



Article

Re-storying environmental policy: An ecological AI-assisted approach

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Abstract

In recent years, growing awareness of the cultural roots of the socioecological crisis has led to major scholarly interest in how language mediates socioecological relations. While ecolinguistic research has extensively documented how linguistic patterns promote destructive or beneficial narratives, experimental evidence on how exposure to different discursive configurations shapes readers' environmental perceptions and attitudes remains limited. This study aims to address this gap by investigating how semantic and syntactic variations in policy texts may influence readers' environmental perceptions. A questionnaire was administered in summer 2025 to a sample of Chinese environmental science graduate and doctoral students, who evaluated three versions of an environmental policy document, re-storied using an AI-assisted protocol. The questionnaire was based on the New Ecological Paradigm (NEP) scale, adapted to assess the perceived environmental positioning of the texts. Results show statistically significant differences across assessments of the three documents, highlighting a correlation between linguistic variations and readers' interpretations of the texts. From a methodological standpoint, this study provides empirical evidence for the validity of the NEP scale as a tool for the ecolinguistic assessment of texts relevant to environmental decision-making. Furthermore, it demonstrates the methodological potential of generative AI as an ecolinguistically informed re-storying tool.

Keywords: ecolinguistics; ecological perception; AI-assisted re-storying; NEP scale; Chinese policy discourse

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1. Introduction

The triple crisis of climate change, biodiversity loss, and environmental pollution has long stimulated attempts to gauge — and possibly transform — the nexus between human culture, psychological processes, and social-ecological interactions (Dunlap et al., 2000). In this context, recent years have witnessed an increased interest in how language can reshape the relationship between humans and the rest of nature. Broadly speaking, such efforts are consistent with the Hallidayan strand of ecolinguistics. They focus on studying linguistic patterns in environmental discourse that promote ideologies shaping public perceptions, attitudes, and behaviors (see, for example, Alexander, 2009; Brombal et al., 2024, 2026; Stibbe, 2014, 2021; Zhang & Cheung, 2022; on ideology and discourse, see also Gramsci, 1948–1951). Despite the growing body of literature on this topic, there remains limited experimental evidence on how these linguistic and discursive patterns influence individual and collective perceptions of environmental issues (see Johnstone & Stickles, 2024; Reijnierse et al., 2025; Rotondi et al., 2024).

By contrast, relevant research in social and sustainability sciences has produced valuable insights and actionable tools since at least the 1970s. One of the most notable examples has been the New Environmental Paradigm (NEP). Introduced in 1978 by Dunlap and Van Liere (1978), NEP aimed at measuring people’s environmental attitudes and their perceptions of ecological issues, serving the purpose of a gradual evolution of human cultures towards sustainability (on NEP’s intellectual origins, see par. 2.2). In 2000, the scale was updated to include new items, linguistic adjustments, and a new name, the New *Ecological* Paradigm (Dunlap et al., 2000).

Since its first inception almost fifty years ago, NEP has been consistently employed across a variety of sociopolitical and cultural contexts (Hawcroft & Milfont, 2010; Ntanos et al., 2019; Ogunbode, 2013). Yet somehow surprisingly, NEP has rarely — if ever — been applied to the evaluation of discursive frames (Hawcroft & Milfont, 2010). In fact, its application to ecolinguistics research may provide a reliable instrument to complement ongoing efforts to assess the overarching environmental positioning informing texts (see, e.g., Stibbe’s ecosophy in Stibbe, 2021). Compared with other tools employed to this end, the NEP scale has two main advantages: on the one hand, it offers robustness and replicability, allowing for statistical analysis of correlations between a text and its environmental positioning in a sample population. On the other hand, and perhaps more importantly, the NEP allows us to measure texts’ positioning along a continuum from destructive to regenerative, thereby enabling the identification of subtle variations in how different narratives convey different ecological meanings.

Against this backdrop, this study extends ecolinguistic work by adopting an experimental approach to evaluate how variations in the semantic and lexical building blocks of environmental texts are reflected in readers’ perception and interpretation of textual information. This aim is pursued by developing and testing a novel methodology that combines corpus analysis and generative AI to identify linguistic variables of

ecolinguistic relevance and to re-story texts (on re-storying, see Brombal et al., 2026). Readers' interpretation of such texts is ultimately gauged through an NEP-informed survey, administered in Summer 2025 to a sample of Chinese environmental science students, which measures how they perceived the ecological positioning of three texts characterized by distinctive patterns of ecolinguistic relevance. The texts comprise one original prefecture-level government work report and two re-storied versions, modified by generative AI trained by the authors. The process of re-storying was carried out using a set of syntactic and semantic variables of ecolinguistic relevance, identified through a preliminary corpus-based analysis of a broader sample of government work reports.

The paper is structured into five sections: first, Section 2 reviews the theoretical background underpinning the methods adopted in this study. Section 3 details the procedures of AI-assisted re-storying, questionnaire administration, and analysis. Section 4 presents the results of the survey. Finally, in Section 5, we discuss the broader scientific significance and social implications of our work.

2. Theoretical and conceptual background

2.1. Ecolinguistics and ecological characterization of texts

In examining how language shapes relationships between humans and the rest of nature, ecolinguistic research often focuses on text evaluation to determine whether destructive or beneficial narratives are conveyed. In this respect, two strands of evaluation can be identified: the *analysis of ecological discourse* and the *ecological analysis of discourse* (Alexander & Stibbe, 2014). While the former examines language explicitly concerned with environmental matters, the latter evaluates any discourse in terms of its socioecological assumptions. Such discourses, encompassing economics, politics, education, tourism, and media communication, are highly relevant because they shape how readers perceive their connection to the natural environment in daily life, reinforcing unsustainable views or promoting ecological awareness.

In this regard, a central reference is Stibbe's ecosophy (an ecological philosophy), defined as "a set of values concerning the ideal relationship of humans with each other, other species and the physical environment" (Stibbe, 2021, p. 223). Stibbe proposes the creation of an ecosophy, against which texts can be evaluated and their ecological positioning assessed, thus functioning as a scale rooted in environmental ethics, spanning between two opposing poles, such as anthropocentrism and ecocentrism, neoliberalism and anarchism, or optimism and pessimism (Stibbe, 2021).

Stibbe's ecosophy, and its subsequent extension into the *beneficial–ambivalent–destructive* framework, has been widely applied across a variety of genres and methodological traditions as a reference framework for ecolinguistic evaluation. In particular, ecosophies have been employed to examine media representations of environmental problems, climate change narratives, educational materials, and representations of non-human animals.

Within media discourse, Al-Shboul (2023) applied Stibbe's Framework to analyze political speech on climate change, classifying ideologies as environmentally positive or negative (2023, pp. 205–207) and showing how linguistic choices contribute to broader ideological constructions of environmental problems. Similarly, Wei and Hu (2024) integrate Stibbe's ecosophy with systemic functional linguistics (SFL) to classify attitudinal language in Chinese, Indian, and American news reports on the Belt and Road Initiative as beneficial, neutral, or destructive toward the environment. Zhang and Cheng (2024) further analyze *China Daily* reports concerning the migration of Asian elephants through the ecosophy of "diversity and harmony, interaction and co-existence", revealing both anthropocentric representations of the elephants and discursive patterns that promote wildlife conservation.

Beyond media discourse, the educational genre has attracted particular attention in applications of Stibbe's ecosophy, especially in its extended *beneficial–ambivalent–destructive* formulation, which classifies text segments into one of three categories and then calculates the frequency of each to assess the overall positioning of the text. Zahoor and Janjua (2020), for instance, combined ecolinguistic analysis with ecopedagogy and Hallidayan transitivity analysis to investigate environmental texts in Pakistani primary school English textbooks. More recently, Komarawan et al. (2025) applied Stibbe's ecosophy to Indonesian EFL textbooks, using its ecological principles as a benchmark for evaluating linguistic representations of environmental awareness, identifying both beneficial representations and ambivalent patterns in which nominalization, participant exclusion, and visual distancing obscure human responsibility for environmental degradation.

Ecosophy-based evaluation has also been extended to corpus research, moving beyond close reading. Poole (2022) combined the ecosophy framework with corpus-assisted methodologies to investigate how linguistic patterns construct narratives across large corpora. Similarly, Franklin et al. (2022) established a predefined ecosophy centered on protection, rights, systems thinking, and fairness to analyze a 5.6-million-word corpus of UK discourse surrounding plastics.

