a royal decree was approved to stop open-air calcinations. Although it was challenged by Rio Tinto, the company started to look for alternative techniques, partly also due to the high cost of the compensations (Perez Cebada, 1999). Also analysed by Perez Cebada (1999) are the cases of copper mining in Butte, Montana in the US and Swansea Valley in the UK. During the 18<sup>th</sup> C. local peasants in Swansea complained about air pollution and managed to stop the allocation of smelters in populated areas. However, during the 19<sup>th</sup> C., copper mining became more strategic and an important source of employment, so environmental demands were pushed aside. Although started only in the 19<sup>th</sup> C., heavy air pollution in Butte also sparked protests by peasants that were seeing their land, animals and health deteriorating. In La Oroya, Peru a smelter-refinery was inaugurated in 1922 by the Cerro de Pasco Company and was later denounced by 28 land-owners for "acute environmental damages" (Dore, 2000). The area continues to suffer from severe air pollution and health impacts (FIDH, 2012).

Protest over the environmental pollution of the Watarase River in Japan seemed to be common during the operations at the Ashio copper mine, Japan's largest mine and one of the largest in the world. It has been portrayed as the birthplace of pollution in Japan (Nimura, 1997). Environmental protests are not however the main focus of

Nimura's book but rather the labour dispute and riot that took place in 1907 due to the introduction of new furnaces that limited the amount of well-paid skilled workers needed.

In fact, most of the historical literature on mining conflicts has labour issues at their core. The coercive organisation and isolation of the mines (Burawoy, 1976; Kerr and Siegel, 1954; Moroney, 1978), combined with low wages, exploitation and dangerous working conditions pushed for the creation of workers' solidarity and labour movements (Godoy, 1985; Johnstone, 1976; Nash, 1979; Van Onselen, 1976; Wilson, 1972). A debate in the literature emerged around the Marxist political roots of the uprisings (Campbell, 1945; Zapata, 1977; Zeilin and Petras, 1970). Laite (1978) and Dewind (1975), studying the Cerro Pasco Corporation conflict in Peru, questioned the proletarianisation of the miners and instead described them as peasant-miners and migrants that maintained their ties to the land, only using the mine as an intermittent cash earner.

Workers engaged in everyday forms of resistance such as ore theft, desertions, migrations and loitering as well as wastefulness (Freund, 1982; Van Onselen, 1976). In several cases however resistance coalesced in the creation of labour unions and the outbreak of strikes. Several works narrate the birth and growth of mining movements during the 19<sup>th</sup> and 20<sup>th</sup> century. Godoy's (1985) excellent review covers works from South America as well as Africa. In Peru, a massive strike sustained from 1969 to 1971 that included long marches to the capital, clashes with the police, kidnappings and deaths (Dewind, 1975; Laite, 1980). In South Africa, Moroney (1978) analyses the use of the mining compound to subjugate the worker and extract labour as well as effectively quelling all forms of resistance organisation. In Zimbabwe, Van Onselen (1976) explains the problem mines found to recruit workers between 1989 and 1903 as a result of continuous mobilisations due mainly to wage disputes. The union militancy in Nigeria's tin mines is developed by Freund (1982, 1984) and Zambia's union struggles are widely analysed (Burawoy, 1972; 1976; Fraser and Larmer, 2010; Kapferer, 1978). Whilst Bates (1971) explains the early formation of the copper workers' union and their struggle for development, Larmer (2005) explores how after independence their high expectations weren't matched by the new Zambian government, eventually pushing for the establishment of a one-party state.

Several authors postulate that workers political consciousness antedates the outbreak of strikes or the creation of labour unions (Godoy, 1985; Zapata, 2002). Parpart (1983) shows how in Northern Rhodesia (present day Zimbabwe) black miners developed a sense of themselves as a class of workers that led them to associate and strike against the copper companies in 1935 and 1940, eventually becoming independence fighters. In Chile, with the mines of El Teniente and Chuquicamata, Finn (1998) and Latham (1926) analyse the formation of a miner identity and the identification with the mining community that pushed citizens to press demands to the Chilean government. On the formation of this 'miner status' Nash (1979) describes how low salaries, "dehumanizing working conditions" in the mines and the high risk of accidents as well as the isolation of the mines pushed the creation of strong solidarity networks, conviviality and social cohesion. She shows how their resistance was rooted in the 'cholo' culture built on Andean cosmology,

solidarity and “kinship based systems of mutual assistance”. Like in Zimbabwe or Zambia, workers’ union mobilisations eventually coalesced in Bolivia’s 1952 revolution, which was also a peasant revolution. In Australia, a rebellion of gold miners took place in 1854 against the imposition of a new tax. Known as the Eureka Stockade, this rebellion transformed into a movement that prompted the introduction of electoral legislation and male suffrage; being controversially identified as the birth of democracy in Australia (Blainey, 1963).

### **3. From labour to ecological distribution conflicts**

Mining has always been a locus of resistance and conflicts. Most of the historical literature (as just explored) describes these as labour conflicts, i.e. conflicts over labour conditions and wages (Moodie, 2002). Since the 1980s conflicts and resistance in most countries have been shifting their focus from labour to environmental and social (community) impacts (Bebbington, 2008a; Dore, 2000), with an increase of ecological distribution conflicts (Martinez Alier, 2001). Even earlier, during the 1960s and 1970s, Barca (2012) identified the rise of a working class environmentalism where workers’ associations and unions reacted to workplace hazards and campaigned for the recognition of industrial hazards and the enactment of environmental regulations.

Below I examine some of the causes behind this shift and revival of conflict and resistance against mining (Bebbington and Bebbington, 2011; Bridge, 2004b; Martinez Alier, 2003). In particular, I find in the literature five broad forces.

First, economic growth is behind the increasing social metabolism of industrial societies in the global North. As mentioned in the introduction, the increasing amounts of energy, materials and biomass production required is pushing the extraction frontiers into new territories causing ecological distribution conflicts (Martinez Alier, 1991, 2003, 2009). This creates a “clash of metabolisms” in the source regions, between a subsistence and an extractive economy. Illustrating this clash, Silva-Macher and Farrell (2014) use the Yanacocha-Conga conflict in Peru to compare a local form of social metabolism such as milk production as it encounters the industrial social metabolism of gold mining. Through the use of a flow/fund MuSIASEM model, they show how the magnitude of the impacts of the mining process through land removal and hydrological alterations disrupt local milk producers who consider land as a fund and not as a flow like mining companies do. A plausible hypothesis already mentioned by Bebbington (2008a) is that, due to technological improvements, mining is becoming highly capital intensive with a low requirement of workers. Large-scale machinery is now being used to dig giant open-pits that extract and process ever-increasing quantities of soil and water. At the same time lower grade deposits are increasing the footprint of mines and causing more environmental impacts (Bridge, 2004b; Mudd, 2007; Prior et al., 2012).

These impacts affect the local livelihoods of peasants that react to protect themselves. They see how the quality and quantity of water decreases, their grazing areas are encroached and socially they confront increasing community conflicts and loss of cultural traditions (Bury, 2007). In Perreault’s (2013) excellent account of Bolivia’s mining enclosures, he argues that it is not only the dispossession of land

that is driving conflict (accumulation by dispossession) but the accumulation of toxic waste, water and water rights (to pollute water) and the accumulation of the spatial land of the mines that is driving livelihood dispossession through a process he names “dispossession by accumulation”. Switzer (2001) and Klare (2001) highlight also how environmental burdens can lead to community-level grievances and in turn to larger violent conflicts.

Using Melanesia as a case study, an anthropological debate emerged around this issue. Kirsch (2001) and Hyndman (2001) seem to acknowledge that the impact on local livelihoods and health is the most important reason for the rise in socio-environmental conflicts whilst Banks (2002) argues these movements emerge as a result of their demand on resource and livelihood control (next).

As a consequence of this frontier expansion, a second factor behind this shift in conflicts is the lack of participation or representation of local communities living nearby mining projects and their lack of rights to effectively decide their own development path (see; Ali and Grewal, 2006; Ballard and Banks, 2003; Dwivedi, 2001; Escobar, 1995; ICMM, 2015; Kuecker, 2007; Mohanty, 2010; Walter and Martinez Alier, 2010). Many local communities aspire to determine what happens on their land (Horowitz, 2002), wanting to receive visibility and recognition of their rights (Ali and Grewal, 2006). Anguelovski (2011), based on her analysis of protests in the Tintaya mine in Peru, she argues that some communities react in order to start a dialogue with the mine on equal footing and mobilise each time that they need to obtain more legitimacy and recognition in the dialogue. For other authors (Escobar, 2001; Muradian et al., 2003; Urkidi, 2011) participation entails not dialogue with the mine, but the community’s right to decide over their own practices such as communitarian access to land, organic agriculture production or democratic decision making processes. Indeed some groups want to have access to and influence institutional spaces where political decisions are taken (De Echave et al., 2009) whilst others want to look for alternative institutions where they can express themselves. These groups, crucially, don’t want to participate in the political system, they want to participate in the definition of what political system they want (Alvarez et al., 1998).

Third, monetary compensation due to land or resource losses are common claims behind contestation to mining. Arellano-Yanguas (2011) in his quantitative and qualitative analysis of conflicts in Peru, states that most conflicts in Peru originate due to “people’s sense of grievance regarding previous [supposedly unfair] land transfer agreements” and the high company profits that incentivise communities “to claim the fulfilment of promises” by the mining company as well as a greater share of these profits and compensation for their lost assets and livelihoods (Barrantes, 2005). Kirsch (2007) in Papua New Guinea or Ali and Grewal (2006) in New Caledonia also point to financial benefits as one of the motives behind opposition to mining in their studies.

Fourth, the distrust many communities have of the mining company and the government can also be a source of increased confrontation (De Echave et al., 2009; Horowitz, 2010; Muradian et al., 2003). According to De Echave et al., (2009), the perception of the magnitude of the effects an activity can generate relates to the



relations of trust these communities have. Horowitz (2010), studying the decisions of Kanak villagers in New Caledonia, argues that trust wasn't determined by the scientific validity of the information provided by the company but by the affiliation of each villager to either the company or the protest group that "stemmed from expectations of long-term social relationships and economic benefits for themselves and for their community, as well as feelings of empowerment".

Fifth, neoliberal reforms, investment expansion and the structural adjustment plans pushed forward by multilateral organisations like the World Bank are also behind increasing conflict and rejection of mining projects (Bridge, 2004a; Campbell, 2009; Gordon and Webber, 2008; Hilson and Yakovleva, 2007; Machado Araoz, 2009; Özen and Özen 2009; Stahler Stolk et al., 2007). The profound reforms introduced during the 1980s and 1990s pushed by the 'Washington consensus' advocated for public-sector cutbacks, privatisation and market oriented mechanisms, which "converted states into brokers for a transnationalised capitalist class" (Stahler Stolk et al., 2007). In the mining sector this was accompanied by mining legislation reforms that facilitated investments, over-bloated tax concessions and reduced standards of environmental protection, in many occasions diminishing institutional capacity (Hilson and Yakovleva, 2007; Otto, 1998; Szablowski, 2002).

This paved the way for a rapid rise in mineral production in South America and to a lesser extent South East Asia and Africa that didn't always lead to the promised development goals (Bridge, 2004a; Schaffartzik et al., 2014). Instead, conflicts, community dislocations and environmental concerns have provoked widespread criticism and rejection of mining investment (Bury, 2007; Campbell, 2009; Özen and Özen, 2009). In Latin America, the rejection of the neo-liberal project was reflected through ballot box elections through the 1990s and 2000s in a swing to the 'left', although they were not less extractivist (Gordon and Webber, 2008; Stahler Stolk et al., 2007).

