

# **Disarticulating the inevitability of catastrophe: Narrative, responsibility, and possible futures between Science Education and Literary Criticism**

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## **Abstract**

The overwhelming perception that climate catastrophe is inevitable leads to disorientation and a widespread sense of powerlessness, in which responsibility is lost amidst the multitude of possibilities.

This contribution proposes an interdisciplinary reflection at the intersection of science education and literary criticism to deconstruct the idea of catastrophe as a singular, inevitable event. The intertwining of these fields allows, on the one hand, the enrichment of science education with critical and pluralistic tools; on the other, a reinterpretation of eco-dystopias as laboratories of imagination. Drawing on the conceptual framing of the storyline approach, developed in climatology to analyse extreme events, we propose a perspective that allows us to interpret catastrophes and disasters as complex, historically and socially situated processes, thereby dismantling the perception of inevitability and paving the way for the reconstruction of open, interconnected, non-deterministic futures.

**Keywords:** Climate Change; Science Education; Storyline approach; Bio-ecocriticism; Futures.

We live in a time in which the very idea of the future appears deeply compromised. The climate crisis, the accelerating loss of biodiversity, the lingering effects of pandemics, and the metastasis of global inequalities have progressively narrowed the horizon of collective imagination. In this context, the concept of the Anthropocene has played an important role in foregrounding the impact of human activity on a planetary scale. At the same time, however, it risks flattening the complexity of historical processes and the differentiated responsibilities involved, obscuring the systemic inequalities that lie at their origin. As scholars such as Jason Moore (2013) and Marco Armiero (2021) have argued, alternative terms such as Capitalocene or Wastocene enable more situated and historically grounded interpretations of contemporary ecological crises. These perspectives are particularly relevant in contexts where the wounds left by colonisation,

extractivism, and neoliberal exploitation do not belong merely to theoretical abstraction but are inscribed in the materiality of lived experience.

In the context of the current planetary crisis, continuing to narrate only disaster risks reinforces a horizon of inevitability. It therefore becomes necessary to shift attention from what paralyses us to what mobilises us, moving from narratives of the end toward narratives of desire. As Francisco Martorell Campos argues in *Contra la distopía. La cara B de un género de masas* (2021), the stories elaborated by individuals and communities are not simply reflections of reality; rather, they operate as active forces in the construction of identities, in the modulation of desires, and in the shaping of the political imagination. From this perspective, the question that motivates this collaboration arises: What narratives are we currently telling ourselves? Which futures are imaginable, or, conversely, rendered inaccessible? And what political effects do these narratives produce in the present?

These questions take on particular urgency in educational contexts, especially when education is conceived as a transformative process that provides students with critical tools to become aware and responsible agents in the communities they inhabit.

As highlighted in the literature on teaching and learning about climate change (Stevenson *et al.*, 2017; Monroe *et al.*, 2019; Miani *et al.*, 2026), the main difficulties stem from students' difficulty in perceiving the deep uncertainties and complexities of the climate crisis. Students are not prepared in their school curricula to deal with wicked problems (Pietrocola *et al.*, 2025), and are instead more led to simplify and adopt linear solutions (Rosenberg *et al.*, 2022). If this type of approach can be helpful in standard problems, it is not the case for issues affected by a lack of clear modelling, interrelated variables, and intrinsic uncertainties associated with both natural phenomena and human ways of thinking (Miani *et al.*, 2026).

Moreover, classic approaches that study the science behind climate change, focusing only on specific aspects of the issue, such as the greenhouse effect or the interaction between light and the atmosphere, are unable to capture the profound complexity of the different actors involved in the problem. To address such issues, Rousell and Cutter-Mackenzie-Knowles (2020) stress the importance of adopting participatory and interdisciplinary approaches to climate change education, in which creativity and affect-driven reasoning are considered effective means of thin-

king critically and imagining alternatives. The emphasis should be on developing competencies vital to tackling climate change, including systems and strategic thinking, anticipation and future planning, embracing complexity, and encouraging action (Bianchi *et al.*, 2022; Wiek *et al.*, 2011). At the same time, attention should be paid not only to understanding the inner mechanisms and possible “solutions to the issue”, but also to the justice-related dimensions and the need to focus on marginalised and disproportionately affected groups (Trott *et al.*, 2023).

