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Water, Agriculture, and Power: Reframing the Nation State in the Arabian Gulf through Political Ecology

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Recent scholarship on the political ecology of the Arabian Gulf has challenged prevailing understandings of nation-state formation and the construction of national identity by repositioning the environment as a central driver of social and political change. This article provides an overview of this emerging body of work and examines how it sheds light on the dynamics of state formation, nationalism, and political power in the Gulf. In contrast to earlier studies that approached the region's environment primarily through archaeological, technical, or economic lenses, focusing on issues such as water scarcity and management, sustainability initiatives, and the development of agriculture as an economic sector, political ecology explores the dynamic interplay between environmental transformation and socio-political processes, viewing each as constitutive of the other. By demonstrating how environmental practices, resources, and narratives are integral to the production of state authority, territoriality, and national belonging, this literature frames the environment as an active force in shaping political dynamics rather than merely the context within which they unfold. The article argues that this perspective offers important insights for rethinking prevailing paradigms of state power by moving beyond narrow institutional accounts of governance and state development to consider the role of environmental relations in the construction of modern sovereign nation-states. The review concludes by identifying key directions for future research.

Keywords: *environment, state, Arabian Gulf, political ecology, resource governance*

Introduction

Scholarship on the environmental history of the Arabian Gulf has grown considerably over the past two decades, addressing various issues related to agricultural development and the management and use of water resources. A sizeable body of this work explores the technical dimensions of land and water use, preoccupied with measuring, modelling, and mitigating water scarcity and agricultural stress. While this work sheds light on the physical and policy-related dimensions of water and agricultural practices and projects, it does not critically examine land and water management as historical, social, and political phenomenon. An emerging body of literature, however, focuses on the political ecology of the region, assessing who benefits from particular resource arrangements, and how

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environmental change intersects with broader transformations in state power, social structure, and economic organization.

This paper offers an analytical overview of the literature on environmental change in the Gulf, with specific attention to the development of agricultural and water resources. It traces the evolution of the field from an early phase dominated by archaeological and technical approaches, in which the environment was treated largely as background context, to more recent scholarship that applies political economy frameworks to oil-driven transformations in agriculture and water management, and to studies exploring the intersections of national identity, environmental discourse, and resource governance. The emerging research rests on a premise that the environment is more than just a biophysical setting; it is an object of governance whereby natural resources are measured, extracted, distributed, and manufactured. This relationship is fundamentally political because it entails decisions about who controls access and for what purposes, and it shapes power relations among states, corporations, technical experts, and local communities in which the state is a leading but not a unitary actor.[1] In line with how Whitehead et al. theorize the relationship between the environment and the state, this paper approaches resource governance as a process through which nation-states are constituted, rather than merely as a discrete policy or economic domain.[2] It identifies three interrelated dimensions of this process: the development of state capacity and consolidation of territorial authority; the production and reproduction of national identity; and the assertion and exercise of political sovereignty. Across these dimensions, resource governance becomes a means through which states commodify resources, extend authority over weakly integrated territories, foster nationalist sentiment through visible symbols, address food-security concerns, and engage in climate diplomacy.

The paper examines how political ecology research in the context of the Arabian Gulf sheds new light on the role of nation states by recognizing that environmental change is inseparable from power relations, economic systems, and social transformation. This approach offers an alternative to dominant frameworks of state power in the Gulf, specifically paradigms with a more institutional focus. The paper concludes with suggestions for future research.

Archaeological, Economic, and Technocratic Approaches to Agriculture and Water Development

Existing research on environmental and agricultural history in the Arabian Peninsula has largely concentrated on prehistoric periods, with a strong reliance on archaeological and geological evidence.[3] Even within this body of work, however,

[1]Raymond L. Bryant and Sinead Bailey, *Third World Political Ecology* (London and New York: Routledge, 1997).

[2]Mark Whitehead, Rhys Jones, and Martin Jones, *The Nature of the State: Excavating the Political Ecologies of the Modern State* (Oxford: Oxford University Press, 2007).

[3]Stefan Siebert, Jutta Häser, Maher Nagieb, Lorenz Korn, and Andreas Buerkert, "Agricultural, architectural and archaeological evidence for the role and ecological adaptation of a scattered mountain oasis in Oman," *Journal of Arid Environments* 62 (2005): 177-197, https://doi.org/10.1016/j.jaridenv.2004.09.023; Peter Magee, "Beyond the Desert and the Sown: Settlement

scholars have noted that Arabia is often marginalized in studies of western Asia, partly due to prevailing assumptions that the development and renewal of arid environments depend on external intervention.[4] There are, however, some descriptive accounts of traditional farming practices in the region. Frauke Heard-Bey's work, for example, details the diverse geography of the Trucial States, types of crops grown by local populations, and the role of tribes in managing land and water resources.[5] In addition, a body of scholarship on Islam and the environment occasionally references early Islamic Arabia, for instance in discussions of *hima* (reserved pasture).[6] Finally, some research addresses contemporary environmental challenges in the region, especially issues related to sustainability, pasture and forage management, water scarcity, land use, environmental policies, and proposed strategies to mitigate the impacts of development.[7] By and large, the environmental history of the Arabian Gulf during the modern, pre-statehood period remains largely understudied.

Twentieth-century agricultural development initiatives and water scarcity in the GCC have been widely studied. The literature on Gulf economic development and urbanization, for instance, underscores the expansion of the agricultural sector after the 1970s, yet it rarely engages with the political dynamics that shaped this growth

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Intensification in Late Prehistoric Southeastern Arabia," *Bulletin of the American Schools of Oriental Research* 347 (2007): 83-105; Peter Magee, Hans-Peter Uerpmann, Margaret Uerpmann, Sabah A. Jasim, Marc Handel, Donald C. Barber, Crystal Fritz, and Emily Hammer, "Multi-disciplinary research on the past human ecology of the east Arabian coast: excavations at Hamriya and Tell Abraq (Emirate of Sharjah, United Arab Emirates)," *Arabian Archaeology & Epigraphy* 20 (2009): 18-29; and Margareta Tengberg, "Beginnings and early history of date palm garden cultivation in the Middle East," *Journal of Arid Environments* 86 (2012): 139-147, https://doi.org/10.1016/j.jaridenv.2011.11.022.