During a 'big policy table' organised in Africa by the United Nations Economic Commission it was recognised that overly generous investment laws and regulations had been implemented. This catalysed into the formulation of the 'African Mining Vision' aiming at achieving more linkages to local economies and partnerships at different levels (UNEC, 2011). This framework has also been criticised however as being externally driven and contributing to further de-legitimise the governments of mineral-rich countries (Campbell, 2009).

From the year 2000, the emergence of Asian economies and specially China has caused a steady and rising demand for natural resources worldwide (Muradian et al., 2012). India's increase in material consumption has been more modest and has relied so far on internal supplies, causing many resource extraction conflicts (Martinez Alier et al., 2014b; Vagholikar and Dutta, 2003). Also recently, speculative trading activities with hedge funds have provoked investment booms pushing mining exploration projects in many parts of the world (Fraser and Larmer, 2010; Tavasci and Ventimiglia, 2011) and increasing conflict (see Chapter 1; Conde and Kallis, 2012).

This shift to environmental conflict does not imply that labour concerns have disappeared; low salaries and work-place grievances are still articulated by mineworkers. A well-explored example is the Marikana massacre that occurred in South Africa in 2012 where 44 mineworkers were killed by the police. The initial strike promoted by the unlikely alliance between trade unions and urban communities was demanding better salaries due to their inability to pay their bank debts (as a result of high interest rates). Global forces, apartheid historical grievances and hard working conditions in the mines are all playing a part in the current social movements in South Africa (Bond and Mottiar, 2013).

It should also be noted that environmental history literature remains limited so more studies could reveal whether the historical focus and quantity of literature on labour issues reflects the relevance and intensity of these conflicts or whether environmental conflicts in the past were just ignored by press and historians as well as academia.

#### **4. Are conflicts increasing?**

Although interest and research on mining conflicts has been increasing during the last decade (Bebbington, 2012), it is difficult to assert if the actual number of conflicts has increased. The factors described above have most likely increased the number of conflicts taking place. In support of the hypothesis that there has been a rise in the number of mining conflicts I explore several studies carried out by think tanks and NGOs that have estimated trends in the number of conflicts and related deaths, during the last decade.

The ICMM's (2015) latest report on mining company-community conflicts shows an increase in the number of reported incidents (from 10 to 90) between 2002 and 2012, and a small decrease (to 88) in 2013. Two acknowledged caveats of the report are that the data has not been corroborated by the parties involved or by third parties, and that due to data constraints it is not possible to determine if conflicts have been increasing from the previous decade. Coinciding with ICMM's data, the report "Deadly Environment" of Global Witness (Global Witness, 2014) shows an increase in the number of killings of environment and land defenders. During the period 2002-2012 Global Witness documented that at least 150 (out of 908) killings have taken place in extractive conflicts. Countries with the highest number of killings are Peru (46) and Philippines (41). The update report for 2014 (Global Witness, 2015) reports nine activists' killings in mining conflicts in the Philippines plus eight others in other regions, positioning mining and extractive industries as the biggest driver of killings over land disputes in 2014. Methodologically this report is more robust than ICMM's because data has been triangulated. Regional organisations like the Latin American Observatory of Mining Conflicts (OCMAL) also report an increase in conflicts most of which began in the 2000s, with presently more than 200 active mining conflicts in the region (OCMAL, 2014).

The Centre for International Environmental Law prepared a report in 2010 for a thematic hearing of the 'Inter-American Commission on Human Rights on the Situation of Environmentalists in Mesoamerica' (CIEL, 2010). It denounces an increase in recent years in mining activity and conflicts in Mexico and Central

America. The report explores 14 case studies in Mexico, Guatemala, Honduras, El Salvador and Panama describing threats and violence: destruction of personal and communal property, forced relocation, death threats, kidnappings, arbitrary detention and killings. Although it doesn't show any increase over time, it highlights the high number of violent conflicts, especially in the late 2000s.

Similarly there have been several attempts to give visibility to this rise in conflicts through conflict inventories and maps. Apart from OCMAL's work, Firpo et al. (2013) carry out an inventory of 300 socio-environmental conflicts in Brazil of which at least 16% are directly related to mineral extraction. In Colombia, Perez Rincón (2014) carried out an inventory of 95 conflicts many of which are related to mining (27 are gold mining conflicts and 12 related to coal mining). As part of the EU funded EJOLT project, a database and map with around 1500 conflicts is being created and analysed of which 23% are also mining conflicts (Özkaynak et al., 2015).

## **5. Why do some communities resist while others do not?**

Even though we are experiencing a rise in conflicts not all communities resist mining and not all who do, do with the same intensity. What factors can determine if a project becomes conflictive?

Communities are more likely to resist when they are able to perceive a threat to their health or livelihood. This in turn depends on a number of factors, such as the stage of the mining operation when this threat is perceived, when and what information they have access to, who they trust (e.g. what the companies tell them or what concerns an NGO raises) and their degree of marginalisation, meaning the degree of access to information and their capacity to organise.

If communities are not able to perceive any threat to their health and livelihood, they are not likely to react. In Chapter 1 I explore the uranium mining expansion in Namibia, using the term 'spatial ecology' to describe the geographical and physical characteristics of the mining resource and the livelihood landscape that determine the (lack of) resistance of some communities (Conde and Kallis, 2012). Özkaynak et al. (2015) analysis of 346 mining conflicts of the EJAtlas database also identify mobilisation when there is actual incidence and the impacts are felt by local communities.

Communities might also be too marginalised to understand the implications of a mining project opening near them or have the time and resources to participate in resistance (Bebbington, 2007; Conde and Kallis, 2012). As Özkaynak et al. (2015) point out, when excluded or marginalised groups such as women or indigenous groups are involved in conflicts, negative events such as repression, criminalisation of activists or corruption are more common than when farmers or industrial workers are involved. Marginalised communities might be also more willing to trust the company's promise of development and jobs (Horowitz, 2010; Walter and Martinez Alier, 2010). In contrast indigenous territorialities; culture, land use and tenure or political claims to land can lead to resistance if they perceive a new project might impact their land or way of life (Ali, 2009; Liffman, 1998; Rumsey and Weiner, 2004; Yagenova and Garcia, 2009).

Ballard and Banks (2003) also argue that resistance is likely to emerge in remote resource frontiers with a lack of effective presence of the State. As De Echave et al. (2009) and Bebbington et al. (2010) point out; when the population lacks institutionalised means to channel their demands or social or political actors to represent them, the main path for those that can get organised is mobilisation and protest.

Using the EJAtlas database Özkaynak et al. (2015) point that 39 out of 71 cases analysed were started at a preventive stage. A crucial factor that allows for resistance to emerge at an early stage (and expand) is the extra-local alliances made by communities and local organisations (as pointed in Chapter 1). It is often through the diffusion of information across networks that communities learn about the impacts mining can cause and react before the operation starts (Bebbington et al., 2008a; Conell and Cohn, 1995; Walter and Urkidi, 2015). Özkaynak et al. (2015) carry out a mining resistance network analysis highlighting the importance of inter and intra-scale alliances with international and national actors for successful strategy resistance. Agreeing with Rootes (2007) they point to the need to decentralise cooperation between national and local organisations. Bebbington (2007) points to the crucial role of everyday and informal networks, what he defines as 'social movement organisations' such as NGOs, churches and student organisations as catalyst in social environmental struggles.

There can also be a diffusion of strategies of resistance through these networks; Özen and Özen (2011) use the term "strategic action fields" to analyse the interactions of two social movements against two gold mines in Turkey. They conclude that both the resistance movements and the mining companies learn from previous resistance movements; what to do but also crucially what not to do. Walter and Urkidi (2015) describe how referendums to reject mining projects have spread; a priest arriving in Guatemala who had experienced the Tambogrande consulta in Peru, regional networks like the Red Muqui in Peru, documentaries like the one of Sipakapa in Guatemala or the internet. Svampa and Antonelli (2009) analyse the increasing resistance in Argentina against mining projects based on the dissemination of information about two previous mining projects; the "Alumbrera effect" that had important environmental impacts and the "Esquel effect" where communities organised and built local and regional territorial networks of mobilisation and information exchange. Communities that don't have this information through extra-local contacts might be more willing to accept the development discourse brought forward by the mining company and the government. Alliances at local level can also be decisive. As Holden and Jacobson (2009) and Bebbington et al. (2008a) describe, the church has been a huge ally for resistance movements in Latin America having had a decisive role in the conflict.

It's important to highlight that responses to mining projects (or extractive projects in general) are rarely homogenous. Divisions and internal fighting between community members are common due to different visions of development, different vulnerabilities -including the gender divide- (with some community members relying on their land and resources more than others) or some community members (males, for instance) obtaining more benefits from the mines than others through jobs or development projects (Bebbington et al., 2008a; Horowitz, 2002, 2012).

McNeish (2012) warns against the simplified portrayal of indigenous communities as 'noble savages' in "avatar-like" conflicts, pointing to their evolving colonial nature. He argues that on many occasions "militant pragmatism" drives communities' leadership to seek dialogue and negotiated settlements with the mining company. As examples, Horowitz (2012) shows through her analysis of a mining conflict in New Caledonia how the local indigenous group *Rhé'é'bu` Nu`u`* struck a deal with the mining company in exchange for some monetary compensation leaving the regional government and the environmentalist groups aside. Ali and Grewal (2006) show how after initial opposition to the Koniambo project in New Caledonia, the community ultimately felt they were going to benefit from it due to an agreed "ownership scheme" that would allow for much of the profits to stay in the territory.

Research on gender related impacts in socio-environmental conflicts is not extensive. Authors point out that women's reliance of common resources and their lack of access to the monetary benefits from the industry leaves them in a relatively weak position in mining conflicts (Agarwal, 2003; Guha and Martinez Alier, 1997; Martinez Alier, 2003; Scheyvens and Lagisa, 1998). On top of this issues Jenkins' (2014) excellent review explores the role of women as mineworkers and the changing role of women in communities affected by mining. The role of women, however, is explored less in resistance; why and how do they engage in resistance? Agarwal (2001) and Veuthey and Gerber (2012) carry out excellent analyses on this but focused on forestry conflicts. An exception is the analysis by Bantjes and Trussler (1999) about a uranium mining conflict in Nova Scotia, Canada. The authors identify network links and alliances rather than gendered concerns about local threats to livelihoods as women's motivation behind their activism. More analyses of developing countries or more marginalised settings would shed more light to this important facet of resistance.

## **6. Discourses and scales**

When activists jump scales liaising with different national and global actors such as NGOs, scientists or lawyers, it allows them to broaden the perception of the scope of the conflict. They realise it's not just a local problem but the result of regional and national regulatory frameworks (Urkidi and Walter, 2011) and their weak position within the market geopolitical dynamics of global capitalism, where the power balance is in favour of mining companies that allows them to impose monetary valuation over the values and needs of the local population (Martinez Alier, 2003; Watts, 2005). This is sometimes incorporated in their framing and discourse.

Culture, local narratives and the values of the communities are still present in these alliances. Although there is an apparent contradiction between place-based or local discourses and global discourses, they are in fact part of the process to overcome 'militant particularisms' that focus on local loyalties and identity politics (Harvey, 1996). Instead, through these cross-scalar alliances, discourses can shift in scale. As Haarstad and Fløysand (2007) point in their study of the opposition to the Tambogrande project in Peru, local identity with the land was re-positioned with national Peruvian identity through the defence of lemons to cook ceviche, a national dish, and more global discourses such as the violation of democratic rights. In the Pascua Lama conflict transnational activists defended the livelihoods of local

communities and local resistance movements spoke about climate change, glacier protection and other wider global claims such as democracy and participation or access to information (Urkidi, 2010). In opposition to coal mining it has been argued (for example in South Africa, Bond, 2008) that leaving the “coal in the hole” is at the same time a good local idea and a good global idea - there is a lot of “unburnable fossil fuels” that must be left underground to prevent carbon dioxide emissions. This slogan has spread through platforms such as the Climate Action Network.

