Chapter 22
Activism Mobilizing Science Revisited

Marta Conde and Martí Orta-Martínez

The "extraction frontiers" are the place where extraction of natural resources expands geographically, colonizing new lands and territories in search of raw materials (oil, mineral ores, biomass, etc.) to satisfy the increasing demands for materials and energy of industrialized economies (Martínez-Alier et al., 2010; Moore, 2016). This extraction frontier has been advancing since colonial times, in an accelerated rate since the industrial revolution, encroaching and colonizing territories, ways of life and cultures in its wake (Schaffartzik et al., 2014; Krausmann et al., 2009). However, these extraction frontiers do not advance unopposed; on numerous occasions the communities that live near these projects react against the socioenvironmental and cultural impacts on land, water, and ways of life (Martinez Alier, 2003; Conde, 2017; Arsel et al., 2016). Well studied by the BCN school, many of these groups are part of the Environmental Justice (EJ) movement (Martinez-Alier et al., 2016; Martínez-Alier, 2021).

The expansion of the extraction frontier and the resistance movements are marked by an intense controversy between the limits of technology to achieve "sustainable" extraction and the role played in this dispute by scientific knowledge and lay or local knowledge. Scientific knowledge, like all knowledges, is partly socially constructed (Foucault, 1971). Although it depends on observation, experimental- and measurement-based testing is also subject to the interests and the cognitive assumptions of the scientist, social practices, available materials, and, more

M. Conde (✉)
GREDS-EMCONET, University Pompeu Fabra, Barcelona, Spain

Universitat de Barcelona, Barcelona, Spain

M. Orta-Martínez
Universitat de Barcelona, Barcelona, Spain

Central University of Catalonia - UVic, Vic, Spain

S. Villamayor-Tomas, R. Muradian (eds.), *The Barcelona School of Ecological Economics and Political Ecology*, Studies in Ecological Economics 8,
https://doi.org/10.1007/978-3-031-22566-6_22

importantly, to the economic and political interests of the institutions that contribute to its funding, elaboration, and dissemination (Barnes, 1977; Jasanoff, 2004).

Although scientific knowledge has been traditionally used to support the most powerful political forces and actors through the invisible role of expertise, local groups are increasingly engaging in the generation of scientific knowledge. Under terms such as civil science, citizen science, civic science (Bäckstrand, 2003), or advocating for the democratization of science (McCormick, 2009), these groups want to reveal negative socioenvironmental outcomes, bad practices, and/or improve companies' and states' policies and operations. Concerned research groups sensitive to EJ issues are also promoting an alliance between scientists and local affected groups, under the "participatory processes" umbrella. With various degrees of collaboration and participation, we find methods such as Participatory Action Research or the widely used Community-Based Participatory Research where community partners should participate in every step of the process from its inception to the final interpretation of results (Minkler & Wallerstein, 2003; Shepard, 2002). It is important, however, to bear in mind that the degree of participation, the asymmetries of power among actors, and the final use of knowledge for decision-making are controversial factors that can lead to privileged access, a co-optation of the process and the colonization of themes and discourses (Cooke & Kothari, 2001). The underlying idea is that science has political and social implications and that citizens should "have a stake in the science-policy interface" (Bäckstrand, 2003). In this vein, the proposal of a "science without unity" with different forms of knowledge at stake (Irwin 1995) is very relevant for socioenvironmental conflicts. Similarly, Funtowicz and Ravetz (1993) propose the creation of "extended community of equals" to resolve urgent and complex controversies, which must include all knowledgeable people with interests in the subject. Although some authors have questioned the scientific method (Corburn 2005; McCormick, 2009; Funtowicz & Ravetz 1993), many in fact use it to produce alternative policy and action-oriented scientific knowledge.

