



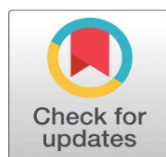


# ANTHROPOCENE AND ECOLOGICAL CONCERNS: A COMPARATIVE ANALYSIS OF NOVEL AND FILM DUNE

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## ABSTRACT

The paper discusses about Dune by Frank Herbert and its film adaptation as an ecological story of Arrakis. Rather than viewing Arrakis as an unusual environment to be used as a political conflict, the article understands the desert planet as a living system that determines scarcity, violence, and biological complexity that influence social and imperial institutions built over it. Along with ecocriticism, posthumanism, and film theory, the article claims that Dune does not just show ecology as a setting but acts as a fundamental framework of narrative. The functions of power, survival of life, all come together with climate, water, sandworms, and spice. Throughout the novel, Herbert repeatedly demonstrates that environmental knowledge is related to political consequences, so that understanding of the planet is necessary to survive. The same ecological logic is presented with visualization in film through broad desert landscapes, the exposed settlements, suspended harvesting machines, and the emergence of sandworm, which repetitively demonstrates the frailty of human technology. This article will argue that Dune provides one of the most effective approaches to thinking about the Anthropocene by reading the novel and film together. Arrakis turns into a speculative reflection about contemporary extractive systems. It may be regarded as an imperial order that requires dependence on resources that it lacks the ability to generate itself and an ecology that lacks complete control. The contrast of imperial exploitation and Fremen adaptation further explains the environmental politics of the text. It implies that it is not those who attempt to dominate the planet that will survive, but those who learn to know its limits and adapt to its needs. Dune thus comes out not only as a science-fiction epic, but also as a warning on planetary life, and challenges readers and viewers to reconsider how human ambition interacts with ecological systems that sustain life.

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## 1. INTRODUCTION

Over the past few decades, Anthropocene has emerged as one of the most significant concepts by which the transformation of literature, environment, and planet can be thought. The term somehow relates to a historical condition where humans gained importance by shaping climate, geology, and the ecological system [Crutzen and Stoermer \(2000\)](#). It is not just a scientific change in the naming of an era. It also transforms the way history is to be comprehended. It is the age where consumption of resources is extensive, and environmental destruction and exploitation of various natural

reserves occur. Dipesh Chakrabarty believes that Anthropocene disrupts the older distinction between natural and human history since planetary processes now carry the marks of industrial civilization [Chakrabarty \(2009\)](#). The same argument can be made by Bruno Latour, who states that once human technological practice has entered the geological scale, nature and society can't be regarded as distinct anymore [Latour \(2017\)](#).

Literature and cinema are particularly significant in capturing the changes that are occurring around us. It is not just a reflection of the ecological crisis that they present. They assist individuals in imagining environmental change, narrating about it, and becoming aware of its impacts. Ecocriticism has maintained that cultural texts don't just reflect reality, but they inform about environmental awareness. The most well-known definition of ecocriticism by Cheryll Glotfelty as the study of the relationship between literature and physical environment contributed to opening the inquiry of study [Glotfelty and Fromm \(1996\)](#). This was later expanded by Greg Garrard, who highlighted recurring environmental topics including pollution, apocalypse, wilderness, and resource depletion [Garrard \(2012\)](#). Lawrence Buell also shares the same view that environmental texts are important since they reveal the material dependency of human lives on nonhuman conditions [Buell \(2005\)](#).

This has been especially possible in science fiction, which establishes ecological fears in speculative worlds to make them more visible. Ursula K. Heise introduces the idea that environmental thinking in literature and media needs to think more with "sense of planet", i.e., the ability to imagine global interdependence through local realities [Heise \(2008\)](#). Timothy Morton also explains that ecological thought needs to meet processes whose size and spread are beyond immediate human perception [Morton \(2010\)](#). It can also be applicable in terms of cognitive estrangement offered by Darko Suvin since science fiction will render crises appear innovative by placing them in other worlds and futures [Suvin \(1979\)](#). *Dune* by Frank Herbert strongly agrees with tradition. The novel, which was first published in 1965, is one of the most significant ecological works in modern science fiction as it imagines not just a planet, but a whole environmental system.

