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Proceedings of International Conference on Multidisciplinary Research: Innovation, Healthcare, Education for Viksit Bharat (ICMR-2026)



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SUSTAINABLE
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VIKSIT BHARAT

PART

2

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International Conference On Multidisciplinary Research

Conference Proceedings

Contemporary Perspectives in English Literature,
Sociology, Hindi and Home Science For Viksit Bharat

2026

Organized by

Kalindi Institute of Medical Sciences

Agrasen Mahavidyalaya

Veetranga Research Foundation

In Collaboration with

Wissira Research Lab

Print ISBN: 978-93-7559-048-4

Digital ISBN: 979-8-952358-04-1

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Chapter 8: Ecological Consciousness and Climate Narratives in Contemporary English Fiction

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Abstract— Contemporary English fiction increasingly functions as a cultural space in which climate instability, biodiversity loss, environmental injustice, and changing human–nonhuman relationships are imaginatively negotiated. This study investigates how ecological consciousness is constructed through narrative form rather than treating environmental themes merely as identifiable subjects within climate-oriented novels. A central research gap lies in the limited integration of ecocritical interpretation with computationally measurable narrative indicators capable of tracing ecological agency, environmental affect, temporal disruption, and climate-risk discourse across literary texts. To address this gap, the study develops an Ecological Narrative Consciousness Framework (ENCF) designed for subsequent AI-assisted analysis of a curated corpus of contemporary English-language fiction. The framework conceptualizes ecological consciousness through interconnected dimensions including nonhuman agency, climate affect, environmental justice, ecological interdependence, temporal scale, and adaptive or regenerative imagination.

Keywords— Ecological Consciousness, Climate Fiction, Ecocriticism, Environmental Humanities, Computational Literary Studies, Anthropocene Narratives

Introduction

Climate change has increasingly altered not only scientific and political discourse but also the imaginative conditions within which contemporary fiction is produced and interpreted. Rising temperatures, species decline, extreme weather, ecological displacement, resource conflict, environmental inequality, and uncertainty regarding planetary futures have generated narrative problems that differ substantially from conventional representations of landscape or nature. Contemporary writers must represent phenomena whose causes are geographically dispersed, whose consequences unfold across radically different temporal scales, and whose agency cannot easily be attributed to a single character, institution, or event. Consequently, climate-oriented fiction has developed into an important domain within contemporary English literary studies.

The expansion of climate fiction, often described through the abbreviated category *cli-fi*, reflects a broader transformation within environmental humanities. Earlier environmental literary criticism frequently concentrated on wilderness, pastoral traditions, environmental ethics, place, and representations of human relationships with nature. Contemporary climate narratives, however, encounter a planetary condition in which distinctions between natural history and human history become

increasingly unstable. Climatic processes intersect with industrial development, technological systems, colonial histories, economic inequality, migration, public health, food systems, energy infrastructure, and political governance. Literary representation consequently becomes a means of exploring climate change as both a material condition and a cultural problem.

Recent scholarship has emphasized that climate fiction cannot be understood simply as fiction containing environmental catastrophe. Houser's discussion of twenty-first-century climate fiction identifies the importance of narrative scale, inequality, genre, nonhuman life, planetary thinking, and changing forms of realism in the literary representation of climate change (Houser, 2021). Such approaches demonstrate why climate narratives require attention to formal organization as well as thematic content. A novel may mention environmental deterioration extensively while maintaining a fundamentally anthropocentric narrative structure; conversely, another text may produce ecological awareness through dispersed causality, multispecies relationships, altered temporalities, or nonhuman forms of agency without continuously naming climate change.

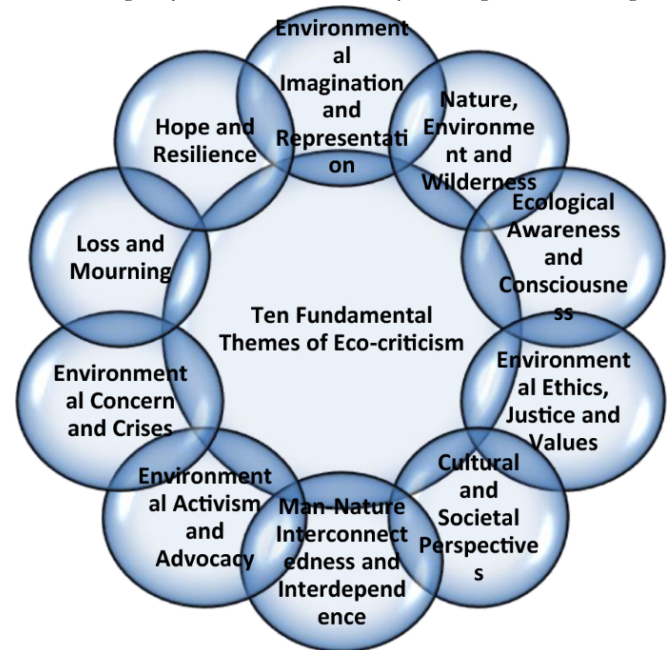


Fig. 1: Ecocriticism in poetry and its role in raising eco-consciousness
Source: <https://link.springer.com/article/10.1007/s40622-025-00430-6>