Stibbe's ecosophy and its subsequent developments have provided an important evaluative framework for ecolinguistics; however, the issue of how effective an ecosophy is at sustaining evaluative judgment remains the object of considerable debate. Stibbe acknowledges that each linguist may develop his own ecosophy based on his personal philosophical and ethical principles. However, he also argues that all ecosophies share a core of "ecological consideration" oriented towards the promotion of beneficial and balanced "interactions of humans with other organisms and the ecological environment" (Stibbe, 2021, p. 12), thus providing a degree of evaluative continuity and comparability across analyses grounded in different ecosophies. Despite the common baseline, the plurality of possible ecosophies has generated substantial methodological and theoretical discussion within ecolinguistics. Huang and Chen (2018), for instance, argue that Stibbe's ecosophy does not provide a standardized foundation against which texts can be consistently assessed and findings compared, as individual and personal ecological values

and ethical orientations inevitably shape how individuals interpret and evaluate the world. The authors further argue that scholars from different cultural backgrounds may apply different criteria when deciding whether the same discourse is beneficial, ambivalent, or destructive, thereby introducing an additional source of potential inconsistency.

Against this backdrop, no standardized framework has yet been established that adequately balances subjective interpretation with objective evaluation in assessing the environmental positioning of texts. This limitation is particularly relevant when ecolinguistic analysis moves into the territories of comparative, corpus-based, experimental, or computational research, where a researcher-defined ecosophy provides a rich qualitative foundation for interpretation, but is more difficult to translate into a replicable set of evaluative dimensions, applicable across multiple texts or experimental conditions. This methodological challenge raises the question of whether existing instruments developed to assess individual and collective environmental attitudes might be adapted for ecolinguistic purposes. Among them, the New Ecological Paradigm (NEP) scale offers a promising point of departure, as it organizes environmental attitude around a set of explicit and evaluative dimensions, adaptable to different sociocultural contexts. Building on this potential, the present research explores the applicability of the NEP scale to the evaluation of environmental discourses embedded in texts.

2.2. New Ecological Paradigm (NEP) scale

The New Ecological Paradigm (NEP) scale¹ provides a useful conceptual basis to design metrics of ecolinguistic relevance. First introduced in 1978 by Dunlap and Van Liere (1978), the NEP scale is one of the most widely used tools for measuring environmental attitudes. Over the past decades, its application has expanded considerably beyond the social and geographical context in which it was originally developed, being consistently employed across different age groups (Kopnina, 2011), cultural contexts (Bostrom et al., 2006; Caron, 1989; Edgell & Nowell, 1989; Hosseinneshad, 2017; Ntanos et al., 2019; Widegren, 1998) and professional backgrounds (Luo & Deng, 2008; Veselaj, 2023; Wallhagen & Magnusson, 2022). Bechtel et al. (1999), for instance, administered the scale to 505 university students in the United States, Mexico, and Brazil, identifying cross-cultural differences in the organization of environmental beliefs. Similarly, Vikan et al. (2007) compared responses from Brazilian and Norwegian students, finding stronger endorsement of the NEP among the Brazilian sample. In recent years, NEP has also been applied in the Chinese context. Wu (2012) developed and tested a Chinese version of the revised NEP with 507 children aged 10–12 years from three elementary schools in Shenzhen, demonstrating acceptable internal consistency. Zhu and Lu (2017), using nationally representative data from the 2010 Chinese General Social Survey, evaluated the psychometric characteristics of the NEP through item response theory (IRT) and identified

¹ Annex A provides the original version of the NEP scale in the 2000 version (Dunlap et al., 2000).

differences in the performance of individual items and response categories. Xue et al. (2018) administered a Mandarin version of the revised NEP to 515 Chinese adults and found that environmental attitudes were associated with perceptions of climate change risk and mitigation behavior. This extensive body of research demonstrates that the NEP can capture socioecological relationships across time and place(s), while remaining sensitive to contextual variations.

The reasons for NEP's continued relevance and reliability can be traced back to its cultural and scientific roots. In fact, the original NEP scale was designed to operationalize the critique of what Pirages and Ehrlich conceptualized as the Western Dominant Social Paradigm (DSP), centered on industrial capitalism and characterized by confidence in continued economic and technological progress, support for material growth, and an anthropocentric, instrumental conception of nature (Pirages & Ehrlich, 1974). Amidst the broader debate on human development epitomized by the seminal report *The Limits to Growth* (Meadows et al., 1972), the authors called for the development of forms of “social technology” able to “meet mankind psychosocial needs” and address the socioecological crisis (Pirages & Ehrlich, 1974, p. 45). In their proposition, cultural evolution has to be governed to facilitate the emergence of novel norms, beliefs, values, and habits — the core components of what they called “world view”, or DSP — steering capitalist civilization away from the course of social injustice and ecological catastrophe (Pirages & Ehrlich, 1974). It was precisely against this background that Dunlap and Van Liere originally designed a scale both normatively positioned and analytically sound, aimed at measuring progress towards a new paradigm, which they called the New Environmental Paradigm (NEP) (Dunlap & Van Liere, 1978, 1984). Through its 12 items, the original NEP aimed at measuring individuals' support for pro-environmental worldviews, focusing on three core concepts: 1) the ability of human beings to negatively affect the balance of nature; 2) the existence of limits to growth as theorized by the Club of Rome (Meadows et al., 1972); 3) the right of human beings to control nature and to use it to serve their needs (Dunlap & Van Liere, 1978).² NEP therefore made explicit the socioecological assumptions and concerns that informed DSP development in the first place, by focusing on competing assumptions about human–nature relations, economic growth, technological control, and the ecological conditions within which human societies operate.

The NEP scale was revised in 2000 (Dunlap et al., 2000) to expand its scope and address the flaws of the original version. The revised scale, renamed *New Ecological Paradigm*, included 15 items and removed outdated and sexist language, while also adding two new

² The original NEP scale was tested in 1976 on two samples: Washington households and members of big environmental organizations. Results showed a high degree of internal consistency among the three core concepts, supporting the use of the scale as a coherent measure of pro-environmental orientations. Furthermore, the significant differences across the two subsamples (with higher values recorded in the sample of environmental organizations members) led the authors to conclude that the endorsement of the NEP was negatively related to the support of the Dominant Social Paradigm (DSP), a societal worldview that emphasizes material prosperity, unlimited economic growth, faith in technology and human control over nature (Dunlap & Van Liere, 1984).

concepts: a) anti-exemptionalism, measuring the extent to which individuals view themselves as exempted from nature constraints (Dunlap & Catton, 1994); and b) eco-crisis, assessing the degree to which individuals believe a major ecological crisis is imminent (Dunlap et al., 2000).^{3,4} Importantly, these dimensions conceptualize environmental attitude not simply as concern for environmental protection, but as a more general understanding of humanity's position within ecological systems.

Since the scale emerged from a critique of observations of Western — particularly US — societies, scholars have questioned the extent to which the NEP could be transferred to other cultural contexts, particularly in relation to the opposition between anthropocentric and ecological worldviews (Chatterjee, 2008; Kopnina, 2011).⁵ Nevertheless, empirical research indicates that the NEP, once adapted, despite being an established environmental framework whose operationalization must remain sensitive to local sociocultural and linguistic contexts (Bechtel et al., 1999; Vikan et al., 2007), demonstrates broad applicability that extends beyond political, geographical, and cultural borders (Xiao et al., 2019). Furthermore, prior application in the Chinese context supports these findings, providing further reassurance over its applicability to social and cultural environments different from the one in which it originated, provided that appropriate adaptation and context-sensitive interpretation of the resulting data are implemented (Orderud & Vogt, 2016; Zhu & Lu, 2017).

Quite surprisingly, given its inception as a form of social critique rooted in the study of capitalist institutions, NEP has not been applied in the past as a tool for critical or ecological discourse analysis. This may be due in part to the lack of a purposeful critical framing in the DSP framework, factoring in the role of what Gramsci — and de-/post-colonial thinkers — would refer to as “hegemonic power”. Be that as it may, meaningful space for experimentation remains to employ NEP as a tool supporting ecolinguistic work today. Against this backdrop, our study does not employ NEP in its traditional way to measure individuals' environmental attitudes; instead, we employ NEP to evaluate the environmental positioning of texts and readers' perceptions of them. In this sense, the NEP provides a conceptual bridge between observable linguistic patterns and the broader environmental worldviews they construct. Indeed, as environmental meanings emerge as a cumulative effect of lexical, syntactic, and discursive choices, the NEP scale offers a useful

³ As for the original version, high NEP results were indicative of pro-environmental worldviews, while low NEP scores align with the DSP (Dunlap et al., 2000).

