

Knowledge Co-Production in Scientific and Activist Alliances: Unsettling Coloniality

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Abstract

This paper examines alliances between scientists and local groups in the context of environmental justice conflicts. We analyze the trajectories of two white male scientific experts collaborating with activist groups in mining and nuclear conflicts around the world. We posit the knowledge co-production processes that take place in these collaborations can challenge (internal and external) power relations and hegemonic discourses around pollution. These collaborations can entail three types of co-production: (i) co-production of knowledge where new technical knowledge is co-created; (ii) co-production of interpretation through which knowledge is contextualized technically and politically; and (iii) the co-production of the mobilization of knowledge where different expertise collaborate in the elaboration of strategies based on their (scientific, local, Indigenous, traditional or experiential) knowledges and networks. Whilst knowledge co-production provides legitimacy and confidence to local groups; knowledge interpretation and its mobilization provide public legitimacy, visibility, and political leverage. This paper unsettles seemingly colonial processes pointing to the importance of locally driven alliances, the collaborative dynamics at play merging local and scientific expertise as well as the motivations and trajectories of scientists and local groups. Our approach makes visible how these alliances are the result of supra-local networks of support that connect scientists with local groups struggling against extractive activities.

Keywords

scientific activist alliances; environmental justice; colonialism; knowledge co-production; environmental conflict

Introduction

Local groups around the world mobilize to defend their livelihoods, territories and health against the expansion of extractive and polluting activities. Peasant, Indigenous communities as well as other affected groups and movements lead these Environmental Justice (EJ) struggles ([Temper et al. 2018](#)). They deploy

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diverse strategies that range from public mobilization and networking to the presentation of technical or legal objections to projects ([Scheidel et al. 2020](#)). However, formal decision-making procedures give a central place to some experts and some forms of knowledge (e.g. Western science), while neglecting local knowledges ([Frickel 2011](#)).

This is particularly flagrant in socio-environmental conflicts where communities face different forms of social discrimination and racism, and are often treated as ignorant, antidevelopment or politically biased. In order to confront these injustices local groups and scientists bring together their expertise and knowledge to challenge unequal power relations in EJ struggles. According to the Environmental Justice Atlas, a global registry of EJ conflicts, about 41 per cent of all registered EJ cases (1446 of the 3538 cases in October 2021) have the involvement of scientists or professionals ([EJ Atlas 2021](#)). This is becoming a key strategy of EJ movements ([Conde 2017](#)).

There is therefore growing scholarly interest in the role of these scientists in Environmental Justice activism. Much of the work in this area has focused on scientist-community collaborations in the USA, such as Barbara Allen's (2003) account on the role of expert activists and scientists in Louisiana's legendary "cancer ally" or Scott Frickel's (2011) work on experts, institutions and networks. STS and participatory science have pointed out how science and certain structures of collaboration can reinforce or challenge power inequalities in the collaboration between scientists and local groups ([Liboiron 2021](#); [Ottinger 2013](#)). Scientists seeking to aid community groups may inadvertently reproduce the structures of injustice that they seek to encounter, reinforcing power inequalities ([Cable, Mix and Hastings 2005](#)). In order to navigate these power inequalities it becomes paramount to expose and challenge the epistemic privilege of academia ([Coombes 2012](#)). Mignolo (2009) calls for the exploration of knowledge production as a site of struggle against colonial dominance. This is of special importance in the context of EJ struggles whose main culprit are already historically contested unequal power relations ([Peet and Watts 2004](#); [O'Connor and Martinez-Alier 1998](#)).

In this paper we examine a seemingly colonial alliance between white Western experts and local activists, that does not follow the usual patterns of unequal colonial relations. We unsettle the way these colonial relations work by examining the multi-directional flows of expertise ([Arancibia 2016](#)) between both groups where different types of knowledge enter into play. Whilst the relevance of local, Indigenous and traditional expert knowledge ([Agrawal et al. 2008](#); [Peluso 1995](#); [Harding 2011](#)) and the social capital or hybrid knowledge held by scientists liaising with communities has been signaled in previous research (e.g. [Frickel 2011](#); [Jasanoff 2009](#)), this paper provides an example of how the borders between scientific and local expertises are blurred ([Appleton et al. 2011](#)) deriving in knowledge co-production and importantly, also its interpretation and its use.

We contribute to research on scientists-local groups' collaborations from three perspectives. From an empirical perspective, we address locally driven collaborations that emerge from the needs of local groups and are not part of research projects or institutions. We also broaden the geographical focus of EJ studies by showing different cases from Latin America and Africa. From a methodological perspective, we examine the biography and trajectory of collaborations of two white male scientists (from US and France) with local groups. This approach does not allow for a fine-grained examination of local groups' perspectives, but provides a novel approach to analyze the motivation and trajectories of scientists—as well as local groups—across different collaborations, allowing also for their comparison. We conceptually innovate by

critically engaging with the colonial critique of scientist and activist collaborations and proposing a new typology that examines different forms of knowledge co-production.

The paper is organized in five sections. After this introduction we outline our conceptual framework (section one) followed by a short methodological section (section two) where we introduce the two scientists that became key allies for mobilized groups around the world; Robert Moran (PhD, hydro-geologist) and Bruno Chareyron (nuclear engineer). Both scientists have collaborated with local groups in the context of contentious mining and nuclear projects. Section three is the main contribution of the paper where the three forms of co-production (knowledge, interpretation, and mobilization) are explained with examples. In section four we examine the implications of these different co-production processes. We conclude in section five unsettling the coloniality of these scientific-activist alliances. We begin to address the following questions that, we claim, require further attention: Why are local groups engaging with Western scientists? Aren't they immersing themselves in the same colonial logic that is pushing for the extractive projects and their exclusion? Are these alliances useful to EJ movements?