Also adopted through cross-scalar alliances is the ecological pro-conservation discourse. This is one of the discourses adopted by Intag’s resistance in Ecuador - even though it didn’t represent the communities’ own views on it (Buchanan, 2013). It has also been used by local populations in Peru (Arellano-Yanguas, 2011) and Colombia (Grueso et al., 2003).

The discourse of rights; land, territorial and water rights is one of the main argumentations of movements resisting the enclosure and privatisation of land and water by mining projects (Bebbington et al., 2008b). Some communities also claim their right to use environmental services such as river sediments for agriculture or the fish in the rivers (Ballard and Banks, 2003; Clark, 2002; Martinez Alier, 2009).

Recognition of indigenous rights is being increasingly demanded with success, but not without controversy, by communities affected by mining who want to maintain control over their land, have access to and participate in social and political life, and decide over their own development (Andolina, 2003; Bebbington, 2007; Rumsey and Weiner, 2004; Urkidi, 2010; 2011; Yagenova and Garcia, 2009).

Situated often in post-colonial contexts, communities who claim indigenous status are “seeking equal rights through reversing their continuing history of dispossession” (Schippers, 2010). As Bebbington (1996) points out in Ecuador, the recovery and projection of the idea of being Indian is a form of resisting white and mestizo domination and regaining a space for the values of being indigenous. In the study of the Guatemalan struggle against the Marlin mine, Urkidi (2011) explains how communities linked local-based demands such as water depletion and contamination with the defence of their Mayan traditions, culture and “cosmovisión” and claimed “legal participation rights and the democratisation of decision-making processes”. This cultural defence was not connected to a specific local place but to the historical grievances suffered by their culture and communities. Although some had lost the connection with the land, they knew they wanted to follow a different development path to that offered by the mine. This discourse was in fact articulated by different actors at different scales at the international level as well as through national coalitions such as the ‘Western Peoples Council’ that ultimately helped the communities to carry out mining consultas.

Indigenous rights can be invoked as a strategy to stop a project or to obtain something from the company or the State. In the context of a mining conflict this has been very well described by Schippers (2010) who shows how a local organisation promoted the legal establishment of an indigenous region in Bakun, the Philippines, by framing a community that didn’t originally identify themselves with the term indigenous. The strategy gave them the power to negotiate access for companies

potentially interested in their lands. Similar strategies have been used in India to defend the rights of the Adivasi people who are seeing their land encroached by mining projects and metal factories (Padel and Das, 2010). As in Chhattisgarh, this strategy can be externally articulated; middle-class activists used the idea of 'indigeneity' and attachment to land of the Adivasi to defend their rights in a coal mining conflict (Sharma, 2012). In the Philippines, mining conflicts have strengthened the indigenous discourse of several groups (Holden, 2005).

Groups adopting an indigenous discourse risk being judged as "inauthentic" and their concerns ignored if they don't reach certain traditions or ecological standards (Horowitz, 2011; Conklin and Graham, 1995). It might also create conflicts between indigenous and non-indigenous groups (Horowitz, 2011) as well as internal conflicts in the communities themselves if there is a need to demonstrate who has 'indigeneity' (Ballard and Banks, 2003).

Another example of strategic global discourses that are increasingly being used by resistance movements due to extra-local alliances is Environmental Justice (Guha and Martinez Alier, 1997; Martinez Alier, 2001a; Sikor and Newell, 2014). The language of environmental justice (and against "environmental racism" as used in the US) implies the claim that certain communities or groups in society are disproportionately exposed to environmental impacts and risks than other groups. The concept originated during the late 1980s in the US as a distributional claim against the exposure of racial minorities to environmental hazards (Bullard, 1990). Martinez Alier corrected (2003) that is not about "minorities", but about poor people of various colours in all continents who suffer environmental injustices, and complain accordingly. The discourse has since then been adopted by numerous resistance movements all over the globe (Carruthers, 2008; Martinez Alier et al., 2014a ; Timmons, 2007; Walker, 2009). Whilst some activists and communities don't identify themselves explicitly with the words "environmental justice", others (more in the US and Brazil than elsewhere) use explicitly the words "environmental justice" in their own names or the descriptions of their work. For instance, in Mozambique, 'Movement of Environmental Justice' is the name of the local member of Friends of the Earth. Whilst in Colombia, the local member of Friends of the Earth is CENSAT (S from Salud, Health, T for Trabajo, Labour), and in Nigeria ERA (Environmental Rights Action). All these are environmental justice organizations (EJOs) as hundreds and indeed thousand of other small environmental justice organisations supporting communities around the world.

Through the analysis of this global expansion Schlosberg (2007) uncovered and incorporated other important aspects such as the recognition of the groups' collective identities and rights and their participation in decision-making processes. Urkidi and Walter (2011) identify all three dimensions in the Chilean and Argentinean mining struggles in Pascua Lama and Esquel. Whilst both resistance movements demanded participation initially, recognition and procedural claims increased specially in the Huasco (Pascua Lama) movement. Distributional claims only appeared at the onset of the conflicts. They also show how Environmental Justice was not part of their initial discourse; it was used as a strategy to gain more visibility after networking and exchanges with other communities had broadened the perception of their struggle.

## 7. Strategies of resistance

The repertoire of strategies traditionally used by resistance groups to mining include among others, diffusion activities, protests, blockades and occasionally violence. Peluso (1992) shows how the repertoire of actions depends on “specific historical and environmental circumstances”, the nature of the complaint and the tools (including social and political) at their disposal. More recently the EJAtlas analysis of 1500 cases carried out by Martinez Alier et al. (forthcoming) identify 27 strategies of mobilisation with complaint letters, public campaigns, street protest and the development of networks for collective action as the most commonly reported strategies by activists. Networking and cross-scalar alliances have increased the tools, strategies and discourses at the disposal of activist organisations, achieving in some cases a high degree of complexity with different strategies and discourses being operationalised at the same time.

Another crucial factor that influences which strategy is used is the stage of the mining operation in which the community decides to take action. Before the mine is in operation, communities are more likely to confront and oppose the project, but if the mining project has been operating for a long time, the community is more likely to focus on concessions, compensation or mine rehabilitation (Bebbington, 2012). Bebbington et al. (2008a) show in their analysis of peasant and urban protests against Yanacocha mine in Peru, that their objective was not to shut down the mine but to obtain fair compensation for lost land, greater participation in the governance and an increased share of benefits obtained from the mine. Contrary to this view, Machado Araóz (2009) shows in his analysis of the Alumbrera resistance in Argentina that communities' demands shifted from increasing royalties and environmental controls to the utter rejection of the project due to rising environmental impacts and their increasing connections and participation in regional and national assemblies.

Adding to traditional repertoires used by resistance movements, I explore below three strategies and institutional avenues appearing more prominently in the literature.

Already mentioned, consultas or referendums emerged in the 2000s as a strategy used increasingly by communities in Latin America (De Echave et al., 2009; Urkidi, 2011; Walter and Martinez Alier, 2010). Starting with the Tambogrande, Peru, consulta in 2002 (Haarstad and Fløysand, 2007; Muradian et al., 2003) as many as 68 consultas have been carried out up to 2012 in five different countries, and more are on-going with all mining projects being rejected by the communities. Activists in these consultas network through cross-scalar alliances questioning and legitimating the scale of participation and decision-making that should be in place to decide over mining activities (Walter and Urkidi, 2015).

Although not new, taking a mining company to court is becoming a more realistic possibility for poor and marginalised communities through the alliances created with national and international NGOs and lawyers. Since the Rio summit in 1992 new legislative frameworks and judicial systems for the protection of the environment have appeared allowing for more legal avenues (Hirsch and Warren, 1998). Legal



actions can start in the country where the mining company is operating. This was the case of a landmark judgement by the Supreme Court in India that recommended the closure of almost all limestone mines in the Doon Valley (Bandyopadhyay and Shiva, 1985; Gadgil and Guha, 1995). A more recent case is the demands put forward by the Dongria Kondh tribe against the UK based mining company Vedanta. The mining approval was rejected before the Supreme Court of India in 2013 (Temper and Martinez Alier, 2013).

A second option is the use of legal avenues in the company's home state; this is possible in countries such as Australia, Canada, in domestic courts of several European countries (Pigrau et al., 2012) as well as the Council of Europe (Grey and Minguet, 2014). As explored in Chapter 1, in the UK courts, two ex-workers from Rössing, Rio Tinto's uranium mine in Namibia, claimed compensation for health damages due to their work in the mine with their claims finally 'prescribed' as too much time had elapsed. BHP was taken to court in Australia by local communities in Papua New Guinea for the environmental impacts caused by the tailings of the Ok Tedi mine. It was also found that they had been involved in drafting Papua New Guinea's legislation trying to prevent court action in foreign countries (Connell and Howitt, 1991). In 1995 the local authorities of Ilo, Peru, presented a class-suit action in the US denouncing the impacts from a copper mine and the associated smelter. It was however dismissed on the grounds of *forum non conveniens* (Martinez Alier, 2003). With similar results, the Amungme tribe filed several class-suit actions in regional US courts against Freeport McMoran for the impacts of its Grasberg mine in West Papua. Also in the US, the Alien Tort Claims Act (ATCA) has received several extractive industries related claims. It is however now a closed avenue since a demand placed by Nigerian citizens against Shell. The Supreme Court decided ATCA couldn't be applied if the case didn't occur in the US or with US companies. International Courts are a third avenue and these include the International Court of Justice or regional systems for human rights protection such as the Inter-American court of Human Rights (Pigrau et al., 2012). These courts however have limited capacity. An example is the demand placed also regarding the case against Southern Peru Copper Corporation in Ilo, Peru at the International Water Tribunal in the Netherlands. Local groups only obtained moral support (Martinez Alier, 2003). Grey and Minguet (2014) distinguish between civil and criminal avenues at national and international levels and offer a legal guide for groups seeking environmental justice.

Also important with legal strategies is the stage of the mining operation as it determines the objective of a court case or legal avenue. In the US, the native American Chippewa struggle against mining operations used previous court cases that had protected native land and treaty rights to fish, to protect their lands from future mines (Clark, 2002; Geddicks, 1993). The Ok Tedi mine had been operating for 10 years when the Yonggom indigenous group filled the court case against BHP in Australia in 1994. They didn't want the mine to close down; their objective was to get better environmental protection and monetary compensation (Kirsch, 2007).

Legal cases where communities have been successful such as the Vedanta case in India or the Chevron-Texaco case in Ecuador, do exist. However, as North and Young (2013) state, legal routes can take a great deal of time, money and effort, needing a well organised community and alliances with professional lawyers making it

“cumbersome and sometimes effectively impossible for communities to pursue” (Fulmer et al., 2008). A court case may also diminish the number of options offered to local communities who, like in the Yonggom (Ok Tedi mine) case, had to choose between protecting the environment, compensation or the job and economic benefits of keeping the mine open (Kirsch, 2007).

Obtaining compensation through legal cases often entails the monetary valuation of losses to the community where a fair price has to be established for lost land, water, biodiversity and in many cases livelihoods. In the field of ecological economics it is argued that “human rights, collective territorial rights, sacredness, ecological, and aesthetic values” (Martinez Alier, 2009) cannot be monetised. Temper and Martinez Alier (2013) also add, based on the bauxite mining conflict against Vedanta in the Niyamgiri hills in India, that setting prices deepens inequalities, excludes local participation and encourages economic decisions.