The desert world of Arrakis, where the whole novel is focused on, is influenced by heat, scarcity, sand, and biological danger. These are not just atmospheric details, as demonstrated by Herbert's achievement. The desert is more than just a backdrop. It is a means of structuring too much force. This is evidently shown when Herbert writes, "Growth is limited by that necessity which is present in the least amount" [Herbert \(1965\)](#). It is an ecological, but also political statement, in the sense that it means, even before rulers or empires control them as in authority, its scarcity predetermines the method of social organizing.

Ecological logic is addressed in the novel *Dune*. The base of imperial mobility and galactic power, i.e., spice melange, cannot be analyzed without mentioning its political significance, which requires the ecology in which it is produced. This dependence is revealed when Herbert writes, "The spice is the vital necessity for space travel" [Herbert \(1965\)](#). What initially seems like a technologically advanced civilization with a controlled foundation is shown to have deep dependence on a rare substance rooted in desert biology. This dependence is even more unsettling when the viewer finds out that spice cannot be removed without sandworms, and from the violent ecology of Arrakis itself. This interdependence is emphasised by Herbert when he writes, "Life improves the closed system's capacity to sustain life" [Herbert \(1965\)](#). This concept of a self-sustaining and self-intensifying planetary system makes it difficult to imagine an empire as independent from the environment.

These ecological concerns are revitalized and elaborated in recent film adaptations through visual means. At the beginning of the film, Arrakis is defined by Villeneuve as barren by showing descent into Arrakeen, the low light on immense dunes, fortress-like architecture that is vulnerable to wind and sand, and a clear perception that imperial buildings are just considering temporality on the planet they are meant to control. In other places, the film improves this environmental logic with scenes concerning water and perception. The palm trees outside palace reveal an abundance of imperial display in world of extreme scarcity, whereas Paul dreams of a sequence of still tents that transform the desert into a space of distorted consciousness, where violence of the future, ecological dependence, and fear of the planet unite. Francesco Sticchi believes that the desert in film turns into an eerie chronotope instead of a neutral setting, which gives Arrakis a greater philosophical and ecological impact [Sticchi \(2022\)](#). However, according to Misha Grifka Wander, adaptation modifies some of the political focus of Herbert, in particular, by softening some of his criticism of imperialism and messianic violence [Wander \(2022\)](#). These debates are important since they indicate that this movie does not simply repeat the ecology of the novel. It transforms with the use of scale, sound, atmosphere, and visual tension.

To understand *Dune* properly, we must have a framework that is capable of going through literature, environment, embodiment, and image. There is no single method sufficient. Ecocriticism provides an understanding of how Arrakis

serves as an evaluative environment instead of a decorative one. Posthumanism poses the question of the extent to which human systems are connected to nonhuman structures of agency. The film theory describes how deeply human systems are tied to nonhuman forms of agency. Taken together, all of these methods demonstrate *Dune* is a story that is not just a story set on a desert planet. It is a planetary narrative where environment determines politics, biology, perception, and survival.

## 2. ECOLOGY OF ARRAKIS: ENVIRONMENTAL SYSTEMS IN THE NOVEL AND FILM

Among the strongest aspects of *Dune* is that it has defined the presence of Arrakis, not as a decorative science-fiction environment, but as a planetary ecology, in which material conditions of life influence all aspects. Frank Herbert does not put politics, religion, and culture in a neutral desert and follow it up by having them respond. Rather, he demonstrates that they emerge as aridity, exposure, scarcity, and adaptation. By doing this, Arrakis creates narrative and doesn't simply hold it. This is an excellent way to ecocritical work that regards the environment as an active force rather than as a passive backdrop [Iovino and Oppermann \(2014\)](#). Ecocriticism would particularly be very helpful in explaining that Herbert's desert is not an empty setting, but rather a material system where environment precedes and shapes the way of thinking, ruling, and surviving that appear in it.

Herbert presents Arrakis by defining it as one of the extremities by stating that it has minimal water, relentless heat, storms, and terrain that cannot be easily inhabited. But the novel writes that this seeming barrenness is no emptiness. It is a strictly organized system, wherein bodies, institutions, and imagination are predetermined by severity. This is well conveyed by Herbert, "Growth is limited by that necessity which is present in the least amount" [Herbert \(1965\)](#). This is a significant line because it depicts that ecological scarcity can either be political or biological. Arrakis would not be only dry. It is a world in which the scarcest aspect determines all other possibilities. This is justified with the input of Kate Rigby to the imagination of ecological settings when she says that ecological stories have abundance to show that material is limiting [Rigby \(2015\)](#). This argument is further explained by Herbert when he writes, "The more life there is within a system, the more niches there are for life" [Herbert \(1965\)](#). Arrakis is not a void but rather a dense ecology of inter-dependence, where life endures as it adjusts to limitations and does not escape them.