⁴ As with the 1978 scale, the revised version was tested on a sample of Washington residents, showing internal consistency across the 15 items. As for the original version, high NEP scores were indicative of pro-environmental worldviews, while low NEP scores were associated with the DSP (Dunlap et al., 2000).

⁵ Although this is beyond the scope of this paper, it is worth noting that NEP's applicability to non-Western contexts may be further strengthened by incorporating in its architecture concepts and approaches developed and debated in the context of post- and de-colonial studies. Works by Dipesh Chakrabarty (2009) on overcoming eurocentric, one-fits-all approaches to development, and by Ashish Kothari and colleagues (2019) on post-development ideas are particularly promising in this respect.

framework to evaluate textual environmental positionings. Furthermore, its analytical structure also provides a reliable basis for developing replicable and scalable measures of textual environmental positioning⁶, without requiring the construction of an entirely new evaluative framework. Such an adaptation extends the scope and range of ecolinguistics text evaluation in two directions: 1) NEP-derived dimensions are used to identify the broader ecological worldviews constructed through different combinations of linguistic features; 2) NEP-derived dimensions are used to establish a connection between the linguistic construction of environmental meaning and how readers may interpret such meanings.

2.3. Policy documents as a site for ecolinguistic intervention

Across different political and administrative contexts, policies are materialized through a range of different textual forms, but although these texts differ in legal status, audience, and communicative purpose, they share an important characteristic: rather than merely describing social realities, they participate in defining which aspects of those realities become recognizable as policy problems and what kinds of responses appear necessary, legitimate, or achievable (Bacchi, 2009; Fischer, 2003). Policies in fact represent the crystallization of worldviews (norms, beliefs, values, and — to some extent — habits) dominating⁷ each polity⁸ at any specific point in time. As such, policy texts are of key relevance for the critical effort at the core of critical discourse analysis and, by extension, for critical ecolinguistics.

Policy discourse, unlike other genres, is governed by stringent writing conventions that constrain how meanings can be formulated and communicated (Bhatia, 2010), while also performing persuasive and legitimizing functions, seeking to establish desirability, necessity, or legitimacy (Ho, 2016). Given the nature of policy documents, linguistic framing is particularly important for determining how problems are approached, especially in the environmental sector, where such policies reflect how powerful actors articulate problems to normalize public perception of ecological issues and societal goals. Indeed, environmental policies not only determine whether ecological issues are explicitly addressed but also define how relationships among different socioecological paradigms⁹ are negotiated, legitimized, and rendered meaningful. Therefore, examining how seemingly inconsequential or isolated linguistic choices concerning agency, modality, evaluation

⁶ Furthermore, this approach may facilitate follow-up research on variations of environmental attitudes and behaviors among readers exposed to texts informed by different ecological and environmental discourses.

⁷ As in Pirages and Ehrlich's dominant social paradigm, DSP (1974).

⁸ Here understood as a society which is organized and where decision-making is structured in formal institutions.

⁹ By socioecological paradigms, here we refer to overarching models shaping the relationships and tradeoffs between material development, human well-being, ecosystems, and non-/more-than-human life on Earth.

transitivity, nominalization, and inclusion or exclusion construct and legitimize these relationships — while remaining consistent with established genre conventions — is particularly relevant.

The Chinese case makes no exception. Rather, it epitomizes the importance of language and discourse in shaping social perceptions and values on a wide range of political relevance, thus offering a vantage point to observe and act upon the way language and discourse interact with and influence socioecological realities (Brombal et al., 2024; Schoenhals, 1992). Chinese policy communication operates through a vertically articulated but territorially differentiated administrative system (Lorentzen et al., 2014), making local government documents particularly valuable for investigating how policy objectives are negotiated across different governance contexts, both hierarchically and spatially. Indeed, while national priorities are generally shaped by large-scale visions and pressing international relations, local priorities are primarily influenced by economic and fiscal constraints, cadres' personal interests, and local development needs (Lieberthal & Oksenberg, 1988; Lorentzen et al., 2014; Mertha, 2009; Kostka & Hobbs, 2012), thus affecting the way in which central national directives are re-elaborated at the local level. In the context of environmental policies, this mismatch between national and local objectives is particularly visible: if at the national level, environmental policies are largely aligned with international objectives, depicting China as a potential leader in future sustainable development (Li & Shapiro, 2020; Volcovici & Paraguassu, 2025; Xinhua News Agency, 2025); at the local level, implementation plans differ significantly, favoring economic development, industrial modernization and technological innovation (Eberhardt, 2015), thus making it essential to understand not only how environmental issues are framed in policy discourse but also how they are framed at different levels of the institutional hierarchy.

In this context, Government Work Reports (政府工作报告), reviewing governmental achievements and performance while establishing priorities and targets for subsequent governmental action (Wang, 2017), represent a valuable source for investigating Chinese policy framing and the relevance attributed to environmental issues. Work Reports display features traditionally considered both scientific and political: they present claims based on scientific data to persuade readers to support specific policies developed through recommended actions, and they serve as a key reference to guide governmental actions and national value orientations.

At the local level, Work Reports can be understood as an interface between broad national development visions and the concrete socioecological conditions of particular territories, combining conformity with central policy priorities and a degree of autonomy in defining local work agendas (Ahlers & Schubert, 2015; Kostka & Hobbs, 2012). They therefore represent a valuable source for examining both the relationship between higher-level policy objectives and local governmental priorities (Wang, 2017) and the framing of environmental objectives at the local level. However, their relevance extends beyond administrative coordination; indeed, being distributed through government websites,

educational apps, and community activities, they also serve as educational and informational resources, influencing how civil society interacts with the policy plan, perceives urgency and severity, and assesses governmental efforts.

Policy documents thus exhibit a distinctive multifunctional profile: 1) they define governmental priorities; 2) they contribute to shaping what individuals perceive as salient in the policy context; 3) they perform education and information functions. Importantly, this functional flexibility coexists with relatively strict genre conventions that constrain their structure, organization, and linguistic formulation, making them particularly relevant for examining how meanings can be reformulated while remaining recognizable within established genre boundaries.

Their highly structured nature has also drawn attention to the potential use of artificial intelligence in policy writing, particularly to support the generation and reformulation of policy texts while preserving genre-specific conventions. Ray (2023) and De Villiers et al. (2024), for instance, showed that generative AI has significant potential for writing highly technical ecological documents, enhancing specificity, increasing accuracy, reducing the effort required to achieve intended communicative goals, and thus producing coherent academic or professional texts. Furthermore, generative AI offers methodological opportunities for controlled linguistic intervention, enabling investigation of whether environmental relationships and responsibilities can be made more salient by modifying specific linguistic or discursive features while retaining the functional identity of the policy text. Generative AI therefore provides an experimental means of exploring alternative formulations within the discursive boundaries of policy writing, rather than outside them, that can subsequently be evaluated for their effects on readers' perceptions, priorities, and interpretations.

3. Methods

The methodology adopted in this study consists of four main steps: 1) AI-assisted sample text production; 2) questionnaire design; 3) data collection; and 4) data analysis. Each step produced a distinct output; while outputs of Step 1 and Step 2 served as inputs for Step 3, results obtained in Step 3 were analyzed as the final output of the study.

3.1. Text description

The first phase of this study entailed the re-storying of the introductory section (titled: “Development Vision” 发展思路 *fāzhǎn sīlù*) of the 2023 Prefecture-Level City Government Work Report (PLCWR) for the city of Suzhou (宿州 *Sùzhōu*), located in Anhui Province (安徽省 *Anhuī Shěng*).¹⁰ This report was selected because, while consistent with the intended goals and production process of virtually all PLCWRs, it is one of the few that presents

¹⁰ Coordinates: 33°38'53"N 116°57'50"E.

this as a distinct section, explicitly focused on development pathways with clear social-ecological implications.¹¹ This structural distinction makes it particularly suitable for re-storying, ensuring coherence and continuity without the risk of abrupt or fragmented transitions. Furthermore, the explicit framing of a “Development Vision” is analytically valuable, since it encapsulates guiding principles, priorities, and ideological orientation of the entire report, offering an ideal entry point for ecolinguistic analysis.