A third phenomenon and evolving strategy concerns the role and mobilisation of science in resistance that has been increasing also through extra-local alliances. Initially, the only providers of scientific knowledge were the mining companies, creating issues of distrust within the communities (Horowitz, 2010; Walter and Martinez Alier, 2010; Muradian et al., 2012). Due to the local-national-global nexus, scientific knowledge can be introduced at early stages before the mining project has started that can drive the local population to reject the project outright as happened with the Esquel case in Argentina with the participation of hydrogeologist expert, Robert Moran (linking with Appendix of Chapter 2 above, Walter and Martinez Alier, 2010; Svampa et al., 2009). Once the mining operations are underway activists can create alliances with sympathetic scientists to challenge the information produced by the mining companies who on many occasions deny the impacts they cause on the environment or on the health of their workers (Bebbington and Bury, 2009). In Chapter 2 I refer to how local activists engaged with scientists because they wanted to understand how they could protect themselves from radiation emanating from uranium mines as well as gain visibility and legitimacy by denouncing the impacts with scientific data (Conde, 2014a). Since all knowledge, including scientific knowledge are partly socially constructed, the ‘co-production’ of new knowledge combining local and scientific knowledge can be used to challenge the knowledge produced and “manufactured” by the mining companies.

Activists have also developed concepts that have later been adopted by academia such as ‘ecological debt’, ‘land grabbing’ or ‘climate justice’ (Martinez Alier et al., 2014a). Conversely, activist organisations are increasingly using concepts developed in academia such as ‘peak oil’ or ‘ecological footprint’ (Martinez Alier et al., 2011).

## **8. Is resistance to mining projects effective?**

Beyond an analysis and identification of strategies, a pertinent question is whether these means make any difference. The effectiveness of resistance is difficult to evaluate and define because it is a political and value laden concept. While some scholars would consider a movement that has stopped a mine effective (Martinez Alier, 2003; Özkaynak et al., 2015; Urkidi, 2010), others might identify effectiveness as a mining project that brings development opportunities to the community (Ali,

2009; Kemp et al., 2011). I would argue effectiveness depends on the objective set by the community, which generally depends on the moment the conflict is generated and the diffusion of information the community has been exposed to. For the mining company or the state, effectiveness would depend on the success of the company to exploit those minerals and keep the community content. Ultimately, it is unrealistic to assume that agreements can be reached in which all parties are completely satisfied (Hilson, 2002). As De Echave et al. (2009) points out, “conflicts don’t get resolved but transformed” and win-win situations are unrealistic.

Effectiveness is an elusive term; even when a movement might not have been effective in stopping a mine or obtaining its goals, a culture of transformation takes place through which they can organise and develop their own idea of development (Alvarez et al., 1998; Bebbington et al., 2008b), impact wider public opinion (Urkidi, 2010) or change the mindset of the government (Connor et al., 2009). Özkaynak et al. (2015) identify as environmental justice achievements -in projects that are still operational- the consolidation of activist networks, favourable legislative development and governmental support. Also, resistance might be considered successful at a certain point in time but over time this might change as companies renew their claims for those or nearby projects (Bebbington et al., 2008a; Kuecker, 2007).

Still, there is a literature that tries to determine the factors that influence the effectiveness of movements, effectiveness defined by different authors in their own terms. Dense social networks (Tarrow, 1994; Vasi, 2004), cohesive communities and their capacity to organise (Bebbington et al., 2008a; De Echave et al., 2009; Kuecker, 2007; McAdam et al., 1996) are identified as crucial factors not only for movements to be successful but even to emerge. Bebbington et al. (2008a) in their analysis of the opposition to the Yanacocha mine point to community divisions as a crucial factor for the continuing dominance of the mine. Once again, strategic cross-scalar alliances have been identified as a key factor as they allow for larger political alignments (McAdam et al., 1996) and more public exposure and empowerment for local organisations to confront big mining companies (Haarstad and Fløysand, 2007; Özkaynak et al., 2015; Urkidi, 2011).

Good governance institutions such as open decision-making mechanisms, legal avenues or advisory organisations can be crucial to provide channels, tools and alliances for grassroots organisations to obtain their demands. Bebbington and Bury (2009) in their analysis of institutional challenges for local development in Peru point to the role of the Ombudsman office in Peru as a legitimate mediator in these conflicts. They argue that sub-national initiatives such as participatory water monitoring and ecological zoning allowed the combination of local and expert assessments. As analysed in Chapter 2, these initiatives could however also give way to the co-optation of local organisations if the alliances are not driven by local groups (Conde, 2014a).

A step further in analysing the effectiveness of environmental justice movements is being undertaken by Özkaynak et al. (2015) through the statistical analysis of the EJAtlas. They point to several success factors such as the time of mobilisation; where preventive actions are more successful than when the mining operation has started.

At a preventive stage they also point out that positive events such as the application of existing regulations or a victorious court decision increase the likelihood of a project being stopped. Interestingly, they found that no project had been stopped in a low-income country (linking to the marginalisation and governance issues).

Bebbington et al. (2008a) also point to other structural determinants affecting the outcome of a movement; on one hand, the national economic situation at the time and how dependent the country is on mining and on the other, the size of the company and its capacity for lobbying and mobilising resources for social development programs.

## **9. The state and resistance**

The state has a prime role in shaping mining investments through the development of mining policies at different levels. Despite its importance, literature analysing mineral (or extractive) policies by governments is patchy and fragmented.

In the North, the role of regional state regulation and policy has been examined by Kenny (1994) who analyses the interventions of the New Brunswick provincial administration in Canada in 1953 exposing the limitations of regional governments. Bridge and McManus (2000) expose the obsolescence of institutions and legislation in the US Southwest during the 1980s that, they argue, pushed the emergence of social conflicts over land access. Hilson's (2000) analysis of the 1996 minerals policy carried out by the Canadian government to achieve sustainable development argues that although some major successes were achieved, there is room for the improvement of industry-government partnerships, more participation and the review of environmental practices. Carrying out more current analyses of resource policy challenges Solomon et al. (2008) analyse the social dimension of regulation and practice in Australia.

In the South, several authors analyse the policies of economic liberalisation adopted during the late 1980s and 1990s that profoundly shaped the patterns of mining investment (Bridge, 2004a). Campbell (2009, 2010) showed the impacts these changes had on the states' authority and the "development outcomes" of "three generations" of liberalisation in Africa. According to Antonelli (2009), in Latin America, the mining industry together with the state have carried out during the last two decades an intensive campaign around the idea of 'new mining' or 'nueva minería'. It's argued that mining is beneficial for the community and the country as a whole if adequate technology and controls are set up making it compatible with other adjacent on-going activities, the benefits are shared and invested appropriately, and brings jobs and new opportunities for local development (Ali, 2009; Antonelli, 2009; Veiga et al., 2001). Lagos (1997) analyses Chilean government policies through both military and democratic periods discussing the role of foreign direct investment and state-owned Codelco in the copper mining boom. He suggests only minor policy changes to what he considers has been a rather successful model.

Whether natural resource endowment is a blessing or a curse for a country is a contested topic (see Ross, 1999). Mineral rents can lead to rent seeking behaviour through bribes and patronage increasing the levels of corruption and further

corroding the quality of government (Auty, 2008; Leite and Weidmann, 2002; Torvik, 2002). Mineral exploitation can also originate armed conflicts (in order to control its revenues) or re-fuel an existing conflict (Le Billon, 2001). Resource curse scholarship also link economic shocks and currency overvaluation (also known as the Dutch disease) to weak growth rates (Sachs and Warner, 1995). Several countries are proving to be exceptions to the Dutch disease diminishing support for this explanation (Auty, 2001). Instead, there is increasing interest in the connection between extractive industries and institutions. According to Bulte et al. (2005) countries well endowed with minerals (or oil) are expected to have “bad policies,” and suffer rent seeking effects, repression, or policies that postpone the transition to a competitive diversified economy.

Given the strong connection between resource distribution and conflict, there is flourishing interest in the field of revenue management. The decentralisation of revenues is necessary to reduce inequality and compensate communities suffering the burdens of extraction. Experiences so far however have heralded several criticisms due to under-prepared local governments and corruption, generating frustration and internal conflicts (Arellano Yanguas, 2011; Morgandi, 2008). Studying oil rent distribution Ross (2007) points out that direct distribution schemes (through uniform transfer to all citizens) adopted in the US and Canada are the more equitable form of distribution. He doubts however this would function in developing countries due to weak institutions. Whilst several authors consider central management of revenues -with input from local and regional authorities- as the best approach (Ahmad and Mottu, 2003; Brosio, 2003), allowing regional government to levy taxes can reduce the risk of secessionist movements.

An emerging tool to share the benefits of extractive activities with communities is the use of foundations, trusts and funds (FTFs). Wall and Pelon's (2011) analysis of these schemes point to the need to simplify schemes, take into account all beneficiaries and integrate the schemes with other regional and local development plans. The relevance of these funds for inter-generational equity and fairness is highlighted by O'Faircheallaigh (2013).

Whilst transparency is not the only solution to the challenges posed by corruption, theft and money laundering, it is a necessary step towards greater openness and accountability of revenue management (Vierya et al., 2014). To achieve this objective the Extractive Industries Transparency Initiative (EITI) was created in 2002 by a global coalition of governments, companies and civil society groups with the objective of making public all revenues and avoid corruption. So far there are 31 complaint countries as well as more than 900 companies. In its analysis of the application of the EITI in Nigeria, Asgill (2012) emphasises the amount of information from the oil industry that is now in public domain that has in turn allowed for the creation of a political space through which civil society is channelling demands for greater transparency and accountability. She however warns that the tool ignores a “longstanding history of marginalisation and a complex interaction of forces” where powerful elites have vested interests in maintaining the status quo of revenue management. Aaronson (2011) states the EITI has not been as successful as it could have been because civil society has not been allowed to participate in the process, with many not even aware of it. Without the policing of revenues by civil

society, the ability of the EITI is limited.

Also flourishing is the interest in progressive governments like Bolivia, Ecuador, Brazil or Uruguay that promote an extractivist model based on resource nationalism (specially oil and gas, but also iron ore in Brazil and Uruguay) with promises of redistribution of revenues and economic diversification. Several authors are looking at the apparent contradiction between the progressive-based-extractive-model and the social unrest and resistance it sparks (Bebbington and Bebbington, 2011; Bridge, 2013; Kohl, 2006; Perreault, 2006; Perreault et al., 2011). Gandarillas (2014) in fact points to the increasing dependence of Bolivia on natural resource exports and the erosion of basic democratic rights since the progressive government of Morales took power. Also paradoxical is that this extractivist development discourse is shared with conservative governments like Colombia, Mexico and Peru. Authors point to deeply neo-liberalised structural path-dependent economies as main constraints for change (Kohl and Farthing, 2012; Kaup, 2010) and the response to demands from social movements on nationalisation and redistribution of revenues (Perreault and Valdivia, 2010). Not explored enough in the literature is the role of mining in this nationalisation.

Also common with both progressive and conservative governments is a growing intolerance to social resistance to extractive projects. This is resulting in the increasing use of repressive measures, the criminalisation of protest through new legislation and the prosecution of leaders in resistance movements (Bebbington and Bebbington, 2011; Martinez Alier et al., 2014a; Özen and Özen, 2009; Walter and Urkidi, 2015). Global Witness (2014) is currently the best source reporting the number of activists being killed in environment and land conflicts highlighting that “three times as many people were killed in 2012 (147) than 10 years before (57 in 2002)”. But the use of violence is not new. A well-studied case is the role played by the authoritarian regime of Suharto in Indonesia from the mid 1960s to the end of 1990s where the rich Grasberg mine and a movement for independence justified a heavy military presence. On top of major environmental damage, many human rights abuses took place such as displacements and killings perpetrated by the Indonesian military and police, in cooperation with Freeport’s own security service (Leith, 2003; Martinez Alier, 2003). The Indian government also had a decisive role in the violent handling of the Maoist movement that in several areas opposed the privatisation of their lands for mining extraction projects (Guha, 2007; Sundar, 1997). The recent deaths of 44 mine workers protesting in Marikana, South Africa is another example.