[4]Magee, "Beyond the Desert and the Sown."

[5]Frauke Heard-Bey, "The Tribal Society of the UAE and its Traditional Economy," in *United Arab Emirates: A New Perspective*, eds. Ibrahim Al Abed and Peter Hellyer (London: Trident Press Ltd, 2001), 103, 108-13. See also Heard-Bey, *From Trucial States to United Arab Emirates: A Society in Transition* (Dubai; Abu Dhabi; London: Motivate Publishing, 2004), 26, 34, 45, 121-22, 179-80, 205, 225-26, 235-6. For more on date gardens, see Waite R. Osterkamp, L.J. Lane, and C.M. Menges, "Techniques of groundwater recharge estimates in arid/ semi-arid areas, with examples from Abu Dhabi," *Journal of Arid Environments* 31, no.3 (1995): 349-369, https://doi.org/10.1016/S0140-1963(05)80038-2.

[6]Abubakr Ahmed Bagader, Abdullatif Tawfik El-Chirazi El-Sabbagh, Mohamad As-Sayyid Al-Glayand, Mawil Yousuf Izzi-Deen Samarrai, & Othman Abd-ar-Rahman Llewellyn, *Environmental Protection in Islam*, Environmental Policy and Law Paper No. 20. (Gland, Switzerland and Cambridge: IUCN, 1994); and Richard C. Foltz, Frederick M. Denny, and Azizan Baharuddin (eds.), *Islam and Ecology: A Bestowed Trust* (Cambridge: Harvard University Press, 2003).

[7]Mohammed Abdullah Eben Saleh, "Land Use and Planning of Vernacular Landscape in Highlands of the Southwest of Saudi Arabia," *Journal of Sustainable Forestry* 7, no. 3-4 (1998): 53-76, https://doi.org/10.1300/J091v07n03_04; Saud Al-Rowaily, "Rangeland of Saudi Arabia, Tragedy of Commons," *Rangelands* 21, no. 3 (1999): 27-9; Safei-Eldin A.Hamed, "Capacity Building for Sustainable Development: The Dilemma of Islamization of Environmental Institutions," In *Islam and Ecology*, 403-21; David J. Gallacher & Jeffrey P. Hill, "Intensification of rangeland grazing in an oil-rich state; causes, consequences and possible solutions," *Dubai Desert Conservation Reserve*, https://www.ddcr.org/media/lexicjw0/intensification_of_rangeland_grazing_in_an_oil-rich_state.pdf [January 2008]; and Andrew Gardner & Brigitte Howarth "Urbanisation in the United Arab Emirates: The challenges for ecological mitigation in a rapidly developing country," *BioRisk* 3 (2009): 27-38, https://doi.org/10.3897/biorisk.3.18.

beyond considerations of food security and improved living standards.[8] According to the rentier state paradigm, oil revenues flowing into Gulf economies furnished emerging states with the financial means to secure social and political support from indigenous populations through wealth redistribution. In return, the state remained relatively insulated from societal pressures.[9] While oil revenues are essential to understanding the rise of capitalism in the Gulf and, more specifically, the development of land and water resources, it is important to recognize that the development of these resources began before the influx of oil revenues and was in several respects integral to oil exploration efforts pre-statehood. Moreover, the continued development of agriculture in the post-statehood period cannot be explained solely in economic terms but must also be understood in the context of broader social and political motivations.

Scholars have addressed the ramifications of agricultural expansion on water resources. GCC countries collectively have one of the highest per capita consumption rates of water in the world. Groundwater, predominantly non-renewable, has been extracted at rates that have jeopardized both the quantity and quality of aquifer resources across the peninsula.[10] The hydrogeological work of Mohamed et al. uses environmental isotopes to reconstruct the origins, ages, and recharge patterns of groundwater across the GCC. The isotopic evidence establishes that most exploitable groundwater in the Arabian Peninsula was recharged during wetter Pleistocene and early Holocene periods and is now being extracted at rates faster than any plausible natural recharge. As a finite resource that is not being managed sustainably, water use carries potentially far-reaching consequences for agricultural and social sustainability.[11]

Indeed, the consequences for agriculture are well documented. Al-Rawahi and colleagues' study of Oman's mountain oases shows field crop areas collapsing from 32.4 to 20.5 percent of total terrace area between 2007 and 2009 in Ash Sharayjah, with some oases like Masayrat ceasing arable production completely, as urban water infrastructure drew from the same depleted aquifers that had sustained traditional agriculture.[12] Alodah's study of water resources in Saudi Arabia highlights how water consumption in agriculture remains high. Between the 1970s-1990s agriculture expanded in Saudi Arabia considerably as part of government development initiatives. By 2008, in response to the increasing depletion of nonrenewable

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[8]See for instance S.N. Rizvi, "From Tents to high Rise: Economic Development of the United Arab Emirates," *Middle Eastern Studies* 29, no. 4 (1993): 664; and Mohamed Shihab, "Economic Development in the UAE," in *United Arab Emirates: A New Perspective,* ed. Ibrahim Al Abed and Peter Hellyer (London: Trident Press Ltd, 2001): 249-59.

[9]Kristian Coates Ulrichsen, "The Political Economy of Arab Gulf States," James A. Baker III Institute for Public Policy, Rice University, 8 May 2015, https://www.bakerinstitute.org/research/political-economy-arab-gulf-states (accessed June 24, 2026), 20.

[10]Mohsen Sherif, Muhammad U. Liaqat, Faisal Baig, Mohammad Al-Rashed, "Water Resources Availability, Sustainability and Challenges in the GCC Countries: An Overview," *Heliyon* 9, no. 10 (2023), https://doi.org/10.1016/j.heliyon.2023.e20543.