The choice to analyze PLCWRs is determined by two main reasons: 1) Policy documents reflect how national and lower-level entities frame environmental issues, highlighting which problems are prioritized, which solutions are considered more effective, and how these are justified on a political, social, and scientific basis, unveiling how governments deal with the issue at stake. Furthermore, by focusing on primary sources, this research avoids additional levels of reframing added by the media, which often promotes partial interpretations of governmental discourses; 2) PLCWRs, being widely disseminated among decision-makers and laypeople alike, are key documents to foster consensus about salient political issues.¹²

3.2. Text production

The re-storying process was assisted by ChatGPT 4o; the choice to opt for ChatGPT 4o, instead of other AI chatbots, was informed by three key considerations. First, ChatGPT offers a memory function that stores users’ data and makes it retrievable by providing the link associated with the chat (OpenAI, 2024). Second, comparative analyses of political biases in LLMs show that ChatGPT is less ideologically biased compared to Google’s Gemini and DeepSeek (Hartmann et al., 2023; Yüksel, 2025).¹³ Lastly, ChatGPT shows powerful multilingual capacity, supporting over 50 languages with high fluency and over 90 with functional capacity (Chatbase, 2024). Beyond these practical advantages, ChatGPT has also gained increasing acceptance in academic research; Incelli (2025) addressed the potential of AI in corpus analysis, reporting valuable findings with high levels of reliability. Similarly, De Villiers et al. (2024) explored the use of generative AI in drafting full sustainability reports or specific sections of them, highlighting its effectiveness in complex writing tasks.

The re-storying of the introductory section of Suzhou PLCWR (hereafter “*Text 1*”) produced two new versions, *Text 2* and *Text 3*. *Text 2* proposes a weak sustainability

¹¹ The report was identified during a wider corpus-based analysis of PLCWRs, retrieved from government databases as detailed in section 3.2.

¹² Often, these reports are spread within society through a variety of channels, including newspapers, official websites, and official apps.

¹³ In particular, DeepSeek was unable to process this study’s task; when the original governmental document was uploaded, DeepSeek returned “The document may violate terms” and even if pasted as plain text in the chat, the chatbot answered with “你好，这个问题我暂时无法回答，让我们换个话题在聊聊吧” (“Hi, at the moment I can’t answer this question. Let’s change the subject and talk about something else”).

narrative (on the concept of weak sustainability, see Gutes, 1996), in which the government exerts greater effort in environmental protection, but still considers economic, industrial and technological development as its core goal. *Text 3* advances a transformative discourse, characterized by strong sustainability, in which the government emphasizes a radical approach to ecological protection and ecosystem restoration, renouncing fast and ascending industrial and economic development (on transformative approaches, see Foggin et al., 2021).

The re-storying processes consisted of two steps, namely Ecolinguistics Analysis and Narrative Reconstruction. The first served to identify linguistic variables of ecolinguistic relevance, to be modified in the following step, while the latter entailed rewriting texts by modifying the key linguistic features that emerged during the preparatory stage.

The semantic and syntactic variables employed in the re-storying process derived from an extensive corpus analysis of PLCWRs from 152 Chinese prefectures for the years 2003, 2013 and 2023 (Table 1), sourced from official websites and publicly available databases.¹⁴

Table 1. PLCWR corpora composition

Corpus Name	No. of Texts	No. of Characters	No. of Tokens
PLCWR03	152	2.118.680	1.053.599
PLCWR13	152	2.000.008	1.009.503
PLCWR23	152	2.229.637	1.125.838

The corpus analysis, combining collocation and concordance methods, identified recurrent semantic and syntactic patterns (Table 2) deemed relevant from a social-ecological perspective, based on published literature. First, semantic tagging was conducted following the UCREL Semantic Analysis System categories (USAS) (Rayson et al., 2004), isolating four relevant classes, namely A1.1.1 (General actions), A2.1 (Affect: modify, change), A13.3 (Degree: boosters), and A15 (Safety/Danger). High-frequency verbs within these categories were selected as nodes. Second, nodes' collocations were examined to detect incongruent or unconventional syntactic patterns conveying particular meanings to readers. Finally, concordance analysis was conducted, revealing recurrent semantic patterns, narrative framings, and sentence structures that subtly foreground particular interpretations. This analysis resulted in the following variables, as presented below in Table 2.

Building on these findings, the prompt included 1) a lexical variable list, organized by USAS categories (Rayson et al., 2004), including terms present in the Suzhou introductory section and additional related terms occurring in the three corpora; 2) a list of target grammatical structures; 3) an example illustrating how variables should be displayed, ensuring consistency and standardization in model outputs.¹⁵

¹⁴ 中国县城 last accessed on 19th July 2024, link <http://zgcounty.com>; 中国经济网 last accessed on 19th July 2024, link http://district.ce.cn/zg/202301/20/t20230120_38358032.shtml

¹⁵ Annex B provides the set of prompts used in the re-storying process.

Table 2. Semantic and syntactic variables taxonomy

Semantic Variables	Syntactic Variables
A2.1 Affect: Modify, Change	把 Construction
A5.1- Evaluation: bad	被 Construction (Passive structure)
A5.1+ Evaluation: good	Nominalization
A7 Definite + (modals)	Embedded clause
A11.1 Importance: Important	Subject nature
A11.2 Importance: Noticeability	
A13.3 Degree: boosters	
A14 Exclusivizers/particularizers	
N1 Numbers	
T1 Time	
W3 Geographical Terms	
W5 Green Issues	
Z3 Other proper names	
Z8 Pronouns	

Narrative reconstruction entailed rewriting and reframing the text to incorporate and convey sustainable narratives. Specific guidelines for the rewriting were designed in ways consistent with the results of the preparatory corpus analysis and included the following: 1) enrich the text with ecological vocabulary specific for Suzhou; 2) adjust modal verbs and temporal markers to leave space for alternatives and long-term perspectives; 3) reframe appraisal and evaluative terms to acknowledge both positive and negative dimensions; 4) reduce boosting terms in favor of graduality; 5) adapt technical jargon and development-related trigger words toward sufficiency and regeneration; 6) ensure agency is explicit, including non-human agents. Modified elements were marked in bold, and explanations for major changes were provided, ensuring clarity and stylistic consistency with governmental discourse. Prompt design followed a systematic and iterative path, from initial and rough formulations to increasingly refined versions, undergoing a total of 14 rounds of revisions.¹⁶ Early versions (from version 1.0 to version 1.4) focused on establishing prompt structures combining ecolinguistics analysis and re-storying tasks. Revisions highlighted key methodological weaknesses, such as overly broad guiding questions, unclear rewriting inputs, and excessively long prompts; these issues were addressed by developing a fine-grained set of semantic sub-categories within the USAS framework,¹⁷ enhancing clarity of instructions and removing unnecessary sections of the prompt.

Version 1.5 was collaboratively edited by the paper authors, revealing the need to

¹⁶ Intermediate versions of the prompts, documenting the iterative refinement of the procedure, are available from the authors upon reasonable request.

¹⁷ USAS categories were refined into more specific semantic sub-categories, each supplemented by expected linguistic forms.

differentiate output narratives, producing multiple versions of the same prompt differing in the degree of sustainability to be achieved in the re-storying section. Following version 1.6, prompts were differentiated into two clusters: 1) weak sustainability narrative, which, while proposing an upgrade on government positions vis-à-vis environmental crisis, still maintained government documents' macro-structure; 2) transformative narrative, with no stylistic or structural constraints and open to incorporating radical ecological positions.

Although semantic and syntactic variables remained the same across prompts, the two versions differed in the degree to which these variables were modified. Moving from business-as-usual to transformative narratives, ChatGPT 4o was instructed to progressively intensify the strength and scope of the changes. Subsequent revisions (from version 2.0 to version 2.8) further improved prompt clarity by adding paragraph-level analysis, precise identification of lexical and grammatical variables, specific information on Suzhou ecological context, and additional re-narration instructions. Along the process, each new prompt was tested in a new chat to prevent the analysis from being skewed by previous responses.

Both Ecolinguistics Analysis and Narrative Reconstruction were performed paragraph by paragraph to ensure outcomes' quality. However, due to increased paragraph-to-paragraph inconsistency risk, the complete text was validated for consistency, linguistic correctness, and logical coherence, paying particular attention to paragraphs' connections.¹⁸

3.3. Questionnaire preparation

This research includes three questionnaires consisting of two main sections: 1) socio-demographic questions, used to characterize the sample; 2) reading and evaluation tasks, employing a modified NEP scale. To make the NEP scale more suitable for measuring the ecological positioning conveyed by the texts, three indicators were removed, as none of the three texts would have enabled readers to answer without heavily relying on their own value systems, potentially inducing bias in respondents.¹⁹ The remaining 12 items were clustered into two groups, reflecting pro- or anti-ecological positionings (Table 3).

The official language of the questionnaire was Chinese. All the indicators, except for item (7), were translated based on Xue et al. (2018). Indicator (7) was manually translated by the authors.