To enrich this interdisciplinary framework, speculative fiction, whether science fiction, dystopian, or post-apocalyptic literature, can be a powerful way to elaborate on and generate images of change (Claeys, 2017; Suvin, 2010), stimulating younger audiences. As evidenced, the representations of the future that dominate this field frequently centre on catastrophe and disaster, contributing to the spectacularization of the end (Balletta, 2025). While such narratives possess undeniable imaginative power, they also risk consolidating the perception that catastrophic futures are inevitable, thereby limiting the capacity to envision alternative scenarios. Moreover, research in science education highlights the importance of fostering students’ ability to imagine open futures not predetermined by technocratic visions, while also encouraging a departure from exclusively Newtonian and deterministic conceptions of science and causality (Levrini *et al.*, 2024).

Against this background, the need emerges to identify alternative ways of narrating the present and imagining open futures.

This paper operates at the intersection of two research fields that rarely engage in dialogue: literary criticism and future-oriented science education. We begin our reasoning in section 1 by exploring how catastrophes and disasters are conceptualised and studied in literature and in climatology. Section 2 draws on this conceptual framework and explores a specific approach, born in climatology, read through the lens of futures-oriented science education (Levrini *et al.*, 2021; Bol *et al.*, 2023). In section 3, we apply the considerations emerging from the educational analysis of this approach to a speculative ecodystopia, named *El Vasto Territorio* (Lopez Trujillo, 2025), to reconstruct the causal chain of the catastrophe narrated in the book, its origins and its implications on a social, economic and political level. In section 4, we then discuss this exploration and attempt to disarticulate the catastrophe presented in the book, proposing, as a consequence, a series of alternative scenarios.

## Repositioning catastrophes and tragedies

In January 2025, a series of wildfires devastated the area of Los Angeles, USA, and in the consequences of the passage of Hurricane Helene in the southeastern region of the USA (September 2024)<sup>1</sup>, many people on social media described the correlation between what they were seeing and climate change using a specific quote, whose author is unknown:

“Climate change will manifest as a series of disasters viewed through phones with footage that gets closer and closer to where you live until you are the one filming it.”

To better understand this perspective, it is useful to present a categorisation by Luciano Floridi in 2023, in an editor’s letter to the journal *Philosophy & Technology* (Floridi, 2023). In this brief piece, named “Climate Change and the Terrible Hope”, Luciano Floridi introduces the concept of “terrible hope”, a paradoxical yet compelling idea that a relatively small but impactful catastrophe might be the only force capable of breaking humanity’s social akrasia, i.e. our collective tendency to act against better judgment despite knowing the consequences. This “terrible hope” arises from the frustration that, although the dangers of climate change are well understood, meaningful action remains elusive. Floridi suggests that the very nature of climate change, its gradual and prolonged development, renders it more akin to a tragedy than a sudden crisis, and thus more likely to be ignored or deferred, even as its impacts escalate.

Floridi draws a critical distinction between tragedies and catastrophes:

- Tragedies are slow-burning processes that give people time to become aware, but also to procrastinate and normalise the worsening conditions. Climate change, in his view, exemplifies such a tragedy: a crisis unfolding in real time but met with inadequate urgency.
- On the other hand, catastrophes are immediate, shocking events, like pandemics or natural disasters, that can provoke swift and decisive reactions.