[11]Mohamed M. Mohamed, S. Parimalarenganayaki, Qasim Khan, Ahmed Murad, "Review on the Use of Environmental Isotopes for Groundwater Recharge and Evaporation Studies in the GCC Countries," *Groundwater for Sustainable Development* 12 (2021): 100546, https://doi.org/10.1016/j.gsd.2021.100546.

[12]Mohamed Nasser Al-Rawahi, Katja Brinkmann, Eva Schlecht, Andreas Buerkert, "Effects of Changing Water Availability on Land Use in Irrigated Mountain Oases of Al Jabal Al Akhdar, Northern Oman," *Die Erde* 145, no.4 (2014): 197-211, https://doi.org/10.12854/ERDE-145-18.

groundwater resources, the government introduced policies to scale back agricultural production, particularly the cultivation of water intensive crops. Nonetheless, as of 2021, agriculture still consumed approximately 80% of water demand, including renewable, nonrenewable, and treated wastewater.[13] According to Alotaibi et al, in the case of Saudi Arabia, even modest improvements in agricultural water efficiency or substitution of fossil groundwater with treated effluent could significantly extend the viability of the current system. [14]

Other scholars have also addressed the science behind water use and development in the Gulf, highlighting the environmental costs and possibilities for more efficient use of water resources.[15] This literature treats scarcity as a natural condition to be mitigated through development and technology. Approaching the issue from a technical perspective, such works rarely examine how agricultural policies that have promoted water-intensive crops in hyper-arid environments are the byproduct of socio-political realities that go beyond, for instance, food security or self-sufficiency. While the costs and technical complexities of such projects are recognized, the gap between technical possibilities and their actual implementation is not thoroughly addressed. Beyond purely technical factors, the historiographical significance of desalination or treated wastewater is significant. By redefining water as a manufactured commodity rather than a naturally occurring resource, Gulf states have transformed the political economy of water access. Water has become a product generated through energy inputs, capital investment, and industrial infrastructure, controlled and distributed by the state rather than accessed through traditional water rights or governed by seasonal rainfall.

The archaeological, scientific, and development literature on water and agriculture has shed light on the technical dimensions of water use and scarcity and the development of agriculture over time as an economic sector. There are some archaeological works, however, that have gone beyond this to analyze human-environment interactions in the Gulf, providing insight into the socio-political dynamics that impacted the management of natural resources in the ancient world. Geoarchaeological work at the Masafi oasis in the Fujairah Emirate (United Arab Emirates) demonstrates that the region's arid conditions were not simply a natural backdrop to human settlement, but the byproduct of long-term interactions between climate, hydrology, and human management. By integrating sediment analysis, radiocarbon dating, and spatial reconstruction of ancient hydraulic features, Purdue et

[13]Abdullah Alodah, "Towards Sustainable Water Resources Management Considering Climate Change in the Case of Saudi Arabia," *Sustainability* 15, no. 20 (2023): 14674, p. 9, https://doi.org/10.3390/su152014674.

[14]Bader Alhafi Alotaibi, Mirza Barjees Baig, Mohamed M. M. Najim, Ashfaq Ahmad Shah, and Yosef A. Alamri, "Water Scarcity Management to Ensure Food Scarcity through Sustainable Water Resources Management in Saudi Arabia," *Sustainability* 15, no. 13 (2023): 10648, https://doi.org/10.3390/su151310648.

[15]Benyamin Bordbar, Arash Khosravi, Ali Ahmadi Orkomi, and Mohammad Peydayesh, "Life Cycle Assessment of Hybrid Nanofiltration Desalination Plants in the Persian Gulf," *Membranes* 12, no. 5 (2022): 467, https://doi.org/10.3390/membranes12050467; Zohor S.G. Ali, I.M. Abdul Hameed, M.M. Al-Fiqi, "Environmental Impacts of Seawater Desalination Technologies in the Gulf States: A Review," *Zagazig Journal of Agricultural Research* 51, no. 5 (2024): 1001–1019, https://doi.org/10.21608/zjar.2024.391949; and Sherif et al., "Water Resources Availability, Sustainability and Challenges in the GCC Countries."

al. demonstrate that oasis agriculture in southeast Arabia has been practiced, disrupted, and reconstructed across roughly 3,250 years, with alternating phases of intensive water management and episodes of fluvial disruption driven by hydroclimatic shifts. The conclusion is that the oasis was not a natural feature but an artefact and continuously maintained landscape, shaped by humans and dependent upon labor, knowledge, and institutional capacity as much as on rainfall.[16]

Charbonnier et al.'s study of Iron Age hydraulic infrastructure at the same site pushed this argument further back in time, demonstrating that pre-modern water management was significantly more technically advanced than previously assumed. Falaj-based irrigation systems, check dams, and field terraces represented substantial capital investment and are evidence of social institutions capable of coordinating collective labor and maintaining shared infrastructure across generations. Charbonnier et al.'s work challenges modernization narratives by showing that the capacity to manage water in arid environments was not introduced by oil-era development but was an indigenous achievement with a long history, one that oil wealth subsequently disrupted as much as it extended.[17]

Finally, the recent works of Abdullah Saif Al-Ghafri et al. and Timothy Power seek to integrate archaeological, historical, and contemporary environmental perspectives in the study of human–environment dynamics. [18] Power explores how, throughout history, interactions between humans and the environment in the United Arab Emirates (UAE) have been largely shaped by economic factors, requiring communities to adapt their subsistence strategies across diverse ecological zones. In doing so, he demonstrates that local populations, from ancient to modern times, have long played an active role in managing natural resources.

Similarly, Al-Ghafri et al. argue that the *falaj* system is more than a mere irrigation technique; it represents a sustained form of human engagement with the environment. Through this system, local communities have accumulated generations of knowledge on how to manage water resources sustainably and efficiently, thereby strengthening their resilience. By classifying the *falaj* as 'indigenous heritage,' the authors contend that the social and technical expertise developed through centuries of its construction and maintenance should be harnessed to address contemporary challenges such as climate change and environmental degradation.