The NEP variables were measured using a five-point Likert scale, whose items were coded from 1 = “strongly disagree/非常不同意 (*fēicháng bù tóngyì*)” to 5 = “strongly agree/非常同意 (*fēicháng tóngyì*)” where 3 is considered “neutral/不确定 (*bù quèdìng*)”. Negative phrases were reverse-coded during the data analysis.

¹⁸ Annex C provides the set of text generated during the re-storying process.

¹⁹ Removed indicators are: 1) We are approaching the limit of the number of people the earth can support; 2) Human ingenuity will ensure that we do not make the earth unlivable; 3) The earth is like a spaceship with very limited room and resources. These three items were excluded.

Table 3. Selected NEP items and Chinese translation

PRO-ECOLOGICAL		ANTI-ECOLOGICAL	
(3) When humans interfere with nature it often produces disastrous consequences.	(3) 人类干扰自然通常会导致灾难性的后果。 (3) Renlei ganrao ziran tongchang hui dao zhi zannansing de houguo.	(2) Humans have the right to modify the natural environment to suit their needs.	(2) 人类有权利改变自然环境以适应他们的需求。 (2) Renlei you quanli gaibian ziran huanjing yi shiying tamen de xuqiu.
(5) Humans are severely abusing the environment.	(5) 人类过度滥用资源和环境。 (5) Renlei guodu lanyong ziyuan he huanjing.	(6) The earth has plenty of natural resources if we just learn how to develop it.	(6) 地球其实蕴含有足够的自然资源，只要我们知道如何开发。 (6) Diqiu qishi yunhan you zugou de ziran ziyuan, zhiyao women zhidao ruhe kaifa.
(7) Plants and animals have as much right as human to exists.	(7) 动植物与人类享有平等的生存权利。 (7) Dongzhiwu yu renlei xiangyou pingdeng de shengcun quanli.	(8) The balance of nature is strong enough to cope with the impacts of the modern industrial nations.	(8) 自然界自我恢复能力很强，所以现代工业化不会破坏其平衡。 (8) Ziranjie ziwo huifu nengli hen qiang, suoyi xiandai gongyehua bu hui pohuai qi pingheng.
(9) Despite our special abilities humans are still subject to the laws of nature.	(9) 尽管人类能力很强，但仍然要受制于自然规律。 (9) Jinguan renlei nengli hen qiang, dan rengan yao shouzhi yu ziran guilu.	(10) The so-called “ecological crisis” facing humankind has been greatly exaggerated.	(10) 人类所面临的所谓“环境大危机”被过分夸大了。 (10) Renlei suo mianlin de suowei “huanjing da weiji” bei guofen kuada le.
(13) The balance of nature is very delicate and easily upset.	(13) 自然界的平衡非常脆弱而且易被破坏。 (13) Ziranjie de pingheng feichang cuiruo erqie yi bei pohuai.	(12) Humans were mean to rule over the rest of the nature.	(12) 人类应该主宰大自然。 (12) Renlei yinggai zhuzai daziran.
(15) If things continue on their present course, we will soon experience a major ecological catastrophe.	(15) 如果按照现在的情况继续下去，我们将很快遭遇到一场巨大自然灾害或者环境危机。 (15) Ruguo anzha xianzai de qingkuang jixu xiaqu, women jiang hen kuai zaoyu dao yi chang juda ziran zaihai huozhe huanjing weiji.	(14) Humans will eventually learn enough about how nature works to be able to control it.	(14) 人类将最终掌握所有自然规律，并最终控制它。 (14) Renlei jiang zuizhong zhangwo suoyou ziran guilu, bing zuizhong kongzhi ta.

3.4. Data collection

Data collection was conducted in Beijing, China, over a period of 50 days between May 12, 2025, and June 30, 2025. The study sample consisted of 51 respondents, all native Chinese speakers, randomly selected among graduate students affiliated with the School of Environment at Beijing Normal University (BNU).²⁰ The choice of this sample was due both to convenience, as the corresponding author was a visiting scholar at BNU, and to the relevance of including prospective environmental policy practitioners in the study. Data were collected via Microsoft Forms (Microsoft Corporation, n.d.), easily accessible in China without requiring additional apps. The demographic structure of the sample is displayed in Table 4.

Table 4. Sample structure

	Number	Percentage
Sex		
Male	18	35%
Female	33	65%
Age		
18-24	9	26%
25-27	27	52%
28-34	11	22%
Education		
Bachelor	7	14%
Master	16	31%
PhD	28	55%

3.5. Data analysis

We used descriptive statistics, repeated measures ANOVA, and post hoc comparison tests to analyze the collected data. Descriptive statistics were employed to explore basic data characteristics and summarize participants' responses.

To examine differences in ecological positioning as measured by the NEP scale across the three texts, a repeated measures ANOVA with one within-subjects factor (Text) was conducted. This test assessed variations in NEP scores while accounting for within-participant variability. Mauchly's test was used to test the assumption of sphericity and in cases where the assumption was violated, Greenhouse-Geisser and Huynh-Feldt

²⁰ The original sample consisted of 65 respondents. Out of the 65 participants, 51 provided valid and complete responses, which were eventually considered for analysis. Responses were excluded for the following reasons: a) failure to complete the questionnaire; b) respondent is not a Chinese national; c) the respondent is enrolled in another university and/or department; d) duplicate responses across the three questionnaires; e) unrealistic time to complete the questionnaires (< 1 min. each questionnaire).

corrections were applied (Greenhouse & Geisser, 1959; Huynh & Feldt, 1970).

Between-subjects analyses were performed to assess the influence of demographic variables, specifically sex and education level, on participants' NEP scores. Correlations between text and demographic variables were also examined. To identify the specific differences among factor levels, post hoc tests using Bonferroni and Holm corrections were employed (Dunn, 1961; Holm, 1979).

4. Results

4.1. The perceptual effects of ecological reframing: Descriptive statistics

Repeated measures ANOVA with one within-subjects factor (Text) was conducted to investigate the magnitude of the difference across responses relevant to each of the three texts.

Descriptive statistics (Table 5) revealed significant differences in both central tendency and variability across the three narrative conditions.

Table 5. Descriptive statistics

Text	N. of text	Mean	SD
Level 1	51	29.922	9.417
Level 2	51	39.843	3.635
Level 3	51	48.294	4.388

NEP mean scores increased progressively from *Text 1* ($M = 29.92$) to *Text 2* ($M = 39.84$) and *Text 3* ($M = 48.29$), suggesting a systematic increase in the perceived pro-environmental positioning. This progression closely reflected the increasingly explicit ecological framing characterizing the three texts.

Text 1 (BAU-*n*), exhibiting the lowest mean score, foregrounded economic development while assigning a minor role to ecological concerns, as evidenced by expressions emphasizing the expansion of economic output, investment, and consumption to promote societal progress.

Ex 1. Focus on economic construction.²¹

Ex 2. Continuously expand the total economic output.²²

Ex 3. Vigorously promote investment, launch projects, and expand consumption.²³

A similar emphasis is placed on innovation, especially technological innovation, which is presented as a principal driving force of development.

²¹ BAU-*n* line 10: 以经济建设为中心 (*yǐ jīngjì jiànshè wéi zhōngxīn*)

²² BAU-*n* line 11: 持续壮大经济总量 (*chíxù zhuàngdà jīngjì zǒngliàng*)

²³ BAU-*n* lines 17–18: 大力抓投资、上项目、扩消费 (*dàlì zhuā tóuzī, shàng xiàngmù, kuò xiāofèi*)

Ex 4. Treat innovation as the primary driving force.²⁴

Text 2 (WS-*n*), by contrast, scored a significantly higher NEP mean score than *Text 1*, placing it between *Text 1* and *Text 3*. This intermediate position was characterized by an explicit ecological framing while retaining elements of a development-oriented policy discourse. In particular, the balance and harmonious relationship between ecological security and social well-being became predominant, especially in the incorporation of ecosystems and non-human species into the collective trajectory described by the policy narrative:

Ex 5. Prudently advance a transformation that integrates ecological security with social well-being.²⁵

In the narrative proposed by *Text 2*, the intermediate mean NEP score is therefore consistent with integrating ecological concerns directly into policy discourse, without displacing the broader developmental and institutional orientation of the original discourse.

Text 3 (SS-*n*), which recorded the highest mean NEP score, exhibited the most explicit and extensive ecological reframing, already apparent in the opening line, which identified 2023 as the beginning of a new path towards ecological restoration, establishing this as the principal narrative orientation.