Floridi argues that sometimes it is precisely a minor catastrophe, one

<sup>1</sup> <https://www.cleanenergy.org/blog/from-abstract-to-reality-when-your-hometown-becomes-a-climate-casualty/>

not devastating enough to cause irreparable damage but significant enough to disrupt the status quo, that may act as the trigger for behavioural and political change. The paper further explores the psychological and behavioural dimensions of change. Floridi compares society's response to climate change with a smoker who only decides to quit after suffering a non-fatal heart attack. The knowledge of harm isn't enough: it often takes a jarring experience to push individuals or societies toward transformation. If the climate crisis continues to unfold without major shocks, Floridi warns of a "slippery slope" effect, in which humanity becomes gradually desensitised to environmental degradation, reinforcing consumerist habits and delaying necessary reforms.

In conclusion, Floridi warns that placing hope in catastrophe is a dangerous gamble, even if it may seem like the only remaining catalyst for change. He advocates instead for a more mature, moral, and intelligent approach, an approach that moves beyond consumerism and actively embraces responsibility for planetary stewardship. Rather than waiting for disaster to force transformation, humanity must cultivate the ethical clarity and political will to act preemptively, turning philosophical understanding into real-world sustainability.

Given the external conditions of our time, we know very well that risk comes not only from natural hazards such as earthquakes, tsunamis, and volcanic eruptions, but is also manufactured and linked to the ever-increasing role that human technologies play in our societies, thanks to scientific innovations (Beck, 1992). Therefore, there is a need to frame tragedies and catastrophes from an interdisciplinary perspective to unpack them and disarticulate the feeling of hopelessness.

### **Storyline and uncertainty in futures-oriented science education**

The study of extreme events is very interesting for many reasons, being events that highly affect societies at many levels. For the IPCC, "it is an established fact that human-induced greenhouse gas emissions have led to an increased frequency and/or intensity of some weather and climate extremes since pre-industrial time, in particular for temperature extremes" (Seneviratne *et al.*, 2021).

Studying extreme events in Climate Change Education might help realise the severity of climate change, its development and its possible

and future impacts, mainly because younger students often struggle to perceive and understand slow, gradual changes. Focusing on extreme events can be seen as an opportunity to bridge the distance students often perceive regarding climate change and, therefore, to promote agency. Feeling that climate change is too big for us or too far away can prevent us from realising the need to act as soon as possible at all levels (Etkin & Ho, 2007). The agency can be hindered in this way.

Our research proposal seeks to confront this impasse by disarticulating catastrophe, situating it within local contexts. More specifically, Latin America emerges as a critical and generative space, a fertile terrain for literary and political practices that may be understood as collective acts of creation capable of dismantling dominant narratives and opening pathways toward alternative futures.

In order to do so, we take insights from the *storyline approach*, a specific method of analysis developed over the past decade in climatology to produce detailed knowledge of the socio-economic impacts of extreme climate-related events. The storyline approach has recently been introduced in the Detection & Attribution field and was first used to assess the 2011 Texas drought by Hoerling and colleagues (2013). Trenberth and colleagues (2015) defined storylines as “physically self-consistent unfolding of past events, or plausible future events or pathways” (Shepherd, 2016). Storylines “can raise risk awareness by framing risk in an event-oriented rather than a probabilistic manner” (Shepherd *et al.*, 2018).

A storyline-based approach identifies the causal chain of factors leading to a given event and assesses their roles and interconnections. To develop a storyline of an extreme weather event, it is necessary to collect data from a specific event and conduct an “autopsy” of it (Lloyd & Oreskes, 2018). The approach makes it possible to qualitatively attribute the causes of an event when it is driven by a combination of poorly known dynamic and thermodynamic factors (Shepherd, 2016). Using a Bayesian method and, thus, the identification of causal links between events, it is possible to construct a causal network that highlights areas where actions can be taken (Shepherd, 2019).

