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Research Article

Speaking of Extinction: A Comparative Corpus-assisted Analysis of Metaphorical Framing in Climate Change Fiction and British Newspapers

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ABSTRACT

The present study brings a new perspective to climate fiction (cli-fi) studies, addressing two previously unexplored aspects. First, by focusing on how cli-fi writers frame climate change in their works, it extends the findings in earlier studies through corpus analysis of 20 works of cli-fi written after 1990. Second, by comparing the frames of climate change in the works of cli-fi and newspapers, it seeks to validate whether fiction writers frame climate change differently. To achieve this double objective, the study draws on Lakoff's views on metaphors as linguistic manifestations of cognitive frames. Lakoff's conceptual model investigates assumptions about the impact of reading cli-fi, emphasising language's role. The analysis of the cli-fi and newspaper corpora offers key findings about how climate change is portrayed in cli-fi works and newspapers. The findings reveal that cli-fi writers frequently use personification and negative language in metaphorical framing. Additionally, the study highlights cli-fi writers' reliance on figurative language compared to nonfiction writers. Despite the genre's creative nature, the number of identified metaphors in cli-fi works appears relatively limited.

Keywords: Climate Change, Climate Change Fiction (cli-fi), Cognitive Linguistics, Metaphorical Framing, Climate News

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If you use language, you have to use metaphors all the time.
Jorge Luis Borges

1. Introduction

The late twentieth century saw the emergence and popularisation of a new genre of fiction that explicitly focuses on climate change, namely "climate change fiction," or "cli-fi." Although the exact origins of the term "cli-fi" remain obscure, Dan Bloom, an American environmentalist blogger, is usually credited with coining the term on his website *The Cli-Fi Report* in 2007 (Leyda, 2016, p. 12; Irr, 2017, p. 2). Broadly speaking, climate fiction can be defined as a literary response to the climate crisis in the Anthropocene. Many scholars and writers hold the view that cli-fi is an influential instrument to raise awareness about climate crisis through engaging stories that make environmental issues relatable to large groups of people (Gaard, 2014; Goodbody, 2014; Trexler, 2015; Mehnert, 2016; Milkoreit, 2016; Johns-Putra, 2016). For instance, in his *Anthropocene Fictions,* Adam Trexler (2015) considers the novel to be "a privileged form to explore what it means to live in the Anthropocene moment" (p. 27). The privileged status of fiction mainly stems from its ability to activate our imaginative powers to comprehend environmental issues regardless of spatial and temporal limits. This is particularly true in the case of climate change. As Markley (2012) puts it, "[c]limatological time, measured in millennia exists beyond daily experiences of the weather, beyond the duration of individual lifetimes, beyond the accumulated memories of generations […] the time-scales of climatic change cannot be experienced viscerally but only imagined" (pp. 56–57). In the same vein, Corbett and Clark (2017) emphasise the crucial role of climate fiction in rendering the threat of climate change-related extinction comprehensible for readers, leading them to consider how they frame their relationship with the biosphere in a novel and productive way:

> Climate stories, especially those based on lived experiences, offer distinct ways to engage a variety of senses. They allow the "invisibility" of climate change to be seen, felt, and imagined in the past, present, and future. They connect global issues to conditions close to home and create space to grieve and experience loss. They encourage critical reflection of existing social structures and cultural and moral norms, thus facilitating engagement beyond the individual level. (p. 1)

The increasing popularity of environmental narratives and critical speculation about their positive transformative influence on readers paved the way for a subfield of research in the field of ecocriticism, namely empirical ecocriticism. Combining empirical methods (i.e., surveys, interviews, and controlled experiments) with environmental literary theories, the studies within this line of research generally explore the function of environmentally engaged narratives in stimulating a wider and deeper climate consciousness.

In four recent studies, some researchers of empirical ecocriticism, mainly Schneider-Mayerson, investigated the shared assumptions about the positive ecopolitical influence of climate fiction (Schneider-Mayerson, 2018, 2020; Schneider-Mayerson et al., 2020; Lindgren Leavenworth & Manni, 2020). In the first empirical study on cli-fi, Schneider-Mayerson (2018) surveyed 161 American cli-fi readers' perception of climate change through their responses to open-ended questions. The findings showed that "climate fiction readers are younger, more liberal, and more concerned about climate change than non-readers of climate fiction" (p. 473). In 2020, Schneider-Mayerson conducted a similar survey, this time investigating the effects of a single work of climate fiction, Paolo Bacigalupi's *The Water Knife* (2015), on 86 American readers' awareness of climate injustice and their perception of climate migrants. The participants' responses to the detailed questionnaire revealed that reading Bacigalupi's novel led them to develop a greater awareness of climate injustice and empathy for climate migrants. Having thus established that reading climate fiction has some measurable positive influence on readers, Schneider-Mayerson et al. (2020) furthered the research in this field with a study aimed to assess the longevity of the effects of reading a work of climate fiction. Their study reported that "reading climate fiction had small but significant positive effects on several important beliefs and attitudes about global warming, as observed immediately after participants read the stories. However, these effects diminished to statistical nonsignificance after a one-month interval" (Schneider-Mayerson, 2020, p. 1). With their 2021 study, Maria Lindgren Leavenworth and Annika Manni, on the other hand, probed into the educational value of climate fiction in teaching sustainable development in Swedish primary schools. Utilising thematic content analysis in tandem with empirical methods, the researchers investigated how the selected works of cli-fi that students previously read for the research resonate with their own representations of nature, climate change and environmental responsibility. The researchers concluded their study with the suggestion that cli-fi is a useful educational tool that can help broaden discussions about environmental and sustainability issues at schools by providing students with possible environmental scenarios for critical reflection.

