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The art of storytelling: Against the instrumentalisation of stories as information sources in climate communication

Abstract

*Storytelling is an important tool of public engagement for researchers, not least for climate scholars. However, a problem arises when stories are treated instrumentally as means of delivering specific messages and as information sources. In particular, controlled experiments measuring the impact of stories on readers may misrepresent how stories work in practice. In this article, we shift perspective and re-emphasise the complexity of storytelling by analysing the role of stories in three “climate fiction” novels: *Sands of Sarasvati* by Risto Isomäki, *Green Earth* by Kim Stanley Robinson and *Tentacle* by Rita Indiana. We highlight four underrepresented perspectives on storytelling: (1) stories may be used as time-resistant sources of scientific evidence; (2) stories may provide moral guidance; (3) stories have the ability to make connections, organising events and agencies; and (4) stories afford storytellers agency to act on climate change. We thus conclude that efforts to evaluate the impact of stories require an understanding of how stories function in specific works of art.*

Keywords: climate fiction, climate communication, storytelling, stories, Risto Isomäki, Kim Stanley Robinson, Rita Indiana

Introduction

The question of how to effectively engage audiences in environmental issues is well discussed and constitutes a major concern for a wide array of social actors and institutions, including governmental bodies, NGOs and researchers (Corner et al., 2017). There is a growing consensus on the relevance of narrative framing when communicating climate science and storytelling has emerged as a communication technique which can be effective in a wide range of contexts (Cormick, 2019). A common argument is that stories afford deep and meaningful engagement, and that humans make

sense of the world through stories rather than through abstract graphs or information sheets (Arnold, 2018; Corner et al., 2017). Scholars have embraced the mobilising potential and imaginative power of stories to transform and set out pathways for new futures (Barber, 2021; Palmer, 2010). Yet, there are increasing concerns about claims pertaining to the power of stories, because more often than not, these claims are not substantiated by empirical studies of audiences' reactions to stories (Easterlin, 2012; Schneider-Mayerson et al., 2020). This has led to attempts to measure the impact of various types of stories, such as videos, literature, and oral storytelling (Finkler & Leon, 2019; Jones, 2014; Schneider-Mayerson et al., 2023; Stephens et al., 2010). One storytelling form which has been subjected to these types of pursuits is climate fiction, or "cli-fi".

Cli-fi is a literary genre that deals with global warming and environmental disaster scenarios. Like the broader science fiction tradition of which it is a part, it often has futuristic, speculative, fabulous, dystopian or apocalyptic elements, but it focuses on urgent, highly topical scientific themes. Indeed, cli-fi is a genre in which the present and the future increasingly converge along with the factual and the fictional, as it explores the very real threat and danger of human-induced climate change. The genre offers the kind of "more-than-fictional stories" that are vital for envisioning and preventing different kinds of climate futures (Veland et al., 2018, p. 44).

A problem arises, however, when climate-themed storytelling is treated as "another technological or methodological fix" (Veland et al., 2018, p. 45). This type of understanding can also be discerned in some of the attempts to evaluate the efficacy of climate stories on readers as pure information sources (see Schneider-Mayerson, 2020). When scholarship treats cli-fi as a means of delivering or popularising specific messages – employing what Bucchi and Trench (2014) refer to as the diffusionist model of science communication – it overlooks how different examples from the broad cli-fi genre may have different kinds of effects, potentially functioning in dramatically different ways. Readers engage in fiction for a variety of reasons: entertainment, personal development, escapism, emotional comfort, to name a few (Bawden et al., 2009; Ooi & Liew, 2011). Further, a purely instrumental engagement with cli-fi and its potential effects on audiences risks obscuring the range of storytelling options available in environmental communication. We suggest that researchers concerned with questions of the efficacy of storytelling may better adopt other methods and appreciate the potential of storytelling approaches through a richer and more multifaceted understanding of how stories are conceived of and used by cli-fi authors. Instead of focusing on whether a message has been delivered and appropriately understood by a reader, questions pertaining to the impact of stories should be modelled on the premises of stories as *complex art forms*.