1. Conceptual Framework: Knowledge Co-Production Challenging Expertise and Coloniality

This paper studies activist-scientist collaborations in the context of environmental justice struggles and how different forms of co-production can emerge from these apparently unbalanced alliances. Theories of co-production converge across diverse disciplinary traditions (public administration, STS, sustainability science) ([Miller and Wyborn 2020](#)). This paper engages with STS conversations on the social production of scientific facts and the role that politics and power have in these collaborations ([Callon 1999](#); [Jasanoff 2004](#); [ibid. 1996](#)). The term co-production breaks some binaries such as lay/expert or science/politics and explores the production of different forms of knowledge, as well as “forms of life” ([ibid., 397](#)). From a post-colonial approach, STS shows how “Western ethnocentrism” ([Scott 1996](#)) fosters an elite status of Western science and calls for the development of different research methods, organization and imaginaries ([Wylie et al. 2017](#); [Stevens et al. 2014](#)). We argue that the boundaries of scientific, local, Indigenous, traditional or experiential knowledges (henceforth local knowledge) are blurred in these co-production processes and that it is precisely in these “in-between” places ([Moore 2009, 203](#)) where new knowledge that can empower EJ movements is generated. Moreover, these “in-between” places can shape networks of collaborations between scientists and local groups, among other actors.

The concept “co-production” emphasizes the value of local knowledge in these scientific-activist alliances and dissects the processes through which different experts, with and without scientific training, (co)produce and politically mobilize (techno-scientific) knowledge and claims. In her review of the intersection of science and social movements in environmental health conflicts, Arancibia ([2016](#)) signals how the literature tends to heavily emphasize the difference between “lay” and “expert” activists, overlooking the contribution of activism to expertise and vice versa. In this vein, we follow Wynne ([1996](#)) and others ([Funtowicz and Ravetz 1993](#); [Nowotny 2003](#); [Jasanoff 2009](#); [Harding 2011](#); [Eden 2016](#)) in understanding expertise as including those having relevant knowledge on a certain issue, whether or not they hold scientific credentials. Expertise is not limited to scientific knowledge but can also be expressed in other languages and narratives such as local health, geography, livelihoods, weather changes, local culture or social practices ([Harding 2011](#)). Highlighting the importance of alliances, Arancibia ([2016](#)) shows how expertise can be understood as the property of a network, where different actors and knowledges interact or

are co-produced. Similarly, Irwin and Michael (2003) posit that in public scientific controversies there are different coalitions of expertise that orient towards the production and distribution of claims (scientific or otherwise) about what is real. In fact, they suggest different knowledges come into play to sustain scientific—so called truth—claims. This paper responds to the call of Eyal (2013) and Arancibia (2016) to develop more research on the co-emergence or co-production and construction of such networks of expertise in socio-environmental struggles.

Exploring alliances emerging from academia, the field of Participatory Science has critically addressed the issue of how scientists and local groups collaborations are defined (the questions) and developed (the methodologies and power relations). Community Based Participatory Research (CBPR) (Shepard 2002; Minckler & Wallerstein 2011; Israel et al. 1998) and Participatory Action Research (Schensul et al. 2008) aim to democratize knowledge by bringing forward local groups and communities in research projects (Cornwall 2008). However, several authors have pointed out that in these collaborations, research objectives (Guta et al. 2013) and decision-making (Castleden et al. 2012) still remain in the academic domain with communities having little input. This results in racism and tensions within the alliances for example on sharing and using the findings (Minkler 2004). Janes (2015) coincides pointing to two main challenges to furthering academic/community knowledge formation: knowledge hierarchies that give way to an “assimilation of difference” leading to colonial ways of “giving voice” or “capacity building” (ibid., 13), and researchers exercising power by imperceptibly imposing research needs or rules.

In a similar vein, STS literature exposes the risk that collaborations between scientists and local groups “scientize” dissent excluding knowledges, cultures and values of communities (Kinchy 2010, 180). It also claims that the co-creation of knowledge on pollution or risks does not necessarily ensure the success of EJ movements, not even their strengthening (Boudia and Jas 2014; Ottinger 2013; Jameson 2010). Likewise, Wylie et al. (2017) argue that dominant scientific and policy institutions conceive lay knowledge as epistemologically vacuous and as having nothing to provide to scientific knowledge, besides some ethical or sentimental concerns. However, it has also been signaled that by mobilizing science for their own ends, local groups not merely reproduce established scientific practices, they can also create alternative methods for knowing about and representing the effects of pollution, transforming science and technology in the process (Ottinger and Cohen 2012; Medina et al. 2014).

We follow this line of thought by examining seemingly colonial alliances between local groups and two white Western scientists in EJ conflicts highlighting two research contributions.

Firstly, we emphasize the importance of locally driven collaborations. In the context of environmental injustices local groups and social movements are challenging hegemonic scientific knowledge and accounts of expertise in a variety of ways; they develop “counter-expertise” (Topçu 2008); they become scientific experts themselves (Corburn 2005; Epstein 1996; Tesh 2018), or they ally with other experts in order to challenge the knowledge produced by powerful actors (Allen 2003; Conde 2014; McCormick 2007). The term Activism Mobilizing Science refers to processes whereby lay citizens, communities and local grassroots organizations engage with professional scientists to co-produce alternative accounts of impacts and risks, strategies and counter-hegemonic narratives (Conde 2014). This form of collaboration, that is the type addressed in this paper, is crucially born and led (or co-led) by local groups in line with their mobilization aims.