In the light of the foregoing, it ought to be clear that the four studies offer useful insights into cli-fi's impact on pro-environmental behaviours with varying degrees. However, they also share two significant limitations with corresponding opportunities for new directions for further research. First, in their exploration of the influence of climate fiction, these studies focus only on the reader, completely disregarding the role of the author in creating the message within the works of fiction. The language, or more specifically, the literary devices (i.e., metaphors, symbols, personifications) that a writer employs to create an engaging story is as important as the readers' interpretation of the story. As Keen (2006), a scholar of narrative empathy, succinctly puts it, "[b]y using their powers of empathetic projection, authors may attempt to persuade readers to feel with them on politically charged subjects. Readers, in turn, may experience narrative empathy in ways not anticipated or intended by authors" (p. 223). The pioneering ecocritic Cheryll Glotfelty's views on the use of metaphors in environmental literature align with the concept of narrative empathy. She recognises that metaphors have the potential to evoke empathetic responses in readers, enabling them to emotionally connect with the environmental and climate-related issues depicted in the narratives. Hence, in her introduction to the seminal *Ecocriticism Reader*, Glotfelty (1996) formulates one of the typical questions that should be posed by ecocritics as "[h]ow do our metaphors of the land influence the way we treat it?" (p. xix). It is, therefore, essential to investigate the use of figurative language in cli-fi novels if we want to understand how they affect readers' intellectual, emotional, and behavioural responses. Additionally, although the previous studies on cli-fi essentially rest on the assumption that fiction writing has the capacity to provide an alternative, if not a better one, to works of nonfiction (i.e., the news and scientific reports) in environmental communication, none of the aforementioned studies tested this assumption in a comparative analysis of fictional and nonfictional accounts of climate change.

Straddling contemporary literary theories, corpus and cognitive linguistics, the present study is motivated by an ambition to fill this twofold gap in the current scholarship on cli-fi. On the one hand, by focusing specifically on how cli-fi writers frame climate change in their works, it aims to complement and extend the findings in earlier reader-centred studies through corpus analysis of 20 works of cli-fi written after 1990. On the other hand, by comparing the frames of climate change in works of cli-fi and newspapers, it seeks to validate whether fiction writers frame climate change in a different way from nonfiction writers. To achieve this double objective, the study draws on George Lakoff's theory of framing and his views on metaphors as linguistic

manifestations of cognitive frames. Lakoff's conceptual model investigates assumptions about the impact of reading cli-fi, emphasising language's role in shaping perception. This provides valuable insights into how cli-fi narratives influence readers' perspectives on climate change. The first part of the article introduces the key concepts of the cognitive frame and conceptual metaphor and briefly discusses their significance in environmental writing. The second part provides the details of the metaphor identification procedure used in the study and categorises the linguistic patterns of the metaphor identified in the corpus. The article concludes with a discussion on the research findings and suggestions for future studies.

2. Framing Climate Change: Cognitive Frames and Conceptual Metaphors

George Lakoff laid out his theory of metaphorical framing in his individual research works as well as in a book that he co-authored with Mark Johnson, *Metaphors We Live By.* Lakoff and Johnson consider metaphors to be key conceptual devices in shaping public discourse about important societal issues. "Primarily on the basis of linguistic evidence," they write, "we have found that most of our ordinary conceptual system is metaphorical in nature. And we have found a way to begin to identify in detail just what the metaphors are that structure how we perceive, how we think, and what we do" (Lakoff & Johnson, 1980, p. 4). In other words, metaphors function as crystallised frames that enable a smoother and more effective transfer of meaning by turning complex abstract concepts into familiar concrete images. Lakoff and Johnson define metaphor as a cross-mapping between two semantic *domains*, namely the source domain and the target domain. While the former denotes the conceptual domain from which the metaphorical expression is drawn, the latter is the domain that people try to understand. For instance, when nature is described as a mother, it means that all the features of the source domain, "mother," are metaphorically mapped onto the target domain "nature," which generates the meaning that nature should be treasured and protected, for it is the life-giving and nurturing biological source of existence.

Lakoff and Johnson investigate conceptual metaphors in three main categories: structural, ontological and orientational. Structural metaphors help conceptualise a complicated and abstract concept in terms of a simple and concrete concept. To illustrate how structural metaphors affect our everyday activities and the way we perceive reality, Lakoff and Johnson give an example from modern Western culture, where 'time' is

metaphorically conceptualised as 'money.' Therefore, it is not a coincidence that expressions from the vocabulary of time clearly indicate the limited and valuable nature of time as a commodity: waste, save, worth, invest, borrow, lose, have, budget, cost, use profitably, etc. This specific metaphor structures how several daily practices in Western culture are quantified: "telephone message units, hourly wages, hotel room rates, yearly budgets, interest on loans, paying our debt to society (serving time) (Lakoff & Johnson, 1980, p. 8). Ontological metaphors, on the other hand, identify abstract concepts as entities or personify them so that we can easily refer to, categorise and quantify them. This group of conceptual metaphors includes figures of speech, such as personification and metonymy. According to Lakoff and Johnson, Shakespeare's sonnets provide pertinent examples of ontological metaphors since the poet personifies 'time' as 'an enemy,' 'an adversary,' 'a reaper' and 'a besieger' in different poems. Lakoff and Johnson called the last group of conceptual metaphors as orientational metaphors, for they are directly related to our physical movements and how we use these movements to conceptualise abstract concepts in our own culture. For instance, Lakoff and Johnson (1980) show that in the English language, foreseeable future events are conceptualised as "up" and "ahead": "All upcoming events are listed in the paper. What's coming up this week? I'm afraid of what's up ahead of us. What's up?" (p. 16). Lakoff and Johnsons explain the physical basis for these conceptualisations: "Normally our eyes look in the direction in which we typically move (ahead, forward). As an object approaches a person (or the person approaches the object), the object appears larger. Since the ground is perceived as being fixed, the top of the object appears to be moving upward in the person's field of vision" (p. 16).

It is precisely conceptual metaphors, or more broadly speaking figurative language use, that brings literature and literary studies in connection with cognitive framing since Lakoff and Johnson (1980) argue that creative or imaginative metaphors are more functional in changing the existing cognitive frames than conventional metaphors. According to Lakoff and Johnson, "conventional metaphors are metaphors that structure the ordinary conceptual system of our culture, which is reflected in our everyday language" (p. 139). Members of the same linguistic community can effortlessly understand and use conventional metaphors to talk about everyday reality. Creative or imaginative metaphors, on the other hand, are beyond social conventions and "are capable of giving us a new understanding of our experience. Thus, they can give new meaning to our pasts, to our daily activity and to what we know and believe" (Lakoff & Johnson 1980, p. 139). Unlike conventional metaphors characterised by commonality and used to

conceptualise reality, imaginative metaphors are products of linguistic inventiveness and novelty, and they are generally used to encourage people to think about reality from a new perspective. That is what makes creative metaphors more effective in forming new cognitive frames in environmental communication.