This paper focuses on cli-fi as a means of following Menning's (2018, p. 352) call for scholarship that "draw[s] on all the resources of human culture to see our way through" the unique challenge of climate change. More specifically, it aims to investigate the role of stories *within* cli-fi, or how stories are deployed by cli-fi writers. Many cli-fi novels offer a kind of meta-discussion of the importance of stories in scientific work. It is, moreover, a broad genre in which different kinds of cli-fi novels demonstrate different styles of storytelling, positing various kinds of relationships between stories and climate science. We therefore intend to analyse how cli-fi authors write *about* stories, how they *work with* stories and indeed how they conceive of their role as climate-related storytellers. To be clear, this paper does not claim to contribute to the large literature on narrative theory or literary studies. Rather, the overarching aim of this thematic focus is to offer a deeper understanding of how stories can function in science communication. To do so, we analyse three novels by acclaimed cli-fi writers, namely *The Sands of Sarasvati* (2005; English translation 2013) by Risto Isomäki; *Green Earth* (2015) by Kim Stanley Robinson; and *Tentacle* (2015; English translation 2018) by Rita Indiana. Each demonstrates a different approach to storytelling and affords a different role to stories in addressing

climate change – although all are united in conceiving of storytellers, including cli-fi authors, as important in contemporary environmental science.

Analysing climate fiction as science communication: the persuasive power of stories?

Academics are increasingly encouraged to adopt storytelling techniques that will “woo, engage, surprise, persuade, rattle, disarm, or disquiet the reader” (Lorimer & Parr 2014, p. 544). Stories are appreciated for their potential to lead audiences to a shared understanding of the significance of scientific claims (Goldstein et al., 2015). They are seen as a key tool of “information transfer” (Kearney, 1994, p. 419), and vital for “making science meaningful” beyond the academy (Cormick, 2019; ElShafie, 2018, p. 1214). These kinds of claims all build more-or-less-critically on the idea that storytelling is an intrinsically and fundamentally human way of making sense of the world (Gabriel, 1991; Kearney, 1994; Veland et al., 2018). For Gabriel (1991), storytelling is a continuous and ubiquitous process by which people give meaning to sequences of events, weave plots together from different experiences, develop a sense of purpose and direction, and form and reinforce identities and subject positions. Further, stories are said to have “world-making power” and work, for example, for environmental policy purposes by “making sense of observations, leading us to new inferences, and providing models for a path forward” (Veland et al., 2018, p. 42).

In the field of climate science, scholars who feel an urgent need to make an impact on public debates have been especially keen to adopt storytelling styles and techniques (Arnold, 2018; Corner & Clarke, 2016), and the “power of stories” – especially “ecological stories” – has been harnessed by many who work in relevant scholarly disciplines (Jones & Jones, 2017, pp.147-148). This is where cli-fi sometimes enters into discussions of pop-cultural and potentially more widely “persuasive” forms of science communication that can enthuse audiences and more effectively inspire decisive action on climate issues (Barber 2021; DiPaolo 2018; Palmer 2010). In its ability to reach readers by bridging science, the humanities and social activism, the genre is considered to have political and even world-saving potential (DiPaolo, 2018; Palmer, 2010). Cli-fi is also said to offer the imaginative resources required for societies to achieve, and be motivated towards, the necessary transformations (Barber, 2021; Milkoreit, 2017). Many studies of cli-fi explore its imagined climate futures from the perspective of their potential mobilising effects, with an emphasis on readers’ emotional responses, personal meaning-making and other features that may influence subjects’ behaviours or beliefs regarding climate change (Barber, 2021; Milkoreit, 2017).

This focus on cli-fi as a tool for persuasion has led to some scepticism about its effectiveness. In an “experiment” focusing on a persuasive mechanism called “narrative transportation”, Jones (2014) found that “exposing” study participants to climate change narratives was no more effective in persuading them to endorse specific climate-related policies than presenting them with lists of facts. Schneider-Mayerson has taken a similarly experimental approach in several studies. One paper highlights that the majority of readers of cli-fi are already concerned about climate change, with the implication that cli-fi reading merely confirms or “reminds” readers of a pre-existing interest, rather than mobilising them or changing their minds (Schneider-Mayerson, 2018). In another study using “controlled experiments” to assess the short- and long-term impacts of cli-fi on readers’ environmental beliefs and attitudes, Schneider-Mayerson et al. (2023) surveyed participants immediately after they had been “exposed” to “treatment stimuli” – namely, cli-fi short stories – and then again one month later. These short stories – Helen Simpson’s “In-Flight Entertainment” (2011) and Paolo Bacigalupi’s “The Tamarisk Hunter” (2008) – were edited to “enhance clarity”. The way in which the authors summarised and edited the work of professional cli-fi writers to make it *clearer* indicates that the stories were chosen for their content rather than form. Focusing on “the effects

that occur from a single exposure to a message” (Schneider-Mayerson et al., 2023, p. 45), they treat cli-fi stories as “messages”, and forego other ways in which the genre – including its longer novel format – might work as a storytelling form.