Governments can also react in positive ways to resistance. Regulation and legislative changes are a common response to the pressure from social movements. As Khoday and Natarajan (2012) argue based on their analysis in India, several laws on indigenous rights and environmental legislation have been changed, limiting the instances where communities can be evicted from their land and creating better resettlement plans. Also in India, the Green Tribunals created in 2010 will supposedly help expedite environmental claims, involve experts in environmental law and increased citizen participation. The Peruvian government has improved the environmental control of mines and implemented a new ministry for the environment, even though it has no power to fine or sanction mining companies (Bebbington and Bury, 2009; De Echave et al., 2009). Governments like El Salvador,

have created a moratoria on extraction due to social pressure (Bebbington and Bebbington, 2011) and the Ecuadorian government started (and later thwarted) an innovative proposal to leave oil untapped in the protected Yasuní-ITT park in exchange for financial compensation (Rival, 2010).

## **10. Corporations and resistance**

Corporations respond in multi-faceted ways to the increasing resistance they experience to their activities. Although security forces to protect mine investments is a common response, mining companies are increasingly realising conflicts are not good for business and are improving company-community relations through greater community participation.

The industry is resorting to the use private security to guard mine installations and protect executives' homes and supply companies as a response to the increase in protests (Bebbington, 2007; Ferguson, 2005). This can occur with state support that provides and willingly delegates its own security forces (on and off-duty) (Campbell, 2006). Surveillance and violence are therefore shaping the governance of the mining industry with a sharp rise in killings of environmental defenders (Global Witness, 2014).

For the industry, increasing resistance also means rising costs in terms of delays to mining projects. A recent article by Franks et al. (2014) shows that many mining companies fail to account for the full cost of potential conflicts by not adopting appropriate measures to avoid them. The mining industry has reacted by changing radically their community engagement corporate practices from little or no information channels to highly developed communication and development strategies encapsulated under the Corporate Social Responsibility (CSR) umbrella (Ali and O'Faircheallaigh, 2007; Himley, 2013; Jenkins, 2004; O'Faircheallaigh et al., 2008; Vogel, 2005; Yakovleva, 2005). These are a set of policies and programs that include the use of cleaner technologies, improved communication strategies at different levels as well as better distribution and allocation of benefits to local communities with the aim of building trust, minimising conflicts and winning community support for their projects (Himley, 2010; Moffat and Zhang, 2014; O'Faircheallaigh and Ali, 2008; Zandvliet and Anderson, 2009).

A main critique to these programs is their voluntary and non-enforceable nature (Fulmer et al., 2008; Watts, 2005). As Szablowski (2002) indicates based on his analysis of a World Bank Involuntary Resettlement directive; the ideas in principle are good but the way they are implemented fail to fulfil the objectives set up. Based on studies of CSR programs in mining projects in Ghana and Ecuador, Hilson and Yakovleva (2007) and Warnars (2012) conclude these programs are in many occasions not well designed and, coupled with communities' displacements, increase rather than alleviate the communities' hardship. Another common critique is the issue of participation of local communities; moving "beyond-the-state" makes it more difficult for communities to find "clear channels of representation and accountability" (Swyngedouw, 2005). Unlike the state, companies differentiate between recipients of benefits, prioritising those closer to their project or local elites, ignoring some communities that might also be impacted causing on some occasions

inter and intra-community conflicts (Jenkins and Yakovleva, 2006; Newell, 2005; Warnaaars, 2012). The context in which these programmes are developed is also of crucial importance; weak governance (Yakovleva, 2005) or post-confrontational events where the company has already lost its legitimacy don't provide good grounds for CSR programmes (Warnaaars, 2012). With the ever increasing exchange of information across networks and alliances, communities are already questioning the merits of the extractive 'development' model and CSR programs brought by the mining companies (Bebbington et al., 2008a).

In response to these criticisms industry advisory bodies like the International Council on Mining and Metals (ICMM) as well as other think tanks and researchers are exploring ways to improve community-company relations; developing guidelines and providing advice to both mining companies and communities in order to reach agreements and avoid conflict (Ali, 2009; Esteves, 2008; ICMM, 2013a; Kapelus, 2002; Kemp, 2010; Kemp et al., 2011; Lockie et al., 2008; O'Faircheallaigh, 2008; Solomon et al., 2008; Veiga et al., 2001; WRI, 2007). In fact Laplante and Spears (2008) criticise the narrow focus of CSR strategies on environmental and human rights disputes and instead advocate the communities' right to control their own development route.

Community participation has emerged as the most important aspect of these company-community engagements, with recommendations to establish transparent dialogues and negotiation processes at an early stage and allow a genuine involvement of local communities in decision making processes in order to avoid externally driven development agendas (Banks, 2013; Caballero-Anthony, 2013; SUNPFII, 2008; Sawyer and Gomez, 2008). Experience from Latin American countries through the ELLA project shows how rent distribution alone does not diminish conflicts, but needs to be combined with rural or alternative livelihood development (ELLA, 2012).

Free Prior and Informed Consent (FPIC) has arisen globally as one of the most important models to ensure community involvement in extractive projects decision making (Goodland, 2004). McGee (2009) identifies the proliferation of community referendums (already analysed in Section 6) as a democratic way to ensure FPIC. Oxfam America's (2013) report on the application of FPIC in the Philippines however encountered problems ranging from insufficient information and education on the FPIC process itself, to recognition of false leaders, bribery and coercion. Drawing from experience in mining projects in Peru, Schilling-Vacaflor and Flemmer (2013) point to the importance of the impartiality of the institution in charge of the design and implementation of the consultation process, and the need to reduce power asymmetries through the improvement of negotiation capacities. Other recommendations are the inclusion of all interested community members (not only indigenous groups), the need to have a formal dialogue process throughout the lifetime of the project and the communities' right to participate in the monitoring and enforcement of the agreement (ELI, 2004; WRI, 2007). Hill et al., (2010) have designed a guide to achieve FPIC for local organisations supporting communities affected by large-scale projects.

A related model to FPIC is 'social licence to operate' (SLO) through which the mining



company wants to secure broad acceptance of the impacted communities to conduct its operations (Prno and Slocombe, 2012). Because it can be obtained without the state's involvement it is especially relevant in countries with weak governance structures and/or with projects located in remote regions. In contrast, FPIC was initially thought to be only a duty of the state because it was initially derived from the UN Declaration on the Rights of Indigenous Peoples and the International Labour Organisation Convention 169 calling for states to ensure consent. There is however increasing pressure for the industry to implement it, with FPIC being more 'formal' than SLO with regards to procedural and verifiable documentation (Lehr and Smith, 2010). ICMM and financial Institutions like the World Bank and the IMF are however in favour of applying a watered-down version known as "free, prior and informed consultation" leading to "broad community support" (WB, 2005). This has been heavily criticised by institutions like the World Resources Institute (WRI, 2007) arguing that consultations that do not resolve a community's reason for opposition or achieve consent will provide little assurance against potentially costly and disruptive conflict. While the industry's fear that a community can veto a project is understandable, the business risk of going forward without the community's consent is high as conflict can threaten the viability of the project at a later stage, when more money and resources have been committed to it.

In order to achieve durable agreements three other major recommendations can be gleaned from the literature; trust, capacity building and third party involvement. The development of trust is crucial in these negotiations; community members want to feel heard, listened to and their recommendations taken into account and acted upon (Barton, 2005; Commdev, 2008; Horowitz, 2010; ICMM, 2009; Labda, 2011; Moffat and Zhang, 2014; Zandvliet and Anderson, 2009). Also important is the capacity building of local groups so they can understand the potential social and environmental risks a mining project might entail and develop the ability to negotiate with the company (Bamat et al., 2011; Boelens et al. 2010; De Echave et al., 2009; O'Faircheallaigh, 2013; OSSREA, 2006; Schilling-Vacaflor, 2012; UNDP, 2011; Vieyra et al., 2014). Rogge (1996) shows how a legal educational program for communities in Ecuador's Oriente oil-rich region increased their confidence and awareness of their rights. An important tool in these processes highlighted by several authors is social community mapping that allows for the identification of all stakeholders, environmental services and other cultural and religious activities (Herbertson et al., 2009; ICMM, 2013a, 2013b,; O'Faircheallaigh and Corbett, 2005). Finally, the involvement of third parties is decisive in certain community-company processes (Bamat et al., 2011; Padilla et al., 2008). Barton (2005) explains how five Espinar communities signed an agreement with BHP in Tintaya mine after a three year Mesa de Diálogo (dialogue table) negotiation. He points to the importance of transnational advocacy coalitions that empowered, trained and organised local communities. He signals impatience for results, poor communication and unequal negotiating skills as disruptive in the dialogue process.

Criticisms generally related to lack of real community participation abound; Baker and McLelland (2003) expose the poor integration of First Nation people in the decision-making process of the environmental assessments carried out in all three cases analysed. Similarly, O'Faircheallaigh and Corbett's (2005) analysis of 45 negotiated agreements with indigenous communities in Australia expose that in

most cases their contribution is non-existent and only in a quarter of the agreements the industry is required to address the proposals of the Aboriginal landowners. One of the main reasons for this poor participation is the lack of bargaining power communities have prior to the start of the negotiations. In Australia and Canada different land title legislations give communities different powers to negotiate (O’Faircheallaigh, 2008). Szablowski (2007) exposes the unequal power relations in the World Bank’s participatory involuntary resettlement policy with expert-led consultations and minimal input from local communities. Sosa and Keenan (2001), in their analysis of Impact Benefit agreements carried out with First Nation communities in Canada highlight confidentiality in negotiations as a community power balance deterrent that hinders the creation of guidelines for negotiations thus exacerbating uncertainty.

The CSR group based in the University of Queensland, Australia, has been doing extensive research on the role of mining companies based on interviews and surveys with mining companies (Rees et al., 2012; Kemp and Owen, 2013). They highlight how community relations staff struggle to involve other departments such as legal, operations and environment in prevention and intervention of community grievances, even those departments that are the source of the problem (CSR, 2009).

Pro-business organisations and multilateral organisations like the World Bank also wanted to see a response to the criticisms and the rising organisational capacity and cooperation between different resistance networks at different scales (Kapelus, 2002; Szablowski, 2002). Since the 1990s partnerships between multilateral organisations, governments and the industry such as the ‘United Nations Global Compact’ entailed the creation of universal standards with the goal of pursuing common development objectives, the respect of human rights, and labour and environmental standards (Bennet, 2002; Jenkins and Yakovleva, 2006). A plethora of codes of conducts and reporting guidelines are also being developed like the Equator principles (created and endorsed by finance banks), with several being specifically designed for the extractive industry such as the Voluntary Principles, the Global Mining Initiative (GMI) or the already mention Extractive Industries Transparency Initiative (EITI). Most large mining companies now disclose through their annual reports information such as social and environmental performance, health and safety issues and ethics (Jenkins and Yakovleva, 2006; Watts, 2005). This increased transparency is resulting in some “promising developments” (Watts, 2005) and investors can now screen and choose those companies acting more responsibly (Jenkins and Yakovleva, 2006). Others point to the voluntary nature of these initiatives that without objective independent assessment can become “top-level paperwork exercises that mask the reality of the consequences of the mining activities” (Smith et al., 2012).