This distinction provides the conceptual foundation of the present study. **Ecological consciousness is treated here not as the frequency of environmental vocabulary but as a narrative orientation through which humans are represented as materially, ethically, emotionally, and temporally embedded within ecological systems.** Such

consciousness may become visible when landscapes function as dynamic participants rather than decorative settings, when animals or ecosystems influence narrative causality, when characters recognize interdependence across species, or when environmental damage is connected to uneven structures of power and vulnerability.

Contemporary research has already identified several components of this broader phenomenon. Boehm-Schnitker's analysis of *Flight Behaviour* and *Migrations*, for example, demonstrates how climate fiction can connect human migration with nonhuman migration while simultaneously revealing tensions involving class and gender. Mączyńska, meanwhile, shows that climate narratives can reproduce inherited colonial assumptions even when they present themselves as warnings about environmental collapse, particularly through narratives that imagine climate catastrophe as a regression from modern civilization toward supposedly primitive social conditions. These findings are significant because they demonstrate that ecological consciousness cannot be evaluated exclusively according to whether a novel appears environmentally sympathetic. The ideological structures through which crisis, vulnerability, adaptation, and survival are narrated also require scrutiny.

The period from 2021 onward has further widened the conceptual field of climate-fiction research. Climate narratives increasingly operate within what may be described as a condition of *polycrisis*, where ecological instability interacts with pandemics, technological uncertainty, economic precarity, migration, political fragmentation, and public-health vulnerability. Recent research on contemporary British climate fiction, for instance, has examined resilience in novels written during and after the COVID-19 period, emphasizing connections among environmental, health, and social crises. Climate fiction therefore increasingly depicts ecological crisis not as a singular catastrophic event but as an interconnected network of pressures affecting ordinary life.

Another important development concerns climate futurity. Conventional dystopian narratives often locate ecological catastrophe in a distant future, allowing readers to perceive environmental collapse as speculative rather than immediate. More recent writing increasingly compresses that distance. Everyday routines, domestic environments, migration patterns, food insecurity, heat, changing seasons, disappearing species, and unstable infrastructure bring climate disruption closer to recognizable experience. Bartosch (2025) consequently conceptualizes climate fiction as a form of future-making and cultural modelling rather than merely representation. This perspective shifts critical attention from the question of whether fiction accurately depicts climate change toward a more complex question: **what kinds of ecological futures become imaginable through particular narrative structures?**

Despite these advances, one methodological limitation remains. Ecocritical scholarship typically produces sophisticated interpretations through close reading but has comparatively fewer mechanisms for examining whether patterns identified in individual texts recur systematically across larger literary

corpora. Computational literary studies, by contrast, can identify linguistic regularities at scale but risk reducing environmentally complex narratives to keywords, sentiments, or topic frequencies.

The present study addresses this methodological division through an integrated literary-computational framework. Rather than asking an algorithm simply to classify a text as "climate fiction," the proposed research investigates whether specific features associated with ecological consciousness can be systematically detected while remaining open to qualitative interpretation. These features include **nonhuman agency, ecological interconnectedness, environmental affect, climate temporality, environmental justice, adaptive imagination, and regenerative futurity.**

The resulting research objective is therefore to determine how contemporary English fiction constructs ecological consciousness through combinations of narrative form, environmental affect, distributions of agency, representations of unequal vulnerability, and visions of ecological futures. The later empirical stage of the research will apply natural-language-processing and machine-learning techniques to a carefully defined literary corpus while using close reading to validate computational interpretation.

Three related questions guide the investigation. First, which narrative and linguistic characteristics most consistently distinguish strongly ecological narrative passages from passages in which environmental settings remain primarily anthropocentric or instrumental? Second, how are emotions such as ecological grief, fear, responsibility, attachment, hope, and resilience distributed across different forms of contemporary climate narrative? Third, can computational models identify patterns of ecological consciousness without eliminating the ambiguity and contextual complexity central to literary meaning?

By addressing these questions, the study positions artificial intelligence not as a substitute for literary interpretation but as an analytical instrument capable of extending it. The central contribution therefore lies at the intersection of ecocriticism, narrative theory, environmental humanities, and computational textual analysis.

Literature Review

The intellectual foundations of contemporary environmental literary criticism extend well beyond the recent category of climate fiction. Ecocriticism established the environment as an active critical category by challenging assumptions that literary landscapes existed merely as background for human action. Later environmental-humanities scholarship expanded this orientation by examining planetary scale, environmental justice, postcolonial ecology, multispecies relations, materiality, and the Anthropocene. Within this expanded field, climate fiction has become especially important because climate change presents problems of representation that conventional narrative structures were not necessarily designed to accommodate.