Secondly, whilst STS studies tend to focus on “the science” or the “structures of collaboration,” this paper adopts a different approach. Examining in depth the trajectories and motivations of two scientists we offer a novel insight into how their collaborations challenge seemingly “colonial” relations. The trajectories point to the experiential knowledge acquired by scientists (as well as local activists and groups) and their capacity or sensibility to value different forms of knowledge and expertise key in the (co)production, interpretation and mobilization of knowledge. Other authors have pointed to the role of non-scientific knowledge, such as social capital in expert activism ([Frickel 2011](#); [ibid. 2015](#)) or hybrid expertise in public engagement of governance ([Jasanoff 2009](#)). These trajectories also allow scientists to become trustworthy collaborators of local groups and larger activists networks. Exploring the motivations we argue that these scientists engage in these actions for moral reasons “of what is right and good,” understanding this as political actions or political science ([Moore 2009, 194](#)). This political science can be understood as scientists themselves being politicized as well as “the uses to which science” is put ([ibid., 196](#)). Scientists’ motivation can also emerge when they live or have a local attachment to the impacted area so they see themselves as allies in protecting their territory ([Hernández Vidal and Moore 2022](#); [Walter and Martínez-Alier 2010](#)). In this article we aim to provide an account of two scientists’ biographies, motivations and the co-production processes they participate in. We attempt to show how seemingly colonial ties can be fruitful for EJ groups.

2. Methodology and Context: Two International Scientists Allying with Impacted Local Groups

Data for this research is based on the authors’ in-depth analysis of three cases; the Esquel gold mine conflict in Argentina where Moran collaborated with local groups in 2003, Rössing uranium mine in Namibia where Chareyron collaborated with a local NGO (Earthlife Namibia) in 2011 and AREVA’s (France’s nuclear company) uranium mines in Niger where Chareyron has been collaborating with a local organization (Aghirin’man) since 2003. Moreover, in-depth interviews were carried out with both scientists during 2015, ’17 and ’19. In the Argentinian case one of the authors was working on the ground to support the local mobilization process as part of Greenpeace Argentina, one of the organizations that facilitated Moran’s visit to Esquel. She revisited the case years later as part of her PhD on environmental mining conflicts. In the second case, the author collaborated with the local NGO Earthlife Namibia and facilitated the visit of Chareyron to Namibia as part of an international research project on Environmental Justice (EJOLT). Her PhD work on uranium mining conflicts included this case in Namibia and the Niger case; several in-depth interviews with the local organization Aghirin’man were carried out in 2009 and ’13.

The socio-environmental conflicts studied involve international companies that generally have the support of national governments to develop extraction projects (e.g. open pit mining) where there are several pre-existing uses and strong social, cultural and spiritual attachments to the territory. The ensuing conflict and opposition varies from place to place but can entail the formation of different groups and networks operating at different levels and deploying highly diverse strategies aimed at questioning or stopping extractive projects ([Conde 2017](#); [Conde and Le Billon 2017](#); [Urkidi and Walter 2011](#); [Bebbington et al. 2008](#); [Bebbington et al. 2010](#); [Horowitz 2011](#); [Scheidel et al. 2020](#)). Although socio-environmental conflicts are complex processes involving many actors including affected population groups, government institutions, scientists, professionals, NGOs, companies, in this paper we focus on the alliances between local groups and two scientists. By “local groups” we mean local or regional groups, more or less organized, ranging from

small NGOs to groups of peasants, Indigenous people and/or neighbors. Although we term them local, many have developed supra-local networks that, as in this case, allow them to involve different organizations and expertise.

Both Moran and Chareyron followed different personal trajectories that led them to engage in EJ struggles inside and outside their countries. Moran was strongly influenced by his father, who led a famous water claim in California that exposed a diversion of water from the mountains in California to the city of Los Angeles. Shortly after this case, his father died in a car accident under mysterious circumstances (see also [Prud'homme 2012, 156–157](#)). Concerns over justice (and water) marked him from early stages of his life. After obtaining his PhD in Geological Sciences, with focus on geochemistry and hydrogeology, he worked at the United States Geological Survey (a government agency) allowing him to have access to detailed information about the impacts of past and present mining activities in the US. He then worked as a private consultant, having firsthand experiences with companies' data manipulation. Moran termed "half-truths" ([Moran 2011](#); [Moran 2012](#)) the way consultants and companies present data in ways that can be incomplete or misleading without actually lying (which could have serious legal consequences in countries like the US). Disillusioned by his experience as a corporate consultant, in 1983, he opened his own independent consultancy. Since then he worked for different EJ organizations as well as some governments in Australia, Africa, Central and South-America, Europe, Asia, and the United States. Much of his technical expertise is related to the quality and geochemistry of natural and contaminated waters and sediments in mining and nuclear fuel cycle sites.