Conservation is not a technical issue, according to Herbert, but a foundation of ethics, embodiment, and communal living. The depiction of Fremen technology can be regarded as ecological thinking of the novel: "call them 'stillsuits' that reclaim the body's own water" [Herbert \(1965\)](#). This appears to be a detail or survival gear that turns out to be a larger concern of the body as a site of ecological domination. Water is not only consumed. It has been recycled, protected, and socially arranged. Logic is enhanced by Herbert when he says, "The flesh belongs to the person, but his water belongs to the tribe" [Herbert \(1965\)](#). In this statement, we find unity of physiology, ethics, and politics in a desert principle. In *Dune*, scarcity not only threatens culture, but it also creates culture at the level of ritual, movement, and social law.

These ideas are reinforced by the film version, not only by large-scale images of the desert but by the realities of survival in the desert. Visual signs (stillsuits, bodily discipline, water politics) of ecology shape life internally and are repeated themes in Villeneuve. Another crucial moment is stillsuit fitting, which portrays adaptation as precision, and not heroism. To move through the desert, the body must learn demands prior to. Equally, palm trees outside Arrakeen are turned into a visual sign of ecological inequality. Their irrigation is a sign of imperial excess in a world that is limited, revealing tension between symbolic display and the need to survive. This contrast is increased in the Fremen movement on the dunes. Imperial bodies and machines seem to be exposed, heavy, not in rhythm with terrain, and through this, Fremen movement is determined, responded to, and learnt. This form of reasoning is also used in sequence, wherein Paul and Jessica follow a desert after crashing into an ornithopter. The life they live is based on breath, gait, heat, exposure, and not heroic control. The work of Vivian Sobchack on the embodiment of cinema is useful, especially in this aspect, as it explains how film can be used to create experiences of tension, scale, and vulnerability rather than just appearing as scenery [Sobchack \(2004\)](#). Arrakis is therefore made out to be a lived ecology, not a spectacular one.

The sandworms also add to this ecology by indicating that Arrakis is not only a deprived world, but also a world full of powerful nonhuman processes. Herbert does not make worms into monsters or simply signs of danger in the desert. They are being ecological agents with the presence of which reshapes how power and value are organized. In this regard, the progression of Fremen into them becomes important. Throughout the novel, when it is stated that, "That was a brave crossing he made in the path of shai-hulud" [Herbert \(1965\)](#), the point is not only courage. It is in ecological knowledge, movement, timing, and bodily behavior that are associated with forces bigger than humans. The ecological belonging is

a work by Matthew Hall that asserts that existence in the environment is premised on learning to live with other types of agencies and not imagining total control over them [Hall \(2011\)](#). Fremmen understood that, yet the empire is mostly unaware. The result is that novel and film arrive at the same ecological insight. Arrakis is a living planetary system whose laws come before the empire.

### 3. PLANETARY IMAGERY AND CINEMATIC ECOLOGY: VISUALIZING THE ANTHROPOCENE IN *DUNE*

Planetary imagery is central to the ecological force of *Dune* because both the novel and the film imagine Arrakis not as a background for human drama but as a world-system that shapes perception, politics, and survival. The desert planet of Herbert is continuously represented with scale, abrasion, and exposures in such a way that the environment is more of an organization than a scenic container. This type of writing is characteristic of what Ursula K. Heise describes as a “sense of planet,” a way of imagining the world that moves beyond local and contributes to readers considering larger ecological interdependence [Heise \(2008\)](#). In the case of Herbert, planetary imagination is always tied to danger. Arrakis is a place where “They can eat flesh off bones and etch the bones to slivers” [Herbert \(1965\)](#). This line works well as it demonstrates the environment without its passive matter, but as an active force. The desert does not simply surround life on Arrakis; it acts on it.