The most relevant aspect of storylines is that they provide a mechanism to improve decision-making by analysing vulnerability points, partitioning probability factors, and combining regional aspects with climate change risk factors (Shepherd *et al.*, 2018). According to Trenberth and colleagues (2015), in those situations where a risk-based approach,

that relies heavily on macrovariables, averages and probability, brings high-uncertainty results, it can be useful to physically investigate the unfolding of the events, trying to determine how each factor may have been affected by known thermodynamic aspects of climate change (Shepherd, 2016, Figure 1). Tracing the sequence of certain events by determining their causes can help predict and prevent their recurrence with the same consequences. The storyline-based approach does not address potential changes in the probability of the dynamic situation that led to the event but can tie attribution directly to the observed event, rather than merely being probabilistic in a frequentist sense (Shepherd, 2016; Trenberth *et al.*, 2015). “The direct confrontation with data as an essential component of the attribution is a very attractive feature of this approach, as is its emphasis on a physically based causal narrative” (Shepherd, 2016, p. 34).

Although the approach was originally formulated for the analysis of small-scale atmospheric dynamics, the storyline’s conceptual architecture has broader methodological potential, enabling adaptation to other fields as a tool for critical reconstruction and interpretation, as shown by Miani and Levrini (2024).

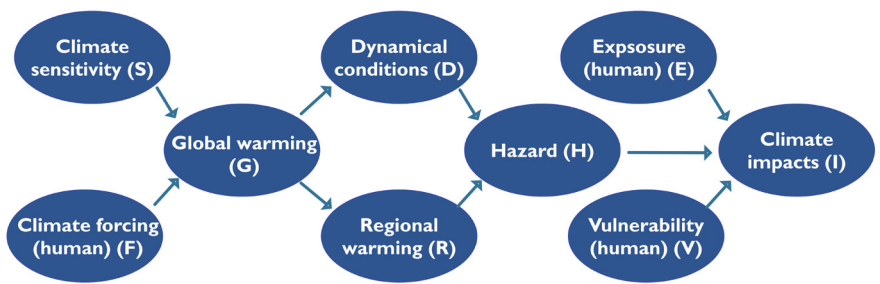


Figure 1: Causal network showing the partition of the different causes behind climate change impacts and their hierarchy. Original source: Shepherd *et al.*, 2019.

From an educational perspective, the storyline approach can function as an effective tool for developing the sustainability competences identified by the GreenComp framework of the Joint Research Centre (Miani & Levrini, 2024). By emphasising causal relationships and contextual dynamics, it recenters the role and responsibility of human actors within science-based decision-making processes. In doing so, it shifts attention from the abstract reliability of scientific knowledge to its practical capacity to guide strategies of risk mitigation and adaptation.

At the same time, it allows information about extreme events to be contextualised and complexified by relating it directly to human actions and socio-ecological conditions. The approach also helps distinguish different forms of uncertainty inherent in climate complexity, thereby clarifying the dimensions of human agency. In this sense, the storyline may be understood as a form of analytical “autopsy” of catastrophic events, capable not only of reconstructing causal chains but also of opening space for the reimagination of alternative pasts and the articulation of multiple possible futures.

The possibility of employing the storyline approach in educational contexts led us to explore it as a methodological framework for analysing eco-dystopian texts, particularly those in which the socio-economic dimensions of climate change are central to the story.

### **Bio-ecocriticism applied to *El vasto territorio* (2021) through the conceptual framing of the storyline approach**

In the field of literary criticism, ecocriticism emerged as a discipline exploring the relationship between the ecosystem and its narrative representation between the late 1980s and the early 1990s. Ecocriticism emerged within a predominantly North American and British academic context. One of the best-known definitions of this discipline was proposed by the North American critic Cheryll Glotfelty in her book *The Ecocriticism Reader. Landmarks in Literary Ecology* (1996). According to Glotfelty, ecocriticism is an approach that places the earth at the centre of the study, exploring and analysing literature and cultural studies from this perspective.