For Lakoff, the distinction between conventional and creative metaphors is crucial in understanding the impact of cli-fi on readers. While conventional metaphors may reinforce existing frames, creative metaphors have the potential to challenge and reshape our understanding of climate change. In his 2010 article, "Why it Matters How We Frame the Environment," Lakoff discusses how the medium and content affect people's perception of environmental problems. He contends that the mainstream media fails to generate cognitive frames necessary for making climate change meaningful and relatable since it mainly depends on popular slogans, figures and factual language. "Many people engaged in environmentalism," he writes, "believe that if you just tell people the facts, they will reason to the right conclusion" (pp. 72–73). Lakoff (2010) suggests that this ineffective method of communication should be replaced with a new language. According to Lakoff, "the new language must make sense in terms of the existing system of frames. It must work emotionally. And it must be introduced in a communication system that allows for sufficient spread over the population, sufficient repetition, and sufficient trust in the messengers" (p. 72). This implies that cli-fi writers can actively contribute to this process by utilising creative conceptual metaphors. In other words, it is possible to gain a deeper understanding of how cli-fi literature influences and transforms our environmental behaviours through a comprehensive analysis of the metaphorical patterns used by cli-fi writers.

Lakoff's emphasis on metaphor aligns with the broader linguistic inquiry into how figurative language shapes perception, a focus shared by other scholars in the field such as Deignan (1999) and Caracciolo et al. (2019). Deignan (1999) underscores that metaphorical framing transfers attributes from a source domain to a target domain, influencing how we perceive and understand the latter. In the context of cli-fi, metaphorical mappings can draw from diverse source domains, such as human emotions, natural disasters, or technological systems, to frame climate change in distinct and impactful ways. For instance, the use of figurative language, especially metaphors, plays a crucial role in conveying the complex and abstract nature of climate change. In her 2017 study, Deignan further explores this idea by analysing metaphors in both scientific and popular texts about climate change, particularly those aimed at young

people. She finds that metaphors in educational materials tend to "open up" complex scientific concepts, often by creatively extending expert metaphors to make them more accessible to non-specialist audiences. However, this simplification can sometimes lead to misunderstandings, especially when students incorporate their own everyday experiences into their interpretation of metaphors, resulting in scientifically inaccurate views. Deignan's study underscores the importance of carefully constructing metaphors in climate change communication to balance accessibility with accuracy, highlighting the powerful role of figurative language in shaping public perception of environmental issues.

Caracciolo et al.'s (2019) study on metaphorical patterns in Anthropocene fiction explores how metaphor functions as a bridge between human experience and the broader nonhuman world in novels that tackle climate change. By analysing three novels—Margaret Atwood's *Oryx and Crake*, Jeanette Winterson's *The Stone Gods* and Ian McEwan's *Solar*—the study reveals how metaphors in these works destabilise the binary distinction between humans and the environment. Key findings show that metaphorical clusters in these novels challenge the entrenched anthropocentric views. For instance, Atwood uses ironic metaphors that diminish human centrality by comparing human characters to objects or animals, while Winterson employs cyclical metaphors that anthropomorphise natural phenomena, suggesting a circular relationship between humans and the environment. McEwan's *Solar* employs bodily metaphors to satirise the scientific community's failure to address climate change but also uses these metaphors to highlight the embodied connection between humans and environmental decay. This study demonstrates that literary metaphors can provide a more nuanced and emotionally resonant way of understanding human entanglement with ecological crises, potentially offering alternative perspectives to conventional climate discourse.

Based on the reviewed literature, we hypothesised that climate change fiction (cli-fi) should contain a significant number of environmental metaphors, as indicated by specific linguistic patterns. This hypothesis stems from the belief that cli-fi writers, who aim to foster emotional engagement and promote pro-environmental behaviours, would employ creative metaphors to influence readers' perceptions of climate change. We expect these metaphors, along with other figures of speech like metonymy and personification, to differ from those found in nonfiction writing and everyday language. This distinction arises from the inherently creative nature of cli-fi, which offers an alternative framing of climate change compared to the factual, objective reporting

style of newspapers. To test our hypothesis, we use a newspaper corpus as a reference framework to demonstrate how and to what extent cli-fi's use of language and metaphors diverges from nonfiction, particularly in its creative representation of environmental issues. Accordingly, in the following sections, we first present the lexical items within specific semantic domains and an extensive list of the metaphorical patterns extracted from our specialised corpus, consisting of 20 works of cli-fi literature. We then compare these targeted lexical items and metaphorical patterns with those identified in newspapers to validate whether fiction writers employ a distinct framing approach compared to nonfiction writers.

3. Method

3.1. Cli-fi Corpus

Based on Lakoff's theory of cognitive framing and metaphor, we hypothesised that climate change fiction should include a significant number of environmental metaphors as evidenced by certain linguistic patterns and that these metaphors, including other figures of speech such as metonym and personification, should be different from those used in news articles focusing on environmental issues. To test these two hypotheses, we employed a combination of quantitative corpus-based methods and qualitative manual analysis based on the suggestions by the following studies and considering their pioneering methodological approaches (Demmen et al., 2015; Koller et al., 2008; Neuman et al., 2013; Semino et al., 2018). Initially, we used LancsBox (Brezina et al., 2020) and compiled a corpus of 20 cli-fi novels written after 1990, consisting of 2,435.431 tokens, 71.520 types, and 64.183 lemmas (see Table 1 for further details). Although the precursors of modern climate change fiction can be traced back to the 1960s, we included 20 works of climate change fiction written after the 1990s in our specialised corpus. The deliberate emphasis on this specific period can be justified for three main reasons. First, the genre of cli-fi gained significant popularity and recognition in the late 20th century and continued to flourish in the 21st century. Focusing on works specifically written after 1990 allows for a study of cli-fi during its period of development and establishment as a distinct literary genre. Second, cli-fi novels written after 1990 exhibit distinct narrative structures, themes, and representations of climate change compared to earlier works.[1] The deliberate emphasis on this specific period is also

1 The novels in the corpus are either classified under the generic category of cli-fi in different sources or have been the subject of literary studies on climate change fiction.

justified by the fact that climate news in newspapers was relatively scarce before the 1990s, a period when the recognition of climate change as a global threat began to gain significant traction.