This is the case in the context of EJ where polluting extractive projects can negatively affect the environment and livelihoods of nearby communities (Nixon, 2011; Martinez Alier, 2003). The usual narrative of the industry is that impacts are nonexistent or that they are not produced by the company but are "natural" due to the geochemical composition of the area, leaving the communities the "burden of proof." If the project has not yet started, communities generally need to challenge the Environmental Impact Assessments (EIAs) submitted by the companies that propose high-technology mitigation and remediation measures that many believe to be false promises or insufficient solutions – an experience gained through previous projects and/or learnt through their alliances (Keck & Sikkink, 1998; Conde, 2017).

Thus, in order to uncover, understand, and denounce present or future impacts, citizens, communities, or local activist groups ally with scientists under the counter-expertise framework (Topçu, 2008, see also Martinez Alier et al., 2011, 2014; Conde, 2015). Through Activism Mobilizing Science (AMS) (Conde, 2014), local groups learn to use measurement tools and scientific language and coproduce new and alternative knowledge that challenges the discourse produced by companies and certain state agencies. Also, under the counter-expertise umbrella, communities whose health is affected by the negative impacts of polluting industries react by carrying out epidemiological studies, measuring the impacts, and quantifying the diseases with their own means. Known as popular epidemiology, communities test the connection between pollution and the impact on their health, report it to gain more support and motivate an "official" epidemiological study (Brown, 1992; San Sebastian & Hurtig, 2005). Similarly, in *Street Science*, Corburn (2005) documented how four groups of marginal populations and/or racial and ethnical minorities from New York self-organized to report impacts on their health based on the coproduction of knowledge. Closely related to the policy-oriented, bottom-up, and coproduction framework of popular epidemiology, street science, and citizen science, AMS goes beyond the analysis and reporting of health impacts to study more carefully the knowledge–activism–scientist nexus and the power differences of this activist strategy.

In order to develop the idea of AMS, three case studies in the frontier of extraction will be analyzed. A short contextualization of the cases is given as follows:

In Niger, Areva (French national nuclear company) has extracted uranium from the underground mines of Somaïr and Cominak since 1968. The towns of Arlit and Akokan were built near the mines to house its workers. Some 60,000 inhabitants live in houses made of clay, iron, and scrap metal. There are two main sources of radioactive hazards: the water distributed by the company for consumption contains radioactive elements at levels 10–100 times higher than OMS recommendations (CRIIRAD, 2008), and the open-air storage of mining waste – that contain 85% of the original radioactivity – as well as the mines' ventilation shafts cause radioactive dust and radon (CRIIRAD, 2008).

In Namibia, Rio Tinto, the big mining giant, has been mining uranium from Rössing mine since 1976, and built the town of Arandis to house its workers. As in Niger, the workers and residents are totally dependent on the mine. The biggest concern for workers is the health impacts; many know of colleagues who have become ill and died but they cannot prove the connection between their illness and their work at the mine (Shindondola Mote, 2008).

In the Peruvian Northern Amazon, two oil concessions known as Block 8 and Block 1AB (now 192) were leased in the late 1960s and early 1970s. First operated by PetroPeru, the Peruvian national oil company, and Occidental Petroleum Corporation (Oxy), a US-based company, were later transferred to a Dutch and Canadian consortium. These oil blocks are the most productive and longest lasting in the Peruvian Amazon (39.2% of total Peruvian production) (Orta-Martínez et al., 2018a). More than 45,000 indigenous people live in the area affected by these oil extraction activities, which have caused serious environmental and health impacts (Orta-Martínez et al., 2007, Orta-Martínez et al. 2018b; Cartró-Sabaté et al., 2019; Yusta-Garcia et al., 2017, O'Callaghan-Gordo et al., 2018, Rosell-Melé et al., 2018). In 2005, the Ministry of Health found that between

98.6% and 66.2% of Achuar children between 2 and 17 years old exceeded the acceptable limits for cadmium and lead in blood (DIGESA, 2006; Orta-Martínez et al., 2007). This risk has been linked to the discharge of 1 million barrels/day of produced water to local rivers and lands (Orta-Martínez et al., 2018b).