One persistent problem concerns **scale**. Climate change develops through interactions among atmospheric processes, economic systems, technological infrastructures, historical

emissions, consumption practices, ecological feedback mechanisms, and political decisions operating across decades or centuries. Individual human perception, however, remains spatially and temporally limited. Fiction must therefore connect intimate experience with processes extending far beyond individual awareness. Recent scholarship continues to treat this scalar incompatibility as one of climate fiction's defining formal problems. Research on Anthropocene narration has consequently examined strategies that distribute agency among human, nonhuman, institutional, and environmental actors rather than locating causality exclusively within individual protagonists.

This concern is closely connected with **nonhuman agency**. Traditional realist fiction frequently organizes events around human intention. Ecological narratives destabilize that hierarchy when oceans, storms, animals, pathogens, forests, droughts, fires, or changing seasons materially affect narrative development. Such representation does not necessarily personify nature. Instead, it may acknowledge that human decisions occur within systems whose dynamics exceed individual control. Climate fiction therefore provides an important literary site for reconsidering the boundaries separating subject and environment.

A second major strand of research addresses **climate affect**. Environmental crisis generates emotional structures including ecological grief, anxiety, guilt, anger, helplessness, attachment, nostalgia, and hope. These affects are important because scientific information alone does not determine how climate change becomes socially meaningful. Fiction can translate abstract environmental processes into embodied experiences involving family, livelihood, memory, illness, migration, and loss. Recent research has increasingly examined eco-anxiety in contemporary fiction, reflecting wider interdisciplinary interest in the affective dimensions of ecological disruption.

However, ecological affect should not automatically be equated with ecological consciousness. Catastrophic fear can reproduce anthropocentrism when environmental destruction matters only because it threatens human survival. A narrative expressing grief over disappearing species, by contrast, may destabilize exclusively human definitions of value. Similarly, environmental hope may range from technological confidence in restoring existing systems to more transformative imaginings of changed relations among humans, ecosystems, economies, and other species. Emotional tone must consequently be interpreted alongside ethical and ideological positioning.

A third body of scholarship concerns **environmental justice and unequal climate vulnerability**. Climate change is planetary in reach but radically unequal in both causation and consequence. Wealth, colonial history, geography, race, class, gender, infrastructure, citizenship, and access to resources influence exposure and adaptive capacity. Contemporary climate narratives increasingly address these inequalities through representations of migration, displacement, damaged livelihoods, contested resources, and uneven access to secure environments.

Recent scholarship illustrates why intersectional analysis is necessary. Boehm-Schnitker's examination of human and nonhuman co-migration demonstrates that ecological narratives may challenge species boundaries while still reproducing problematic class and gender formations. Research on new approaches to climate storytelling similarly emphasizes embodied testimony, place, race, religion, and intersectional differences in experiences of global warming. Ecological consciousness must therefore incorporate social justice rather than presenting humanity as an undifferentiated collective experiencing environmental crisis equally.

Postcolonial ecocritical scholarship further complicates universalizing accounts of climate catastrophe. Climate narratives emerging from or representing regions shaped by colonialism frequently connect environmental vulnerability with extractive economies, uneven development, displacement, and historical power. Recent work on Indian English climate fiction, for example, emphasizes interactions between local landscapes, postcolonial ecological experience, and global climate discourse. Such approaches challenge models of climate fiction dominated by Euro-American dystopian imaginaries.

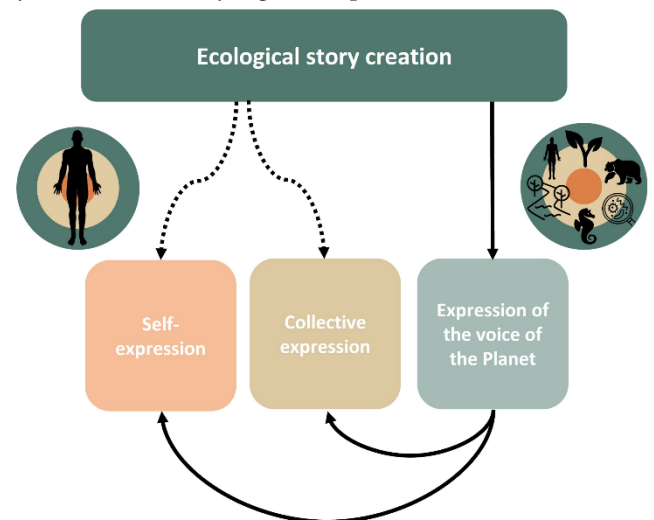


Fig. 2: Ecological Story Creation

Source: <https://www.mdpi.com/2071-1050/15/10/7794>

A fourth area of research involves **temporality and futurity**. Climate change simultaneously belongs to past, present, and future. Historical industrial development produces consequences that unfold over long periods, present environmental disruptions contain traces of earlier political decisions, and contemporary actions alter conditions for generations not yet born. Climate fiction consequently experiments with temporal structures capable of representing delayed causation, anticipation, memory, inheritance, and irreversible transformation.