It is repeatedly implied by Herbert that planetary systems are not to be understood in static or purely human terms. Among the most clear statements in the novel is one where it is said that “A process cannot be understood by stopping it” [Herbert \(1965\)](#). This is a concern of planetary imagery as it introduces ecology as movement, sequence, and change. Arrakis cannot be understood as a fixed object. It has to be viewed as a continuous process. This idea is reflected in the work of Gilles Deleuze on film since he claims that film has the ability to express forms of time and change which go beyond ordinary linear perception [Deleuze \(1989\)](#). The novel and film make us see how the planet is grasped by unfolding patterns as it shows continuous storms, tremors, migrations, delays, rather than stable control. This is at least one of the reasons why the desert keeps resisting imperial certitude. This is why the desert is never completely possessed; it keeps on moving.

Ecological structure is strengthened through film as it turns into atmosphere and exposure. Villeneuve constantly places human bodies, vehicles, and buildings against desert expanses, creating an image-world where human presence appears temporary and fragile. Yavuz Selim Balcioğlu signifies that adaptation creates an emotional sense of awe, fear, and instability, according to which the landscape itself becomes a central narrative force [Balcioğlu \(2024\)](#). The work by Martin Lefebvre about landscape in cinema can explain why it is important, since he states that landscapes in films contribute to meaning and emotion and provide a visual background [Lefebvre \(2006\)](#). This is made apparent by early views of Arrakeen, half buried in windswept dust, within open sand, and small in relation to the horizon. The architecture appears fragile in a world that is older, bigger, and less manageable than the empire. The film reveals that Arrakis exceeds structures built upon it, even before obvious danger appears.

The visibility of planets is even more powerful in action scenes in film, and most of the sequences are where environmental forces overwhelm technological confidence. Among the most revealing examples is escape by sandstorm, where Paul and Jessica attempt to escape in an ornithopter and are swallowed by turbulence, dust, and darkness. Technological control and movement prevail at the initiation of the scene, but the storm quickly brings destruction to instruments, sight, and certainty. Wind and sand erase the conception that machines can just rise above the environment. Giuliana Bruno's concept of cinematic space is instrumental in this context since she demonstrates that filmic space is perceived as pressure, motion, and vulnerability instead of neutral scenery [Bruno \(2002\)](#). The storm is not just a decoration in the scene. It reshapes action and transforms terms of survival.

The same logic continues after the crash, where Paul and Jessica are crossing the open desert. This is when the film removes the machinery and exposes the body to heat, distance, exhaustion, and uncertainty. The movement of humans becomes hesitant, measured, and fragile against a landscape that is seen to erase the distance but increase vulnerability. The desert is no longer considered to be a giant screen of spectacular action. It becomes a lived field of breath, work, and sensory strain. Thomas Elsaesser and Malte Hagener define spectacle as a sense of intensity, constructed on a scale and force [Elsaesser and Hagener \(2015\)](#). However, in *Dune*, spectacle is ecological before it is merely grand. The planet not only frames human action. It changes the time, locomotion, and life of the body.

This cinematic ecology is further elaborated by sandworms since they allow a visible relationship between planetary process and nonhuman force. Herbert has not only shown a descriptive ecology but also a causal one, and this causality can be seen in the line, "This 'water-stealer' died millions each spiceblow" [Herbert \(1965\)](#). The phrase is used to point out the hidden violence and biological cost that is part of the spice cycle. But here, in this part, worms are of more value as tools of extraction than as figures of planetary agency. Their presence changes perception of space, perception of sound, and how movement is to be controlled. The ecocinema by Scott MacDonald can be used in this case as he implies that film is to make the viewer dwell in the environment and not see the landscape as a visual image [MacDonald \(2013\)](#). Arrakis of Villeneuve does just that. It has not only been inhabited but also been an unstable ecological field. What is created by novel and film in general, then, is an ecological model of the planet in which visual scale and ecological implication cannot be separated.

#### 4. RESOURCE EXTRACTION, EMPIRE, AND ENVIRONMENTAL POWER IN *DUNE*

If we assume Arrakis to be a planetary ecology, then it is an extractive one. The major political insight that Herbert learned is that the environment is not inferior to the empire in *Dune*. It is reliant on it and preys on it. Spice melange is not only a valuable commodity. It is the material basis of transportation, trade, state, and imperial reach. This is quite evident in the novel very early when Baron Harkonnen asks, "What is CHOAM but the weather vane of our times?" [Herbert \(1965\)](#). This line is significant as it correlates political authority with corporate control and economic circulation. Resource management can't be easily separated from power in *Dune*, and Arrakis is a location where it is most evident. Ecocritical terms imply that the environment is never outside politics. Possible material is the basis of politics.