Bruno Chareyron studied physics in Grenoble, France. In 1986, when the Chernobyl reactor accident produced a fallout that flowed over France, Baltic Countries, and other places, he doubted his engineering school that "minimized the question of radiation risks" and told students "nuclear energy did not present risks that could not be controlled." (Chareyron pers. comm. 2015). Later on, working in Caen in the solar industry, not far from The Hague nuclear reprocessing plant, his two-year-old son was diagnosed with leukemia. Although he was cured, Chareyron started to ask questions about similar pathologies occurring in the vicinity of the plant. At that time CRIIRAD, an independent nuclear watchdog laboratory in France, was looking for a laboratory manager so he applied and got the job. His first project was on uranium mining in France where he was shocked by "the extent of contamination, the level of misinformation practiced by COGEMA (now French nuclear company AREVA) and the complacency of the Administration" and since then "the fight to shed light on the impact of uranium mines and obtain improvements has become a priority." (Chareyron pers. comm. 2015). Chareyron, together with other members of CRIIRAD, has been working with communities affected by radiation to denounce the wrongdoings of nuclear and uranium companies and the state. They have worked with local groups impacted mostly in France as well as in Niger, Namibia, Malawi, Brazil and had a very crucial role in the Fukushima tragedy helping set up ten independent laboratories to study the radiation fallout.

When invited to assess a particularly contentious project or pollution event both experts usually reviewed available technical documents before visiting the field. Once in the field they tried to visit the project site and surrounding areas with the local group, meeting with different actors. In this process some measurements and samples could be taken. After their visit a report was prepared and sometimes presented to the public and press. Other activities included training, giving public talks together with local groups, providing expert testimonies and reviewing technical documents such as EIAs and regulations. Moran used

to get paid for his work and trips a small fraction of what consultants working for industry usually obtained. The funding came from local, national and international NGOs or networks that support local movements. Funding sources are clearly stated in his reports. Because Moran worked as a private consultant that required specific funds for each collaboration, his collaborations were usually bounded in time with limited follow-up contacts. In the case of Chareyron, CRIIRAD is mostly supported by individual donations from France. This different institutional context allowed Chareyron to maintain a more fluid and long-term contact with local groups. Furthermore, CRIIRAD's long-term collaboration with Aghirin'man in Niger can be understood as institutional colonial responsibility related to CRIIRAD's capacity to influence AREVA in France.

There are numerous scientists from universities (e.g. [Frickel 2011](#); [Allen 2003](#); [Wylie et al. 2017](#); [Liboiron 2021](#)), NGOs (e.g. Public lab, Source international) as well as consultants (e.g. Wilma Subra in USA) active in environmental struggles worldwide. Perhaps not as common are the two scientists examined in this paper; they worked not only in their countries, but became international experts in contact with large networks of activists critical to mining and nuclear activities around the globe. By examining the trajectories and motivations of these two scientists, this paper analyses the deployment of different processes of knowledge co-production that challenge colonial dynamics at play.

3. Forms of Co-Production in EJ Struggles

Through the analysis of the collaborations between these scientists and local groups we have identified and analyzed below three forms of co-production: knowledge co-production, co-production of interpretation, and co-production of knowledge mobilization. These processes can occur independently, one after the other or at the same time.

Knowledge Co-Production

We argue co-production of knowledge takes place when the knowledge and expertise of locals and scientists enter into play. Scientists like Moran and Chareyron have the technical expertise and experience to analyze potential impacts and risks. They know which equipment is needed to measure pollution and how to use it, but when they arrive at an unknown place with a particular geography, socio-cultural history and in the midst of a contentious process, the knowledge of local actors is key to mobilize their technical knowledge. Local actors are experts regarding the local geography, the impacts and signs of contamination (e.g. changes in water smell and color, water flows, livestock and fisheries, etc.), the map of actors and key informants. Safety is also an issue, as it is not unusual to receive pressures and even death threats considering the high economic stakes of these projects ([Brown and Ferguson 1995](#)).

In Niger, Almoustapha Alhacen, director of local NGO Aghirin'man, asked CRIIRAD to help them understand the impact that the uranium mines of SOMAIR and COMINAK (run by AREVA) were having on their health and their town, Arlit. Alhacen had seen three work colleagues die and suspected it was related to their work in the mine. CRIIRAD sent over a Geiger counter, and after confirming high radiation measurements a mission to Arlit was organized in 2003. Chareyron didn't know the local geography or which areas could be polluted. Alhacen pointed to potentially polluted waterholes, to the scrap metal and material from the mines that was sold in the market and to the ventilation shafts from the underground mine. Chareyron was then able to use—as well as teach—measuring techniques and devices to corroborate the suspicions of Alhacen (for a more detailed account [Conde 2014](#)). Together they demonstrated there is a

radiological and chemical contamination of groundwater as well as the presence of radioactive scrap metal sold on the market (Chareyron per. comm. 2017).

In 2003, Robert Moran was asked to conduct an independent assessment of the Environmental Impact Assessment (EIA) prepared by a Canadian mining company that was planning to extract gold less than 7 kilometers away from the city of Esquel (Chubut, Argentina). His visit was funded by the U.S. Mineral Policy Center and Greenpeace Argentina at the request of a local anti-mining group (AVA, Asamblea de Vecinos Autoconvocados por el No a la Mina). In this case, local groups already had some level of scientific or technical knowledge. Two chemistry professors of the local university were amongst the first members of AVA. Early in the conflict, these professors started to highlight the risks related to the use of cyanide, risks that were minimized by the company. Their credentials were however not recognized by the government. Many neighbors also devoted a lot of time to research online about metal mining and its impacts. Local criticisms and concerns were received with skepticism by local authorities who trusted the company and government experts. Moran's visit aimed to support and improve the visibility and legitimacy of AVA's technical arguments. AVA arranged Moran's visit to the surroundings of the mining area with local mountain guides that showed him some water flows and geological structures. He also flew over the mining area and conducted different interviews with local actors (water cooperative, local politicians, activists, etc.). Moran signaled evidence that the geological structure (e.g. rock formations, underground water flows) could entail water pollution risks. As this issue was not addressed in the EIA report, Moran's visit allowed AVA to technically argue for the need of further studies. In a parallel process, an Argentinean hydro-geologist, Dr. Fernando Diaz, hired by the local water cooperative, provided further evidence of this risk. In the midst of a highly intense local conflict involving large mobilizations and social unrest, this became a key technical argument used by local groups and politicians to demand the cancellation of mining plans.