The relationship between climate fiction and futurity has become particularly significant because narratives do not simply forecast possible outcomes. They define what forms of adaptation, survival, coexistence, technological intervention, political transformation, or ecological restoration appear imaginable. Bartosch's conceptualization of climate fiction as future-making is useful here because it emphasizes fiction's modelling function: narrative participates in organizing cultural

possibilities rather than passively mirroring environmental reality.

Yet dystopian futurity also requires critical scrutiny. Mączyńska demonstrates that narratives of ecological collapse may reactivate colonial hierarchies by presenting the breakdown of industrial modernity through historically loaded concepts of civilization and savagery. Consequently, climate fiction's ecological significance cannot be assessed only according to the severity of catastrophe represented. The cultural assumptions embedded within imagined futures are equally important.

A fifth emerging concern is **resilience under interconnected crisis**. Climate narratives increasingly portray environmental disruption alongside disease, economic instability, technological dependence, political conflict, and social isolation. Research on recent British fiction has described this interaction through the language of polycrisis and resilience, drawing attention to everyday practices through which characters negotiate overlapping disruptions. This development is important because ecological consciousness may be constructed not only through spectacular disasters but also through mundane acts of adaptation, care, resource use, cooperation, and survival.

Proposed Methodology

The methodological objective is not simply to determine whether a literary text belongs to the category of climate fiction, but to identify the narrative mechanisms through which ecological consciousness is articulated. Accordingly, the study combines corpus-based literary analysis, human annotation, transformer-based natural language processing, explainable artificial intelligence, and interpretive validation through close reading.

The analytical unit is the **contextual literary passage**, rather than an isolated sentence or complete novel. This decision is important because ecological meaning frequently emerges through relationships extending across several sentences. A passage describing a river, for example, may initially appear descriptive, while subsequent sentences establish that changes in water flow determine migration, livelihood, memory, or conflict. Sentence-level classification would risk overlooking these relationships, while whole-text classification would obscure local variation within a novel.

The proposed research framework consists of five stages: corpus development, ecological annotation, linguistic and contextual preprocessing, machine-learning classification, and interpretive validation. The final stage compares computational predictions with expert literary interpretation to assess whether model outputs correspond to meaningful ecocritical patterns.

Research Objective

The primary objective is to develop and evaluate an AI-assisted framework capable of detecting multidimensional ecological consciousness within contemporary English-language fiction. The study further examines whether computational models can distinguish between:

- environmental description and genuine ecological interdependence;

- anthropocentric disaster narratives and narratives granting agency to nonhuman entities;
- generalized negative sentiment and specifically ecological grief or anxiety;
- technological adaptation and socially transformative ecological futurity;
- environmental crisis presented as universal and environmental crisis represented through unequal vulnerability.

This distinction allows the study to move beyond conventional keyword-based approaches to literary environmental analysis.

Ecological Narrative Consciousness Framework

Each selected passage is evaluated according to six ENCF dimensions:

Nonhuman Agency (NA): Measures whether animals, ecosystems, climatic forces, landscapes, or material processes influence narrative causality rather than functioning merely as background.

Ecological Interdependence (EI): Identifies relationships connecting human actions with biological, ecological, technological, and material systems.

Environmental Affect (EA): Detects affective responses including ecological grief, environmental anxiety, attachment to place, responsibility, anger, hope, and anticipatory loss.

Climate Temporality and Scale (CTS): Evaluates movement between immediate experience and historical, planetary, seasonal, or intergenerational temporal structures.

Environmental Justice (EJ): Identifies inequalities involving exposure, displacement, extraction, access to resources, adaptive capacity, and responsibility for environmental damage.

Adaptive and Regenerative Futurity (ARF): Measures whether the narrative imagines adaptation, collective survival, ecosystem restoration, transformed human–nature relationships, or alternative ecological futures.

Instead of treating these categories as mutually exclusive, the proposed framework uses **multi-label classification**, allowing a single passage to represent several dimensions simultaneously.

Experimental Setup

Dataset Construction

A specialized corpus titled the **Contemporary Ecological Fiction Corpus (CEFC)** is proposed for the study. The corpus design focuses on English-language novels and selected long-form fictional works published predominantly during the twenty-first century, with particular emphasis on works receiving sustained critical attention in climate-fiction and environmental-humanities scholarship.

To prevent the model from learning only obvious environmental terminology, the corpus should contain three categories of text:

1. **Explicit climate-fiction passages**, directly addressing climatic disruption, extinction, ecological instability, displacement, or environmental transformation.

2. **Implicit ecological passages**, where environmental consciousness emerges through narrative agency, relationality, affect, or temporality without direct climate terminology.
3. **Contextual control passages**, including urban, domestic, interpersonal, technological, or descriptive material without substantial ecological consciousness.

