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Oil, gas, and mineral industry role in rangeland restoration: a systematic review

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Abstract

The rapid expansion of unconventional oil and gas development in the oil-gas-mineral (OGM) states has been controversial because of numerous environmental and social impacts. OGM industries have existed on rangelands for many years with various impacts depending upon the scope of operations and level of professional management (Walsh and Rose 2022; Allred et al. 2015; Chomphosy et al. 2021). In the last decades, energy production has become the largest user of rangelands in several parts of the OGM produced countries, occupying large areas and becoming the largest driver of land-use change (Kreuter et al. 2016). Although emerging energy resources, such as wind and solar, are growing rapidly due to the new advanced technologies, fossil fuel production continues and is predicted to expand in the future (Covert et al. 2016). This will have significant increases in damages to rangelands in terms of reduction of biodiversity, loses in vegetation, increase in carbon emissions, disruption on the natural ecological process, reduction and contamination of ground water, and decrease on the ecosystem services – the potential benefits that natural rangelands provide to humanity.

In the frame of STELARR (Sustainable Investments for Large-scale Rangeland Restoration) project, this paper aims to give a comprehensive overview on the role this industry could play on rangeland restoration in the West Asia and Middle East (WAME) region and what is expected from it in terms of sustainable business practices and what roles the OGM countries-governments are to play given that are currently confronted by overlapping rangeland-oriented demands from ecologists and industry.

Introduction

OGM industries have existed on rangelands for many years with various impacts depending on the scope of operations and level of professional management (Walsh and Rose 2022; Allred et al. 2015; Chomphosy et al. 2021). Advanced technology has stimulated growth in mineral, oil and gas development, not only in the number of wells, but also in the size of operations around the oil, gas and mining countries. In the last decades, energy production has become the largest user of rangelands in several parts of the oil and gas-producing countries, occupying large areas and becoming the largest driver of land-use change (Kreuter et al. 2016; Holechek et al. 2015; Moran et al. 2017; Covert et al. 2016; Hosseini and Shakouri 2016). Although emerging energy resources, such as wind and solar, are growing rapidly due to new advanced technologies, fossil fuel production continues and is predicted to expand (Covert et al. 2016; Hosseini and Shakouri 2016). This review aims to give a comprehensive overview on the industrial foundation of oil and gas and looks at what is expected from this industry

in terms of sustainable business practices and focuses on how rangeland restoration can be an economic and environmentally friendly investment opportunity that the oil and gas sector should investigate.

Methods

The proposed method is a two-stage process analysis relying on quantitative and qualitative data. First, we used a quantitative framework developed by Derek (2024, *pers.comment*), to identify the potential value chains for potential investment in rangeland rehabilitation in the WAME region. The selection process was based on specific factors such as: (1) Availability of inputs and production capacity in the target regions/countries; (2) Existing market demand and growth potential; and (3) Diversification in the use of the final product. The results emerging from this framework regarding the oil, gas, and minerals value chain are displayed in Table 1.

Table 1. Oil, gas, and minerals value chain characteristics for rangeland products

Value Chain	**Oil, Gas, and Minerals (OGM)**
Main product and application	Minerals, oil, gas, oil by-products (i.e. derivates, etc.)
Location	Gulf Cooperation Council countries
WAME largest producer/target	Saudi Arabia

Source: Adapted from Derek (2024, pers.comment).

In the second step, we used qualitative data based on various published and unpublished sources. The data was analysed to provide an overview of the oil and gas industry including its main actors, the key challenges facing this industry and its impact on the environment. In addition, a comprehensive analysis on the potential rangeland restoration investment and support opportunities for the oil and gas industry was conducted.

Results

The oil and gas industry plays a central role in the global economy, constituting 3.8% of the world's Gross Domestic Product (GDP). The United States of America, Saudi Arabia and Russia are the largest producers and exporters of crude oil and gas worldwide. These three nations have a combined total of 43% of the market relative to the world figure in 2022, with production levels standing at 43.3 million barrels a day (MDD Forensic Accountants, 2023). Most rising economies such as the BRICS nations (Brazil, Russia, India, China and South Africa) have accelerated the escalating demand for oil and gas production. In 2022, BRICS members accounted for 25.8% of total world GDP, while the G7 nations held 51.9%. (Energy Information Administration 2023; IMF 2021). In 2023, the oil and gas industry employed over 41 million people worldwide (IEA 2022).