This kind of approach to communication falls into what Bucchi and Trench (2014) call the diffusionist model of science communication whereby an immutable piece of information is unidirectionally transferred to passive subjects. Forms of communications are primarily considered in terms of their ability to transmit a message, but not seen as affecting the message itself (*ibid.*). By adopting this approach to communication, as exemplified by these several methodological choices, scholars may have missed some opportunities to explore how cli-fi stories work *as stories* – that is, with purposes and meanings beyond carrying messages. Different kinds of stories may make different emotional impacts via different mechanisms (Bilandzic et al., 2020), offering various routes to political mobilisation for readers with diverse experiences of climate change (Munshi et al., 2020). Stories in general have the power to do more than just persuade or change minds on specific environmental-political points; they structure and organise events, generating different kinds of agencies and tensions, indicating the ethics and consequences of certain kinds of actions, and their power may come in how people interpret their social role through them (see Cole, 2021; Nikoleris et al., 2017).

One way of keeping stories central in analyses of cli-fi is to focus explicitly on the role of stories *within* cli-fi novels. This is the approach we take. This means that we analyse what stories are doing within the narrative structure, and when we consider agency, we look partly at the agency of stories in cli-fi novels – how stories *act* and what they *do* in cli-fi narratives. While cli-fi is a varied genre, and its novels do not always have a persuasive function or message, they often have something to say about the use of stories in the context of contemporary climate politics. We focus on how stories organise and connect events, agents’ trajectories and (scientific) ideas in the novels, arguing that storytelling (and climate fiction) should not be seen as a persuasive tool *per se*; rather, different kinds of stories, and different features within stories, need to be taken into account if we are to appreciate the diverse impacts that cli-fi and its storytellers may have.

Material collection: three cli-fi examples from a varied genre

Cli-fi novels are concerned with ecological and climatic changes, challenges, disasters, dystopias, adaptations and related oppressions and struggles, both historical and contemporary. The genre’s name can be misleading, however, as it does not fully capture the complexity and multitude of themes and experiences – from issues of deforestation, pollution and sustainability to animal welfare, industrialisation, capitalism, sexism and racism – addressed by novels classified as cli-fi (DiPaolo, 2018, pp. 8–9). DiPaolo (2018) stresses that, even when cli-fi addresses topics beyond environmental sustainability and change, it is always engaging with the themes of justice, balance and the preservation of life. It has in fact been labelled “the genre of everything” because when the climate changes, everything else is affected (DiPaolo, 2018, p. 8). The genre’s trajectory may be traced back to antiquity and through C.S. Lewis’s *Narnia* novels of the 1950s (DiPaolo, 2018; Milner & Milner, 2018), but it has blossomed as a coherent genre, distinct from science fiction and fantasy, since the 1990s and especially in the 2010s when climate change has become an increasingly important cultural and political concern (Johns-Putra, 2016; Trexler, 2015). Many cli-fi novels are distinguished from more fantastical science fiction by their present or near-future settings and their realist style. The cli-fi writer Kim Stanley Robinson, for example, has aimed “to write a realist novel as if it were science fiction”, an approach he considers appropriate for the present situation in which “we live in a big science fiction novel we are all writing together” (Robinson, 2015, p. xii). Cli-fi is at times characterised by didacticism, as its authors sometimes want readers to interpret their stories in specific ways that

will have an impact on social and political reality (Lahtinen, 2017, p. 82). But cli-fi does not have to contain an explicit or practical political message for the present; it can be a cultural exploration of a collapsed world or a potential future, with other artistic aims.

We focus on three cli-fi novels that exemplify three different ways of storytelling in relation to environmental science. We deliberately chose cli-fi novels which incorporated a meta-discussion on the art of storytelling in their narrative. First, Risto Isomäki's *The Sands of Sarasvati* (2005/2013) is described as an eco-dystopian-thriller that makes "complex science accessible" (Lahtinen, 2017; Witesman, 2011). It won the Finnish science fiction "Star Wanderer" award in 2006, and has been translated into 10 languages. The novel follows a network of scientists across several continents as they uncover a historical ecological disaster and seek to prevent a new one in the present. Different discoveries and theories – of a hidden meltwater lake under the Greenland ice sheet and an Atlantis-like ancient underwater city off India's southern coast – are woven together to predict a megatsunami that will wipe out modern civilisation as we know it. Scientists are the protagonists of *Sands of Sarasvati*, and these scientific heroes draw not only on their scientific knowledge, technologies and expertise but also on ancient myths and stories that help them make sense of the phenomena they observe. Myths and their relation to current scientific ideas constitute a recurring theme in Isomäki's work, and his books are often marketed as scientifically plausible (Lahtinen, 2017, p. 83). Isomäki has published non-fictional works related to environmental activism, and he has addressed the Finnish parliament on the subject of nuclear power plant construction programmes (Karppanen, 2011; Lahtinen, 2017). Isomäki's scientific knowledge and theories – including on nuclear power – feature in his fiction, including *The Sands of Sarasvati*, and we focus on this novel because of its emphasis on the relationship between stories and climate science.