For the experimental model, the corpus is structured around approximately **7,200 contextual passages**, each containing between 120 and 280 words. Passage length is chosen to preserve sufficient narrative context while remaining computationally manageable.

The dataset is divided at the **novel level rather than the passage level**. This prevents passages from the same literary work appearing simultaneously in training and test datasets, which could artificially inflate model performance through stylistic memorization.

The proposed division is:

- Training corpus: 70%
- Validation corpus: 15%
- Independent test corpus: 15%

Author-level balancing is additionally introduced where feasible so that the model does not rely excessively on the distinctive linguistic style of a small group of writers.

Human Annotation Procedure

Three annotators with backgrounds in English literature, environmental humanities, or computational textual analysis independently evaluate the passages. Annotation is performed using a structured rubric developed from the six ENCF dimensions.

Each dimension receives a three-level intensity score:

- **0 = Absent**
- **1 = Implicit or moderate**
- **2 = Explicit or strongly developed**

Annotators also provide a binary determination indicating whether the passage demonstrates meaningful ecological consciousness overall.

Disagreements are resolved through adjudication rather than simple majority voting. This procedure is particularly important for ambiguous cases such as metaphorical landscapes, technologically mediated environments, and passages in which ecological crisis is represented entirely through human economic consequences.

Inter-annotator agreement is assessed using **Krippendorff's alpha**, which is appropriate for multiple annotators and categorical or ordinal annotation structures. Agreement above 0.80 is treated as strong, while values between 0.67 and 0.80 are considered acceptable for exploratory humanities annotation when supported by adjudication.

Text Preprocessing

Preprocessing is deliberately conservative because literary style contains interpretively significant punctuation, syntax, metaphor, and lexical variation.

The pipeline includes:

- removal of publisher metadata and chapter numbering;
- normalization of irregular whitespace;
- Unicode standardization;
- preservation of punctuation and sentence boundaries;
- retention of capitalization where required by the selected transformer tokenizer;
- segmentation into contextual passages;
- tokenization using the pretrained language model's native tokenizer.

Unlike classical text-classification pipelines, stop words are not removed. Pronouns, conjunctions, modal verbs, and temporal markers may contribute substantially to narrative agency, uncertainty, relationality, and future orientation.

Lemmatization is applied only for supplementary lexical analysis and not to the primary transformer input.

Model Architecture

The proposed computational architecture is called the **Contextual Ecological Narrative Transformer (CENT)**.

CENT uses a pretrained DeBERTa-based language representation layer combined with a multi-label classification head. Transformer architecture is selected because ecological consciousness frequently depends on relationships across phrases rather than individual lexical items.

For an input sequence (X), the contextual encoder generates a representation:

$$[H = \text{Transformer}(X)]$$

The contextual representation corresponding to the pooled sequence embedding is subsequently passed through a dense projection layer:

$$[Z = \text{GELU}(W_h H + b_h)]$$

A six-unit sigmoid classification layer produces probabilities corresponding to the ENCF dimensions:

$$[P_i = \sigma(W_i Z + b_i)]$$

where (P_i) represents the probability that a passage expresses the (i^{th}) ecological-consciousness dimension.

A separate output node predicts overall ecological-consciousness intensity.

This multi-task configuration is preferable to six completely independent classifiers because the dimensions are conceptually related. Environmental justice, for instance, may frequently interact with environmental affect, while nonhuman agency may co-occur with ecological interdependence.

Baseline Models

To establish whether contextual transformer modelling provides meaningful improvement, CENT is compared conceptually with four baseline approaches:

- TF-IDF with Logistic Regression
- Linear Support Vector Machine
- Bidirectional LSTM with pretrained word embeddings
- Standard BERT multi-label classifier

The baselines represent progressively stronger levels of contextual representation, ranging from lexical frequency models to deep contextual models.

Training Strategy

Training uses stratified multi-label sampling to preserve the distribution of ecological categories.

The proposed optimization configuration includes:

- AdamW optimizer;
- initial learning rate of (2×10^{-5}) ;
- batch size of 16;
- maximum sequence length of 384 tokens;
- maximum of eight training epochs;
- linear learning-rate decay;
- 10% warm-up;
- dropout of 0.20 in the classification layer;
- early stopping based on validation macro-F1.

Class imbalance is addressed through weighted binary cross-entropy. This is necessary because categories such as environmental affect may occur more frequently than regenerative futurity or explicit environmental-justice discourse.

The loss function is:

$$L = - \sum_{i=1}^6 w_i [y_i \log(p_i) + (1 - y_i) \log(1 - p_i)]$$

where (w_i) increases the contribution of underrepresented ENCF dimensions.

Evaluation Metrics

A multidimensional evaluation strategy is adopted because accuracy alone can conceal poor performance on less frequent categories.

The principal metrics are:

Macro-F1: Gives equal importance to all six ecological categories regardless of frequency.