Numerous organizations play crucial roles in forming policies, standards and practices within the oil and gas sector. The International Energy Agency (IEA) delivers data, analysis and recommendations for reliable, affordable and clean energy to its member nations and beyond (Esu and Sindico 2016). OPEC, or the Organization of the Petroleum Exporting Countries, is committed to stabilizing prices by coordinating oil policies among member states (Heath-Brown 2015). Also known as API, the American Petroleum Institute is a standardization body for operational and environmental safety in both the oil and gas sectors (Miller 2014). The International Association of Oil and Gas Producers serves as a global voice for the upstream oil and gas industry, advocating for sound regulatory practices and sustainable operations, as stated on their website (iogp.org) (Threadgold 2018). The World Bank's Oil, Gas and Mining Policy Division offers economic and technical support to developing nations to help them develop their mineral, gas and oil industry in effective and sustainable ways (Toussaint 2023). These companies have made several commitments concerning the environment and society, aiming to reduce emissions and invest in renewable energy projects as well as supporting local development schemes (Al-Fattah 2013; Victor 2013). Sometimes, these efforts have been criticized by environmental activists and researchers as greenwashing and insufficient to mitigate the industry's substantial environmental and social impacts (Parafiniuk and Smith 2019).

Discussion

Possible rangeland restoration investment and support opportunities for the oil and gas industry

The oil and gas sector does not consider rangelands as raw material sources. Nonetheless, its accompanying activities influence local communities and ecosystems, especially in regions with delicate environments or native populations. It is imperative that responsible development practices, stakeholder engagement and environmental protection measures are employed in mitigating these impacts and ensuring social licence to industry officers (Elijah et al. 2021; Ruble 2019). Oil and gas firms invest in restoring land in several ways. Economic benefits of capping and remediating abandoned wells include eliminating pollution. In the past, all lands lying around shut-in wells in the Lower 48 states of America were rehabilitated for approximately US$7 billion. Research shows that reviving unused oil or gas land may have greater economic returns if there is enough crop yield from such areas, if we consider carbon-sequestration efforts and general improvement in environmental quality services. The industry could further evaluate these potential returns to justify investments in rangeland restoration (Moran and McClung 2021).

Mobilizing private sector funding for rangeland restoration: The STELARR project approach

The STELARR project (ILRI, 2024) is intended to reverse rangeland degradation and impact productivity through sustainable livestock value chains that benefit pastoralists and other land users globally. As the project engages with livestock value chain actors, particularly the private sector, it promotes sustainable practices and incentives for investment in rangeland restoration. The project encourages businesses to allocate a portion of their profits toward restoring degraded rangelands through a rangeland's stewardship scheme, which includes a certification standard that rewards sustainability efforts. Companies that meet the highest criteria for restoration investments receive Platinum-level recognition, providing a market-driven solution to rangeland degradation. A key component of STELARR is the development of a global rangelands monitoring system and data platform. This system consolidates datasets into an interactive platform, offering data on rangeland health, trends, and educational resources for policymakers, researchers, and pastoralists]. The platform ensures transparent monitoring and compliance, guiding decision-making and promoting sustainable management practices. It is designed to facilitate the adoption of globally recognized monitoring frameworks for rangeland stewardship and restoration. Capacity building is also central to STELARR's approach, providing support for value chain actors to implement monitoring systems and improve sustainability practices. By aligning its efforts with international initiatives such as the Land Degradation Neutrality targets and the UN Decade on Ecosystem Restoration, STELARR highlights the critical role of collaborative governance and private-sector engagement. It addresses the intricacies of rangeland governance and improves pastoral livelihoods. It will serve as a good example for all future interventions toward demonstrating how such sustainable value chains for livestock can steer economic development and ecological restoration to help in enhancing long-term resilience at the global scales of rangeland systems.

Conclusions and future directions

OGM development significantly impacts rangelands in the West Asia and Middle East (WAME), affecting pastoral livelihoods and ecosystems. The STELARR project explores investment opportunities for rangeland restoration to benefit pastoral communities and promoting sustainable rangeland management, including specific actions to mitigate OGM-related challenges and enhance the resilience of pastoral systems. The review provides some avenues on how rangeland restoration can be a viable investment for the oil and gas sector, aligning economic development with environmental sustainability and improved livelihoods for pastoralists. This initiative would potentially contribute sustain the transformed rangeland system, also raising the chances for successful environmental outcomes.

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