However, the critical paradigm of ecocriticism raises numerous questions when applied to textual, visual and artistic expressions from Latin

America. Gisela Heffes has contributed significantly to this debate with her book *Políticas de la destrucción/Poéticas de la preservación. Apuntes para una lectura (eco)crítica del medio ambiente en América Latina* (2013). Her analytical approach is based on ecocriticism as a tool for cultural and social research, and on adapting this theoretical framework to the Latin American context. According to Heffes, Latin America's literary and cultural output, in fact, extends beyond the boundaries of ecocriticism as a purely theoretical analytical tool. Gisela Heffes explores which theoretical tool can effectively guide the interpretation of environmental issues in Latin America and, from this perspective, develops bio-ecocriticism, an aesthetic practice designed to shape a new episteme that brings together ecocriticism and biocriticism.

From this perspective, bio-ecocriticism shows strong affinities with the storyline approach, particularly in their shared effort to disarticulate and render intelligible extreme events. Disarticulating catastrophe does not merely entail reconstructing the chain of causes that led to a given event; it also has a futures-oriented dimension. Through the reconstruction of non-linear causal relationships and the contextual analysis of environmental crises, it becomes possible to identify critical moments: points at which alternative trajectories might have emerged. These moments may operate within forecasting dynamics, when they serve as the basis for imagining alternative future scenarios, or within backcasting processes, when the aim is to reconstruct the decisions required to reach a desired future. In both cases, critical moments serve as points of openness in which the role of external conditions and specific contextual factors must be evaluated to understand how one trajectory rather than another becomes historically realised.

To illustrate this methodological proposal, we apply the reasoning that emerges from the confrontation between the educational analysis of the storyline approach and bio-ecocriticism to an eco-dystopian text from contemporary Hispano-American literature: *El vasto territorio* (2021) by the Chilean author Simón López Trujillo.

The plot and narrative structure unfold along interwoven threads: on the one hand, the story of Pedro Marambio, a forestry worker who, together with his children Patricio and Catalina, lives under the oppressive regime of Chile's eucalyptus plantation industry; on the other, that of Giovanna, a mycologist who returns to Chile to study a mysterious fungus thriving within these monocultures. In the text, extractivism and

the exploitation of labour power emerge as forms of human parasitism: eucalyptus plantations, managed by large forestry corporations, not only deplete the soil and devastate the ecosystem, but also undermine the health and dignity of workers, as evidenced by the spread of *Cryptococcus gattii* among them.

At the same time, however, the narrative gestures toward the possibility of symbiotic relations between humans and the natural world. Although *Cryptococcus gattii* appears to be a threat, it also serves as a medium of communication and interconnection across species. By exploring these networks, the text suggests that alternative modes of coexistence with the environment are possible. In this sense, a third voice, liminal and deeply rooted, emerges through the footnotes. Positioned beneath the main text, they symbolically evoke an echo rising from the underground, reinforcing the idea of a subterranean network of connections. The author thus mobilises their lower placement to emphasise the chthonic provenance of this voice, which, beyond offering narrative clarifications and supplementary information, at times adopts an ironic and poetic tone, establishing a subtle dialogue with the main narrative. Gradually, its appearances intensify, outlining an almost parallel narrative as a counterpoint that surfaces from below and gestures toward an alternative, potentially liberatory mode of coexistence.

Taking from the description proposed by Floridi (2023) between disasters and catastrophes, we can see how, in the novel, different elements have different roles and impacts. In the novel, disaster appears as a set of slow and structural conditions, including eucalyptus monoculture, biodiversity degradation, and labour exploitation, that gradually prepare the ground for catastrophe, represented by the sudden outbreak of the *Cryptococcus gattii* epidemic among plantation workers.

Within the narrative, eucalyptus monoculture alters ecosystems, soils, and hydrological cycles, while the progressive loss of biodiversity reduces ecological resilience and facilitates the proliferation of pathogens. At the same time, exploitative labour conditions expose workers continuously to fungal spores. Against this background unfolds the catastrophe itself: a localised and highly visible event that nonetheless originates in the largely invisible dynamics of structural disaster.