This is what makes the struggle on Arrakis not strictly territorial only. It is a struggle over extraction. Herbert frequently shows the fact that the desert is considered by the empire as a place that has to be worked, measured, and harvested. Among the most evident examples is to be found in the practical description of spice mining: "Harvesting the spice is a process of getting in and getting out with as much as possible" [Herbert \(1965\)](#). The sentence is quite technical, and it is precisely here that it matters. Extraction is seen as a method, speed, and calculation. The petroleum culture of Stephanie LeMenager can be used to explain this logic as she reveals how modern extractive systems normalize the idea of energy dependence by making it an inherent part of daily life, mobility, and power [LeMenager \(2014\)](#). Herbert eliminates such a notion of normality. Extraction on Arrakis is obviously dangerous, ecologically unstable, and politically violent. Ecocriticism can explain this, as it demonstrates that the environment is not background to extraction but an unstable condition. Posthumanist thought drives further to demonstrate how the supposedly human system of imperial management is repeatedly disrupted by nonhuman forces that would not want to remain as resources.

In the novel, it is also evident that the value of spice cannot be distinguished from war and governance. At one point, Herbert remarks that "The entire spice income of Arrakis for fifty years might just cover the cost of such a venture" [Herbert \(1965\)](#). This is a powerful scene as it makes ecology directly into military calculation. The wealth of resources in this case is already imperial spending. Imre Szeman believes that extractive systems tend to hide the ecological foundation of political economy by treating energy as if it were endlessly available [Szeman \(2017\)](#). Herbert does the opposite. He demonstrates how an empire is expensive, unstable, and dependent upon fragile continuities. In this regard, there is Anthropocene criticism of contemporary power in *Dune*. It is through these ecological arrangements that systems that sustain control over nature themselves without being capable of making or entirely controlling it.

The film adaptations reinforce this criticism with visual form, and in this case, relevance is placed on the scene of the spice harvester. The harvesters of spices have descended as heavy industry, and support craft above them in efforts to become their bureaucratic projections of extraction. But such scenes do not seem fully safe. Dust moves over the machine, the horizon is against the enclosure, the crawler sits on exposed sand as though it has got itself temporarily mistaken for control. The scene in the harvester rescue sequence slowly turns into that of industrial order to ecological vulnerability. The worm-sign does not come as a sudden spectacle. It accumulates gradually as a force within the landscape. Francesco Sticchi is right to say that Arrakis of Villeneuve is not static or mastered but active and open instead [Sticchi \(2022\)](#). The scene is governed by desert, rather than empire. Here, especially, film theory comes in useful as the scene transforms political ecology into an image with the help of scale, delay, vibration, and exposure, in that extraction is depicted as temporary but not sovereign. This scene also yields one of the strongest claims in film concerning empire that machineries might be immense, but they are fragile within the ecological system to which they attempt to exploit.

Herbert also demonstrates that extraction establishes other forms of political relations. Arrakis is yielding to imperial houses. It is a limited world to Fremen. This opposition is highly evident in their ethic of sufficiency: “The necessity and no more” [Herbert \(1965\)](#). The entire political ecology is in a brief phrase. It is against accumulation with restraint and turns life into a discipline of measure. Herbert explains the collective group logic behind this ethic, a few pages later: “The flesh belongs to the person, but his water belongs to the tribe” [Herbert \(1965\)](#). Water is not private surplus, but collective necessity. Critique of mastery done by Val Plumwood can be useful as the author argues that dominant systems tend to confuse dependence with sovereignty [Plumwood \(2002\)](#). This is done in Arrakis by the empire and not by the Fremen. Fremen interpret it as a state of life that necessitates a form of measure, reciprocity, and adaptation as long as the empire views Arrakis as a reserve.

From the perspective of posthumanism, this distinction is even sharper. The empire imagines itself as the organizing force of Arrakis, but its personal strength lies in nonhuman forces of worms, spice, climate, and terrain, which constantly exceed its authority. The desert is unavoidable, and worms interrupt extraction, almost reminding the empire that ecological systems are not inert matter. In terms of the Anthropocene, this understanding is decisive. Jason W. Moore claims that modern power is based on forms of appropriation that portray nature as endlessly available to empire [Moore \(2015\)](#). *Dune* reveals the instability of such an assumption.