Campaigns like Publish What You Pay (PWYP) advocate for mandatory disclosure of revenues (Hayman and Crossin, 2005). The first legislation with global reach came in 2010 with Section 1504 of the US Dodd-Frank Act, requiring all US oil, gas and mining companies to disclose revenue payments made in each country in which they operate. Similar disclosure requirements have been agreed by the European Union (Alley, 2013).

Seldom explored in the literature is not only how the companies respond to conflicts but also what their role is in generating or shaping them. Dougherty (2011) points to the increasing role of junior mining companies; high competition and low cash flow is making these firms go to politically and environmentally low-cost production countries that have less stringent environmental and social legislation or less enforcement (Ferguson, 2005). Using gold mining in Guatemala as a case study Dougherty (2011) shows how this country has become one of the lowest-cost gold producers in the world. Bridge (2004b) also points out that larger mining firms will more likely adopt stricter environmental plans and encourage participation than junior companies. The demand pattern and market structure of each mined commodity also determines the industry behaviour and responsiveness to social resistance (see Chapter 1 for uranium). Consumer markets, NGOs and mining companies can be influential in the development of initiatives like the Kimberley process that attempts to stop the trade of diamonds used by rebel movements in countries with legitimately elected governments (Le Billon, 2006).

## **11. Discussion**

The renewed conflictivity and resistance around extractive and mining projects can be considered as part of the New Social Movements (NSM) that emerged to resist and oppose the “destabilisation of the established citizenship” (Stahler Stolck et al., 2007) imposed partly by neoliberal reforms. NSMs can help describe and understand some of the strategies and discourses used by mining resistance movements, although one might claim that there are distinct roots that make mining movements of resistance different.

NSMs, such as gay and feminist rights movements, emerged as a response to post-industrial preoccupations, the increasing rationalisation of modern life and the everyday colonisation of the state and market economy (Melucci, 1985). Differing from previous working-class struggles, NSMs rest on the reconstruction of a new identity based not on labour but on new values, new actions and complaints that don't rest on material claims (Tarrow, 1994). Following Habermas (1984) these movements are a rejection of the ‘colonisation’ and control of people's lifeworlds – their domains of everyday, meaningful practice. Some argue that in Latin America, movements against resource extraction are NSMs because they are driven by the same rejection of neoliberal intervention and the precariousness that emerged from it (Stahler Stolck et al., 2007; Urkidi, 2010). De Echave et al. (2009) also argues that the cultural dimensions of resistance struggles over resources -the dispute over ways of life, the relationship between communities and their environment and traditions- are part of the identitarian process of NSMs. Alvarez et al., (1998) on the other hand, criticise this division between NSM and previous “popular” urban or peasant movements precisely on the issue of culture because they consider all movements have a cultural dimension that is used to question dominant (neoliberal or Eurocentric) practices.

Other authors argue that NSMs differ from the socio-environmental justice movements in poor and peripheral areas in that NSM theory is based on post-industrial and middle class post-material values. Inglehart (1977) argued that only

when basic necessities are covered could people begin to be concerned with 'non-material' issues like the "environment". Contrary to this argument, environmental movements in the North were very concerned about very material issues like nuclear radiation and dioxins from incinerators. There is also a long tradition in industrialised countries of concern for safety and health in factories, mines and urban environments (Hays and Hays, 1989). In the global South communities defend the environment and the land as the space in which they live (Guha and Martinez Alier, 1997): they are a 'materialist' movement. Moreover mining conflicts have a long history in Latin America, South Africa and elsewhere, prior to the arrival of NSMs in the West (Martinez Alier, 2001).

Against Inglehart's interpretations, these social movements emerge from struggles of the poor and the indigenous for their own survival, as they try to preserve ecological necessities such as energy (including food), water and other materials (Martinez Alier, 2003). These poor communities react against the disproportionate use of environmental resources by the rich and powerful that threatens their livelihood, health, culture and autonomy. The reaction against this unequal distribution of ecological costs and benefits is what Guha and Martinez Alier (1997) named the 'environmentalism of the poor'. Crucially, Martinez Alier (1991) argues that they are ecological movements that try to remove natural resources from the economic sphere, that value local livelihoods and material and economic needs, not as market opportunities but as basic needs for life.

Alternatively, these movements have also been considered historical, class or ethnic-based- movements that are contesting changes in the management of their land. They might use an environmental issue sometimes only strategically (Robbins, 2004). Local peasants are on many occasions integrated in the market economy so their demands to preserve nature or land might be more linked to capturing the flow of value coming from exploiting that land (and selling the products of the market). As Bebbington (1996) points out in his analysis of indigenous and non-indigenous resistance to mining in Ecuador, communities developed alternative agriculture-based economies embedded in the neo-liberal model of profit-making and export that arrived in the country before the mining project. More than trying to preserve their livelihoods, they are fighting against their lands being used by somebody else, against privatisation, against accumulation by dispossession.

Both arguments being correct, it could also be claimed that class, ethnicity, market driven local economies and livelihood and environmental values go together; lower class or marginalised local communities (immersed or not in the market economy) are impacted more by extractive projects because they are closer and depend more on the environment that is being impacted.

Another emerging debate revolves around the political demands of these movements. Are resistance movements against mining NIMBY (Not In My BackYard) or are they demanding broader structural changes in the socio-political-economic structure? As pointed out by Bloodworth et al. (2009), NIMBY resistance might shape the resource extraction frontier and even drive companies to extract resources elsewhere. However their demands are limited to keeping a project away from their lands. Many movements that might start with a NIMBY discourse realise these

projects are driven by the neoliberal socio-economic order once they start connecting with other networks and start demanding broader structural changes (Campbell, 2009; Gordon and Webber, 2008; Hilson and Yakovleva, 2007; Hyndman, 2001; Stahler Stolck et al., 2007). The environmental justice movement embraces this consciousness destroying the NIMBY image of grassroots environmental protests and turning them into NIABY protests (Not In Anyone's BackYard) (Martinez Alier, 2001).

NIABY, however, might not be enough. Swyngedouw (2014) seems to go a step further criticising "the micropolitics of dispersed resistances and individualised alternative practices". He argues that resistance by itself is playing the neoliberal game, and that we need to enter into 'the political' to create a truly egalitarian society. He describes 'the political' as "the contested public terrain where different imaginings of possible socio-ecological orders compete over the symbolic and material institutionalisation of these visions" (Swyngedouw, 2014). He insists on the importance of equality to take part in "a life-in-common" and the need to achieve this through the "re-organisation, transformation and distribution of socio-ecological things and services" (Swyngedouw, 2014).

Are the resistances analysed in this review individualised and dispersed? Or do they aim for a broader egalitarian transformation and the re-distribution of environmental bads and goods? I would argue that some of them do. Some of the resistance movements to mining have visions of alternative cultural projects that are trying to destabilise the dominant neoliberal order, aligning under the environmental justice paradigm. They don't want inclusion into the present system, but a transformation of the Eurocentric political culture into one they can participate in. They are not frightened of modernity; they want to be modern and different, enter in modernity without losing their identity (Alvarez et al., 1998; Dwivedi, 2001; Muradian et al., 2003; Mohanty, 2010; Urkidi, 2011). An example of this is the resistance movement against the Rosia Montana project in Romania (Velicu, 2012); they realise that to become "agents of their own destinies, they need to regain a policy space where they can articulate and make visible their own narrative". They link their vision of development to quality of life and to their choice to have a productive and creative life "according to their needs and interests". Merlinsky and Latta (2012) write about the "productivity of environmental conflicts" as they contribute to the construction of environmental rights, in terms of developing economic alternatives or institutional changes (such as provincial legislatures in Argentina forbidding open pit mining).

Some groups create alternatives based on a defence of cultural difference and local knowledge linked to place, to the valorisation of local livelihoods (Escobar, 2001; Martinez Alier, 2003). Radical alternatives have been endorsed for example by the Diaguita indigenous group in Chile recovering farming traditions with low ecological impact and defending communal property as a land management model (Urkidi, 2010).

These radical socio-ecological alternatives are being developed together with wider visions or post-development ideas shared through resistance movements in Latin America. The philosophy of 'Buen Vivir' based on the Ecuadorian 'sumak kawsay'

and Bolivian 'suma qamaña' are indigenous philosophies aimed towards quality of life and the recovery of an ethical relationship with nature (Gudynas, 2011a). Linked to this is the 'post-extractivism' model that implies a substantial downscaling of extraction to levels that are genuinely necessary (Escobar, 2012; Gudynas, 2013). Both ideas challenge basic tenets of the neoliberal paradigm such as economic growth and perpetual progress. Similarly, in India, due to so many cases of conflict in the extractive industries or because of land grabbing for infrastructures, a vision of Radical Ecological Democracy has been proposed by Shrivastava and Kothari (2012) in their book *Churning the Earth*.

But not all resistance movements have this radical impetus of breaking with the neoliberal order. Many have also been successful in shaping territorial development and their own livelihoods with less radical projects that are immersed in national and global markets. Bebbington et al. (2008a) show in their analysis of Intag's resistances in Ecuador how the 'Assembly for Cantonal Unity' (with help from *Acción Ecológica* and other outside sympathisers), twice pushed the region to reject mining and develop new economic activities such as organic coffee production or community managed eco-tourism. Eco-tourism is criticised by Büscher and Davidov (2013) who argue it reinforces the Eurocentric view of development supplanting traditional forms of rural subsistence. However, as shown by Larrea et al. (2014) in their monograph on Intag, eco-tourism (and small hydroelectricity) are locally preferred alternatives to a very large open pit copper mine owned by a foreign company. Other communities such as the 'galamsey' in Prestea, Ghana, want to carry on with their traditional artisanal gold-mining activities that are also embedded in the global economy (Hilson and Yakovleva, 2007). These communities are in fact being shaped by the "friction" between local and global forces such as trade or power (Tsing, 2005).

## **12. Conclusions**

Below I summarise four hypotheses that have been identified, explored and tested in this literature review. The review explores academic peer reviewed publications around resistance to mining as well as selected relevant non-academic publications. Moreover there are whole regions of the world that are not covered because of the limitations of looking at English and Spanish literature alone. As such, the findings of this review are considered as hypotheses.

Firstly, this review explores a hypothesis whereby resistance movements against mining are changing their focus from labour to environmental issues. Although environmental impacts from mining have always existed and have indeed been articulated in protests by different groups throughout history -and labour issues in mining are still present- I identify a shift in the demands of major resistance movements to mining. The literature on mining resistance prior to 1990s covers mostly labour disputes such as workplace accidents and salaries and the creation, rise and demands of labour unions. However during the last 20 years (most of the literature covered by this review), the demands articulated by communities living in the vicinity of the mines have mostly (although not exclusively) related to the environment. Although there is certainly a parallelism with a rise of environmental movements elsewhere (McCormick, 1991), this shift has followed a path of its own.

In the 1960s, the shift towards open pit mining and new mechanical and chemical processes revolutionised and transformed the industry, allowing it to increase production at the expense of grave environmental impacts (Dore, 2000). Growing social metabolism and neoliberal reforms have been pushing the opening of new mines. Taken together with the expanding footprint of mines this is providing the catalyst for increasing number of communities that react in order to preserve their lands and livelihoods, decide their own development path or at least obtain monetary compensation for their losses.

Already acknowledged is that further research on environmental history of mining conflicts could reveal whether this shift in social resistance is real or is due to a gap in research on the topic.

Another hypothesis explored in this article is that there is an increase in mining conflicts at the commodity frontiers. We know that the social metabolism of our society is demanding increasing quantities of material and energy that as a consequence is expanding the commodity frontier. This is coupled with the use of new technologies with huge environmental impacts increasing the likelihood of conflicts. The use of databases (ICMM, 2015; Global Witness, 2014; OCMAL, 2014; Özkaynak et al., 2015) and investigations with several case studies (CIEL, 2010) seem to confirm conflicts are increasing. These estimations are conservative because not all mining conflicts reach the press or activist organisations, let alone research circles. The data shows that conflicts have been increasing since the turn of the century, however is difficult to compare with the previous decade due to lack of data.