Throughout the text, a series of dispersed clues gradually converge, allowing the reader to reconstruct the causes, relationships, and even the seemingly minor, everyday events that ultimately lead to the catastrophe.

The death of Pedro's wife from an unexplained cough, the precarious and harmful conditions to which plantation workers are exposed, Pedro's progressively worsening malaise, and the very presence of monocultures composed of a non-native species, alien to the Chilean ecosystem; all these elements form a chain of interconnected causes.

Tracing these elements backwards and analytically reconstructing the sequence of events through the conceptual framing of the storyline approach not only brings the author's political critique into focus but also invites the reader to reflect on alternative possibilities. This reflection unfolds on another analytical level within the text: the footnotes and Pedro's deliriums during his comatose state (marked in italics). These alternative projections intertwine with the main narrative, revealing how the disaster opens up a broader meditation on the human condition: its relationship with other forms of life, with the earth, and with the network of life that continues to pulse and resist despite catastrophe.

Constructing a causal network (Fig. 2) following Shepherd's logic allows these dynamics to be articulated across multiple scales:

- At the global level, the climate crisis and international forestry markets drive the expansion of eucalyptus plantations, a dimension that is further brought into focus through the researcher's investigations, which return to Chile to study the fungal epidemic and situate the local outbreak within a broader planetary framework.
- At the regional level, monoculture practices generate ecological feedbacks, including alterations in soil microbiota and increased ecosystem vulnerability, which facilitate the spread of the fungus. These alterations also suggest that the disaster has deeper temporal roots: earlier deaths, preceding the large-scale epidemic, were not recognised as part of the same process but can retrospectively be understood as connected to it, as in the case of María, Pedro's wife, whose death anticipates the wider catastrophe.
- At the human level, exposure occurs through inhalation of spores during plantation labour, leading to consequences such as illness, coma, and death. This exposure is inseparable from the precarious social conditions in which workers live and operate: exploitation, environmental toxicity, and structural neglect intensify both vulnerability and impact. These biological effects are therefore amplified by social feedback, including collective trauma, marginalisation, and forms of distress that exceed the strictly medical dimension.

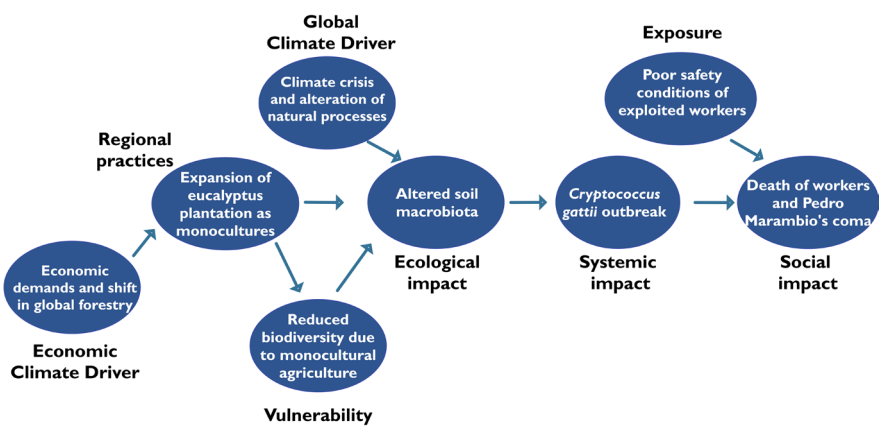


Figure 2: Causal reconstruction of the events described in the book “El vasto territorio” (Lopez Trujillo, 2025), made following the partition among specific factors through a Bayesian perspective, as discussed in the storyline approach.

By making all these interrelated aspects of the story evident, specific elements that have paved the way for the catastrophe’s subsequent evolution are brought to light. The exercise we propose at this point is therefore to think creatively about alternative scenarios by building a chain of connections and interventions that could have prevented the catastrophe from unfolding. More than just a rhetorical activity, this type of reasoning is fundamental to preparing new generations to learn from and respond to future events: look critically at what has already happened, understand the underlying causes, explain why and how certain events have unfolded as they did, and act to prevent their repetition. In the case of climate-related events, this process is far from trivial and can mean the survival of entire habitats if applied properly.