Ex 6. The year 2023 marks the beginning of a gradual shift toward a new path centered on ecological restoration and the coexistence of multiple species.²⁶

Text 3 did not simply integrate ecological objectives into a developmental framework; rather, it redefined the principal focus as ecological, reinforcing the contrast between the new development trajectory, based on restoration and deep relationships, and the traditional approach, rooted in construction and rapid accomplishments.

Ex 7. We can attempt to shift from “pushing forward with construction” to “accompanying restoration”, and from “high speed” to “deep relationships”, moving toward the future in a humbler and more resilient manner.²⁷

In this context, relationality and multispecies coexistence are positioned as central

²⁴ BAU-*n* line 19: 把创新作为第一动力 (*bǎ chuàngxīn zuòwéi dì-yī dònglì*)

²⁵ WS-*n* line 9: 有节制地推动生态安全与社会福祉融合型转型 (*yǒu jiézhì de tuīdòng shēngtài ānquán yǔ shèhuì fúzhǐ rónghéxíng zhuǎnxíng*)

²⁶ SS-*n* line 1: 2023年是逐步转向以生态修复和多物种共存为中心的新路径的起点之年 (*èr líng èr sān nián shì zhúbù zhuǎnxiàng yǐ shēngtài xiūfù hé duō wùzhǒng gòngcún wéi zhōngxīn de xīn lùjīng de qǐdiǎn zhī nián*)

²⁷ SS-*n* lines 19–20: 我们可以试图从“推进建设”转向“陪伴修复”，从“高速度”转向“深关系”，以一种更谦逊而有韧性的方式走向未来 (*Wǒmen kěyǐ shìtú cóng “tuījìn jiànshè” zhuǎnxiàng “péibàn xiūfù”, cóng “gāo sùdù” zhuǎnxiàng “shēn guānxì”, yǐ yì zhǒng gèng qiānxùn ér yǒu rèn xìng de fāngshì zǒuxiàng wèilái.*)

principles for future policy orientation, reinforcing the explicit positioning of humans as members of a broader socioecological community.

Ex 8. As urban residents and members of an ecological community, we should perhaps strive to establish more responsible and mutually beneficial connections with the land, rivers, plants, and animals.²⁸

The upward progression in mean NEP scores across the three texts thus corresponded to increasing linguistic explicitness and strength of ecological framing, shifting from economics-driven development to restoration-oriented development.

Variability, measured by standard deviation (SD), was highest for *Text 1* (SD = 9.42), while *Text 2* (SD = 3.63) and *Text 3* (SD = 4.38) showed more consistent results, thus indicating considerably higher agreement in participants' evaluation of *Text 2* and *Text 3* compared to the considerably more heterogeneous responses elicited by *Text 1*.

The greater variability in *Text 1* was reflected in participants' free comments, where difficulties answering questions were reported due to the lack of explicit references to environmental issues in the text. Indeed, in *Text 1* (BAU-*n*), environmental concerns were explicitly addressed only in lines 39–40, where the text referred to general improvements in the ecological environment and the completion of annual energy-saving and emission-reduction targets, without specifying the actions by which such improvements would be achieved.

Ex 9. Continued improvement in the ecological environment; fulfillment of annual targets for energy conservation and emissions reduction.²⁹

The relative absence of such information also explained the predominance of “不确定 (neutral — *bù quèdìng*)” answers in questions related to *Text 1*.

By contrast, *Text 2* (WS-*n*) and *Text 3* (SS-*n*) provided substantially more explicit information about ecological systems, environmental pressures, and human–non-human relationships, as reflected by the increasing frequency of 生态 (*shēngtài* — ecology/ecological), which occurred only once in *Text 1*, compared with 64 occurrences in *Text 2* and 71 in *Text 3*.

Text 2 showed the lowest variability among the three narratives, indicating a comparatively high degree of consistency among participants' evaluations. The increased consistency may reflect its closer alignment with existing Chinese policy frameworks, where ecological protection and socioeconomic development are presented as interconnected

²⁸ SS-*n* lines 17–18: 作为城市的居民和生态共同体的一部分，我们或许应当尝试建立与土地、河流、植物和动物之间更具责任感和互惠性的联系 (*zuòwéi chéngshì de jūmín hé shēngtài gòngtóngtǐ de yí bùfēn, wǒmen huòxǔ yīngdāng chángshì jiànlì yǔ tǔdì, héliú, zhíwù hé dòngwù zhījiān gèng jù zérèngǎn hé hùhuìxìng de liánxì*)

²⁹ BAU-*n* lines 39–40: 生态环境持续改善，节能减排完成年度任” (*Shēngtài huánjìng chíxù gǎishàn, jiénéng jiǎnpái wánchéng niándù rènnù.*)

policy objectives. By making the ecological dimension explicit while retaining a familiar developmental framework, *Text 2* appears to have reduced interpretive ambiguity and facilitated a more consistent understanding of its environmental positioning. By introducing a stronger ecological positioning while still retaining a developmental framework compatible with familiar Chinese policy discourse, *Text 2* may therefore have been more readily interpretable, resulting in greater consistency across participants' responses.

Ex 10. Prioritize the primary task and systematically guide the synergistic evolution of ecological and social needs.³⁰

Ex 11. Adhere to an approach driven by ecological awareness, linking social innovation with the process of ecosystem restoration.³¹

Ex 12. While boosting market confidence, efforts can also balance the protection of water sources in rural areas with green employment practices and sustainable interactions with habitats such as grasslands, rivers, and lakes.³²

Text 3, similar to *Text 2*, elicited more consistent responses than *Text 1*, although its SD (4.38) was slightly higher than that of *Text 2*, suggesting that while its pro-environmental positioning was highly recognized, leading to a higher mean NEP score, it also displayed greater variation in how it was interpreted. The higher variability could be related to the more explicitly transformative framing of *Text 3*: while *Text 2* integrated ecological concerns into an established developmental framework, *Text 3* more directly questioned the ecological consequences of existing development trajectories and contrasted current practices with alternative forms of human–environment interaction, thus producing a narrative conceptually more distant from those currently available in the Chinese context.

Ex 13. We should strive to break free from our reliance on “growth” in our mindset, establish pathways for cross-departmental ecological collaboration in our mechanisms, and build sustainable, mutually beneficial ecological networks in our actions.³³

Text 3, thus, while conveying a more explicit ecological message, also presented a more

³⁰ *WS-n* line 12: 坚持第一要务，有步骤地引导生态与社会需求协同演进” (*Jiānchí dì-yī yàowù, yǒu bùzhòu de yīndǎo shēngtài yǔ shèhuì xūqiú xiétóng yǎnjìn.*)

³¹ *WS-n* line 26: 坚持生态感知驱动，联结社会创新与生态系统恢复过程 (*Jiānchí shēngtài gǎnzhi qūdòng, liánjiē shèhuì chuàngxīn yǔ shēngtài xìtǒng huīfù guòchéng.*)

³² *WS-n* lines 52–53: 在提振市场信心的同时，也可兼顾农村地区水源地保护、绿色就业实践、以及与草滩、河湖等生境的可持续互动” (*Zài tízhèn shìchǎng xìnxīn de tóngshí, yě kě jiāngù nóngcūn dìqū shuǐyuándì bǎohù, lǜsè jiùyè shíjiàn, yǐjí yǔ cǎotān, héhú děng shēngjìng de kěchíxù hùdòng.*)

³³ *SS-n* lines 38–39: 尝试在观念上破除对“增长”的依赖，在机制上打通跨部门生态协同路径，在行动上建立持续互惠的生态网络” (*Chángshì zài guānniàn shàng pòchú duì “zēngzhǎng” de yīlài, zài jīzhì shàng dàtōng kuà bùmén shēngtài xiétóng lùjīng, zài xíngdòng shàng jiànlì chíxù hùhuì de shēngtài wǎngluò.*)

complex evaluative structure, requiring readers to assess not only the presence of environmental concerns but also how different forms of development and human–nature relations were framed as more or less desirable.

4.2. Differentiating re-storied narratives: Within-subjects effects

Within-subjects factor analysis (Table 6) yielded significant p-values ($p < .001$), indicating a robust effect of the repeated-measures factor and confirming large, significant differences among the three proposed narratives and supporting the hypothesis that different linguistic patterns affect readers' perception and convey different narratives. Importantly, while some variables exhibited more pronounced differences among the three narratives, these differences emerged from the cumulative manipulation of multiple textual features. The large overall effect of narrative condition should therefore be understood not merely as a consequence of differences in environmental content but as the result of coordinated changes across the linguistic variables through which development, agency, ecological actors, certainty, and temporal progression were represented.