Local activists can also increase their technical expertise. Moran and Chareyron explained in their interviews the importance of training, stressing how local groups could learn to better understand technical results, use technical equipment and identify critical technical issues and information voids. For example, in Niger, after some training Alhacen was able to independently carry out measurements and workshops with local groups and workers to help them understand the risks and impacts uranium could cause thus pushing workers to take protection measures seriously.

It's important to point out that in some cases scientists can produce new knowledge without engaging in co-production processes with local groups. For instance, although Chareyron generally works with local groups in France, he also visits polluted sites and takes samples without the collaboration of local citizens, but as part of CRIIRAD's monitoring activities. Moreover, we would like to distinguish between the action of (co-)producing knowledge and the action of giving it political meaning and mobilizing it in a certain context. The generation of co-produced knowledge and a basic technical interpretation (e.g. soil sample results indicate that soil is polluted) does not imply or guarantee its politicization or, in other words, its potential to challenge power relations between affected groups and mining promoters or regulators, for instance. In order for this knowledge to be used in a struggle over power and knowledge in an EJ conflict, it has to be interpreted and become part of a strategy of action.

The Co-Production of Interpretation

In order to have an impact, co-produced knowledge needs to be contextualized and interpreted technically and politically. Of all technical data available, how can local groups identify what is key for their struggle? Technical data, the result of samples or measurements, be it produced or co-produced, is not useful per se; it needs to be interpreted to become meaningful and relevant in a particular socio-political context.

Both scientists and local groups have different forms of knowledge and expertise that can become useful in this step. An important part of this co-production step is to understand technical results; technical knowledge allows the technical interpretation of sampling results (e.g. quality, thresholds). For example, Chareyron explains how “technical things such as monitoring radon gas, are expressed in Beq/m³ so we will give him [Alhacen] some support to understand and analyze the results” translating from Becquerel to annual risk so they can use it in their argumentation (Chareyron per comm. 2017).

In order to give political meaning to these results other types of knowledge (not necessarily held by the scientists) are crucial. For example, in Niger measurements showed that scrap metal sold in the market had high radiation levels. Alhacen showed how this scrap metal came from the mine and was being used to build houses. Chareyron calculated local inhabitants were being exposed to radiation doses exceeding the World Health Organization standards. Alhacen made this issue a priority demanding the local authorities and AREVA to provide new houses for those affected (Chareyron per comm. 2017). The understanding of social and cultural practices and needs is key to identify the socially and politically most sensitive risks and impacts in a particular context. For instance, high radioactivity and pollution pose a danger to local health and livelihoods but this depends on local land uses and access to polluted sites as well as cultural practices and customs with gender and ethnic implications. In Niger (like in other parts of the world) women eat soil, a custom named geophagy. When Alhacen realized the soil in Arlit was highly polluted from the open storage of radioactive residues, he organized specific workshops with women’s groups to teach them about radiation. As Chareyron states:

The interpretation has to be done with the local people because they know the transfer routes for the radiation to the community, they know the habits, what do they do, how they behave. (Chareyron per comm. 2017)

This knowledge is always rooted in local knowledge and expertise.

In this step, a central aim is to co-produce a political interpretation for practical activism. We present below both two examples. In Namibia, Bertchen Kohrs, a representative of a local NGO, Earthlife Namibia, liaised with CRIIRAD in order to assess the impact Rössing uranium mine was having on its environment since its opening in 1976 by Rio Tinto, the mining giant. When CRIIRAD visited Namibia in 2011 many samples and measurements were taken in the vicinity of the mine. Guided by Kohrs and other local activists, new co-produced knowledge was generated (measurements, samples) that needed to be interpreted in order to decide which were key for Earthlife’s struggle. Kohrs and Chareyron discussed them and chose to focus on three key aspects: a riverbed sample downstream from the mine that showed higher pollution than upstream. Kohrs knew this would be of critical importance to demonstrate the radioactive pollution of the river; that despite not being highly used due to high salinity, it had an impact on downstream farmers and on critical water sources in an arid country such as Namibia: “it’s easier to take salt than radiation from water” she noted (Kohrs pers. comm. 2013). Also the management of waste rock (rock

discarded before processing that still contains uranium producing low level radiation) was of concern. Not only was it being stored without confinement but it had also been used for the construction of the parking lot in Rössing's entrance. Chareyron had also identified this issue earlier in France and Niger. In the latter, measurements carried out by foreign students visiting Arlit showed that waste rock had also been used for construction, for example in front of Arlit's hospital. The correct storage and management of mine waste became one of the main demands of Aghirin'man and Earthlife Namibia.