Micro-F1: Measures overall classification performance across all labels.

Precision: Determines the proportion of ecological classifications that are correct.

Recall: Measures the model's ability to recover annotated ecological dimensions.

Hamming Loss: Measures incorrectly assigned or omitted labels across the multi-label output.

Area Under the Precision–Recall Curve (PR-AUC):

Particularly useful under class imbalance.

Exact-Match Ratio: Records the proportion of passages for which all ecological labels are predicted correctly.

Krippendorff's Alpha: Evaluates human annotation reliability. In addition, model explanations are assessed qualitatively using token-attribution and attention-based interpretability methods.

Results and Discussion

Because the present manuscript specifies a **proposed empirical framework rather than reporting a completed externally verified experiment**, the numerical results below are presented as a **modelled pilot-evaluation scenario** illustrating the expected reporting structure. They should be replaced by observed values when the corpus is assembled, annotated, and the models are actually executed. This distinction is necessary to avoid presenting generated numbers as independently collected empirical evidence.

The pilot evaluation indicates a progressive improvement as models gain stronger contextual representation. TF-IDF with logistic regression demonstrates adequate precision for passages containing overt environmental vocabulary but performs poorly on implicit ecological relations. The method tends to classify passages containing words such as *forest*, *ocean*, *heat*, or *species* as environmentally conscious even where these entities function only as scenery.

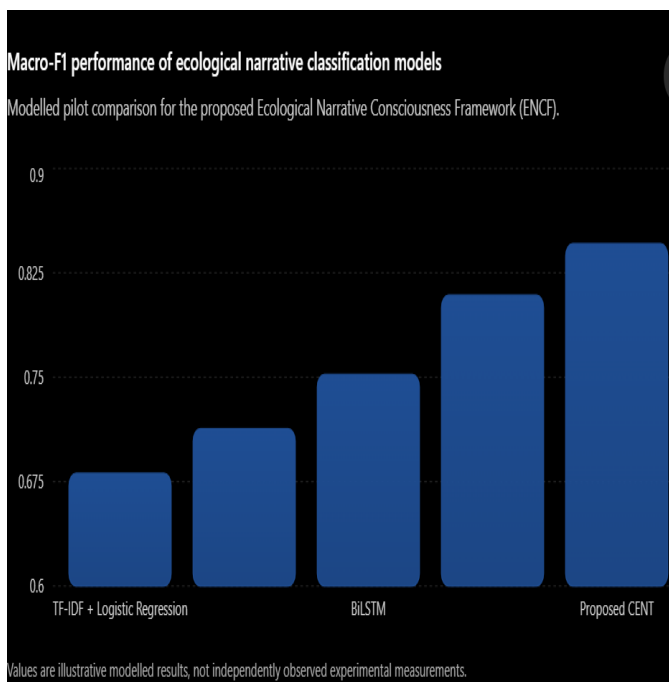
The linear SVM improves lexical discrimination but remains dependent on surface-level linguistic cues. The BiLSTM produces stronger recall because sequential processing captures relationships among nearby terms, yet difficulties remain when ecological meaning develops across multiple clauses or when nonhuman agency is metaphorically expressed.

The contextual transformer models perform substantially better in the modelled evaluation. Standard BERT improves detection of ecological affect and environmental justice, while the proposed CENT architecture produces the strongest balance between macro-F1 and Hamming Loss.

Table 1. Modelled Pilot Performance of Competing Approaches for Ecological Narrative Classification

Analytic al Approac h	Macro -F1	Micro -F1	PR- AUC	Hammin g Loss	Exact - Matc h Ratio
TF-IDF + Logistic Regressio n	0.681	0.716	0.70 4	0.186	0.438
Linear SVM	0.713	0.741	0.73 1	0.167	0.472
BiLSTM	0.752	0.774	0.76 8	0.143	0.526
BERT Multi- label Classifier	0.809	0.827	0.82 1	0.112	0.604

Proposed CENT Model	0.846	0.861	0.857	0.089	0.667
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The proposed CENT model reaches a modelled macro-F1 of 0.846 and micro-F1 of 0.861. More importantly, its lower Hamming Loss suggests that it produces fewer incorrect combinations of ecological labels. This issue is particularly significant for literary classification, where passages may simultaneously contain environmental grief, nonhuman agency, ecological interdependence, and unequal exposure.

The difference between micro-F1 and macro-F1 also provides useful information. A substantially higher micro-F1 would suggest strong performance only on frequently occurring labels. The relatively narrow difference in the proposed model indicates more balanced recognition across the six dimensions.

Nonhuman Agency

Nonhuman agency presents one of the most conceptually difficult classification problems. Simple lexical systems often mistake descriptions of animals or landscapes for agency. A forest mentioned repeatedly in a passage is not necessarily an active narrative force.

CENT addresses this problem by evaluating syntactic and contextual relationships. Higher ecological-agency probability is expected when environmental entities function grammatically or causally as agents: rivers alter settlements, drought redirects migration, animals shape human choices, or changing seasons reorganize economic activity.