## 5. CONCLUSION

Collectively, *Dune* (by Frank Herbert and its film adaptation by Denis Villeneuve) is much deeper than the familiar science-fiction story of succession, rebellion, and prophecy. They involve persistent focus on ecology, excavation, planetary vulnerability, where the greater part of the environment is not just a stage where politics occurs, but one of the primary situations that generates politics in the first context. If read from the lens of ecocriticism, posthumanism, and film theory, the issues of climate, scarcity, species, and infrastructure can't be distinguished from power. Ecocriticism assists in demonstrating that Arrakis is not a decorative desert but a material ecology that shapes life. It is demonstrated in posthumanism that this ecology includes forms of agency that are beyond human control. Film theory describes how these relationships become visible, emotional, and spatially powerful in adaptation. And in this regard, novels and films do not depict a deserted planet. They enquire about what it is to live in a system in which material limits recurrently disrupt human aspirations of control. The description of science fiction as large system thinkability by Fredric Jameson can be useful in service here since *Dune* makes ecological totality imaginable without reducing it to something simple [Jameson \(2005\)](#).

What Herbert shows with unusual consistency is that environmental knowledge is never decorative. It is political, embodied, and sometimes deadly in its absence. Without knowing the system that supports it, Arrakis could not be ruled or exploited. The ecological force of novel, then, is not just in world-building but also in its critical attitude towards imperial perception. Herbert reveals apparent mastery, which is often misunderstood. This issue is actually one of the most evident in lines: “Hope clouds observation” [Herbert \(1965\)](#). This is expressed more than psychological advice in the context of Arrakis. It becomes an ecological warning. Political ambition, technological confidence, and colonial desire consistently prevent the empire from seeing the planetary forces on which it depends.

This is what makes the spice economy so central to the meaning of *Dune*. Spice appears to hold the galaxy together by regulating trade, transit, and order, but Herbert slowly reveals that this apparent order is dependent on fragile biological and environmental premises. His critique of power can thus not be separated from his critique of progress. Herbert provides one of his sharpest reflections towards the end of the novel: “The concept of progress acts as a protective mechanism to shield us from the terrors of the future” [Herbert \(1965\)](#). This sentence is a direct response to the logic of extractives that organizes empire in *Dune*, but the sentence is also aimed at wider Anthropocene debates. It demonstrates how modern systems imagine forward movement and reject ecological consequences. Arrakis is strong, and it precisely does not permit such refusal. In Arrakis, there are always consequences.

This ecological critique of film adaptation is not just due to scenes of industrial extraction, but the ecological effect is achieved by Arrakis being pressed, scaled, perceived, and exposed. A temporary form of empire is announced at first glance as architecture half-buried at Arrakeen and exposed to the wind source. This is enhanced by palm trees outside the seat of power that transform water into a visible sign of ecological inequality and imperial excess. The stilltent sequence enhances the Anthropocene force in film further. It is there that Paul feels the pressure of spice and prophecy, and his consciousness is attached to a vision of future violence, ecological consequences, and messianic catastrophe. The

desert is no longer scenery but atmosphere, burden, and demand. These moments make visible what is asserted across the novel, that the environment is not passive matter. It acts back. The importance of film theory in that matter is that it explicates how scale, length, sound, and landscape transform ecological relations into sensory experience. The film does not just depict Arrakis. Instead, it causes viewers to feel that there is instability on a human scale in the larger planetary order.

This is also a reason why *Dune* is a significant posthuman text. It has a world that is not structured around self-sufficient human subjects, but rather in terms of multispecies entanglement, material dependence, and responsiveness to the environment. The deserts, bodies trained to endure in them, sandworms, spice cycle, all of it is part of a network of mutual connection. Fremen most nearly comprehend this network because they don't rise themselves over Arrakis, rather romanticizing it. They need relations instead of conquest to survive. Where the Empire reads a hostile environment, Fremen understand a difficult field of coexistence.

*Dune* is still pressing in Anthropocene, as it demonstrates that no empire, even powerful or technologically advanced, can exist beyond ecology. Novel and film bring to our minds that history never exists outside its environment. Their deepest lesson is simple. It is not people who are denying planetary limits and surviving, but those who know how to live within them.

## CONFLICT OF INTERESTS

None.

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