The second example took place in Peru, in 2012 when Moran was asked by GRUFIDES to review the EIA of one of the most contentious and violent mining conflicts in the country: the proposed Conga gold mine. GRUFIDES is a local NGO that has been supporting peasants opposing numerous mining projects in their lands. Moran spent a month in Peru where, with members of GRUFIDES, he visited the area where the Conga mine was to be built. They observed the mine site and construction activities, made field measurements of water quality at several lakes, wetlands and streams and had technical discussions regarding the site hydrogeology with national and international scientists acquainted with the area. The final report was a co-produced interpretation of technical documents and samplings, highlighting a series of key concerns such as the amount of water that would be used or the contamination risk of superficial and underground water sources. These reports and narratives became a key resource for the local movement — and were then mobilized via different strategies (see [Moran 2011](#); [Moran 2012](#)).

We argue that with this collaborative interpretation of results, technical knowledge is politicized through a narrative about risks and injustices — with concrete demands. In Niger, for example Aghirin'man was able to prove that workplace clothes — that were taken home for washing — were polluted. After exposing this, the company changed this practice. Aghirin'man also demonstrated early on (2003) that highly radioactive scrap metal was being sold in the market and used for the construction of houses, but it was not until 2013 that AREVA withdrew all the scrap metal from the market.

Interpretation can also occur without co-production. On many occasions Moran and Chareyron have revised documents such as EIAs without a visit to affected areas. In these situations they provide an opinion about the technical document (e.g. what is missing, quality) and the scientific studies quoted in these reports (e.g. sample design, what was measured, how, when). These reviews can also be very useful for mobilized groups, but they don't allow data to be collectively interpreted to co-produce a narrative. These dialogues, on narratives and strategies, are more likely to take place through informal interactions; during a long bus trip or over a beer than during a videoconference meeting, hence the importance of visits and place-based exchanges.

Co-Production of Knowledge Mobilization

The co-production of knowledge mobilization takes place when scientists and local groups interact to design strategies that challenge hegemonic technical knowledge, using scientific as well as other types of knowledges and demands. This usually goes beyond the initial aims of the collaboration foreseen between scientists and local activists.

This form of co-production relies mainly on non-technical experiential knowledge or expertise held by all actors. We stress the co-production dynamics at stake. Each actor has key resources and social capital: Local actors have particular knowledge about key political issues and the institutional history and momentum (elections, legal changes, positioning of politicians). Which strategies could catalyze the

cancellation of a project, a public debate or inform new legislation? Scientists and local groups can acquire experience from previous or ongoing EJ struggles. This can provide different expertise (communication, legal, technical, political) as well as access to national and international networks and audiences—a valuable source of support and pressure when confronting large economic interests. Together, scientists and local groups can shape new strategies that can adopt many forms: communication outputs, mobilization, political lobby, dialogue with governments or companies, legal avenues.

The co-design of strategies can have a high impact for local groups. The visit of these scientists is in most cases a deliberate strategy to strengthen and make local demands more visible. During the visit of Moran to Esquel (Argentina) and Conga (Peru), his scientific claims—although mostly known—allowed to legitimate local claims, as well as local groups, reopen debates, generate new evidence and gain access to difficult audiences (e.g. other local actors, political parties, media). For instance, the post-closure impacts of mining activities were among AVA's concerns in Esquel. Robert Moran was able to contribute to this narrative by providing more information about worldwide experiences related to post-closure water remediation and its costs and the insurance funds that companies were asked to provide in other countries of the world, when none was asked in Argentina. This forced the company to offer a voluntary insurance fund that was announced in all local newspapers days after Moran's visit. Moreover, as part of his visit to Esquel, Moran gave many interviews and a public presentation that filled the city auditorium with hundreds of local neighbors and politicians where he presented his comments on the project's EIA and addressed questions from the public. He was able to refute some of the company's arguments and offer an international perspective on worldwide practices, which de-romanticized mining in the North. This took place only a few weeks before a municipal referendum (promoted by AVA) that resulted in 81 per cent rejection of the mining project. This strategy—and Moran's involvement—was among a large range of legal, mobilization and political strategies to stop mining plans. The project was canceled shortly after the referendum and this became a landmark case in the country and region ([Walter and Urkidi 2017](#)). Moran became part of a larger network; in 2016 was invited to work with communities in the North of Argentina to give his expert opinion on the Veladero mining project in the Senate.

In Namibia, the main objective of the visit was to give visibility to the co-produced results and narratives; Kohrs and Chareyron decided to carry out a national-based strategy consisting of a press release and press conference inviting all major newspapers with Chareyron travelling back to Namibia to share the results of their collaboration. Kohrs organized several meetings with government bodies, regional councils and the mining company to present the results and participated in the drafting of new regulations (Kohrs. per comm. 2013). Chareyron stated to us:

CRIIRAD will not know the local structure of power, but can use the local experience in other cases to suggest some possibility for action. And, the community will suggest what to do depending on the local situation, the relation with local media we will decide together what to do.

When local groups have less mobilizing experience, visiting scientists' knowledge of strategies can be useful for the design of supra-local strategies. In Niger, given the ties of AREVA with France, a dual strategy was adopted; a regional strategy in Niger led by Alhacen and an international strategy in France led by Chareyron. In Niger, Alhacen had meetings with local chiefs and different groups to inform them about the risks of radiation. His work is ongoing, monitoring mining activities, publishing newsletters, writing in newspapers,

as well as liaising with local authorities providing, for example, expert advice about new proposed mines ([GOSCRAZ 2013a](#)). In France, Chareyron has created cross-scalar alliances promoting and publicizing the work of Aghirin'man in France and other European countries, raising money as well as organizing different European tours with Alhacen. As a result of these efforts Alhacen has become a public figure on nuclear issues not only in Niger but also in Europe. In 2008 Alhacen spoke about AREVA when it was given the "Public Eye Award" in a ceremony in Davos (Switzerland), an event organized by a network of NGOs that each year grant an "award" to the worst corporation. In 2017 he also obtained the Nuclear-Free Future Award, given yearly to anti-nuclear activists by a German foundation.