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[16]Louise Purdue, Charbonnier J, Régagnon E, Calastrenc, C, Sagory, T. et.al., "Geoarchaeology of Holocene Oasis Formation, Hydro-Agricultural Management and Climate Change in Masafi, Southeast Arabia (UAE)," *Quaternary Research* 92, no. 1 (2019): 109–132, https://doi.org/10.1017/qua.2018.142.

[17]Julien Charbonnier, Louise Purdue, Carine Calastrenc, Emmanuelle Régagnon, Thomas Sagory, Anne Benoist, "Ancient Agricultural Landscapes in Southeast Arabia: Approach and First Results of an Archaeological, Geo-Archaeological, and Spatial Study of the Masāfī Palm Grove, Emirate of Fujairah," *Proceedings of Water and Life in Arabia Conference, 14th - 16th December*, Dec 2014, Abu Dhabi, United Arab Emirates. https://shs.hal.science/halshs-01792812.

[18]Abdullah Saif Al-Ghafri, Majid Labbaf Khaneiki, and Nasser A. Al Saqri, "Falaj Indigenous Knowledge in Oman and Iran," *AlterNative: An International Journal of Indigenous Peoples* 19, no. 2 (2023): 484–494, https://doi.org/10.1177/11771801231168668; and Timothy Power, "Human– Environment Interactions in the United Arab Emirates: An Archaeological Perspective," in *A Natural History of the Emirates*, ed. J. A. Burt (Cham: Springer, 2024), 673-702, https://doi.org/10.1007/978-3-031-37397-8_22.

State Formation, National Identity, and Environmental Governance

State Capacity and Territorial Authority

Although still in its infancy, there is a growing body of scholarly work that explores the relationship between state power and environmental governance in the Gulf. This research sheds light on how political forces have impacted the physical environment and vice versa. In their capacity as leading social and environmental actors, states are not only driven by economic concerns, but also political and national concerns.[19] Scholars who have embraced this approach in the context of the Arabian Gulf region have positioned environmental governance at the center of state formation, power consolidation, nationalist discourse, and institution building. Hoffman's concept of 'social energy' provides a useful framework for understanding this dynamic. Advancing a 'geo-political ecology' approach to move beyond environmental determinism in analyses of the Middle East, Hoffman emphasizes that nature is socially produced while also demonstrating how geopolitical relations shape the processes through which that production occurs. His concept of 'social energy' conceives of water infrastructure, agricultural systems, and energy networks as not just mechanisms for the provision of 'public goods, such as food, water, shelter, health, and energy, but [as].. organically linked to the social project,' constituting and reconstituting the political order rather than simply serving it.[20]

Toby Jones's account of Saudi hydraulic state-building and my own work on the development of land and water resources in the UAE during the pre-statehood period demonstrate how environmental modernization functioned as a vehicle for state formation. Jones explores how the Saudi state in the early twentieth century forged its power by managing and controlling natural resources, including water and oil. Science and technology, via global networks of expertise, were key in harnessing these resources. Thus, the interplay between state institutions, multi-national corporations and engineering companies proved instrumental in reshaping Saudi society and the environmental landscape.[21] Saudi Arabia's agricultural expansion program, which reached its peak in the 1990s, made the kingdom a significant wheat exporter through massive fossil water extraction before being wound down as aquifer depletion became critical. This expansion was motivated by food security anxieties, rent distribution to rural elites, and Cold War-era concerns about self-sufficiency.

My research on oil-era agricultural transformation in the UAE explores the relationship between state formation, resource management, and national identity. The emergence of agriculture in the Trucial States (later UAE) should be understood not as an economic sector in the conventional sense but as a political project

[19]Bryant and Bailey, *Third World Political Ecology*, 56, 61.
[20]Clemens Hoffmann, "Environmental Determinism as Orientalism: The Geo-political Ecology of Crisis in the Middle East," *Journal of Historical Sociology* 31, no. 1 (2018): 101, https://doi.org/10.1111/johs.12194. See also Hoffmann, "Beyond the Resource Curse and Pipeline Conspiracies: Energy as a Social Relation in the Middle East," *Energy Research & Social Science* 41 (2018): 39–47, https://doi.org/10.1016/j.erss.2018.04.025.
[21]Toby Jones, *Desert Kingdom: How Oil and Water Forged Modern Saudi Arabia* (Cambridge: Harvard University Press, 2010).

underwritten by oil revenues and serving purposes of territorial integration, population management, and legitimacy production. The expansion of agricultural production over time was driven by oil revenues and functioned as a mechanism through which a newly consolidated state extended its reach into peripheral areas and integrated traditional populations into national developmental projects. The environmental consequences of this agricultural expansion have included massive fossil groundwater extraction, desert reclamation schemes, and the importation of water-intensive crops unsuited to arid conditions.[22]

Taken together, these studies demonstrate that environmental degradation in Gulf agriculture cannot be understood apart from the political economy of petro-state formation. Groundwater depletion, therefore, was in large part the outcome of agricultural policies driven by socio-political considerations. By this logic, the broader political and economic factors, rather than technical solutions alone, must be considered in addressing unsustainable agricultural water use.[23]

The Production and Reproduction of National Identity

Scholars have also examined the discursive dimensions of the relationship between environment and state authority, highlighting the interplay between sustainability rhetoric, resource governance, the political economy of states, and identity politics. Ouis's analysis of the 'greening of the Emirates' shows that UAE environmental development, including parks, nature reserves, and agricultural intensification, was as much a project of political legitimacy as ecological restoration. Through such initiatives, newly consolidated state power extended into landscape management, and national identity was partly constituted through a particular construction of modern nature. The importation of Western environmental technologies and concepts was motivated by local political needs, producing what Ouis terms a 'glocal' ecological modernization that simultaneously globalized environmental practice and embedded it in distinctively Emirati forms of national culture.[24]

Subsequent scholars explore how states and elites have invoked legible environmental symbols to reaffirm notions of collective belonging and national identity. Koch's work on falconry is a case in point. She demonstrates how the desert landscape, represented by the falcon and the hunt, is not merely a backdrop to Gulf nationalism but one of its primary symbolic media. Local elites have harnessed heritage discourse to construct an image of an ancestral Arab homeland shaped through notions of ethnicity and gender, legitimizing citizen-national claims to ownership of territory and state through a carefully curated relationship to the physical

[22]Sabrina Joseph, "Farming the Desert: Agriculture in the Oil Frontier, the Case of the United Arab Emirates, 1940s to 1990s," *British Journal of Middle Eastern Studies* 45, no. 5 (2018): 678–694, https://doi.org/10.1080/13530194.2017.1320977.