Table 1. A descriptive overview of the cli-fi corpus

Writer	Novel	Words	Types	Words per sentence
David Brin	*Earth* (1990)	232.686	19.852	13.0
Norman Spinrad	*Greenhouse Summer* (1990)	98.730	10.618	14.9
Larry Niven, Jerry Pournelle, and Michael Flynn	*Fallen Angels* (1991)	121.942	11.052	8.7
Octavia E. Butler	*Parable of the Sower* (1993)	84.984	6.020	10.7
Bruce Sterling	*Heavy Weather* (1994)	104.736	11.077	11.5
John Bames	*Mother of Storms* (1994)	206.364	13.255	22.1
Robert Silverberg	*Hot Sky at Midnight* (1994)	121.790	10.567	12.2
Maggie Gee	*The Ice People* (1998)	97.615	9.410	13.7
T. Coraghessan Boyle	*A Friend of the Earth* (2000)	122.967	13.601	19.8
Robinson Kim Stanley	*Forty Signs of Rain* (2004)	103.274	10.153	13.5
Jeanette Winterson	*The Stone Gods* (2007)	65.917	7.373	12.2
Liz Jensen	*The Rapture* (2009)	114.673	12.123	11.1
Paolo Bacigalupi	*The Windup Girl* (2009)	145.428	11.099	9.4
Marcel Theroux	*Far North* (2009)	84.496	7.399	16.1
Matthew Glass	*Ultimatum* (2009)	144,142	8.164	10.3
Ben Bova	*Empire Builders* (2011)	113.297	10.044	11.3
Kim Stanley Robinson	*2312* (2012)	166.827	13.430	14.8
Nathaniel Rich	*Odds against Tomorrow* (2013)	76.100	6.329	11.0
Richard Powers	*The Overstory* (2018)	174.174	16.156	10.9
John Lanchester	*The Wall* (2019)	73.096	5.597	15.8

The method of analysis comprises two stages. First, we investigate the key semantic domains and analyse the words in context and collocational patterns to detect figurative use in the cli-fi corpus using metaphorical pattern analysis (Stefanowitsch, 2007). To computationally identify the structuring presence and implications of climate change framing through figurative language use in climate change fictions, we initially used the USAS semantic annotation tool in Wmatrix (Rayson, 2009), which enabled us to extract the key semantic domains in our corpus. Wmatrix is software with a web interface that helps users investigate lexical patterns, their frequencies, and the semantic representations.

It extends the keywords analysis feature of the corpus tools and provides users with key semantic domains. Using the tool, researchers can build their own corpora and compare them with the built-in corpora to explore keywords, key semantic collocations and key semantic domains. In our case, key semantic domain extraction helped us focus on the lexical patterns that are particularly related to climate change and ecological issues. The tool provided us with more than 200 key semantic domains, but we decided to scrutinise the domains with the potential to reveal writers' framing of environmental issues. The domains under investigation were *universe*, *weather*, *damaging and destroying*, *geographical terms*, *temperature: cold*, *temperature: hot*, *science and technology*, *green issues*, and *living creatures*. In the following step, we unpacked the semantic domains and decided to investigate the lexical items with at least 100 instances in an attempt to identify elaborate patterns with potential figurative use. We furthered our investigation with more detailed searches exploiting the target lexis under scrutiny. Using the KWIC (key word in context) feature of LancsBox, we set some search criteria to analyse how certain themes are framed through lexical choices and their associations (i.e., metaphorical pattern analysis). In doing so, we aimed to identify the modifiers of the search terms (as suggested by Wendy & Semino, 2020) to detect figurative uses and gain insight into how environmental issues in the corpus are framed metaphorically. We adopted a similar approach summarised in Neuman et al. (2013) for the identification of metaphorical patterns and related figures of speech, which focuses on identifying linguistic deviations from literal norms. This approach, while potentially overlooking some nuances of metaphorical meaning, allows for more efficient and reliable automatic detection of potential metaphorical expressions. The lexical extraction criteria are as follows:

- If the search term is a noun, we search for the adjective before and the verbs before some items.
- If the search term is a noun, we search for the copula following the noun (as in *time is money)*.
- If the search term is an adjective, we search for adverbs before and nouns following.
- If the search term is a verb, we search for nouns following and adverbs preceding and following.

Using these criteria, we explored some search terms. The following CQL samples show an advanced search option investigating search terms on our target list:[2]

2 See the SketchEngine website https://www.sketchengine.eu/documentation/corpus-querying/ for further details regarding the Computer Query Language.

1. [tag="JJ.* "] OR [tag="VV.*"] [lemma="search term"] [tag="JJ.*"]
2. [tag="RB.*"] [lemma="search term"] [tag="N.*"]
3. [lemma="search term"] [lemma="be"]

After filtering the patterns with the CQLs, we went through all the related concordance lines to determine whether the search term in question signifies a metaphorical pattern and thus indicates a conceptual metaphor or not. Then, we manually highlighted the salient figurative uses around our search terms. To present the figurative uses clearly, we extracted the related word pairs from the concordance lines and presented the striking instances of "adjective+noun" and "adverb+adjective" combinations.

3.2. Newspaper Corpus

In the second phase of our study, we repeated the same analysis on the British newspapers with the same search terms and criteria to detect the metaphorical patterns and compare the metaphorical framing in the newspapers and cli-fi novels. To this aim, we developed a specialised corpus consisting of news articles printed on British newspapers (between 1990 and 2019) and particularly discussing issues regarding climate and the environment. We intentionally wanted to build our own news corpus because there is no available corpus addressing texts, particularly about environmental issues. The only environment corpus (*Climate Change* by Carmen Dayrell) is available online through LancsBox (Brezina et al., 2020), which covers a specific year (2011) and is not representative of the period in which we are interested.