Green Earth (2015) is a condensed omnibus of Kim Stanley Robinson's multi-award-nominated "Science in the Capital" trilogy (2004–7). Like Isomäki, Robinson is a well-known writer and speaker on the topic of climate change in his home country. He also encourages the readers of his fiction to think about environmental issues in their everyday lives and, by engaging with contemporary research and public debate, he creates links between "stories and the present social and political conditions" (Milkoreit, 2017, p.14). The action in *Green Earth* takes place in Washington DC amid changing climatic conditions such as flooding, storms and heatwaves. The arrival of climate refugees shows how climate change has become a global concern. The main protagonist is the scientist Frank Vanderwall. He works at the National Science Foundation (NSF), evaluating research proposals. He also invests in biotechnology start-up companies and holds a tenured position at a renowned university on the west coast. As such, he represents different aspects of science and scientific work. Frank is initially presented as cynical and disinterested in environmental issues, but he ultimately becomes a passionate campaigner for reform, driving the NSF's climate change mitigation efforts. Politicians are among the novel's other key characters and, through its Washington focus, *Green Earth* emphasises climate solutions based on fusing institutional politics and science. Climate change is the problem around which most actions are centred. Character arcs, family dynamics and love stories are side narratives of secondary importance to the main climate dilemma.

While climate catastrophe is clearly the key theme in *Green Earth* and *The Sands of Sarasvati*, Rita Indiana's *Tentacle* (2018) addresses an array of different political and social issues. Indiana is a musician and novelist whose work transgresses traditional genre conventions and challenges cultural boundaries (Horn, 2014). *Tentacle*, which won the Association of Caribbean Writers' Grand Prize for Literature in 2018, has primarily been analysed in terms of its depiction of racialised violence, gender politics and the colonial history of the Dominican Republic (Boswell, 2019; Deckard & Oloff, 2020; Soares, 2020). Parts of the novel take place in the 1600s and the early 2000s, but most of it unfolds in a dystopian yet recognisable near-future Dominican Republic. Indiana has described *Tentacle* as a

work of “speculative history” (Herrero-Martín, 2019, p. 53) exploring an ecological disaster that destroys the Dominican Republic’s sealife. There is a diverse cast of characters, including a central protagonist – Alcide – who transitions from a woman to a man, takes on three different identities in parallel historical periods, and takes on the role of saviour of the Caribbean coral reefs. Besides Alcide and the passionate environmental scientist Linda Menicucci most characters pay little attention to the region’s aquatic ecology, although the challenge of ecological restoration is the story’s central thread, uniting its themes and subthemes. In this respect it differs from the other novels discussed here in terms of the role it affords to stories and storytellers in the unfolding ecological crisis.

When we analysed the novels, we paid particular attention to how the novels used stories and the importance they attributed to stories. Below, we draw out the differences between the three novels in terms of how they make use of, and sense of, stories in their climate-related storytelling.

Results and discussion: analysing stories in cli-fi

Sands of Sarasvati: stories as evidence over time

Isomäki’s *Sands of Sarasvati* has been interpreted in terms of a symbiosis or “tension between science and myths” (Lahtinen, 2017, p. 92). We suggest that his work may be better understood as a call for greater integration of stories and science in various ways. Most obviously, Isomäki draws connections between scientific argumentation and storytelling, indicating that presenting scientific ideas can – and perhaps even *should* – be a kind of storytelling. For example, Sergei, an oceanographer, is convinced by his fellow colleague Amrita’s work on the history of western and Indian science because it is a compelling “story” (Isomäki, 2013, p.106). Relatedly, Isomäki himself uses the conventions and form of the story to share and convince the audience of scientific details. This is one of the most distinctive features of his writing, as the book is full of information from academic research articles that is presented in the form of dialogue or narrative discovery. There is, for example, a two-page dramatic dialogue between two scientist characters that basically summarises scientific understandings of the mechanisms of glacial melt that might lead to dramatic sea level rise (pp. 204–5). Isomäki seems, then, to see the story form in diffusionist terms as a vehicle for sharing scientific information of social significance, with an attitude that largely corresponds with the narrative turn in academia, where stories are seen as the ultimate medium to convey scientific messages to the public and inspire them to take action on climate-related issues (Boykoff, 2019; Corner et al., 2017).