This review also identifies and explores a shift that has been taking place in resistance movements to mining where local passive confrontations are evolving into pro-positive resistance movements. Communities are not only denouncing local impacts on the environment and their livelihoods but are starting to reject the overall 'development' model that supports these projects. The Intag and Sipakapa communities in Ecuador and Guatemala or the Rosieni in Romania have realised their weak position within the commodity chain and the capitalist complex that is ultimately destroying their way of life. This hypothesis argues local groups are innovatively combining local narratives and alternatives with global discourses on rights and climate, social and environmental justice, and thus becoming the first agents for change. This review uncovers an emerging anti-capitalist and non-Eurocentric discourse articulated with local place-based demands. It has however been only identified in some communities and peripheral analyses. Further research on new cases and with the specific objective of identifying this trend would be welcomed.

This shift has been facilitated by cross-scalar alliances. Another hypothesis emerging from the literature is the decisive role played by alliances and exchanges at different scales that have facilitated changes in strategies and discourses of anti-mining movements. Strategic contacts with NGOs, lawyers and scientists are contributing to legal court cases, activist-scientist collaborations and the spread of consultas to formally reject mining projects at community level. Is difficult to assert the decisive role of these alliances due to a lack of comparison with "successful" mining resistances that have not experienced these alliances. Also, not sufficiently explored

in the literature is how these alliances are formed and get organised. An initial exploration shows that some are organised against specific minerals such as the “African Uranium Alliance” or “WISE” for uranium, specific companies such as “International Articulation of those affected by Vale”, “PARTIZANS” against Rio Tinto, “Foil Vedanta”, per country or region such as “JATAM” for Indonesia, “No a la mina” in Argentina, and by communities or indigenous groups such as “CONACAMI” in Peru. Further research such as that carried out by Özkaynak et al. (2015) will uncover routes, similarities, conditionings and limitations of these alliances that could help to consolidate and expand them. For example, there is perhaps a potential alliance between the global environmental justice movement and the (small) Degrowth or Prosperity without Growth movement in the North (Martinez Alier, 2012). Some anti-mining movements (as in Goa against iron ore mining) have proposed the introduction of “resource extraction cap”, which is also an instrument proposed in Europe (RCC, 2012).

In retrospect, the academic as well as the industry literature on mining explored is biased by the authors’ general outlook on the relation between the economy and the environment. There is predominance in the literature of “ecological modernisers” or supporters of “weak sustainability” that might support mining projects, provided better environmental protection and compensation is offered. There is a lack in much of this literature of “strong sustainability” views that explore the possibilities of an economy less based on extractive industries, and the global environmental justice movement in pushing the economy towards sustainability (let alone the idea of an equitable reduction of energy and material consumption encapsulated in degrowth)

Other gaps and weaknesses identified in the literature have been already identified in the manuscript. Literature on the state’s response and role in shaping mining expansion and resistance is also sporadic and unstructured and would welcome a cross-cutting comparative analysis of states’ role and response in mining conflicts. Despite recent efforts by organisations like Global Witness (2014, 2015) and CIEL (2010) a big gap in the literature is the role of violence in mining conflicts. There is a need to compare and understand current upsurges in Philippines, Latin America and South Africa.

This review has identified a new space of contestation where power balances are being swung between globally connected resistance movements – participating in local and wider debates around post-neoliberal socio-ecological alternatives- and mining companies (and the state on most occasions) with Eurocentric and growth based development programs. The territorial dynamics and the geographical expansion of the mining frontiers can be determined by the interaction between these two forces.





## Conclusions

A major contribution of this thesis is the identification of the factors that cause and influence mining resistance. Although all aspects and dynamics covered in these chapters are to be taken into account, three underlying factors have emerged as decisive in shaping mining resistance. The resource to be mined and the geography of the mining area can determine not only the type of processing but also the size and type of impacts that can affect communities and workers and in turn their response to those impacts. Groups or communities that perceive a threat to their livelihoods and social and cultural domains are demanding to participate in the decisions affecting their development paths. Resistance can then be shaped by the extra-local contacts and alliances and the control (or lack of) over the flow of information in the conflict.

Firstly, the geographical and resource characteristics determine not only the location of the resource frontier (e.g. availability of resources) but also the type of mining processing and the corporate, social and environmental interactions.

Each mined commodity has different traits that can determine the process of extraction (e.g. flotation, lixiviation, bioprocessing), the reagents used and in turn the impacts caused. For example, copper is obtained through the concentration of copper ores through flotation, smelting and refining processes whilst gold and uranium are lixiviated with cyanide and sulphuric acid (respectively). Flotation is rather innocuous but smelting releases toxic pollutants to the atmosphere whilst lixiviation can contaminate underground water sources with the reagent used and acid mine drainage. Other types of mining don't require concentration resulting in less but still noticeable impacts. In the extraction of coal for example, soil removal and erosion, fly ash and mine subsidence are some of the consequences. River degradation and biodiversity loss are widespread in sand mining. Also determinant for the type of processing and the magnitude of the impacts caused is the concentration of the mineral. New commodity frontiers tend to have lower grades whilst some commodities like gold or uranium are found in very low concentrations, having to use more water and reagents, thus creating more waste per unit produced. This matters when the project is on-going because less pollution means less likelihood of resistance, however prior to the start of a project, the technical processing details might not be a determining factor in halting the formation of a resistance movement.

The commodity type might also determine the size and experience of the mining company that exploits it; low-grade deposits or complex mineral processing might require special techniques that only big mining companies might want to tackle. This in turn relates to the experience in dealing with community-mining conflicts or negotiation; intermediate or junior companies might not have the resources to operate a 'community relations' department to deal with potential resistance or negotiate with local communities.

Geographically, where the resource is located, influences not only how it's extracted (open cast mine, underground, In Situ Leaching) but also the impacts caused to the surrounding environment. Open cast mining can cause severe impacts on the

landscape as well as severe damages to the underground and surface hydrogeology. Mining in arid areas is risky if precious water reservoirs are contaminated or overexploited but is also likely to cause less impacts than mining in areas with large water bodies where arable land and rich biodiversity risk being impacted.

Also geographically important is the location of the communities or mineworkers in relation to the mine. Communities can oppose a mining project if they feel the impacts (spatial ecology); the greater the proximity and visibility of hazards like dust or acid mine drainage, the more likely mobilisation is. In the Yanacocha gold mine in Peru or the Ok Tedi mine in Papua New Guinea, mining conflicts emerged when the communities realised water was being diverted and polluted. With uranium mining the impacts of radioactivity are not felt and diseases take a long time to show explaining why resistance took a long time to emerge or didn't emerge at all.

If the mine is located in an isolated area only 'culture of wilderness' environmentalists might want to oppose its development for conservation purposes. If these isolated areas are populated, the communities might experience a lack of government presence and services making the development opportunities brought by mining projects perhaps more alluring. Living in isolated areas might also limit access to extra-local contacts and information that as we see below can be a determinant in the formation of resistance.

Secondly, communities in mining conflicts strive for recognition. Recognition of their status as peasants or workers, of free individuals, of their dependence and right to live in a clean and healthy environment, of their indigeneity, ancestral connection to the land and cultural traditions as well as their right to claim benefits from the project. Linking sometimes with the environmental justice discourse, groups that have been negatively affected by a project also want recognition of the unequal distribution of social and ecological bads. In order to acquire this recognition they demand participation in the decision-making mechanisms that determine their future. This might entail a rejection of the mining project altogether or the engagement in negotiation or 'participatory processes'. These processes don't generally allow them to have a stake in crucial decisions; of whether a project is to go on, the environmental impacts that they are willing to tolerate in exchange for development, which development projects the community needs or more importantly what type of development they want. Although mining companies have been improving company-community relations and participatory processes, the results vary depending on the willingness of the company (to allow communities to take decisions for example) and the capacity of the community to negotiate but most importantly on the relative bargaining positions of the communities and the mining companies. If communities are backed by institutions or appropriate legislation, they are in a much better position to stop a mine or negotiate more beneficial agreements (O'Faircheallaigh, 2008).

Participation might be deterred by marginalisation and poverty. Communities like Spitzkoppe in Namibia are more likely to accept cursory participatory processes for they want and trust the development plans proposed by AREVA. Trust is an important feature in participation and resistance. With early mining conflicts like Yanacocha or Ok Tedi, little was known about the possible impacts of this industry so

communities desired and trusted the promises of progress and development. With the information about the impacts of these mining projects travelling through networks, this trust is now challenged and companies have to build it. The marginalisation of workers can also explain their lack of participation in health-related demands; workers at Rössing mine have been dying of unknown diseases during the last two decades. Unions and international NGOs helped focus attention on the mineworkers' health complaints during the 1980s. When these alliances vanished in the 1990s, their deaths became invisible again.

As we have seen in Namibia, in Esquel in Argentina or Intag in Ecuador, as well as in the cases explained by Robert Moran, an important factor that can compensate unequal power structures in community-mining conflicts is the support of external individuals and organisations across scales. Alliances can provide technical information, political connections, visibility and negotiating skills as well as make funds available to pay scientific consultants or legal advisors and more importantly, to maintain the movement for extended periods of time.

In Namibia, the Topnaar community started to oppose new projects after learning about the impacts through workers or ex-workers of Rössing uranium mine. In Niger, it was not until extra-local alliances with scientists and lawyers in France were created that grassroots organisations like Aghir in'Man started to be heard. Despite the halt of most prospecting and planned mines in Namibia (Trekkoopje, Etango, Valencia, see Map 2 in Chapter 1) after the drop in the price of uranium following the Tepco-Fukushima disaster, uranium mining expansion is still taking place in several African countries. Those local organisations with extra-local contacts are managing to articulate visible opposition to the Imouraren project in Niger, the Falea project in Mali and the Mkuju River project in Tanzania. As members of the African Uranium Alliance and with the assistance of the Uranium Network (based in Germany), they have organised two international conferences (in Tanzania and Mali) bringing attention to their warnings and fears of contamination.

Strategies like these international conferences, political connections (with international NGOs or lobbies) and knowledge (scientific, negotiation skills, international legislation) are being shared through these networks. As part of this knowledge sharing, resistance movements are starting to understand the extent of the neoliberal reforms that took place in the last three decades and assigned them to a weak position in the global commodity chain where the social metabolism of the consumer core is pushing the commodity frontiers further into their land.

Local activists in mining conflicts are becoming self-conscious environmentalists and 'glocal' activists. At the local level, the rootedness to the land and the distinctive historical and cultural connection to nature and landscape, draw valuation languages that on many occasions deeply contrast with the profit driven values of the extractive projects proposed by the companies and (on most occasions) the state. Local concerns are being linked to global demands for environmental and climate justice, rights to land, water and human rights. Increasingly the recognition and articulation of indigenous rights is linking their culture with their material-livelihood rights. This framework helps us understand and compare the trajectory of different movements as they develop and connect local and global demands.

A confluence of visions is occurring; although NSMs that emerge in developed countries have a non-material component differing from movements closely linked to the defence of livelihoods and environmentalism of the poor, they share a rejection of the colonisation of capitalism in their lives and livelihoods. This global view and understanding of capitalism and the power connections between productive and consumption spheres is increasingly being understood by resistance movements to mining.