4. Implications and Impacts of Co-Production Steps

In this paper we have identified three different forms of co-production that (can) occur in the alliances between scientists and local groups. Knowledge co-production involving scientists and EJ movements has been addressed in previous studies (e.g. [Ottinger and Cohen 2012](#); [Boudia and Jas 2014](#); [Corburn 2005](#); [Conde 2014](#)). We go further identifying different forms of co-production, highlighting the different types of knowledges involved and the potential impacts for local groups and their struggles. This approach sheds light on the "co-production of knowledge mobilization" and the role of political and experiential knowledges and multi-scalar networks, a process that has received little or no attention in the literature on scientists' collaborations with EJ movements. These are unexpected outcomes that are usually born in informal spaces of collaboration.

The three forms of co-production can empower local groups, increasing their legitimacy and visibility ([ibid.](#)). We highlight below some impacts that can result from each co-production form. During the co-production of knowledge local groups confirm or produce *scientific proof of risks or impacts* that they can use in their demands ([Allen 2003](#); [McCormick 2007](#)). In this process organizations co-generate new knowledge that allows them to understand better what they are confronting. It fosters the *internal empowerment* of activists and local groups. In Niger, Alhacen states:

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. [And adds] 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. (Alhacen pers. comm. 2013)

This might not be the case of local organizations that are already aware of the impacts the extractive activities are causing. In this case local groups liaise with scientists to generate scientific data to prove or expand what they already know and claim, thus strengthening and bringing further attention to their arguments. This boosts the *internal legitimacy and confidence* of local groups as their opinions are "taken more seriously" (Kohrs per comm. 2013). After obtaining technical data in Namibia, Kohrs pointed out:

... 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. (Kohrs per comm. 2013)

In a recent interview, Marta Sahores, a chemistry professor from Esquel that was among the first actors to raise the voice against the technical statements of the mining company, stated that Moran's visit in 2003 was a big endorsement ("espaldarazo") that ratified that "what is said here is true" ([ANred 2020](#)). The co-production of knowledge, however, does not guarantee its mobilization nor the empowerment of local groups ([Conde 2014](#); [Boudia and Jas 2014](#)).

In the co-production of interpretation and knowledge mobilization, emphasis is placed in the particular institutional and political contexts. These forms of co-production can improve the *public legitimacy* of local groups and their capacity to challenge external power relations through, for instance, influencing decision-making. The co-production of interpretation entails the construction of a politically sensitive counter-hegemonic narrative based on the technical co-produced knowledge. As a result, local groups can feel empowered, entitled to participate in technical debates about the impacts they previously weren't involved in. In Guatemala, in 2004, at the Marlin Mine conflict, Moran explained how the company agreed to have a public meeting with the citizens and their technical people:

the citizens were so happy after the meeting! They were telling me about how they basically destroyed the experts from the mining company by just asking some basic questions.

Finally, the co-production of mobilization can give *visibility and political leverage* to the narratives, claims and the local groups themselves. Kohrs in Namibia states:

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 realizing or knowing. (Kohrs per comm. 2013)

The political leverage gained can reach other political matters; Alhacen is now a public figure in Arlit and in the national nuclear debates, contributing to demands such as the need for more government decentralization ([Ressortissants d'Agadez 2011](#)) or a fair payment and distribution of mining taxes in Niger ([GOSCRAZ 2013b](#); [Aghirin'man 2011](#)). In this vein, knowledge mobilization also entails the strengthening and enlargement of *networks and alliances* of local groups. The creation of bridges between affected groups (within and among localities) or the shaping of international alliances (e.g. Alhacen's tours and prizes in Europe) can have concrete impacts for local groups and their struggles.

Moran emphasized that one of his main contributions was his role as "facilitator" of strategic alliances between affected communities and local scientists as well as government representatives. In the case of Cajamarca, Colombia and their struggle against the opening of a gold mine, Moran successfully promoted a visit of activists from Cajamarca in Colombia to Cajamarca, Peru so:

. . . they could compare what was being promised in Colombia with what had actually happened in Peru. (Moran pers. comm. 2016).

Also in Colombia, Moran promoted meetings between local activist groups and rice farmers in order to:

. . . develop some political power [because] they were the most powerful farmers and landowners. [They also tried unsuccessfully] to develop a connection with regional universities so they could analyze their own samples.

A week after Moran passed away, a Colombian–Dutch organization with whom he worked in Colombia published a tribute stating, “there are many good and expert hydro–geologists but they rarely combine their expertise with their political instincts. Bob did.” And added “‘Let’s look at the larger picture’ was one of his typical phrases, when the interlocutors got lost in details and fragmented approaches” ([Moor 2017](#)).

5. Unsettling Colonial Relations in EJ Struggles

In this paper we have analyzed the relation between science and activism in locally driven environmental justice struggles through the collaboration of two Western–educated male scientists and their work with communities in the Global South and North. We hypothesize below how these co–production processes challenge common accounts of colonial relations in scientist–local groups collaborations.