[23]This argument parallels Natalie Koch's analysis of 'spectacular forgetting' in Gulf agricultural technology. See Natalie Koch, "AgTech in Arabia: 'Spectacular Forgetting' and the Technopolitics of Greening the Desert," *Journal of Political Ecology* 26, no. 1 (2019): 666-686, https://doi.org/10.2458/v26i1.23507.

[24]Pernilla Ouis, "'Greening the Emirates': The Modern Construction of Nature in the United Arab Emirates," *Cultural Geographies* 9, no. 3 (2002): 334–347, https://doi.org/10.1191/1474474002eu252oa.

environment.[25] The desert is not just where Gulf nationals live; it is what makes them Gulf nationals.

Rico's analysis of 'heritage trees' in Qatar extends this framework into the domain of cultural memory and environmental anxiety. The designation of certain trees as heritage objects, with cultural and historical significance, reflects a mobilization of heritage rhetoric in response to the rapid and comprehensive transformation of Qatar's landscape under hydrocarbon-funded development. Symbolically, these trees embody anxieties about environmental loss and cultural discontinuity, while simultaneously lending legitimacy to state-directed conservation programs that might otherwise lack popular support. The significance of Rico's work lies in its attention to how environmental meaning is produced and contested, specifically how particular natural objects come to carry social and political significance.[26]

The environment can also function as a driver of territorial politics that mobilizes citizens to act in the national interest when confronted with a threat. In her work on Qatar, Monroe examines how, during the blockade, 'the intensification of local agricultural production forged a 'buy local' consumer culture that shaped, and was shaped by, nationalist sentiments.'[27] Agricultural landscapes, therefore, were producing political subjects.

The Assertion and Exercise of Political Sovereignty

Beyond mediating processes of state formation, legitimacy production, and national identity, environmental governance provides a means through which modern Gulf states assert and enact sovereign authority. Koch's work on the United Arab Emirates highlights how Emirati political elites leverage green nationalism to bolster the perceived status and legitimacy of the state. She argues that sustainability initiatives such as afforestation, nature reserves, green investment, COP28 hosting, are not merely policy responses to environmental pressure but instruments legitimating state power. The environment has become a technology of rule, not just a resource to be managed.[28]

Scholars have also exposed the tensions and contradictions embedded in state environmental projects. Koch's concept of 'spectacular forgetting' provides a critical framework for understanding Gulf environmental governance in relation to

[25] Natalie Koch, "Gulf Nationalism and the Geopolitics of Constructing Falconry as a 'Heritage Sport,'" *Studies in Ethnicity and Nationalism* 15, no. 3 (2015): 522–539, https://doi.org/10.1111/sena.12160. She expands the argument that the politics of belonging are inseparable from the politics of land, nature, and territory in Neha Vora and Natalie Koch, "Everyday Inclusions: Rethinking Ethnocracy, Kafala, and Belonging in the Arabian Peninsula," *Studies in Ethnicity and Nationalism* 15, no. 3 (2015): 540–552, https://doi.org/10.1111/sena.12158.

[26] Trinidad Rico, "Are Trees Rooting for Us? The Heritage of Greening in Qatar," *Culture, Agriculture, Food and Environment* 39, no. 2 (2017): 72–79, https://doi.org/10.1111/cuag.12095.

[27] Kristin V. Monroe, "Geopolitics, Food Security, and Imaginings of the State in Qatar's Desert Landscape," *Culture, Agriculture, Food and Environment* 42, no. 1 (2020): 26, https://doi.org/10.1111/cuag.12243.

[28] N. Koch, "Green Nationalism from Above: Authoritarian State Power and the Greening of UAE Nationalism," *Nations and Nationalism* 31, no. 4 (2024): 946–965, https://doi.org/10.1111/nana.13042.

agriculture and water development initiatives. Her analysis of agricultural technology deployment demonstrates how each new technological intervention, be it precision irrigation, agtech startups, or vertical farming, is presented as an unprecedented breakthrough capable of resolving the region's resource constraints. The failures and environmental costs of previous schemes are erased from public and institutional memory. The political function of this forgetting is to sustain the credibility of technocratic environmental management even as failure accumulates, perpetuating the conditions under which unsustainable resource use continues. Applied to water, this framework helps explain why desalination capacity continues to expand despite its environmental costs, why states continue to extract fossil groundwater despite demonstrated depletion, and why consumption demand management remains peripheral to water policy despite being perhaps the most cost-effective approach.[29]

Zumbrägel's work provides a critical analysis of the 'green state' transformation of Gulf monarchies, which accelerated through the 2000s and 2010s, toward environmental institution-building, sustainability rhetoric, and high-profile green investment while the economic foundations of these states remain fossil fuel extraction.[30] Indeed, the tension between oil revenue dependence and environmental governance has constrained the translation of policy-level sustainability initiatives into tangible environmental outcomes. Saudi Arabia's Vision 2030 represents one of the more ambitious attempts within the GCC to integrate environmental sustainability into a comprehensive economic diversification strategy, including expanded desalination capacity, agroecological farming promotion, ecosystem restoration, renewable energy development, and digital transformation. Toukabri and Chaabi's study frames this as a genuine strategic reorientation, identifying specific policy mechanisms through which environmental objectives are being operationalized.[31] Yet empirical assessment of progress tells a more complicated story. Keskin's recent analysis of OPEC countries' SDG performance finds notable deficits even among the GCC's better performers— the UAE, Saudi Arabia, and Kuwait. He points to persistent failures in environmental indicators, particularly relating to renewable energy consumption, suggesting that institutional commitment and implementation capacity remain misaligned.[32]