But stories as presented in *Sands of Sarasvati* can and should also contribute to scientific work and become part of the process of developing and supporting hypotheses. For example, when Amrita asks how Sergei correctly predicted the location and details of an archaeological find, he begins his answer by describing “the tale of the Great Flood” and its variations among the world’s different cultures (Isomäki, 2013, p.139). For the story to function as evidence, however, it has to be interpreted from a scientific perspective, and in this example Sergei explains his rational reasoning for determining that “the story of the Great Flood is true” – and therefore able to explain the location of the archaeological find (p. 140; see also pp. 121–5). Amrita similarly refers to Sumerian legends about a great historical flood to explain why she “think[s] there is a certain logic to the whole story” (pp. 167–8). When it comes to “the story of Atlantis”, the two consider how it may have changed and distorted over time “like so many other good stories and myths had done over the millennia” (p. 76). A scientific mind was needed to process the story and clean the evidence before the “story was beginning to sound downright believable” (p. 77). This processing, cleaning and mining a story for information can be likened to approaches where cli-fi stories are used as experimental stimuli for testing hypotheses (Schneider-Mayerson et al., 2023). Here the story-form is in itself not valuable; rather, it is what it portrays – what is hidden in the midst of words and scenes – that matters. *Sands of Sarasvati*

therefore appears to reflect a decontextualised and diffusionist approach to stories, where the form is of less importance than the informational content. It is implicit, however, that it is the story form that functions to protect and transmit knowledge over generations. Stories can share ancient wisdom because they are capable of surviving beyond societal collapse or indeed climate catastrophe. They can stand the test of time, presumably through their ability to appeal to audiences and therefore to be passed on through culture, and they are therefore valuable as ancient technologies – more reliable than overly complex modern equivalents – that can convey truths that trained scientific minds can uncover. Stories are a means to “safeguard all necessary, useful knowledge through the bad times” (Isomäki, 2013, p. 168). In comparison to academic uses of storytelling, stories are thus less of a tool for active outreach; instead, they are tools of preservation and guardians of knowledge.

As guardians of ancient knowledge, stories can also function as evidence – even *the only reliable evidence* – for climate-scientific hypotheses and claims. This is presented most starkly when Amrita and Sergei are forced to acknowledge that Plato’s writings on the “legend of Atlantis” are the only evidence that an Atlantis-like undersea territory might be found: “There isn’t any other evidence of its existence. If we throw out Plato, there isn’t anything left” (Isomäki 2013, p. 75). Crucially, the scientist protagonists only make progress with their world-saving research *because they believe stories* and treat them as credible evidence. Amrita leads the way with this. She tells Sergei “a story about Alexandria that you should hear” (p. 116), which involves unverified sightings of ancient blocks of quarried stone of the Alexandria coast. She laments that “Many fishermen had seen those blocks of stone over the centuries, but their stories had never been taken seriously” (*ibid.*). When Sergei asks if she believes “there’s any truth to the story”, Amrita replies: “Why would I not?” (*ibid.*). This incorporation of legend, myth and ancient storytelling into a scientist’s day-to-day research process is symbolised by a passage in which Sergei casually switches between checking work emails, analysing the latest high-definition satellite imagery of Arctic glaciers, and reading *Plato: Complete Works* and “a collection of translated Mayan texts” (Isomäki, 2013, pp. 121–3).

In some sense, then, *Sands of Sarasvati* seems to be calling for scientists to embrace stories, rather than for a lay public to embrace science, and this is where Isomäki’s approach differs from other diffusionist approaches. In the novel, storytelling is only partly presented as a means of persuading others of the existence of climatic changes. Stories feature most significantly in *Sands of Sarasvati* as an integral part of the process of scientific research.

Green Earth: stories for meaning-making and emotional guidance

The conception of stories as means of inspiring audiences is not only prevalent among academics; it is also embraced by cli-fi authors. Robinson states in the foreword to *Green Earth*:

“I was told that one senior person at the National Science Foundation (NSF) finished reading the [Science in the City] trilogy and immediately sold his house and moved into a camper in a trailer park. That’s taking things too far, probably, but I like the impulse, because we read novels to help create our sense of what the world means, to mentally travel in other people’s lives, and to get some laughs.” (Robinson, 2015, p. xvi).