For corpus development, we used the web interface of Lexis Library News[3]. Lexis Library News (now known as Lexis+ UK) is a vast online database that provides access to a wide range of news sources, including newspapers, magazines, transcripts of TV broadcasts, and summaries of public records. It is a powerful tool used by researchers, journalists, legal professionals, and businesses to gather information and conduct analysis. Lexis+ UK offers an extensive collection of UK national and regional newspapers, including: *The Times, The Guardian, The Independent, The Daily Telegraph, The Financial Times, Daily Mail, Daily Mirror, The Sun*. The inclusion of both national and regional newspapers provides a diverse range of perspectives on climate change, allowing us to explore the phenomenon under investigation thoroughly. We set certain criteria to filter the articles of our interest. As search words, we used "climate change", "nature", and "environment" and the interface refined the

3 See the website lexisnexis.com.

related headlines on the broadsheet media accordingly. To make it as comparable as possible with the cli-fi corpus, we focused on the news articles and stories between the years 1990 and 2019. The selected pieces consisted of around 200 words at least and were set in the various countries around the world, such as the USA, the UK, Japan, Australia, and Europe. To tentatively match with the size of the cli-fi corpus, we had around 85.000 words for each year except for the years 1990 and 2000 simply because the number of the articles with environmental concerns is considerably lower than the years to follow. We intentionally excluded the letters and personal memos from the corpus to avoid the contexts with the potential to distort the register of our newspaper corpus. After applying these filters and the text selection criteria, our newspaper corpus consisted of 3,404.276 tokens, 57.493 types and 51.755 types. Despite the potential difference between the two corpora due to their register features, we think they are comparable in terms of their similar size and their potential to include the target lexical patterns under scrutiny in this study. We should also note that newspapers can have varying political leanings, which could influence their framing of climate change. Future research could explore the potential impact of partisan bias on the metaphorical framing of climate change in newspapers.

4. Results

Table 2 illustrates the numerical output of the selected key semantic domains. O1 indicates the observed frequency in our (cli-fi) corpus, and O2 shows the observed frequency in the BNC (The British National Corpus) Sampler, readily available on Wmatrix as the reference corpus. The notations "1%" and "2%" signify the relative frequencies in the texts. The domains are sorted on the basis of their log likelihood (LL) value.

Table 2. Key semantic domains

Item	O1	%1	O2	%2	LL	LogRatio	Domain
W1	4003	0.25	912	0.09	866.97	1.42	Universe
W4	3508	0.22	770	0.08	802.36	1.47	Weather
A1.1.2	2927	0.18	815	0.08	447.15	1.13	Damaging and destroying
W3	7770	0.49	3466	0.36	243.18	0.45	Geographical terms
O4.6-	1143	0.07	303	0.03	192.09	1.20	Temperature: cold
O4.6+	2579	0.16	988	0.10	164.37	0.67	Temperature: hot
Y1	2024	0.13	778	0.08	127.37	0.67	Science and technology
W5	493	0.03	225	0.02	13.42	0.42	Green issues
L2	5629	0.35	3225	0.33	8.05	0.09	Living creatures

LL is a probability statistic simply comparing the frequency of occurrence of words (or semantic domains in our case) in the two corpora. LL foregrounds the more frequently used domains in the cli-fi corpus and helps us pinpoint the linguistic phenomenon under examination. The numbers show that the domains *universe* and *weather* have comparatively higher LLs (866.97 and 802.36, respectively) than the rest of the domains, which is an expected outcome, given the intended theme of the novels. Table 3 illustrates the target lexical items represented under the selected semantic domains.

Table 3. Key semantic domains and target lexical Items in the cli-fi corpus

Domain	(Word (lemma	(Frequency (raw and normalised
Universe (Semantic Tag-W1)	world	2054 (8.434)
	planet	617 (2.553)
	sky	689 (1.414)
	moon	344 (1.412)
	star	432 (1.408)
	solar	213 (0.875)
	universe	147 (0.604)
Weather (Semantic Tag-W4)	wind	880 (3.092)
	rain	557 (2.113)
	cloud	453 (1,860)
	weather	445 (1.476)
	storm	311 (1.277)
	snow	284 (1.163)
Damaging and destroying (Semantic Tag-A1.1.2)	break	701 (2.878)
	damage	217 (0.891)
	destroy	196 (0.806)
Geographical terms (Semantic Tag-W3)	earth	1228 (5.042)
	sea	810 (3.326)
	land	598 (2.455)
	wave	578 (2.373)
	forest	510 (2.094)
	river	436 (1.791)
	island	351 (1.442)
	mountain	336 (1.379)
	global	294 (1.207)
	lake	245 (1.006)
	coast	232 (0.953)
	atmosphere	225 (0.924)
	horizon	208 (0.854)
	landscape	151 (0.613)

Temperature: cold (Semantic Tag-O4.6-)	cold cool frozen freeze	734 (3.014) 211 (0.866) 160 (0.657) 118 (0.484)
Temperature: hot (Semantic Tag-O4.6+)	fire burn hot heat warm	608 (2.496) 598 (2.456) 480 (1.971) 459 (1.885) 421 (1.729)
Science and technology (Semantic Tag-Y1)	science	338 (1.388)
Green issues (Semantic Tag-W5)	nature environment	265 (1.088) 156 (0.641)
Living creatures: animals, birds, etc. (Semantic Tag-L2)	animal bird horse fish	494 (2.029) 202 (0.811) 151 (0.590) 119 (0.485)

When the lexical items with at least 100 instances in the investigated semantic domains are analysed, it can be seen that nouns appear to dominate the list. Given the discoursal features of novels, this could partly be predicted. One striking finding in this initial analysis is the scarcity of words related to certain semantic domains, such as *damaging and destroying*, *science and technology*, *living creatures* and *green issues*. Since cli-fi novels specifically focus on climate change and its catastrophic effects, we postulated that there would be more words denoting environmental destruction and its effects on living creatures.

The detected lexical items were the main focus for further analysis. After filtering the output with our pre-determined search criteria (CQL 1-2), we went through all the related concordance lines (16.362) to determine whether the search term in question reveals a metaphorical pattern that could indicate a conceptual metaphor. Then, we manually highlighted the salient figurative uses around our search terms (160 instances in total), which corresponds to a little over 1% of the corpus. To present the figurative uses clearly, we extracted the related word pairs from the concordance lines and presented the striking instances of "adjective+noun" and "adverb+adjective" combinations in a table. The examples in Table 4 represent all the semantic themes under examination and show all the metaphorical patterns, including the figurative uses noted by Lakoff, detected in the concordance lines.