The reasons behind this misalignment are explored by scholars analyzing the relationship between oil revenue dependence and environmental outcomes at the macro level. Mahmood et al.'s analysis of oil and gas rents and carbon emissions across MENA countries produces a counterintuitive finding with significant implications. While oil production at the local level shows a small negative effect on emissions (reflecting some efficiency optimization), the indirect spillover effects of oil rents are positive. They produce a net increase in regional emissions through the

[29]Koch, "AgTech in Arabia."
[30]Tobias Zumbrägel, *Political Power and Environmental Sustainability in Gulf Monarchies,* Contemporary Gulf Studies Series (Singapore: Palgrave Macmillan, 2022).
[31]Maher Toukabri and Antar Chaabi, "Climate Change and Sustainable Resource Management in Saudi Arabia: Strategic Adaptation," *Agrociencia* 60, no. 1 (2026): 1–13, https://doi.org/10.47163/agrociencia.v60i1.3364.
[32]Burak Keskin, "Sustainable Development Goals Performance Measurement for OPEC Member Countries Using Gray Relational Analysis Method," *Frontiers in Sustainability* 6 (2025): 1682731, https://doi.org/10.3389/frsus.2025.1682731.

consumption patterns, economic activities, and energy systems they finance. The economic logic of the petro-state thus works against environmental improvement even where producers nominally optimize their own operations.[33] Khan and Basali's analysis of Saudi Arabia's energy sector reaches a similar conclusion, essentially that improvements in energy productivity and economic diversification contribute modestly to emission reductions, whereas oil revenue dependency and population growth do not appear to exert a significant mitigating influence.[34] Salem, Pudza, and Yihdego extend this analysis to the energy transition question, documenting how deeply the GCC depends on fossil fuels. The fact that per capita oil consumption in the region is substantially higher than in the US reflects not simply individual consumption choices, but built environments, transport infrastructures, and economic systems constructed over decades around the availability of cheap and abundant energy.[35]

While scholars have illuminated how Gulf states exercise sovereignty through environmental projects and policies, less attention has been paid to the role of local communities in shaping these power dynamics and to how they have experienced the effects of such development projects. Research on the mapping, surveying, and exploration activities of British oil company experts in the Trucial States during the 1940s and 1950s reveals that local tribes actively resisted and sabotaged such works to the dismay of local authorities, at times forcing the suspension of operations. Therefore, power over land and water resources was negotiated and contested among various constituents including local sheikhs, tribal communities, and British experts and political authorities.[36]

Llavero-Pasquina et al. provide context for understanding why it is critical to examine the role of local communities in environmental governance across the Gulf region. They trace how oil and gas corporations concentrate resources in wealthy industrialized centers while externalizing environmental degradation and social costs to peripheral communities. This demonstrates how state power works in concert with corporate power to reproduce colonial-era patterns of extraction and exploitation, challenging the notion that postcolonial Gulf states have achieved true sovereignty over their natural resources. Llavero-Pasquina et al. conclude that environmental justice requires meaningful engagement by local communities.[37]

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[33]Haider Mahmood, Najia Saqib, Anass Hamadelneel Adow, Muzaffar Abbas, "Oil and Natural Gas Rents and CO2 Emissions Nexus in MENA: Spatial Analysis," *PeerJ* 11 (2023): e15708, https://doi.org/10.7717/peerj.15708.

[34]Ruby Khan and Mona Basali, "Profitability and Environmental Sustainability: Analyzing the Energy Sector's Role in Saudi Arabia's Sustainable Development," *Arab Gulf Journal of Scientific Research* 43, no. 2 (2025): 116-131, https://doi.org/10.1108/agjsr-03-2025-0048.

[35]Hilmi S. Salem, Musa Yahaya Pudza, and Yohannes Yihdego, "Harnessing the Energy Transition from Total Dependence on Fossil to Renewable Energy in the Arabian Gulf Region," *Sustainable Earth Reviews* 6, no. 1 (2023), https://doi.org/10.1186/s42055-023-00057-4.

[36]Sabrina Joseph, "Territorial Mapping and the Formation of Frontier Zones: The Trucial States (1930s–1950s)," in *The Oxford Handbook of Commodity History*, eds. Jonathan Curry-Machado et al., Oxford Handbooks (Oxford: Oxford University Press, 2024; online edn, Oxford Academic, 18 Dec. 2023), 405-426, https://doi.org/10.1093/oxfordhb/9780197502679.013.25.

[37]Marcel Llavero-Pasquina, Grettel Navas, and Roberto Cantoni, "The Political Ecology of Oil and Gas Corporations: TotalEnergies and Post-colonial Exploitation to Concentrate Energy in

Strachan and Winkel present an oral history of social, cultural, and environmental change in Saudi Arabia before and after the arrival of Saudi Aramco. Their work sheds light on people's lived experiences of agricultural and water transformation, perspectives that are often missing from official records, quantitative data, and technical reports. Through their interviews, the authors show how petroleum infrastructure reshaped traditional ecological relationships. Pastoral communities, oasis farmers, and pearl divers had developed livelihoods carefully adapted over generations to the specific resources and rhythms of their environments. However, these relationships were disrupted in a relatively short time. Oil revenues created new avenues of employment, increased the opportunity cost of agricultural labor, and funded infrastructure projects. While this development opened up new possibilities, it also led to the breakdown of existing systems.[38]