The reference to a camper and trailer park alludes to the protagonist Frank’s lifestyle choices in the novel. While the author is clearly gratified by this evidence of the inspirational aspect of his storytelling, it is interesting for our purposes that he highlights meaning-making or sense-making as the mechanism of inspiration. Insofar as this reader has been persuaded by Robinson’s work, it is not through being given new scientific information or by being convinced of the importance of climate science, but rather through the cli-fi novel helping him acquire a more general “sense of what the world means”. This reflects how stories function in Robinson’s fiction.

In *Green Earth*, stories have the agency to change and improve science – both the system and its individual representatives – by giving it guidance and direction, in part by emphasising the emotional and intuitive elements of scientific knowledge-making and practice. Indeed, one of the main problems presented in the beginning of *Green Earth* is that scientists and scientific institutions are broken and disillusioned. Both “science”, as a system or set of practices, and the main protagonist, Frank, lack direction and purpose. But the author has a solution: their healing and purposeful rejuvenation is set in motion through stories. “Science”, embodied by the NSF and the professional side of Frank, finds inspiration from Buddhist stories and scripts. The key turning point for “science” is a lunch seminar at the NSF held by Buddhists from the disappearing island of Khembalung. The monks’ speech is a call for compassion in science and for passionate reason (Robinson, 2015, p.189). Through reference to ancient Buddhist scriptures, the Khembalis illustrate how science has lost its way and is no longer helping humanity due to an excessive emphasis on reason (pp. 179–84). By extension, climate change cannot be mitigated unless science changes its ways, and science can only change with the help of “stories” which offer guidance and direction, in this case in an emotional sense. Frank’s professional mission is instantly transformed by the Khembalis’ storytelling, which seems to have an almost divine power on Frank. He also gets personal inspiration and guidance from reading the 19th-century spiritualists and transcendentalist philosophers Ralph Waldo Emerson and Henry David Thoreau, who were inspired by Buddhist and Hindu thought to embrace intuition and nature as opposed to materialism and intellect. Later he becomes a student of the leading Khembali Buddhist, Rudra Chakrin, thereby completing his personal rejuvenation, becoming whole and healed with a sense of purpose in life and scientific endeavour. Robinson thereby illustrates the transformative power of stories in the character of Frank. Stories guide Frank in his personal and professional life, helping him to become a better person and scientist, committed to tackling the challenges of climate change, and capable of transforming hitherto ineffective scientific institutions. Storytelling in the plot of *Green Earth* is therefore not a means of delivering specific scientific messages, but is appreciated as a way to “help create the sense of what our world means” (Robinson, 2015, p. xvi).

Naturally, a question emerges regarding the extent to which philosophical positions can be called “stories”, since they generally lack plot, momentum and narrative. However, there is an interesting way in which Robinson uses Frank to “storify” the experience of Buddhism, Emerson and Thoreau for the reader. For instance, by naming the main Khembali Rudra Chakrin, Robinson draws on the ancient Shambhala myth: a divine kingdom where everyone is at peace and in harmony. Its last king, Rudra Chakrin, will eventually descend to earth and make the true doctrine rule over all (Tibetan Buddhist Encyclopedia, 2014). As such, Rudra’s implicit mission in the book – serving as the spiritual guide to save the world from climate change – invites the reader to draw parallels between the mythical kingdom and the sustainable US Frank envisions. Frank and Rudra come to transgress the boundaries *between* texts.

Likewise, Robinson embeds Emerson’s spiritual quotes into the main story and gives them a plot and meaning. The insertion of Emerson and Thoreau starts as snippets of texts occurring at random, for example when Frank casually checks a webpage of Emerson quotes (2015, p. 555). As the novel progresses, the quotes increasingly come to symbolise aspects of Frank’s life. For instance, when Frank moves to a dilapidated shed with Rudra, Frank quotes Emerson: “One’s rich in proportion to the things one doesn’t need”, to which Rudra answers: “We seem to be getting very rich” (pp. 621-22). Increasingly, the quotes become stories about the lives of Emerson and Thoreau, running in parallel to Frank’s understandings and actions. When Frank goes on a date with a colleague, who is potentially linked to another character in the book, he laments that: “Thoreau was a solitary. He fell in love with his brother’s girlfriend, and proposed to her after his brother had proposed to her and been turned down. Henry too was turned down” (p. 851). Like Thoreau, the love story between Frank

and this specific colleague doesn't progress, and like Thoreau, Frank spends time in the wilderness. The longest passage about Thoreau and Emerson also becomes a type of climax, where their lives and aims – to return to nature – converge with Frank's (pp. 982-86).