Table 4. Word pairs indicating figurative use in the cli-fi corpus			
Collocate	**Node**	**Collocate**	**Node**
Crazy Drowned Friendly Virgin Malevolent Pollution-chocked Lovely	WORLD	Worn-out Woebegone Useless Hell-bound Tired Sad Fragile Moribund	PLANET
Angry Sweet Concrete Remorseless Ferocious Uncompromising	SKY	Stinging Insane Bitter Fierce Ill Mighty Whipping Lonely Sweeping	WIND
Merciless Stinging Wild Purposeful Violent Ear-battering	RAIN	Treacherous Poor Busy Filthy Loathsome Sad	EARTH
Angry Blood-warm Calm Hungry	SEA	Drowned Pestilent Penurious Hostile Lucky Richest	LAND
Horribly Dangerously Frighteningly Uncomfortably Painfully Screamingly Bitterly Fiercely	COLD	Wild Mind-numbing Murderous Hungry Angry Fiercest Oppressively Fiercely	HEAT FIRE HOT
Virgin	NATURE	Resourceful	ANIMAL

When viewed through the lens of cognitive linguistics, a clear pattern emerges in the tables. Ontological metaphors with "adjective+noun" combinations dominate the way environmental matters are depicted in our corpus. As almost all the examples from the semantic domains in the corpus indicate, when target domains (environment-related lexis) are used in conceptual metaphors, the source domain (human traits) are mapped on the target domain. In other words, the underlying conceptualisation of the environment in cli-fi novels largely depends on personifications, generating the conceptual frame that "the environment is a human being." Thus, the earth is framed as "poor," "treacherous," "filthy," or "loathsome," while the sea is depicted as "angry," or "hungry" and land as "hostile," "lucky," or "penurious." Expectedly, the adjectives used in the conceptual metaphors are predominantly negative with very few instances of positive framing, such as "beautiful earth," "calm sea," and "lucky land." One might expect to see a depiction of the environment (i.e., plants, animals and human life) as being damaged and destroyed given the main aim of the cli-fi genre; however, the corpus output does not meet the expectations as the semantic domain *damaging and destroying* is not represented in the corpus through figurative language use.

In an attempt to do a more in-depth analysis and in the hope of revealing more figurative uses based on the suggestions by the same study (Neuman et al., 2013), we conducted another search with a specific search criterion (CQL 3). Table 5 shows the concordance lines highlighting metaphorical patterns and indicating the potential figurative use.

Table 5. KWIC indicating figurative use in the cli-fi corpus

CQL 3

UNIVERSE	**WEATHER**
• World is *chocked to death*.	• Wind is *raging*.
• World is *constantly hungry*.	• Wind was *blowing, gently making music*.
• World is *drowned in ten years*.	• Wind was *so loud*.
• World is *a lonely place*.	• Wind is *whipping fiercely*.
• World is *finally growing up.*	• Wind was *bitter*.
• World is *abundant and extravagant*.	• Rain is *still hammering down*.
• World was *short-sighted.*	• Storm is *raging*.
• World is a *scaly old snake.*	• Storm is *brewing*.
• World is *sentimental, but pitiless.*	• Weather is *crazy*.
• World was *holding its breath.*	• Weather was *lovely*.
• World is *on the mend.*	• Clouds were *boiling away*.
• Planet is *immune from this.*	• Clouds were *eating up the daylight*.
• Universe is *performing a drama.*	
• Universe is *an imprint.*	
• Universe is *a memory of our mistakes.*	
• Universe is going to be *lonelier.*	
• Universe is *Godseed*.	
• Universe is *God's self-portrait.*	
• Universe is *a banyan, its roots and branches below.*	

GEOGRAPHICAL TERMS	SCIENCE AND GREEN ISSUES
• Earth was *healing.* • Earth was *home, the oasis*. • Earth was *the prime real estate.* • Earth was *fucked*. • Earth was *a park now, a work of art.* • Earth is *bathed in a flood of sunlight.* • Earth is *healing itself.* • Earth was *shrouded*. • Earth is *trying to speak*. • Earth is *so terribly fucked up.* • Earth was *a massive involuted purple box.* • Sea was *dream or delirium.* • Land was *sacrificed*. • Waves *were fierce.* • Island is *a prison.* • Atmosphere *was wrecked.* • Forest was *silent*. (x3) • Forest was *scarred*. • Living mountains be *able to sue humans.*	• The environment is *alive.* • Science was *the gene trying to pass*. • Western science is *crazy*. • Science was *a conspiracy to pollute*.

Although the metaphorical patterns consisting of "lemma+be" combinations are more varied than those of "adjective+noun" and "adverb+adjective" combinations, personifications are also predominant in this group. The shift from the source domain to the target domain is mostly mediated through human traits and actions. The world, as a planet or human population, is depicted as "hungry," "growing" or "holding its breath." Likewise, atmospheric phenomena are portrayed as anthropomorphic forces, "raging," "making music" or "whipping." Universe, science, land, planet, and earth, on the other hand, are featured with nouns, using impersonal formulas, such as "an imprint" or "a gene." We furthered our discussion by comparing the cli-fi corpus and the British newspaper corpus to detect possible diverging or parallel trends in the way environmental issues are addressed. For an initial comparative lexical analysis, we provide the frequency and dispersion values of the two corpora in Table 6.