Table 6. Within-subjects effects statistics

Cases	Sphericity Correction	p	ω^2
Text	Greenhouse-Geisser	< .001	0.580
	Huynh-Feldt	< .001	0.580
Residuals	Greenhouse-Geisser		
	Huynh-Feldt		
Note. Type III Sum of Squares			
^a Mauchly's test of sphericity indicates that the assumption of sphericity is violated ($p < .05$).			

The robustness of the hypothesis was further corroborated by a large and meaningful effect size ($\omega^2 = 0.580$), suggesting that “Text” accounted for 58% of the variance in the dependent variable. Since the sphericity assumption was violated, as indicated by Mauchly's test, both Greenhouse-Geisser and Huynh-Feldt corrections were applied to ensure valid statistical inference. Both corrections produced the same p-value and effect size (Table 7).

Table 7. Test of sphericity

	Mauchly's W	Approx. X ²	df	p-value	Greenhouse- Geisser ϵ	Huynh-Feldt ϵ	Lower Bound ϵ
Text	0.290	60.684	2	< .001	0.585	0.590	0.500

Lastly, repeated contrasts were conducted to examine pairwise differences across the three texts (Table 8). The comparison between *Text 1* and *Text 2* yielded a mean difference of -9.922 , with a highly significant p-value ($p < .001$), indicating that *Text 2* was evaluated as substantially more ecologically oriented than *Text 1*. Similarly, the contrast between *Text 2* and *Text 3* showed a mean difference of -8.451 , with a p-value inferior to .001 ($p < .001$),

showing a further significant increase in perceived ecological positioning. Both comparisons demonstrated large effect sizes, with Cohen's d values of -1.561 and -1.330 , respectively, indicating that the magnitude of these differences is not only statistically significant but also practically meaningful, confirming that incremental changes in linguistic framing produced measurable shifts in texts' ecological positionings, presenting the ecological problem in meaningfully different ways.

Table 8. Contrast table

Repeated Contrast – RM Factor 1			
Comparison	Estimate	P	Cohen's d
Level 1 – Level 2	-9.922	$< .001$	-1.561
Level 2 – Level 3	-8.451	$< .001$	-1.330

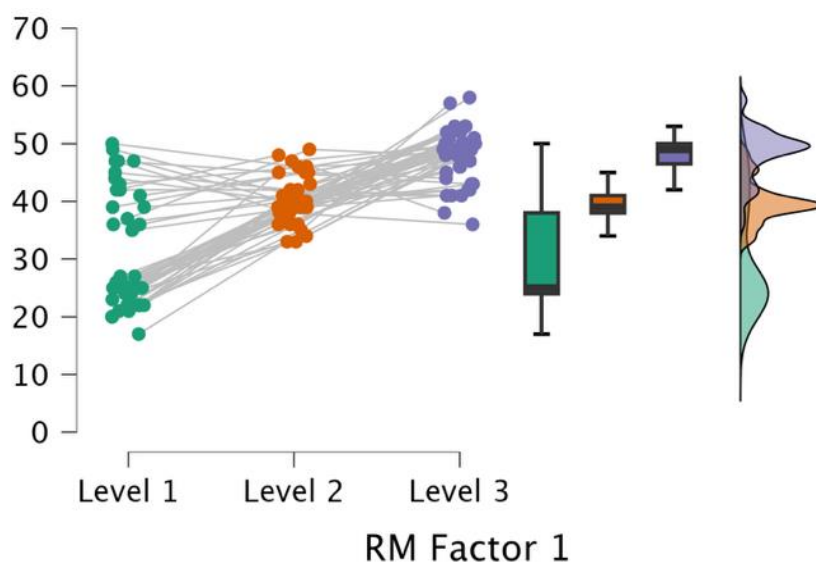


Figure 1. Raincloud plot RM Factor 1 (Narrative)

The raincloud plot (Figure 1), integrating beeswarm plots, boxplots, and density estimates, offers a comprehensive visualization of the distribution of “total NEP score” for each respondent across the three texts. *Text 1* exhibited a lower median but a broader distribution, indicating greater variability in scores. As explained before, variability can be attributed to respondents' difficulty answering questions solely based on the text's content due to a lack of explicit environmental references. Furthermore, *Text 1*'s tendency to focus on technological and economic development left considerable space to different individual interpretations: while some respondents were critical towards the technocentric and economically-driven approach to development, others expressed a generally positive opinion on the “innovation-driven development path” which increases people's quality of life and happiness by adhering to the concept of Ecological Civilization (生态文明 — *shēngtài wénmíng*). This suggested that the technocentric framing of *Text 1* could be interpreted differently depending on the readers' personal assumptions, especially in contexts where

technological modernization and economic development are themselves understood as compatible with environmental progress. Overall, *Text 1* performed the worst not only in NEP values but also in efficiency, confirming a lack of environmental information and concern in the original document.

Text 2 showed a higher median NEP score and the tightest distribution, indicating that it conveyed clear information and that respondents evaluated NEP items coherently and homogeneously. *Text 2* appears to have achieved the clearest balance between ecological reframing and genre conformity, presenting environmental concerns through a linguistic and rhetorical structure that is coherent with the conventions readers may associate with Chinese governmental discourse, while at the same time advancing ecological claims perceived as feasible, thereby eliciting greater support from people.

Text 3 had the highest median NEP score, indicating it best conveyed ecological consciousness and awareness, as it more clearly laid out the severity of environmental problems, the destructiveness of the existing path of development, and the changes required to address these challenges. However, with a wider distribution than in *Text 2*, *Text 3* performed slightly worse on information clarity, which may be affected by style choices: *Text 2*'s style and structure were consistent with the legal genre, proposing a linear discourse organization; *Text 3*, instead, being less rigid in structure, may have resulted in less logical coherence. For instance, the relatively frequent use of modal markers, such as 也许 (*yěxǔ* — perhaps) and 或许 (*huòxǔ* — perhaps), may have appeared less conventional within governmental discourse, where a more authoritative and assertive stance is generally expected. Similarly, the strong emphasis on the limitations of the existing development approach, together with explicit calls to reconsider or reduce prevailing forms of development, may depart from the rhetorical expectations typically associated with policy texts.

Ex 14. We may need to gradually slow the pace of development.³⁴

Ex 15. We no longer view “seeking progress while maintaining stability” as a speed-oriented, inertial logic, but rather as a way to respect the rhythms of nature and alleviate pressure on the land, gradually integrating new social and economic visions into the process of reshaping local ecological culture.³⁵

Despite these factors, given the small magnitude of the difference between the distributions of *Text 2* and *Text 3*, *Text 3* can be regarded as the one that most effectively conveys ecological awareness, strong sustainability, and pro-ecological positionings.

³⁴ *SS-n* line 6: 我们可能需要逐渐放缓开发节奏” (*Wǒmen kěnéng xūyào zhújiàn fànghuǎn kāifā jiézòu*)

³⁵ *SS-n* lines 58–59: “我们不再将“稳中求进”视作速度导向的惯性逻辑，而是作为尊重自然节律、放缓对土地压力的方式，在重塑本地生态文化的过程中逐步融入新的社会想象和经济想象” (*Wǒmen bù zài jiāng “wěn zhōng qiú jìn” shìzuò sùdù dǎoxiàng de guànxìng luójí, ér shì zuòwéi zūnzhòng zìrán jiélǜ, fànghuǎn duì tǔdì yālì de fāngshì, zài chóngshù běndì shēngtài wénhuà de guòchéng zhōng zhúbù róng rù xīn de shèhuì xiǎngxiàng hé jīngjì xiǎngxiàng*)

4.3. Demographic characteristics and environmental evaluation: *Between-subjects effects*

Repeated-measures ANOVA with between-subjects factors was conducted to investigate whether and how sex and education influenced NEP scores. As shown in Table 9, sex did not have a significant effect on NEP scores, with both a negligible p-value ($p = 0.158$) and effect size ($\omega^2 = 0.011$), suggesting no meaningful difference between male and female respondents.

On the other hand, education level showed a significant main effect, particularly for the differences between BA and MA and BA and PhD students, with a very significant p-value ($p = 0.001$) and a moderate effect size ($\omega^2 = 0.088$). These results underscored the importance of educational activities in shaping ecological perspectives, even within a relatively homogeneous group of environmental science students.