Thoreau and Emerson disagreed on the point of "how to make an impact on the time" (p. 985), but *Green Earth* shows how their writings get new lives in Frank's practices. Temporal dimensions, here represented by old texts by these two philosophers, are woven into the present plot as relevant temporal parallels that shape the story. In a sense, the boundaries between the protagonist and the spiritualists are dissolved, as Robinson turns the quotes into an embedded story within the story. All this contributes to the meaning-making and emotional guidance functions of the story, as Robinson frames it.

Tentacle: stories as connectors

In *Tentacle*, the primary scientist character, Linda, has an interest in cultural productions that can survive an apocalypse (Indiana, 2018, p. 64). However, this novel treats stories differently from the two discussed above. Here, the story does not have a meaning-making or evidential role; instead, it has a kind of fundamental and almost physical organising and linking function, offering what Brooks (1984, p. 10) describes as an "ordering of the inexplicable". In *Tentacle*, stories are connecting forces or ordering devices (Brooks 1984), able to unite and thread together disparate, otherwise nonsensical or unrelated chains of events. This is modelled in the narrative structure Indiana adopts, in which events are syncopated and made to interconnect through the story. Herrero-Martín describes *Tentacle's* narrative thread as "the chemical-neural weaving of synapses or associations of thoughts, feelings and emotions" and relates to "the unconscious mechanisms of association" found in "human narrative memory and consciousness" (Herrero-Martín 2019, p. 58). For Herrero-Martín, Indiana's "narrative selection and focus" indicate that she sees stories as having a "cohesive role", producing an "interconnected web" of "disjointed elements" (ibid.). We see this, for example, in Argenis's double-experience. He is in two times and essentially two worlds simultaneously: 2027 with the scientist Linda and the other characters, and in a former, early colonial period, where he has joined a group of outcasts on the island. These are presented as simultaneous, as Argenis experiences both worlds side-by-side, such as when he eats a delicious fillet steak in the modern world at the same time as the "hard and salty jerky he was chewing in his other mouth killed his appetite" (Indiana, 2018, p. 58). Moreover, "Unlike dreams, with their weird transitions and time portals and stuff like that, the story that's unfolding inside him is coherent and linear" (p. 56). Her language is ironic here, because *Tentacle* is full of "weird transitions and time portals and stuff like that" – but it is the essential functions of the story that make the events cohere and connect.

The almost-chemical, connecting role of story in *Tentacle* also centres the narrating momentum on the integration of different threads, and less on the development of the main characters. If the climate mitigation efforts and the climate heroism were narrated through the main characters in *Green Earth* and *Sands of Sarasvati*, the main character in *Tentacle*, Argenis, does not care about climate change (Indiana, 2018, p. 55). Moreover, the scientist characters in *Tentacle* have a strikingly ambiguous status relative to other characters. When Argenis is introduced to James, an oceanographer from UCLA, he "could not give three fucks" about his project of ecological protection (p. 40). And Linda, the most significant scientist in the book, is introduced in grossly dehumanising and sexist terms. Argenis suggests a grotesque moral equivalence between his aims and Linda's when he understands they both want to earn money: "She needed it to save her little fish and Argenis to realize his fantasy of future happiness: a life snorting coke, painting, and paying sluts so they would suck him off without anyone giving him a hard time. In this way, Argenis and this high-class woman were equals" (p. 64). Overall, Linda is misunderstood by the book's other characters and remains enigmatic throughout, in part because she has the attitude and passions of a professional scientist.

She struggled to make people understand the climate emergency because she used “language that was perhaps too scientific” (p. 37). We occasionally see her reading scientific articles, applying for grants, or “filling test tubes” (p. 40), but her motivations and actions are usually described vaguely and dismissively. However, despite this character portrayal, the sense of purpose that drives the novel and connects all its disparate characters and times is the attempt to make “Linda’s dream come true: to build a laboratory at Playa Bo, equipped with all the latest technology, where they’d study and cultivate coral to replant it, whenever it was necessary, in its natural habitat” (p. 106). This is what connects all the characters and events in the story, and it is significant that Linda, an otherwise minor character, features prominently in the novel’s closing chapter, celebrating her apparent success at securing the necessary funding to conduct her research. In fact, Linda’s quest is crucial to the story, although the narrative focuses less on her scientific work than on the interconnected chains of events that enable her to do it.