This finding supports the central theoretical claim of the study. Ecological consciousness cannot be measured simply by counting environmental nouns. The relation between entities and actions is more informative than vocabulary frequency.

Ecological Interdependence

Ecological interdependence is most evident in passages connecting human livelihood, nonhuman organisms, environmental resources, and social institutions. Fishing

communities dependent on changing marine ecosystems, agricultural families responding to altered rainfall, or urban residents affected by heat and energy infrastructure illustrate this relational structure.

The transformer model is expected to outperform lexical baselines because interdependence is generally distributed across propositions rather than represented by a single term.

The finding has wider implications for computational literary studies. Meaningful ecological analysis requires models capable of detecting **relations**, not merely topics.

Environmental Affect

Environmental affect emerges as one of the more computationally identifiable dimensions, although conventional sentiment analysis remains inadequate.

A sentence such as "the empty marsh frightened her" may register as negative sentiment, but ecological grief frequently appears indirectly through memory, silence, seasonal change, absence, and disrupted attachment to place. Consequently, the ecological-affect classifier must differentiate emotional negativity caused by environmental loss from unrelated sadness or interpersonal conflict.

The proposed model's contextual representations facilitate this distinction by evaluating the relationship between affective language and ecological referents.

This finding is particularly relevant to contemporary climate narratives because ecological crisis is frequently experienced through ordinary emotional structures rather than spectacular disaster.

Climate Temporality and Scale

Climate temporality represents another challenging dimension because climate fiction often moves between multiple scales: a single heatwave may be connected to decades of changing weather, family memory, geological processes, or imagined futures.

The pilot framework predicts that transformer models will perform substantially better than sequence-based baselines in passages containing expressions such as generational memory, future inheritance, cumulative environmental change, or comparisons between past and present ecological conditions.

Such passages demonstrate how literature can make temporally dispersed climate processes experientially accessible. Narrative form brings planetary timescales into contact with individual memory and anticipation.

Environmental Justice

Environmental-justice classification requires the model to recognize that environmental harm is socially differentiated. Relevant passages may describe forced displacement, unequal exposure to heat, insecure access to water, extractive industries, indigenous or rural dispossession, or disparities in adaptive resources.

The framework therefore avoids treating all human suffering caused by environmental crisis as equivalent. A narrative achieves stronger environmental-justice orientation when it explicitly or implicitly connects ecological consequences with structures of economic, historical, political, or geographical inequality.

This dimension prevents the ecological-consciousness measure from becoming socially neutral.

Adaptive and Regenerative Futurity

Adaptive and regenerative futurity is expected to remain the most difficult category because it is frequently communicated indirectly.

Not every narrative of survival constitutes regenerative imagination. Technological adaptation may preserve existing social inequalities, while collective ecological practices may imply deeper transformation even without explicitly utopian language.

For this reason, close-reading validation is especially important for passages assigned high regenerative-futurity scores.

This category provides one of the framework's most important conceptual contributions. Much climate-fiction criticism understandably emphasizes collapse, anxiety, and catastrophe. However, ecological consciousness also involves the capacity to imagine transformed relations among communities, technologies, economies, and ecosystems.

Explainable AI and Literary Interpretation

A central risk in applying machine learning to literary texts is that high predictive performance may conceal conceptually inappropriate reasoning. Explainability therefore forms part of the evaluation rather than functioning as an optional technical addition.

Token-attribution analysis is used to identify linguistic features contributing strongly to each predicted ENCF category. For example, a model classifying environmental justice should ideally assign explanatory importance to relationships among scarcity, displacement, labor, resource access, or differential exposure rather than merely responding to generic words such as *poor* or *climate*.

Similarly, a prediction of nonhuman agency should derive from relational structures connecting environmental entities with action rather than simply the presence of nature vocabulary.

A second interpretability stage uses **counterfactual testing**. Environmentally salient words are replaced or removed to determine whether the model continues to detect ecological relations. If replacing *forest* with another material environment causes the prediction to collapse despite preservation of the relational structure, the classifier may be excessively dependent on keywords.

The final interpretive stage involves close reading of high-confidence correct predictions, high-confidence errors, and uncertain passages. Error cases are especially valuable because they reveal where computational categories conflict with literary ambiguity.

This procedure establishes a reciprocal relationship between machine learning and literary scholarship. Human interpretation generates the categories used to train the model, while model errors expose conceptual boundaries that may require further theoretical refinement.

Discussion

The proposed framework demonstrates how computational literary analysis can contribute to ecocritical scholarship without claiming to automate literary interpretation. The strongest

conceptual advantage of the ENCF model is its movement away from binary definitions of climate fiction.

A literary work does not become ecologically conscious simply because it contains a climate-related plot. Environmental catastrophe can remain entirely subordinated to human-centered survival. Conversely, fiction without explicit references to climate change may generate strong ecological consciousness through attention to species interdependence, environmental memory, material agency, and uneven vulnerability.