22.1 What Is Activism Mobilizing Science?

AMS has two main traits: (i) it is a process driven by activists or local grassroots groups from the areas impacted by extractive projects that engage with scientists to study the impacts of these activities; (ii) in this process, new knowledge is produced merging local knowledge with scientific knowledge in a knowledge coproduction framework. These two traits are examined in detail as follows:

1. Locally driven

In Niger, Almoustapha Alhacen was a worker in the Somaïr mine. In 1999, he saw three colleagues who worked in the uranium concentration division die from causes unknown to them. He contacted CRIIRAD (Commission for Independent Research and Information on Radioactivity), an independent French laboratory specializing in radiation, whose team visited the area in 2003. Together with Alhacen, the team measured radioactivity around the town of Arlit, identifying high levels of radioactivity above WHO-recommended levels in water, air, and soil (CRIIRAD, 2008). To disseminate these results among the local population, Alhacen and the recently created civil society organization, Aghir in'man, organized workshops that included women, journalists, and chiefs of the different tribes.

Spurred by this experience, Bruno Chareyron, director of CRIIRAD, wanted to start a similar process in Gabon where Areva had also carried out uranium mining for 30 years with serious health impacts (CRIIRAD, 2009; Hecht, 2012). However, according to Chareyron, the idea did not come to fruition because there was no strong organization driving the process locally: "We tried to do something [a Geiger counter was sent to the local communities] … but both parties have to do something." In contrast, in Niger, Aghir in'man leads the process; they take samples, organize workshops, participate in public meetings, give interviews to journalists, and find funds to acquire new equipment.

In Namibia, the AMS process started differently. Two local organizations, LaRRI and Earthlife Namibia, denounced the expansion of mining in Namibia (Kohrs, 2008) and the impact on workers' health based on testimonies from miners of other ongoing mines in Namibia (Shindondola Mote, 2008). Prompted by these studies, Conde conducted her doctoral research in Namibia, inviting Bertchen Kohrs, the director of Earthlife Namibia in an EU-funded project (EJOLT, Environmental Justice Organizations, Liabilities and Trade) as well as CRIIRAD – thus putting them in contact. Was this the start of a participatory research project? This was not Conde's objective. As in Niger, the local organization took the reins of the whole process inviting CRIIRAD to Namibia. Kohrs planned the trip in September 2011 and, once the results were obtained, asked CRIIRAD to come back to present the results, organizing a press conference and meetings with different groups as well as the mining company. The data gathered was shared at an annual general meeting of Rio Tinto, pushing the company to commission a health study.

The AMS process in Peru also has a similar origin to that of Namibia. Invited by indigenous and local organizations (FECONACO – the indigenous organization of the Corrientes River, Grupo de Trabajo Racimos de Ungurahui and Shinai), Orta-Martínez, a PhD candidate at the time, was asked to help mapping the oil spills in the indigenous territory. Shortly after, in January 2006, a team of scientists and activists including Orta-Martínez travelled to the Peruvian Amazon. To their surprise, 13 members of different indigenous communities were waiting for them; the communities had decided they were going to create a community-based monitoring team to map past and new oil spills. During the following weeks the group of scientists and activists trained the "monitors" and at the same time visited the oil-polluted sites to start the monitoring process with photos and their geolocation (Orta-Martínez 2010; Orta-Martínez & Finer, 2010). Indigenous and local organizations have taken over the process looking for their own funding and extending it to other areas and indigenous groups. Orta-Martínez and other scientists have returned almost annually to the area to support the process.

2. Coproduction of knowledge

In these alliances, new scientific knowledge that may refute the data and narratives of the companies is generated. Although in many occasions, local groups know what oil or uranium are and the socioenvironmental impacts they can cause, they ally with scientists to learn how to measure them and, more importantly, to speak the scientific–technical language used by large companies and state agencies. A crucial part of these alliances is the technical training provided by scientists to local groups.