Table 6. Comparison of normalised frequency and dispersion in cli-fi and newspaper corpus				
Word (lemma)	**Cli-fi Corpus Frequency & Dispersion**		**Climate Change in the British Newspapers Corpus Frequency & Dispersion**	
	Freq.	**Disp.**	**Freq.**	**Disp.**
world	8.434	0.17	22.56	0.03
planet	2.553	0.43	5.046	0.06
sky	1.414	0.20	0.334	0.12
moon	1.412	0.42	0.190	0.18
star	1.408	0.37	0.331	0.22
solar	0.875	0.49	2.746	0.08
universe	0.604	0.40	0.102	0.29
wind	3.092	0.27	4.121	0.08
rain	2.113	0.30	2.311	0.08
cloud	1.860	0.33	0.487	0.20
weather	1.476	0.34	9.070	0.09
storm	1.277	0.43	1.365	0.11
snow	1.163	0.48	1.527	0.09
break	2.878	0.20	1.920	0.08
damage	0.891	0.21	4.252	0.07
destroy	0.806	0.37	1.473	0.61
earth	5.042	0.31	5.369	0.06
sea	3.326	0.32	9.593	0.05
land	2.455	0.29	4.870	0.06
wave	2.373	0.24	0.660	0.09
forest	2.094	0.46	2.270	0.12
river	1.791	0.28	1.662	0.09
island	1.442	0.40	2.009	0.12
mountain	1.379	0.32	0.763	0.18
global	1.207	0.50	27.35	0.03
lake	1.006	0.38	0.549	0.20
coast	0.953	0.38	1.797	0.07
atmosphere	0.924	0.33	4.582	0.06
horizon	0.854	0.37	0.255	0.27
landscape	0.613	0.48	0.825	0.13
cold	3.014	0.35	1.965	0.10
cool	0.866	0.25	0.608	0.12
frozen	0.657	0.35	0.446	0.20
freeze	0.484	0.46	0.164	0.21

fire	2.496	0.32	1.404	0.22
burn	2.456	0.34	2.003	0.16
hot	1.971	0.20	1.715	0.10
heat	1.885	0.22	3.348	0.09
warm	1.729	0.33	1.862	0.10
science	1.388	0.51	6.908	0.11
nature	1.088	0.27	4.271	0.09
environment	0.641	0.49	13.17	0.08
animal	2.029	0.32	0.757	0.08
bird	0.811	0.38	0.693	0.16
horse	0.590	0.52	0.185	0.21
fish	0.485	0.41	2.067	0.13

When we take a broad overview of the numbers indicating frequency and dispersion in Tables 6 and 7, we see that the mean frequency values are moderately higher in the newspaper corpus (1.74 and 3.52, respectively). Likewise, as far as dispersion is concerned, we can say that the target items with the potential to address environmental issues in the texts are more evenly distributed in the newspaper corpus (0.13 – closer to 0) than in the cli-fi corpus (0.35 – closer to 1).

Table 7. Descriptives

	N	Mean	SD	Minimum	Maximum
Cli_Fi_Freq	46	1.746	1.3667	0.4840	8.434
News_Freq	46	3.521	5.3927	0.1020	27.350
Cli_Fi_Dispersion	46	0.356	0.0930	0.1720	0.523
News_Dispersion	46	0.132	0.0952	0.0300	0.610

Additionally, we computed an independent samples t-test to see if the detected difference in the descriptive values is statistically significant or not. Table 8 suggests that there is a statistical difference between the dispersion and frequency values of the cli-fi and newspaper corpus ($p < .001$; $p < .03$, respectively). The numbers also indicate that the difference between the normalised dispersion values outperforms the frequency profiles.

Table 8. Independent samples t-test				
		Statistic	**df**	**p**
Frequency	Student's t	-2.16[a]	90.0	0.033
	Welch's t	-2.16	50.8	0.035
Dispersion	Student's t	11.39	90.0	001.>
	Welch's t	11.39	90.0	001.>

Note. $H_a\ \mu_{Cli_fi} \neq \mu_{news}$

[a] Levene's test is significant ($p < .05$), suggesting a violation of the assumption of equal variances

To further unpack the frequency difference and elaborate on the semantic domains that could affect the difference, we compared the descriptive output of the lexical items represented under each semantic domain. When the frequency values of the items representing the semantic domains are analysed, we detected a pattern that signals certain domains, possibly causing the significant difference in the t-test. The domains regarding *the world* and *the environment* (W) represented by the items, such as nature, environment, and nouns referring to geographical terms stand out with considerably higher frequency values and are more evenly dispersed across the texts. The possible reason for this difference could stem from our filtering criteria as we prioritised texts including these search terms in their headings.

We further our investigation with the CQL search as we did in the first corpus search. There are few instances of figurative use when all the semantic domains are taken into account. Table 9 comparatively exemplifies the very few figurative uses in the newspaper corpus.

Table 9. Figurative use in different semantic domains (with all CQLs)	
UNIVERSE	**GEOGRAPHICAL TERMS**
• The planet can survive the age of humans. • The planet is in ever greater pain • In a world desperate for power • Crazy *world* of a genetic hysteria • *The world's* weather to go mad • Sweltering *world* unable to feed • The world is *gambling* with its future. • The world is *waking up* to the enormity… • The world is *creating industry buzz*. • The world is going to *come and flock to vote*. • The world is *cooking*.	• *Sea* is boiling. • Killing off *river* habitats • The *earth* machine • Deadly *earth* machine • Mother earth *gives up the ghost* • Consumers of virgin *forest* • *Land* gets sick and die • Forest is *your sister/brother/home*

SCIENCE	**GREEN ISSUES**
• Make *science* sexy • Climate science is *witchcraft*	• *Environment* to be the new *global* religion • *Global* warming hysteria • Nature is *trying to skip winter* • Nature can be *cruel* • Nature is *dying*
WEATHER	
• Rain was *killing trees.* • Weather is *literally destroying the homes*.	

Having analysed around 55.000 concordance lines including our target lexical items, we detected 221 potential candidates of figurative use, mainly around the words earth, environment, global, nature, science and world (primarily, [W] green issues) and almost evenly distributed across the years (approximately 7 instances each) under scrutiny.

5. Discussion

The picture of metaphorical framing in the cli-fi corpus presented in the first part of the study and the following comparative analysis with the newspapers yield significant results concerning the purported positive impact of climate change fiction on readers. The most obvious finding to emerge from this study is the prevalence of ontological metaphors of personification in the cli-fi corpus, which aligns with earlier research (e.g., Caracciolo et al., 2019; Deignan, 2017). As presented in the previous section, cli-fi writers tend to attribute human traits to nature and describe natural phenomena as anthropomorphic forces that populate and govern the earth. Despite cli-fi writers' heavy reliance on personification, the use of personification as an ecological argument in environmental writing has been a controversial topic. While in traditional ecocritical approaches "personification" is often seen as a valuable tool for fostering ecological awareness and empathy, the general tendency in contemporary ecocritical and posthumanist theories is moving in a direction towards an anti-anthropocentric language in nature writing. As a representative of the former approach, Bryan L. Moore (2008), for instance, developed the concept of "ecocentric personification" as part of his research and analysis of the intersection between rhetoric, ecology, and the representation of nature in literature. In his *Ecocentric Personification*, Moore (2008) contends that personification can be employed as a rhetorical and literary device to undermine anthropocentrism rather than perpetuate it. What Moore refers to as ecocentric personification is a type of personification that "directly addresses ecocritical and ecological concerns on at least three major fronts: representation, relationship, and

morality" (p. 10). It seeks to persuade an audience that all living things are connected by intersecting the two essential points of rhetoric and ecology.