**Alternative scenarios**

Starting with the map illustrated in Fig. 2, we highlight now the critical moments. These bifurcation points can be seen as generative for alternative narratives, fictional spaces based on “what would have happened if” reasoning.

For example, we can identify a first critical moment at the regional

practice level. The expansion of the eucalyptus plantation of monocultures could have been prevented by diverse forestry policies, in that, as stressed by the Global Forest Coalition<sup>2</sup>, unlike real forests, which are diverse, resilient ecosystems, these plantations reduce biodiversity, deplete water and soil, and can harm local communities through land grabbing, poverty, and social impacts. As evidenced by the Global Forest Coalition and allied organisations, monoculture tree plantations, often promoted as solutions for climate change, are not true forests. Promoting regenerative, locally adapted practices rooted in Indigenous knowledge to protect ecosystems and strengthen food sovereignty could help avoid creating monocultures, allowing for a less fragile ecosystem.

In such an alternative scenario, stronger community-based forest maintenance could be the starting point for sharing local and indigenous knowledge, building a more stable and richer ecosystem, and preventing the advancement of external interests in the area. In such an environment, workers like Pedro would not have been exposed to the fungal outbreak, as the combination of local knowledge and diverse habitats could have prevented it.

A second example relates to the exposure and vulnerability dimensions. In the book, workers like Pedro are unable to cope with the pandemic, partly because they are not well-equipped to adopt protective measures or to access healthcare institutions that could have helped mitigate the effects of infection. In an alternative scenario where risk education is more prevalent, or in a space where the focus is not on the benefit of the minority but on the well-being of the community, attention to implementing specific safety measures could have prevented the high exposure present in the fiction.

Although these alternative scenarios are only introduced and not fully described, it is evident how the catastrophe appears not as an inevitable destiny but as the contingent result of structural dynamics shaped by political and economic choices.

<sup>2</sup> <https://globalforestcoalition.org/statement-monoculture-tree-plantations-are-not-forests/>

## Conclusions

Following Shepherd's interpretation (Shepherd, 2016, 2019), the storyline approach not only clarifies causal relationships but also enhances risk awareness. Human beings tend to respond more effectively to episodic and embodied narratives than to abstract probabilistic models. In this sense, the story of Pedro and his family becomes an episodic memory of the climate crisis, rendering the slow disaster of monoculture and environmental degradation tangible and comprehensible, transforming statistical phenomena such as deforestation into lived experiences charged with emotional significance.

When integrated with a bio-ecocritical perspective, the storyline approach enriches literary analysis by introducing a structured causal logic that connects macro-level systemic processes, such as the global climate crisis, with the micro-level experiences embodied in the narrative of Pedro and his family. This combination creates a bridge between bio-ecocriticism and futures-oriented science education: rather than presenting apocalyptic scenarios as inevitable, it highlights concrete trajectories through which catastrophic outcomes might still be avoided or transformed.

The application of the storyline approach ultimately enables the reinterpretation of the sequence linking eucalyptus monoculture, fungal proliferation, and human illness as a causal narrative, clarifying how structural disasters crystallise into local catastrophes. The approach presented in this paper helps identify critical nodes within this chain of events, thereby opening space to imagine alternative futures and to counter fatalistic interpretations of environmental crises.

Through this interdisciplinary perspective, the disarticulation of catastrophe emerges as both a methodological and a critical tool. It allows us not only to understand the causes of environmental crises retrospectively but also to recognise the moments in which different futures remain open.

In this sense, the future ceases to appear as a closed and inevitable horizon. Instead, it emerges as the outcome of choices, conditions, and responsibilities that must be collectively recognised and negotiated across political, scientific, and cultural dimensions.

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