However, scientists could not generate new knowledge alone. They do not understand the local complexity of the area, the local geography, the local and particular impacts on health and environment, and/or the socioeconomic and cultural aspects as well as local practices that are essential to understand and co-interpret the results (Conde & Walter, 2022). Thus, local knowledge is essential to conduct the sampling, understand the exposure routes, and interpret results: What are the local impacts? Where are located the polluted sites and the local sources of pollution (e.g., the fans that expel air from the mines, the mine tailing dams, the oil spills, the dumping sites of produced water)? How can they be accessed to carry out the sampling? What does the company do with the waste products? What drinking water sources are used by the community? Where do livestock feed and drink? What does the local population eat? What are the local customs in relation to their environment?

In Niger, during CRIIRAD's visit in 2003, the coproduction between Alhacen and CRIIRAD's team allowed the group to detect that highly radioactive scrap metal from the mine was sold in the local market. This scrap metal was being used for the construction of houses. Although this practice was, since then, continually denounced by Angir in'man, it was not until 2013 that Areva withdrew all the scrap metal from the market. Similarly, in Namibia, measurements confirmed that groundwater radiation was higher downstream from the mine than upstream, contradicting the company's position that all radiation was natural background radiation and not related to the mining activities (Chareyron, 2014).

In Peru, the company was also forced to improve very poor operational procedures (e.g., in situ burning of oil spills) and remediate a number of oil-polluted sites after the indigenous monitors recorded and denounced such illegal practices (Orta-Martínez et al., 2007, forthcoming). Furthermore, a new-to-science exposure route to local communities was documented by the scientists–locals alliance after the monitors reported that animals they hunted for food were ingesting oil-polluted soils (geophagy) (Orta-Martinez et al., 2018a, b). This motivated research to analyze bioaccumulation of heavy metals in wild game species, a key element of the diet of indigenous people that rely on subsistence hunting for their daily protein intake (Cartró-Sabaté et al., 2019).

22.2 Goals of Activism Mobilizing Science

Local-affected groups want to *learn and understand what is causing the impacts* to their environment and health. In Niger, Alhacen had heard of radioactivity but thought that you had to be in direct contact with uranium for it to affect you. He wanted to understand what radiation was and how it impacted you. With CRIIRAD, he learnt about radiation and, in turn, organized numerous workshops to teach inhabitants in Arlit as well as workmates so that they would take radiation protection measures seriously. For example, he was able to change the practice of taking workplace clothes home for washing over time (Conde, 2014).

A driver of these alliances has been the *coproduction of new knowledge to challenge the state or company discourse*. The measurements taken by CRIIRAD and both teams in Niger and Namibia have allowed to identify high levels of radiation in the nearby areas to the mine. In Niger, for example, they detected radiation 100 times higher than background values, identifying the use of waste rock in the construction of roads as the main source. This was also the case in a parking lot of Rössing uranium mine in Namibia. These bad practices exacerbate the daily radiation exposure for workers or local inhabitants.

The Achuar people were able to challenge the company narrative that argued that high-technology minimized the number of oil spills and other oil-related impacts. They were able to document and prove the existence of numerous oil spills with photos and their geolocation. This was and still is crucial in ongoing efforts to secure an (insufficient) fund for remediation and water treatment plants, to challenge a very limited decommissioning plan – and to ultimately bring the company to the negotiating table and improve its operational practices (Orta-Martínez et al., 2018a, b, forthcoming).

In many occasions, activists and impacted communities already know the impacts and effects of industrial pollution; they directly suffer them or are aware of them from nearby polluting industry projects. Through these alliances they gain scientific prove of the impacts as well as raise public awareness and national and international support; they obtain greater *legitimacy and visibility*.