Within the context of posthumanism, however, the perception of personification as a literary device is more nuanced. Posthumanism challenges the traditional human-centric perspective and seeks to decentre the human in favour of a more inclusive understanding of agency and subjectivity. Personification, in this context, can be seen as reinforcing anthropocentric hierarchies by projecting human attributes onto non-human entities. Some posthumanist scholars argue that personification perpetuates a human exceptionalist worldview, limiting our understanding of non-human experiences and alternative ways of being in the world. For instance, Barad (2007), a pioneering posthumanist theoretician, points out that "meaning is not a human-based notion; rather, meaning is an ongoing performance of the world in its differential intelligibility" (p. 335). With its emphasis on human consciousness as a constructive agency, personification is, therefore, deemed rhetorically counterproductive since it tends to reify the very categories (i.e., humans' separateness from and superiority to nature) that it aspires to challenge. The key objective of emerging paradigms in posthumanist ecocritical theory, as Serenella Iovino and Serpil Oppermann (2012) succinctly put it, is to formulate a new discourse "against the visions that associate agency with intentionality and therefore with human intelligence" and to demonstrate that "the true dimension of matter is not that of a static and passive substance or being, but of a generative becoming" (p. 76). From this critical perspective, it is clear that the frequent use of personifications of nature in cli-fi novels can be interpreted as an indication of an anthropocentric tendency among writers. Almost non-existent metaphors related to plants and animals in the cli-fi corpus serve to strengthen the argument that the metaphors commonly utilised in this genre primarily centre on anthropocentric themes.

The second key finding of the study is the extensive utilisation of negative adjectives and verbs in the cli-fi corpus. This finding led us to conclude that cli-fi writers deliberately employ these linguistic choices to evoke fear and panic in their depiction of climate change. Like the anthropocentric language, the evocation of negative emotions is considered to be a factor that may diminish the purported positive effect of reading cli-fi. A previous study conducted by Schneider-Mayerson (2020) explored the persuasiveness of cli-fi and highlighted the potential detrimental effect of negative emotions on ecopolitical persuasion and mobilisation. Negative emotions, such as fear and worry, can overwhelm individuals, making them feel helpless or hopeless, and

ultimately leading to disengagement from the issue of climate change rather than inspiring action. Furthermore, Schneider-Mayerson (2018) reported a similar finding in an earlier study, indicating that while climate fiction can effectively reinforce the severity and urgency of anthropogenic climate change for concerned liberals and leftists, it may not significantly influence sceptics and deniers to reconsider their positions. Consequently, it becomes evident that the prevalent use of negative metaphorical framing in cli-fi novels is unlikely to prompt a shift in readers' environmental behaviours, particularly among those who harbour reservations about climate change. In other words, cli-fi writers are not likely to effectively engage climate sceptics and motivate them to prioritise environmental concerns in their daily lives.

Finally, based on the comparison between metaphorical framing in the cli-fi and newspaper corpora, it becomes evident that cli-fi writers rely more heavily on figurative language compared to nonfiction writers. However, the number of identified metaphors in cli-fi works is relatively fewer than expected, considering the genre's creative nature. Cli-fi writers employ a potent language, characterised by a darker and emotionally disturbing tone, which contrasts sharply with the neutral and disinterested tone found in the newspaper corpus. News writers tend to use a language leaning more towards business-oriented discourse, often containing words with strong political and economic connotations. Cli-fi works incorporate a higher number of environment-related conceptual metaphors. However, upon closer examination from the cognitive linguistic and ecocritical perspectives, these metaphors are unlikely to generate new cognitive frames about climate change. This is mainly due to their anthropocentric nature and their negative emotional impact on readers. Consequently, the findings of the present study align with previous research suggesting that cli-fi novels may not be potent instruments of social change capable of prompting immediate environmental action. Instead, the prevalence of personification and the recurrent use of negative language in metaphorical framing by cli-fi writers may indicate potentially counterproductive discourse, raising pertinent questions about the efficacy of cli-fi as a means of environmental persuasion.

6. Conclusion

The present study by no means provides an exhaustive account of metaphorical framing in climate change fiction. However, we hope that this study is complete enough to have shed light on some of the overlooked aspects of metaphorical framing in cli-fi

novels, and that the findings of our study have potential implications for further research in the growing field of ecocriticism and environmental humanities. First, with its specific focus on the metaphorical framing in climate change fiction, it calls attention to the significance of authorial strategies used in environmental communication—an often-neglected aspect in environmental literary studies. In future studies, authors' role in environmental communication can be investigated from diverse perspectives with particular emphasis on lexical choices and metaphorical framing. Additionally, our comparative analysis of metaphorical frames used in cli-fi and newspapers opens up new avenues for research, inviting similar comparative investigations between fictional and non-fictional accounts of environmental issues. This approach can provide valuable insights into how different genres and modes of communication shape public understanding and discourse surrounding climate change. Furthermore, future studies could adopt a diachronic approach to examine the evolution of metaphorical framing in cli-fi novels and newspapers over time. Such investigations can shed light on how our conceptual frames regarding climate change have transformed and adapted over the years. Finally, the impact of metaphorical frames on readers' emotional responses warrants further exploration through empirical studies. By measuring the extent to which metaphorical frames influence readers' perspectives on climate change, we can gain a better understanding of the emotional and cognitive effects of metaphorical framing. In conclusion, while there is still much more to explore in the relationship between metaphorical framing and climate change fiction, we believe that our study serves as a stepping-stone, offering directions for future research that can enrich the field of ecolinguistics, ecocriticism and environmental humanities.

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