Rethinking the Nation State Through Political Ecology

Political ecology offers an alternative lens on state power. Research on the political and social dimensions of land and water development in the Arabian Gulf has shown that resource governance was central both to the emergence of modern states and to the negotiation of state–society relations. In this context, the nation-state is not a fixed or static entity, but a material and political project that must be continually produced. Territory, furthermore, is constructed rather than given. According to Elden, territory is best understood as a political technology, with notions of 'measure' and 'control' being central to the framing of land and terrain. As he points out: 'Territory is a historical question: produced, mutable, and fluid.'[39] Expanding on this framework, Fragaszy, McDonnell and Closas present the Liwa Oasis in the UAE as a 'hydrosocial territory,' applying a concept articulated by Boelens et al.[40] Approaching the issue of water resource management from a socio-ecological perspective, the authors explain how post-independence land titles and agricultural subsidies bound citizens to the state through water and soil, while state projects sought to reorient water users' attachments from tribal politics and nomadism toward new national categories of belonging.[41] Therefore, the nation is materially grounded. Because territorial struggles are also 'struggles over meaning, norms, knowledge, identity, [and] authority,'[42] national

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Industrial Economies," *Energy Research & Social Science* 109 (2024): 103434, https://doi.org/10.1016/j.erss.2024.103434.

[38]Laura M. Strachan and Carmen Winkel, "Oral Histories of Social, Cultural, and Environmental Changes in Saudi Arabia Before and After Saudi Aramco," *Social Change* 54, no. 4 (2024): 561–576, https://doi.org/10.1177/00490857241278782.

[39]Stuart Elden, "Land, terrain, territory," *Progress in Human Geography* 34, no. 6(2010), 812. https://doi.org/10.1177/0309132510362603.

[40]Stephen Fragaszy, Rachael McDonnell, & Alvar Closas, "Creating a hydrosocial territory: water and agriculture in the Liwa Oasis," *Journal of Political Ecology*, 28, no. 1(2021): 286-308. https://doi.org/10.2458/jpe.2369; Rutgerd Boelens, Jaime Hoogesteger,,Erik Swyngedouw, Jeroen Vos, & Philippus Wester, "Hydrosocial territories: a political ecology perspective," *Water International*, 41, no.1 (2016), 1–14, https://doi.org/10.1080/02508060.2016.1134898.

[41]Fragaszy, McDonnell, & Closas, "Creating a hydrosocial territory," 303.

[42]Boelens et al., "Hydrosocial territories: a political ecology perspective," 1.

belonging is anchored in landscapes and resource practices as well as in legal and cultural categories.

Legal, administrative, and institutional approaches to state sovereignty have often treated the environment and the management of natural resources as peripheral to state formation and nation-building. Noora Lori's study of the UAE, for example, demonstrates how the Emirates constructed and consolidated state power through the legal regulation of citizenship, residency, and population. Her concept of 'permanent impermanence' captures how the UAE state reproduces its authority through the ongoing management of legal status, and her analysis shows how the administrative architecture governing belonging became central to Emirati nation-building.[43] Steffen Hertog's examination of Saudi state formation is concerned with related questions, analyzing how the modern Saudi state was constructed through the expansion of bureaucratic agencies, the distribution of oil revenues among competing elite networks, and the relationships between the royal family and technocratic institutions.[44] Each scholar's analytical perspective, whether legal-sociological or bureaucratic-institutional, directs attention to the governance of populations, legal status, and administrative structures rather than to the ways environmental management and territorial consolidation contributed to processes of national identity formation and state power consolidation.

Rentier state theory has also largely fallen short in capturing the complexities of environmental sustainability and sufficiently explaining why states in the region continue to pursue such initiatives despite structural limitations on climate accountability. Although rentier state theory has evolved in recent years to portray states as more dynamic actors, scholarship applying this framework continues to overlook environmental governance as a key driver of state power dynamics.[45]An exception here is Michael Mason's work, which explores how environmental concerns and climate change create new contradictions for rentier state legitimacy. He argues that Gulf petrostates' political economies dependent on oil and gas rents create structural constraints on climate accountability, as meaningful emissions reductions would threaten the revenue bases sustaining state authority and patronage systems. This suggests that rentier state stability may come into direct conflict with environmental sustainability, an unresolved tension that political ecology highlights.[46] Therefore, in this context, political ecology has contributed to a rethinking of rentier state theory. Nonetheless, environmental justice remains a crucial dimension largely missing from conventional theories of state power, including more recent research on rentier states.

A key contribution of scholars studying the political ecology of the Arabian Gulf has been to demonstrate the links between science, state formation, national identity, and environmental change, underscoring the environment's central role in shaping

[43]Noora Lori, *Offshore Citizens: Permanent Temporary Status in the Gulf* (Cambridge: Cambridge University Press, 2019).
[44]Steffen Hertog, *Princes, Brokers, and Bureaucrats: Oil and the State in Saudi Arabia* (Ithaca: Cornell University Press, 2010).
[45]Scott E. Walker, "Rentier State Theory 50 Years On: New Developments," *Frontiers in Political Science* 5 (2023): 1120439, https://doi.org/10.3389/fpos.2023.1120439.
[46]Michael Mason, "Theorizing the Climate Change Accountability of Persian Gulf Petrostates," *Environmental Policy and Governance* 33, no. 6 (2023): 631–640, https://doi.org/10.1002/eet.2082.

political processes. Jones' work on Saudi Arabia, for instance, explores how science and technology were instrumental in the rise of the modern Saudi state. Working closely with Saudi power brokers, American geologists and other experts drove the creation of state boundaries and the compilation of knowledge about nature and society during the first half of the twentieth century.[47] This extensive mapping of territory and populations was instrumental in consolidating the power of the emerging state, incorporating 'underdeveloped' territories into a broader national economy, and laying the groundwork for the development of infrastructure (including a road network).[48]