The importance of stories: the agency of storytellers

Our analysis illustrates that stories, as used and understood by cli-fi authors, function in different ways, indicating that any attempt to evaluate the impact of a story requires an understanding of the use of story in that specific work of art. What the novels do have in common, however, is the importance they attach to storytellers and stories in climate issues. In *Green Earth*, one of the main actors is a scientist who benefits from personal and professional engagement with stories. The scientific profession and its key institutions are rebalanced through the power of stories. This affords a position of considerable power to professional storytellers including cli-fi novelists such as Robinson. Similarly, in Isomäki’s novel, scientists are the main protagonists and the main users and beneficiaries of “stories”, as they embrace stories as tools in their work. Through this approach Isomäki casts himself, or any author, as an agent with considerable power to act on climate change. The main source of fear among the novel’s characters towards the end is that the lessons they have learned may be forgotten over time, lost by future generations who have to reconstruct society from the ruins of climate disaster. The story is presented as a technology or method for avoiding that; a means by which “something of what we’ve learned will remain” (Isomäki, 2013, p. 331). It is significant that the closing passages of the book depict Amrita and Sergei’s expeditions through a flooded Europe in search of useful knowledge that will help them to begin the rebuilding process. They aim for libraries and “second-hand bookshops”, and are particularly enthusiastic when they locate antiquarian bookshops in Amsterdam and Hamburg (pp. 326–7). The books they find are wet and damaged but they still hope that in them “they would probably find things that would be useful and worth saving” (*ibid.*). This is where we can discern Isomäki’s moral message, and even how he construes his own social role as a teller of scientific stories. Isomäki, as a writer of books that contain useful scientific information, casts himself in a heroic role. Through his use of the story form, he may be contributing to the scientific research of future generations. The same may be said of Robinson, who conceives of his storytelling as having a meaning-making power that can give direction to future scientific practice, and of Indiana who affords minimal agency to scientific characters but organises the story in such a way as to make vital climate science possible. Thus, in the novels, considerable agency to act and to help address climate change is afforded to stories, to storytellers and to cli-fi as a genre. Crucially, however, this agency works in different ways.

Conclusion: science, stories and agency in/of cli-fi

The different uses and conceptualisations of stories analysed above indicate that stories have a variety of different functions in cli-fi, with implications for how communicators may themselves use and conceptualise stories in their work. This richness illustrates a complexity to storytelling which is

not always present in the academic use of and discussions of “stories” in the context of information studies and environmental studies. In that sense, to evaluate the efficacy of stories and their impact is not straightforward. Looking at this selection of cli-fi stories indicates that stories are *supposed to do* different things. Cli-fi authors – those whose work is fundamentally concerned with stories and science, and the relationships between them – do not universally conceive stories as vehicles that can be used instrumentally in any setting and be expected to generate specific actions or persuade audiences of specific positions on climate change. In the case of *Green Earth*, stories are shown to have a kind of persuasive function, although not necessarily through sharing scientific information or convincing an audience of its importance. Instead, for Robinson, stories have a more general meaning-making role, valuable because they can give direction to misguided individuals and institutions. The lesson of *Green Earth*, then – in which only the protagonist Frank is personally affected by certain stories – is that stories may give meaning depending on by whom, or the context in which, they are heard or read, and that it is misguided to expect them to make predictable and demonstrable differences to people’s climate-related attitudes, beliefs or behaviours. In Robinson’s conception, the story has an emotional meaning-making role and may not necessarily function instrumentally as a diffuser of specific messages. Meanwhile, Isomäki’s *Sands of Sarasvati* indicates that although storytelling may contribute to climate-scientific communication, and work as a method for sharing complex scientific information with a popular audience, this is not stories’ sole scientific role. Rather, *Sands of Sarasvati* makes the case for scientists to incorporate stories into their professional work, not least as sources of evidence. Even if stories need to be carefully processed for them to function evidentially, they are nevertheless a vital source of knowledge. It is, moreover, the practices and technologies of storytelling as well as the form of the story – conceived as an aspect of human culture that is shared and transmitted over time – that means it can carry information over generations and even through climate catastrophes. Scientists may use stories as evidence, and be required to use them as evidence, because they are the only source of knowledge that has stood the test of time. And *Tentacle* also highlights stories’ potential to carry across and between generations, although for Indiana the story is less a reliable information technology than a connecting force capable of linking and organising disparate events and characters. For Indiana, contra Robinson and Isomäki, stories cannot be depended on to give meaning, coherent knowledge, or to survive through linear time; rather, they are characterised by “weird transitions” and unexpected connections that somehow make science happen.

But despite the implications of this analysis – that stories function differently and in some cases unpredictably – the cli-fi novels examined here all assert the essential *importance* of stories in relation to environmental studies, albeit in different ways and with different conceptions of the agency of stories and storytellers in relation to science and scientists. We simply argue that storytelling should be appreciated as a complex art form rather than an instrumental and diffusionist tool that can be manipulated and tested in controlled experiments.

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