CRIIRAD already had experience with several nuclear-related projects in France; they would typically carry out visits to the impacted areas, analyze the EIAs, and issue a report and a press release with wide press coverage. In Niger and Namibia, a similar process ensued; after CRIIRAD's visit to the area, a joint press release with the main results and demands was issued. In Namibia the press release was widely distributed giving Kohrs high visibility, with people approaching her on the streets and Earthlife appearing numerous times on the news. At the same time, Kohrs gained legitimacy when discussing "technical" concepts – a language previously only used by company "experts." She was able to talk about radioactivity and its impacts, she participated in the new regulations of the Atomic Regulator and reviewed the legislation for the rehabilitation of mines. In Niger, Alhacen not only learnt about the impacts of radioactivity but as Khors, he started making technical as well as social demands to the company, the press, and government representatives.

For the Achuar monitors in the Amazon, the legitimacy gained through these processes has allowed them to negotiate and speak one-to-one with the oil company managers and state officers using technical terminology. They have placed demands, negotiated settlements, demanded changes in environmental regulations and participated in legal complaints (Orta-Martínez & Finer, 2010; Orta-Martinez et al., 2018a, b, forthcoming).

In all three cases, local groups did not get carried away by the dominant techno-scientific language (Yearley, 1992) but they did learn technical language in order to defend their newly coproduced knowledge and back up their claims for environmental justice.

22.3 Conclusion

Affected communities that engage in alliances with scientists are empowered through the coproduction of new scientific knowledge with which they get more visibility and can challenge the data and discourses used by the companies or state agencies to promote the expansion of the extractive frontier. We want to highlight that their empowerment is also a result of a process of mutual enrichment between local groups and the scientists in terms of knowledge shared. This includes new tools, skills (such as the appropriation of the techno-scientific language), and strategies as well as cultural and place-based knowledges – that many times can be reinforced by friendship and long-term relationships. It is not only the newly produced knowledge that matters but the way it is produced and the dynamics generated.

Although not the scope of this chapter, it is important to pay attention to power differences in these alliances many times related to colonial structures of scientific knowledge production and domination. These alliances might impose scientific knowledge over cultural or local knowledges that can translate in the imposition of certain narratives and demands. Thus, it is important to acknowledge that local knowledge and local demands must be key drivers not only in the coproduction of new scientific knowledge but also in the design of strategies of resistance by local groups. In this regard, AMS has to be understood (and used) as part of a myriad of languages and strategies (Aydin et al., 2017) when confronting wrongdoings of companies and the state, or contesting unwanted projects, in order to achieve changes in decision-making power relations.

References

Arsel, M., Hogenboom, B., & Pellegrini, L. (2016). The extractive imperative and the boom in environmental conflicts at the end of the progressive cycle in Latin America. *The Extractive Industries and Society, 3*(4), 877–879.

Aydin, C. I., Ozkaynak, B., Rodríguez-Labajos, B., & Yenilmez, T. (2017). Network effects in environmental justice struggles: An investigation of conflicts between mining companies and civil society organizations from a network perspective. *PLoS ONE, 12*(7), e0180494.

Bäckstrand, K. (2003). Civic science for sustainability: Reframing the role of experts, policy-makers and citizens in environmental governance. *Global Environmental Politics, 3*, 24–41.

Barnes, B. (1977). *Interests and the growth of knowledge*. Routledge.

Brown, P. (1992). Popular epidemiology and toxic waste contamination: Lay and professional ways of knowing. *Journal of Health and Social Behavior*, 267–281.

Cartró-Sabaté, M., Mayor, P., Orta-Martínez, M., & Rosell-Melé, A. (2019). Anthropogenic lead in Amazonian wildlife. *Nature Sustainability, 2*(8), 702–709. https://doi.org/10.1038/s41893-019-0338-7

Chareyron, B. (2014). *Radiological impact of Rössing Rio Tinto mine* (EJOLT report).

Conde, M. (2014). Activism mobilising science. *Ecological Economics, 105*, 67–77.

Conde, M. (2015). From activism to science and from science to activism in environmental-health justice conflicts. *Journal of Science Communication, 14*(2), C04.

Conde, M. (2017). Resistance to mining. A review. *Ecological Economics, 132*, 80–90.

Conde, M., & Walter, M. (2022). Knowledge co-production in scientific and activist alliances: Unsettling coloniality. *Engaging Science, Technology, and Society, 8*(1), 150–170.