In research examining agricultural and water development initiatives in the Trucial States, I draw on Jason Moore's concept of the 'commodity frontier' to illuminate how environmental transformation became intertwined with processes of state formation and social change in the United Arab Emirates.[49] This perspective not only sheds light on the forces that drove the region's development trajectories but also highlights the significant ecological consequences that followed. As part of his broader analysis of capitalist expansion, Moore explains how frontier regions are incorporated into processes of accumulation: 'the production and distribution of specific commodities, and of primary commodities in particular, have restructured geographic space at the margins of the system in such a way as to require further expansion'.[50] Therefore, the expansion of the capitalist system occurs in these frontier areas, which is 'possible so long as there remains uncommodified land'.[51] The concept also draws attention to the ecological degradation inherent in processes of expansion and extraction, which, in turn, necessitate the exploitation of new resources and the continual extension of capitalist accumulation. Moore's framework offers a valuable lens through which to analyze early capitalist development in the region and the socio-economic transformations that preceded the advent of large-scale oil revenues. While Moore acknowledges that the commodity frontier can '[call] forth a complex of commodity frontiers' that lead to 'market-widening and market-deepening,'[52] he does not explore the dynamics driving these 'secondary frontiers' in depth. My work focuses on what I describe as the agricultural 'secondary frontier,' set in motion by the UAE's primary frontier, oil, but shaped by its own complex social, political, and economic dynamics, marked by significant changes in land and labor arrangements.

Political ecology reframes the understanding of state formation processes in the Arabian Gulf by questioning economic and institutional models that perceive the state as a unified actor exercising control over territory and resources. Instead, it highlights how power relations influence access to and control over environmental resources, positioning the state as one among multiple competing actors. This approach ultimately reveals how environmental governance is deeply embedded in complex

[47]Jones, *Desert Kingdom*, 22.
[48]Ibid., 22-23, 31, 35, 41, 46-7.
[49]Joseph, "Farming the Desert."
[50]Jason Moore, "Sugar and the Expansion of the Early Modern World-Economy: Commodity Frontiers, Ecological Transformation, and Industrialization," *Review (Fernand Braudel Center)* 23, no. 3 (2000): 410.
[51]Ibid., 412.
[52]Ibid., 427.

power dynamics. Boelens's concept of 'hydrosocial territories' draws attention to the complex social, political, and environmental processes through which control over water resources is negotiated and contested. Beyond the political-economic relations underpinning territorial projects, it emphasizes the dynamic interactions between society and nature: '*hydrosocial territories* [are] socially, naturally and politically constituted spaces that are (re)created through the interactions amongst human practices, water flows, hydraulic technologies, biophysical elements, socio-economic structures and cultural-political institutions.'[53] This ties back to the argument made by Whitehead et al. that while states have historically tried to control the environment territorially and bureaucratically, 'the geological location and movement of nature continue to defy its framing by the state.'[54] While scholarship on the Arabian Gulf has advanced our understanding of state-environment dynamics, further research is needed to unpack the interconnected political, social, economic, and ecological processes through which these interactions are produced, negotiated, and transformed.

Conclusion

The prevailing scholarship on GCC water and land use has approached contemporary crises and the management of natural resources from developmental, technocratic, and archaeological perspectives. The emerging body of work in the field of political ecology goes beyond these earlier studies by situating environmental governance and change at the heart of state formation and power consolidation. In this context, the depletion of Arabian aquifers becomes not only a natural event but a historical one, produced by specific political decisions, institutional arrangements, and economic incentives over a specific period. Political ecology provides an alternative paradigm for understanding the emergence of states and their evolving control over land and water resources.

Scholars have documented the scale and character of agricultural and water transformations during the oil era, analyzed the political-economic drivers of unsustainable resource use, and examined how states deploy environmental governance narratives to consolidate power and manage the legitimacy challenges associated with environmental degradation. Political ecology frameworks, such as the concept of 'commodity frontiers,' situate natural resource development within broader processes of global capitalism, nationalism, and state formation, thereby positioning the environment as a key driver of societal transformation. However, the field would benefit from more comparative work on agricultural change across the Arabian Gulf, particularly spanning the pre-oil period through the emergence of modern states.

The existing literature on the political ecology of the Gulf gives particular attention to the discursive and symbolic dimensions of environment–state relations, examining how desert landscapes are narrated, how green nationalism is performed, and how food security is securitized in political rhetoric. Comparatively less attention has been paid to the material and distributional dimensions of these processes,

[53]Boelens et al., "Hydrosocial territories: a political ecology perspective," 1.
[54]Whitehead et al, *The Nature of the State*, 6.

specifically, who controls access to water and land, how environmental burdens and benefits are distributed across citizen and non-citizen populations, and how the physical transformation of landscapes shapes the conditions of social reproduction for migrant laborers, oasis farmers, and pastoral communities. There is significant scope for further research into how water and agricultural development intersect with questions of environmental justice in the Gulf, particularly regarding the distribution of costs and benefits across social, spatial, and political divides. Cornea, Véron, and Zimmer argue that urban political ecology gains analytical strength through ethnographic attention to how diverse state and non-state actors interact across scales to shape environmental outcomes. [55] This perspective suggests that understanding governance in the Gulf requires examining not only ruling families and elite networks, but also how communities, ecological systems, and transnational actors contest and reshape state authority over environmental resources.

There is also more work to be done on understanding indigenous ecological knowledge and practices. The water management systems documented archaeologically, including for instance *falaj* irrigation and seasonal pastoral movements, embodied accumulated ecological knowledge transmitted across generations before being disrupted by oil-era modernization. This knowledge matters not only as historical evidence of pre-modern adaptive capacity but as a potential resource for contemporary climate adaptation. It represents tested responses to water scarcity, which the region faces more acutely under climate change. Systematic collection of oral histories on pre-oil agricultural and water practices across all GCC states would help bring such knowledge to light.

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[55]Natasha Cornea, René Véron, and Anna Zimmer, "Everyday Governance and Urban Environments: Towards a More Interdisciplinary Urban Political Ecology," *Geography Compass* 11, no. 4 (2017): e12310, https://doi.org/10.1111/gec3.12310.

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