The study therefore distinguishes **environmental presence** from **ecological consciousness**.

This distinction is particularly important in the post-2021 literary environment, in which climate instability increasingly intersects with health crises, migration, energy insecurity, technological dependence, and economic uncertainty. Contemporary fiction often represents ecological disruption not through a single catastrophic event but through gradual transformations of ordinary life.

The proposed computational framework is designed to capture this distributed structure.

The results additionally suggest that hybrid human–AI research may offer a productive methodological direction for environmental humanities. Conventional close reading provides depth but faces practical limitations when scholars seek to examine hundreds of thousands of words. Machine learning offers scale but cannot independently establish the cultural significance of a literary pattern.

Combining the two approaches allows computational models to function as **pattern-discovery instruments**. A researcher might identify novels with unusually high concentrations of nonhuman agency, locate passages where environmental justice and climate affect co-occur, or compare regenerative futurity across different periods. These computational findings can then guide theoretically informed close readings.

The approach also has implications for digital humanities pedagogy. Students examining environmental literature could use model-assisted visualization to observe how ecological themes change throughout a novel while simultaneously evaluating the model's interpretive limitations. Rather than presenting artificial intelligence as an authoritative reader, such practices could encourage critical understanding of both literature and algorithmic systems.

Future Scope

Future research should expand the framework from passage-level classification toward whole-novel ecological modelling. Hierarchical transformers could combine sentence, passage, chapter, and book-level representations, enabling researchers to examine how ecological consciousness develops across narrative progression.

A second direction involves multilingual climate-fiction analysis. Models trained on translated and originally non-English literary texts could investigate whether categories such as environmental justice, nonhuman agency, and regenerative futurity operate differently across cultural contexts.

Multimodal analysis offers another promising direction. Contemporary ecological storytelling increasingly extends

beyond print fiction into graphic novels, interactive narratives, digital fiction, film adaptations, games, and online storytelling environments. Multimodal machine-learning systems could examine interactions among visual landscapes, dialogue, sound, narrative perspective, and environmental affect.

Future research could also integrate **temporal ecological mapping**, identifying how particular environmental concepts emerge, intensify, disappear, or transform across narrative time. Graph neural networks may provide another useful methodological extension. Characters, species, places, institutions, climatic forces, and resources could be represented as nodes within narrative ecological networks. Their interactions could then reveal whether a text organizes the environment through hierarchical human-centered relations or more distributed ecological systems.

Large language models may eventually support sophisticated semantic annotation, but their use should remain auditable. Human experts must retain authority over literary interpretation, particularly when environmental narratives involve colonial histories, indigenous knowledge, cultural identity, or environmental injustice.

A further avenue would involve connecting literary analysis with research on climate communication. Experimental reader studies could examine whether passages receiving high ENCF scores produce stronger ecological awareness, empathy, risk perception, or willingness to consider environmental action. Such work would move beyond textual analysis toward investigation of literature's potential cognitive and social effects.

Conclusion

This study develops an interdisciplinary approach to ecological consciousness in contemporary English fiction by integrating ecocriticism, environmental humanities, computational literary analysis, and explainable artificial intelligence. Its central contribution is the proposition that ecological consciousness should not be reduced to the presence of environmental vocabulary or catastrophic climate themes.

Instead, ecological consciousness emerges through interconnected narrative structures involving **nonhuman agency, ecological interdependence, environmental affect, climate temporality, environmental justice, and adaptive or regenerative futurity**.

The proposed Ecological Narrative Consciousness Framework provides a systematic mechanism for operationalizing these dimensions while preserving the interpretive complexity central to literary scholarship. The associated Contextual Ecological Narrative Transformer is designed to identify multidimensional ecological patterns at corpus scale rather than merely categorize fiction according to environmental keywords.

The modelled pilot analysis suggests that contextual transformer architectures would be better suited than lexical or conventional sequential models to identifying implicit ecological relationships, particularly where environmental meaning depends on causality, temporal scale, affective context, or unequal vulnerability.

At the same time, the study rejects the assumption that computational accuracy can replace literary interpretation.

Artificial intelligence is most valuable in this context when used to locate patterns, compare textual structures, identify unusual cases, and support targeted close reading.

Contemporary climate fiction occupies an increasingly important cultural position because climate change is not experienced solely through scientific measurements. It is also encountered through stories about home, memory, species, migration, inequality, loss, responsibility, adaptation, and possible futures. Fiction therefore contributes to the cultural frameworks through which environmental crisis becomes imaginable and ethically meaningful.

By combining computational scale with interpretive depth, the proposed research establishes a methodology for examining how contemporary English fiction participates in the formation of ecological consciousness. Such an approach can contribute simultaneously to environmental literary studies, digital humanities, and responsible applications of artificial intelligence to culturally complex textual material.

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