Thirdly, the control of knowledge has emerged as an important determinant in community-mining relations and resistance. Technical knowledge on mining has historically been created and dominated by mining companies. They produce and control knowledge about mining processing and the impacts mining causes on soil, groundwater and hydrogeological structures that is presented most frequently through self-elaborated EIAs. This differs from the communities' rich local knowledge of nature; water replenishment cycles, soil and nutrients cycles, seasonal winds, valuable plants, animals' customs and routes, as well as cultural and social aspects such as common management rules or sacred sites. Although much is being written on how EIAs or participatory processes can take this knowledge into account (O'Faircheallaigh, 2010; Paci et al., 2002), this is generally limited to community participation on development programs with partial technical contributions, restricting real participation in decision-making (Lockie et al., 2008). As Agrawal (2002) points out, local knowledge by itself is not enough, it needs to be compiled and documented and then used in combination with other strategies such as lobbying or more independent decision making processes.

Knowledge is not static or unique. It can travel from scientific to local or activist circles as well as being produced locally and adopted in scientific and policy circles. In mining conflicts, activists can either adopt scientific knowledge and data in their own argumentations or produce new scientific knowledge either by becoming scientists themselves or in co-operation with experts.

In this thesis I uncovered processes where local actors resisting an imposed project challenge the epistemology of scientific statements and scientific institutions; they too can learn about the consequences of radiation or acid mine drainage and impose limits on how much they are willing to tolerate. It is acknowledged that knowledge necessitates and re-produces power, and it's embedded in social practices, norms and conventions, discourses and institutions, historical and cultural processes that determine how this knowledge is formed, conducted, communicated and used. Therefore, alternative processes of knowledge formation will entail alternative social practices and identities, giving way to different types of knowledge. The act itself of producing alternative knowledge is a political act that allows for power to circulate to grassroots networks giving them voice and visibility.

Through Activism Mobilising Science local grassroots organisations and activists are co-producing new knowledge in order to challenge the predominant 'scientific' knowledge produced by mining companies. The term co-production in this sense not only highlights the social construction of knowledge but introduces the idea that this

can be constructed using different types of knowledge, in our case local and scientific, combining diverse discourses and social practices.

The control of scientific and local knowledge allows local activists to discuss or challenge technical issues affecting not only the formation of movements but also the consolidation of their discourses and their choice of strategy. They might choose for example to denounce the impacts on water sources through the publication of reports or newspaper articles instead of barricade in front of the mine. In discussions with the mining company they might demand better environmental protection measures or a greater stake in important decisions such as the development path their community wants to take.

Whilst the resource and geography of a mining project are key determinants in a socio-environmental conflict, the community's strive for participation and recognition drive the connection and integration of local concerns with broader political demands and the control or production of new knowledge, key strategies in the formation and success of resistance movements to mining.

### **Future research agenda**

In Chapter 2 I have pointed to a process that is common to many political arenas and also prevalent in the governance of extractive industries. Co-optation occurs when weaker groups adopt or change their aims or demands adopting those of a stronger group. Although this thesis points how this process occurs in scientific-activist relations, there are many other liaisons in the governance of extractive industries that can also experience co-optation.

Co-optation was first defined by Selznick (1949) to describe how grassroots organisations in the USA had been co-opted to support the construction of the notorious dam and electrification project of the Tennessee Valley Authority. It was later used to refer to the 'institutionalisation' of social protest engineered by powerful groups to demobilise social movements and water down their demands (Meyer and Tarrow, 1998; Piven and Cloward, 1977). One of the most researched co-optation areas has been the field of participatory development that emerged in the 1980s with the objective of making people more central to their own development (Baviskar, 2004; Cooke and Kothari, 2001; Michener, 1998). Critiques range from the theoretical, political and conceptual limitations of participation itself to methodological hurdles linked to issues of representation and unequal power group dynamics (Cooke and Kothari, 2001; Hickey and Moha, 2004; Irvin and Stansbury, 2004).

NGOs and co-optation can also interact with the governance of extractive industries. NGOs can co-opt local grassroots organisations discourses or demands as well as themselves being co-opted through funding or joint initiatives at different scales. How the international welfare system has co-opted many NGOs has largely been explored in the literature (Bryant, 2002; Farrington and Bebbington, 1993; Fowler, 2013; Gary, 1996; Hancock, 1989), explaining also how NGOs have played a role in expanding and consolidating neo-liberal hegemony (Manji and O'Coill, 2002), becoming agents of the 'antipolitics' of the machine of development (Fisher, 1997).

The NGOs studied are generally middle-sized organisations rooted in western countries that differ greatly from the grassroots organisations that we find at local level in mining conflicts. There is no specific research on co-optation of small grassroots organisations and their interaction with the increasing networks and alliances. Are these alliances compromising their initial demands or are they being reinforced? Is the new knowledge created conflicting with their local knowledge? Are the funds secured or requested co-opting their discourses? How is co-optation shaping the interaction between the communities, NGOs, companies and the state in the governance of extractive industries? Are there specific characteristics for mining, oil or gas?

Moreover, literature on co-optation is dispersed and found as a side effect of participatory or development initiative processes. A more accurate definition of what co-optation is and what it entails is required. For example if a community that initially opposed a mining project accepts the development proposed, was it co-opted or has it been merely convinced about the merits of the project? Other caveats to explore include intended or un-intended co-optation, if its accepted -or not- by weaker actors, or co-optation as a strategy. An in-depth research could also uncover the different paths for co-optation together with the ways it is carried out. Some initial hypotheses include liaisons between local community organisations and NGOs, participatory processes led by governments or companies (including CSR strategies or development projects). There can be a co-optation of the discourse, scientific co-optation that AMS activists want to avoid or strategy co-optation where perhaps one strategy (e.g. court case) co-opts other local strategies.

Another research avenue could explore one of the hypotheses analysed in this thesis; the idea that mining conflicts are growing. The ICMM (2015), Global Witness (2014, 2015) and CIEL (2010) studies indicate a rise in the number of community-level conflicts and killings over the past decade. These studies have some limitations. Because not all conflicts have killings, the real number of conflicts is higher. ICMM's report only covers conflicts "which involve protests and/or the use of force, as well as legal proceedings". Conflicts however also encompass non-violent disagreements; open declarations, consultas or even 'everyday' non-visible resistance, that as exposed by Martinez Alier et al. (forthcoming) are more common strategies than violent conflicts and legal proceeding. Therefore, ICMM's estimation is also conservative. Moreover, these works only cover conflicts over the last decade.

However, there are limits on the scope of this work due to a lack of historic data on the issue. Perhaps more useful are attempts to answer questions that characterise mining conflicts such as: Of all mining projects, how many are contested? And of those contested how many are stopped? Or what type of settlements or agreements are reached if the project goes forward? What strategies are more successful for grassroots organisations? Databases like EJOLT or ICMM's can help answer some of these questions. In order to assert which proportion of projects is not contested, these could be compared with world-wide mining databases.

The fact that conflicts between mining companies and communities are increasing demonstrates that despite some industry efforts to improve their engagement with

communities and their environmental footprint, communities are increasingly understanding the implications of a mining project on their lands and rejecting the development promises of the industry. Communities are developing new strategies and using more complex networks and discourses. A comparison of large-scale databases like EJOLT will improve our understanding of the role played by resistance networks in order to empower weak and poor actors and promote more equal relations between communities and mining companies.

A third avenue of research could draw attention to how resistance and social movements in the global South are developing alternatives in contraposition to the current extractivist-based growth development promoted by most countries.

It has not only been the strategies and discourses of resistance movements that have been evolving. Several movements have had access to more information about the projects and the companies and have started to understand how the benefits and burdens of extraction are not only unevenly distributed locally but also along the commodity chain, with consumers at the core not paying and not even aware of the ecological burden of their consumption. The global spread and adoption of the Environmental Justice discourse by several movements is a response to this realisation. Even further, I point to how some resistance groups have combined discourses with alternative and pro-positive visions of development that move away from the Eurocentric and debt-laden vision of development. These alternatives are place-based and have a strong cultural component, but are combined with a strong rejection of capitalistic and Eurocentric visions of development. Some commonalities of these alternatives could be the respect and preservation of nature and the environment for future generations and the move towards a more participative and democratic life, wanting to take decisions about the management of their land and destinies.

De Sousa Santos and Meneses (2014) point how these alternatives are emerging from the resistance to the human suffering caused by capitalism and global colonialism. An epistemology from the South is imploding; it claims and values new production processes and knowledges, it acknowledges the infinite diversity of human beings and their way of collectively organising life, production and leisure.

Some of these alternatives are based on the defence of a quality of life founded on close ties to nature, cultural and ancestral spiritual bonds to land. These communities want to have the choice of living a productive and creative live according to their needs and interests, respecting that of their community and the environment. This type of lifestyle is typically portrayed as poor or backward by the Eurocentric viewpoint of corporate actors. In this thesis the Rosieni in Romania or the Topnaar in Namibia have used this type of argumentation against the settlement of mining projects in their land. Their defence of the land is not only based on the defence of livelihoods but also of a vision of life independent of capitalist and global market forces. Other alternatives nurture from the fructiferous articulation between traditional and modern knowledge. Alternatives to mining-based-development like the ones we have seen in Ecuador use traditional ways of agriculture production combined either with new ecologic production or modern technology.



Also arising from a combination of traditional 'indigenous' philosophies and critical Western tradition, is the idea of Buen vivir that has emerged in South America. Buen vivir rejects the idea of a predetermined development trajectory imitating that of industrialised nations. It defends instead the diversity of knowledges, cultures and relations with Nature that together with the territorial context can give way to multiple futures. Emerging originally from indigenous philosophies it has been further developed by social movements, NGOs and scholars (Gudynas, 2011a, 2011b; Acosta and Martinez, 2009; Acosta, 2009) and institutionalised in the constitutions of Ecuador and Bolivia, risking co-optation of its radical and contesting message. Linking with extractive industries, Buen Vivir envisages a radical reduction of material and energy consumption and a dematerialisation of productive processes, adjusting them to the capacities of the ecosystems (Gudynas, 2011a). Gudynas (2011c) advocates for 'post extractivism' in South America where only the 'indispensable' minerals would be extracted. To carry out this transition Gudynas (2011c) points to three steps; a) enforcing current environmental legislation, b) mining only when the projects have socio-economic benefits that outweigh the environmental burdens and the communities agree to it after a consultation process and c) certain projects with heavy socioeconomic and environmental impacts would be rejected outright.

In Africa the Ubuntu philosophy is an ethical principle that promotes life through mutual concern, care and sharing between human beings as well as with the wider environment, understanding life as a "wholeness" (Ramose, 2014). Its motto is "a person is a person through other persons", where taking care of others also implies taking care of the environment. In South Africa this philosophy has been articulated during the last decade to question how little benefits the extractive industries are accruing for its people and specially the mineworkers. According to Praeg (2014), the Marikana massacre epitomised the drift of the government from Ubuntu ethics towards Western and corporate visions of development.

These philosophies are starting to influence discourses of resistance movements at the extractive frontiers. There is however little research on how they are articulated, if they are increasing, changing or evolving and what are the implications for resistance movements across scales.

What are these movements proposing and how are they enacting their vision? What are the contradictions and tensions of alternative development paths? I have identified in this thesis Ubuntu and Buen Vivir, but are there others? Are they integrated with other demands, projects and development ideas? How are these formed, how do they create politics? What are their geographical characteristics? Many of these ideas are now travelling North through the alliance made with trans-global movements. What can these movements learn from them?

Responding to these questions will help recognise the extension of this phenomenon, the links with movements in the North and the common articulation of their demands.

One of the avenues towards a globally sustainable and equitable future is emerging from one of the main losers of growth driven capitalism; resistance movements at

the commodity frontiers. They are not only refusing to provide for the continuous growth of the social metabolism through the global commodity chain but some of them also reject their own transition towards industrialisation and material growth, understanding the implications that capitalism, market and corporate domination and individualism have on their land, health and culture.



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