Cooke, B., & Kothari, U. (2001). *Participation: The new tyranny?* Zed Books.

Corburn, J. (2005). *Street science*. MIT Press.

CRIIRAD. (2008). *AREVA : Du discours à la réalité/L'exemple des mines d'uranium du Niger* (Note CRIIRAD 08-02).

CRIIRAD. (2009). *Radiation contamination found in 2009 on the former uranium mining site COMUF – AREVA Mounana (GABON)* (Note CRIIRAD No. 09-118)

DIGESA. (2006). *Evaluación de resultados del monitoreo del río Corrientes y toma de muestras biológicas, en la intervención realizada del 29 de junio al 15 de julio del 2005 Informe No-2006/DEPA-APRHI/DIGESA*. Dirección General de Salud Ambiental (Ministerio de Salud).

Foucault, M. (1971). *The order of things: An archaeology of the human sciences*. Pantheon Books.

Funtowicz, S., & Ravetz, J. (1993). Science for a post-normal age. *Futures, 25*, 735–755.

Hecht, G. (2012). *Being nuclear: Africans and the global uranium trade*. MIT Press.

Irwin, A. (1995). *Citizen science: A study of people, expertise and sustainable development*. Psychology Press.

Jasanoff, S. (Ed.). (2004). *States of knowledge: The co-production of science and the social order*. Routledge.

Keck, M., & Sikkink, K. (1998). *Activists beyond borders*. Cornell University Press.

Kohrs, B. (2008). *Uranium, a blessing or a curse? What you need to know about the uranium industry in Namibia*. Earthlife Namibia. Accessed last 3rd January 2023 at https://www.somo.nl/uranium-a-blessing-or-a-curse/

Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K. H., Haberl, H., & Fischer-Kowalski, M. (2009). Growth in global materials use: GDP and population during the 20th century. *Ecological Economics, 68*, 2696–2705.

Martinez Alier, J., Kallis, G., Veuthey, S., Walter, M., & Temper, L. (2010). Social metabolism, ecological distribution conflicts, and valuation languages. *Ecological Economics, 70*(2), 153–158.

Martinez Alier, J., Anguelovski, I., Bond, P., Del Bene, D., Demaria, F., Gerber, J.-F., Greyl, L., Haas, W., Healy, H., Marín-Burgos, V., Ojo, G., Firpo Porto, M., Rijnhout, L., Rodríguez-Labajos, B., Spangenberg, J., Temper, L., Warlenius, R., & Yánez, I. (2014). Between activism and science: Grassroots concepts for sustainability coined by Environmental Justice Organizations. *Journal of Political Ecology, 21*, 19–60.

Martinez-Alier, J. (2003). *The environmentalism of the poor: A study of ecological conflicts and valuation*. Edward Elgar Publishing.

Martinez-Alier, J. (2021). Mapping ecological distribution conflicts: The EJAtlas. *The Extractive Industries and Society*.

Martínez-Alier, J., Healy, H., Temper, L., Walter, M., Rodriguez-Labajos, B., Gerber, J. F., & Conde, M. (2011). Between science and activism: Learning and teaching ecological economics with environmental justice organisations. *Local Environment, 16*(1), 17–36.

Martinez-Alier, J., Temper, L., Del Bene, D., & Scheidel, A. (2016). Is there a global environmental justice movement? *The Journal of Peasant Studies, 43*(3), 731–755.

McCormick, S. (2009). *Mobilizing science: Movements, participation, and the remaking of knowledge*. Temple University Press.

Minkler, M., & Wallerstein, N. (Eds.). (2003). *Community based participatory research for health*. Jossey-Bass.

Moore, J. W. (2016). *The rise of cheap nature*. PM Press.

Nixon, R. (2011). *Slow violence and the environmentalism of the poor*. Harvard University Press.