One could argue that by promoting the expansion of techno–scientific language among local groups (through these alliances or other means) there is an exclusion or disqualification of “subjugated knowledge” ([Foucault 1980 quoted by Scott 1996](#)). Western science has a lack of ethics in knowledge formation due to its “hierarchy and centralized control” whereby all non–Western knowledge is ignored, excluded or disqualified ([ibid., 194](#)). However, it has also been argued that science can serve both ways ([Lyons et al. 2017](#), see also [Woolgar and Cooper 1999](#); [Wylie et al. 2017](#)), offering a means for decolonization through the promotion of different types of knowledges and languages in our understanding of science. In this paper we have shown how in the context of locally driven EJ struggles local, traditional, Indigenous, contextual, political, scientific knowledges were merged through co–production processes.

Nevertheless, let’s take a step back and consider why local groups need to engage in these technical and scientific controversies in the first place. Aren’t they “playing the game” to colonization and neoliberal domination when they engage in the same language? Indeed, decision–making institutions leading the assessment, approval and monitoring of extractive activities are built in technical language and figures of expertise ([ibid., 2017](#)). Science is the language of power. Therefore, the use of techno–scientific language by local groups is a strategy that allows them to expose the technical, social and ethical weaknesses, as well as ask sensitive questions about the impacts of these polluting activities. This is required to participate in debates about future projects, to promote institutional change, to dispute technical documents, in essence, to challenge the power structures that aim to exclude EJ groups and gain leverage in decision–making. However, for local groups the use of techno–scientific language might not be enough. We posit that scientists bring to these collaborations “colonial legitimacy.” The scientists introduced in this paper are white–male Western educated scientists that represent a certain ideology of knowledge (science) that supports their elite status, as well as that of the companies and states behind the projects they dispute. Their contribution to these struggles is grounded on the legitimacy and power of a colonial construct of “expertise” that is played out by both movements and scientists in the struggle. Their scientific authority and certifications as “experts” is the reason why they are summoned to collaborate by local groups. However, the way they collaborate and engage in co–production processes is crucial for the creation of legitimacy and confidence of local groups across the network.

Notwithstanding the strategic use of Western expertise to legitimize and bring attention to EJ issues, one could still ask—can these alliances with scientists backfire? Can these alliances ignore or dismiss the impacts, demands and needs local groups deem more important? This is a common concern in academic projects where research needs overrun local ones ([Minkler 2004](#); [Janes 2015](#)). As we have not studied the

impact of these collaborations locally over large periods of time we cannot fully address this concern. However, we have noticed that these collaborations were driven by (usually well organized) local groups—not scientists in research projects—and as a result local groups had more leverage in the definition of the collaboration aims, needs and use of results. Scientists were summoned to collaborate as part of concrete strategies to challenge dominant accounts of pollution. We have pointed to the ways in which the particular trajectories and motivations of these scientists matter in order to acquire and value different types of knowledge—and other (activist and scientific) networks. More research on these local-led collaborations and the motivation of scientists could have important implications in participatory research collaborations.

Furthermore, even if the co-production process does not neglect local needs or demands, we could ask: are local groups ultimately challenging power relations in their struggles? Could they be focusing on other more “productive” or de-colonial strategies? We could then reflect, if by asking these questions as academics we are also falling into the paternalistic and colonial trap of judging local groups’ strategic choices. Their involvement with scientists is not only a decision or choice, but an urgent need as the approval of projects advances at high speed or their health or livelihoods are being impacted—whilst local claims remain unheard. Allying with scientists and using techno-scientific knowledge is generally just one among many other strategies. In an analysis of the Environmental Justice Atlas global registry of EJ struggles, Scheidel et al. (2020) concluded that mobilizations that succeeded to stop polluting projects, did not rely on a single strategy but a combination of several at once. They found a significantly higher project cancellation rate (26.7 per cent) in those cases where mobilizations were preventive, highly diverse strategies were used and took strong legal action. In this sense, engaging with hegemonic knowledge and institutions seems to have a significant impact for movements’ aims. Both scientists interviewed for this research highlighted how their work was most impactful when working with well-organized and resourceful groups able to mobilize the knowledge produced in coordination with other strategies.

We have examined the alliance between two white male scientists and local groups struggling in EJ conflicts. We highlight three key elements in the scientific/activist alliances that are relevant to understand how colonial relations were challenged: (i) local groups (and not researchers) are driving these collaborations, and in most cases these groups are well organized and active in other strategies, (ii) the knowledge dynamics at play (merging local and scientific expertise) are crucial to co-produce and mobilize knowledge in an empowering way, and (iii) individual and collective motivations (e.g. not research driven) and trajectories (e.g. experiential knowledge) matter to understand how knowledge is co-produced, interpreted and mobilized in contentious EJ conflicts. Although scientific knowledge is important in these collaborations, we highlight the role of local, Indigenous and traditional knowledge as well as institutional, political and strategic expertise brought by the scientists and local groups. In these alliances different knowledges are combined in different forms of co-production. The objective is not only to understand or measure a specific environmental impact, but to put it to use, to mobilize it in order to defend livelihoods and health in the context of environmental struggles.

Our approach makes visible how these alliances are the result of supra-local networks of support that connect local groups struggling against extractive activities with scientists. This research suggests that these networks are shaping the trajectory and experiences of scientists and local groups, and the expertise they bring to different locations. More research in this line could shed light to how scientists constitute networks of expertise that connect and co-produce actors and knowledge across space and time. In a sense,

Bruno Chareyron and Robert Moran are both the result and origin of different processes of collective learning and knowledge production about how to better struggle against power inequalities in EJ conflicts and within science itself.

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