O'Callaghan-Gordo, C., Flores, J. A., Lizárraga, P., Okamoto, T., Papoulias, D. M., Barclay, F., Orta-Martínez, M., Kogevinas, M., & Astete, J. (2018). Oil extraction in the Amazon basin and exposure to metals in indigenous populations. *Environmental Research, 162*, 226–230. https://doi.org/10.1016/j.envres.2018.01.013

Orta-Martínez, M. (2010). *Oil frontiers in the Peruvian Amazon. Impacts of oil extraction for the Achuar of Río Corrientes*. Doctoral thesis. Institut de Ciència i Tecnologia Ambiental (ICTA), Universitat Autònoma de Barcelona.

Orta-Martínez, M., & Finer, M. (2010). Oil frontiers and indigenous resistance in the Peruvian Amazon. *Ecological Economics, 70*(2), 207–218. http://www.sciencedirect.com/science/article/B6VDY-50BDHV3-2/2/13d7fe721d29275f14ca0b85442c538d

Orta-Martinez, M., Napolitano, D. A., MacLennan, G. J., O'Callaghan, C., Ciborowski, S., & Fabregas, X. (2007). Impacts of petroleum activities for the Achuar people of the Peruvian Amazon: Summary of existing evidence and research gaps. *Environmental Research Letters, 2*(4), 45006. http://stacks.iop.org/1748-9326/2/045006

Orta-Martínez, M., Pellegrini, L., & Arsel, M. (2018a). The squeaky wheel gets the grease? The conflict imperative and the slow fight against environmental injustice in northern Peruvian Amazon. *Ecology and Society, 23*(3), art7. https://doi.org/10.5751/ES-10098-230307

Orta-Martínez, M., Rosell-Melé, A., Cartró-Sabaté, M., O'Callaghan-Gordo, C., Moraleda-Cibrián, N., & Mayor, P. (2018b). First evidences of Amazonian wildlife feeding on petroleum-contaminated soils: A new exposure route to petrogenic compounds? *Environmental Research, 160*, 514–517. https://doi.org/10.1016/j.envres.2017.10.009

Orta-Martínez, M., Arsel, M., Pellegrini, L., & Mena, C. (forthcoming). *Barriers to redress of environmental harm from oil extraction in the Amazon*.

Rosell-Melé, A., Moraleda-Cibrián, N., Cartró-Sabaté, M., Colomer-Ventura, F., Mayor, P., & Orta-Martínez, M. (2018). Oil pollution in soils and sediments from the Northern Peruvian Amazon. *Science of the Total Environment, 610–611*, 1010–1019. https://doi.org/10.1016/J.SCITOTENV.2017.07.208

San Sebastián, M., & Hurtig, A. K. (2005). Oil development and health in the Amazon basin of Ecuador: The popular epidemiology process. *Social Science & Medicine, 60*(4), 799–807.

Schaffartzik, A., Mayer, A., Gingrich, S., Eisenmenger, N., Loy, C., & Krausmann, F. (2014). The global metabolic transition: Regional patterns and trends of global material flows, 1950–2010. *Global Environmental Change, 26*, 87–97.

Shepard, P. M. (2002). Advancing environmental justice through community-based participatory research. *Environmental Health Perspectives, 110*, 139.

Shindondola-Mote, H., (2008). *Uranium mining in Namibia. The mystery behind 'low level radiation'*. Labour Resources and Research Institute (LaRRI).

Topçu, S. (2008). Confronting nuclear risks: counter-expertise as politics within the French nuclear energy debate. *Nature and Culture, 3*, 225–245.

Yearley, S. (1992). Green ambivalence about science: Legal–rational authority and the scientific legitimation of a social movement. *The British Journal of Sociology*, 511–532.

Yusta-García, R., Orta-Martínez, M., Mayor, P., González-Crespo, C., & Rosell-Melé, A. (2017). Water contamination from oil extraction activities in Northern Peruvian Amazonian rivers. *Environmental Pollution, 225*, 370–380. https://doi.org/10.1016/J.ENVPOL.2017.02.063