Table 9. Repeated-measures ANOVA: between-subjects effects

Cases	p	ω^2	ω_p^2
Sex	0.158	0.011	0.022
Education	0.001	0.088	0.217
Sex * Education	0.678	0.000	0.000
Residuals			
Note. Type III Sum of Squares			

Post hoc comparisons were then conducted to explore additional differences among educational levels (Table 10). Results revealed that MA students scored significantly higher than BA students, with a mean difference of -4.724 , a significant p-value with Holm correction ($p = 0.004$), and a moderate effect size ($\omega^2 = -0.819$). Similarly, PhD students scored significantly higher than BA students, with a mean difference of 5.108 , a highly significant p-value with both the Bonferroni and Holm corrections ($p = .001$), and a large effect size ($\omega^2 = 0.886$). By contrast, no significant difference emerged between MA and PhD students, with a mean difference of 0.383 and non-significant p-values under both Bonferroni and Holm corrections, indicating NEP scores were highly similar between these two groups. These results suggest that while significant differences emerged between undergraduate and postgraduate students, they stall at higher levels of university training.

Table 10. Post hoc education comparison

		Mean Difference	Cohen's d	p_{bonf}	p_{holm}
MA students	BA students	-4.724	-0.819	0.006	0.004
MA students	PhD students	0.383	0.066	1.000	0.713
BA students	PhD students	5.108	0.886	0.001	0.001
Note. P-value adjusted for comparing a family of 3					
Note. Results are averaged over the levels of: Sex, Text					

Overall, these findings revealed a consistent pattern: higher education levels among students in environmental science are associated with stronger ecological worldviews, with significant differences between undergraduates and postgraduates. These results are somewhat counterintuitive. Indeed, it might be expected that individuals with advanced training in engineering and the hard sciences, given their familiarity with technological and scientific approaches, would be more inclined to support technocentric solutions. From this perspective, their educational background could make it more difficult to foster environmental awareness and an ecocentric orientation, as the technocentric approach may appear to be a sufficient answer to current ecological crises. Instead, these findings suggest that respondents with strong scientific and engineering backgrounds, including expertise in environmental applications, acknowledge that technological and scientific strategies alone are insufficient to address the current ecological crisis and that a shift in societal values and a systemic approach are required.

5. Discussion

The application of the NEP scale to measure the environmental positioning of policy discourse provided robust, statistically significant evidence that variations in semantic and syntactic patterns affect readers' ecological perceptions, confirming that linguistic choices function as framing devices that actively shape environmental interpretation and evaluative stances. In particular, a number of lexical and grammatical variables emerged as substantially altering readers' perceptions.³⁶ First of all, the intensity and frequency of ecological terms appeared to increase ecological salience, facilitating the emergence of ecocentric mental models (Alexander, 2009; Fløttum et al., 2016; Stibbe, 2021).

Another key aspect to highlight is modality, which varies consistently across the three texts. *Text 1* relies on limited modal expressions centered on obligation and necessity, while *Text 2* and *Text 3* show higher frequencies of 可以 (can — *kěyǐ*) and 应当 (should — *yīngdāng*) (Sparvoli, 2012). These modal patterns convey greater commitment and feasibility, especially when co-occurring with the first-person plural pronoun 我们 (we — *wǒmen*), as they construct a shared agentive frame, increasing perceived collective engagement and responsibility (Bandura, 2000) while helping reduce emotional distance. Another aspect that may be influencing readers' perceptions is temporality; *Text 2* and *Text 3* are characterized by a higher frequency of temporal expressions denoting “graduality” (e.g., 逐步 — *zhúbù* and 逐渐 — *zhújiàn*), thus emphasizing a long-term orientation, a necessary precondition for social-ecological transformation. References in *Text 2* and *Text 3* to “natural rhythm” and “time of nature” may further reinforce the understanding that deep transitions need to be based on longer time horizons (Meadows, 2009).³⁷

³⁶ For a detailed overview of such variables, see Annex D, provided among Supplementary Materials.

³⁷ On this note, one needs to bear in mind that government work reports are annual planning documents; therefore, ChatGPT 4o, being instructed on the nature of the analyzed document, limits references to long-term actions, ensuring coherence with the institutional function of the text.

Another factor worth considering in understanding how different lexical features are conducive to diverse perceived narratives is the frequency and nature of appraisal terms. The decrease in positive appraisal terms across texts (with a significant difference between *Text 1* and the other two) signals a shift from an endearing, optimistic, and celebratory tone to a more realistic one. This may translate into a greater degree of problem recognition, potentially leading to a more critical stance toward current and future trends in human development.

Booster verbs and adverbs (such as 加快 accelerate — *jiākuài*, 增强 strengthen — *zēngqiáng*, 增长 increase — *zēngzhǎng*, 扩大 expand — *kuòdà*, 深化 deepen — *shēnhuà*, 全力 fully — *quánlì*, 驱动 propel — *qūdòng*, etc.) significantly decline from *Text 1* to *Text 2* and *Text 3*. As boosters function as linguistic intensifiers, amplifying urgency and importance, their reduction may attenuate cognitive priming toward growth-centered interpretations (Hart, 2011). Furthermore, in Chinese political and governmental jargon, booster expressions are often tied to economic intensification; therefore, their reduction may facilitate conceptual decoupling from habitual economic growth schemas, opening new cognitive spaces for alternative socioecological frames. The reduction in booster expressions is accompanied by a parallel decline in numerical expressions referring to growth percentages or monetary targets, reinforcing the shift from a growth-oriented narrative to a sustainable and transformative one.

Verbs expressing change, improvement, and innovation also show a significant decrease, marked by the declining dominance of 发展 (develop — *fāzhǎn*). A qualitative shift in usage is also registered: in *Text 1*, verbs such as 推进 (push on, advance — *tuījìn*) and 推动 (promote — *tuīdòng*) primarily modify economic activities, while in *Text 2* and *Text 3* they are increasingly employed to frame ecological and environmental enhancement, reorienting readers towards an environmentally grounded notion of progress. This aligns with research showing that shifts in lexical metaphors and processual verbs can directly alter public perceptions of societal goals (Nerlich & Jaspal, 2012; Stibbe, 2021).

Finally, the sharp increase in the use of 我们 (we — *wǒmen*) reflects a strengthened sense of collective responsibility, contributing to a more inclusive and participatory framing, positioning responsibilities as collectively owned (Wei, 2022).

Beyond lexical features, grammatical characteristics may also have contributed positively to reframing the discourse of texts, as captured by our NEP-based survey. On this note, the increased use of 把 (*ba*) constructions is particularly worth highlighting (Tang, 2025). Existing research suggests that 把-constructions usually promote anthropocentric perspectives by foregrounding human agency and positioning nature as a passive recipient (He & Shen, 2023; Liu, 2000). However, the findings of the re-storying process diverge from this tendency: in *Texts 2* and *3*, the increased use of 把 (*ba*) does not reinforce anthropocentric control; rather, it contributes to a more ecologically conscious framing of human–nature relations, aligning with Lü Wenhua’s (1994) functional typology. In this sense, 把-structures either position environmental entities undergoing meaningful, positive change as a direct consequence of policy actions, or position economic actions as being

transformed in environmentally meaningful ways to contribute to natural restoration. This enhances ecological visibility, reinforces institutional commitment, and elevates the salience of environmental transformation. Notably, 把-constructions in *Texts 2* and *3* frequently co-occur with the pronoun 我们 (we — *wǒmen*), anchoring responsibility in a collective human agent and strengthening perceptions of accountability and agency. Rather than depicting nature as passive, the 把 (*ba*) construction underscores the government's active role in producing beneficial ecological outcomes.

Furthermore, across the three texts, the gradual increase in explicit human-agent subjects counters the common strategy of obscuring responsibility (Farooq & Umar, 2021; Zhu, 2024), thereby conveying transparency, agency, and commitment (Fausey & Boroditsky, 2010). In this context, ChatGPT 4o carefully reorganized the text's flow and structure to ensure greater explicit agency (as required by the authors in the prompt). While inanimate subjects are reduced in overall perspective, the nature of the remaining subjects also changes. In *Text 3*, inanimate subjects predominantly refer to elements or inherent characteristics of the natural ecosystem, such as resilience. This shift, implicitly attributing some degree of agency to nature, positions ecological entities as more active participants, potentially increasing moral consideration for non-human beings.

Overall, these results shed light on how specific ecolinguistically relevant linguistic variables relate to variations in the strength of the conveyed environmental positioning. *Text 1* exhibited a strong concealment of ecological information, defined by Stibbe (2021) as “erasure”, thereby underscoring weaknesses in environmental management at the prefecture-city level and fostering reduced public concern and underestimation of environmental problems.

By contrast, *Text 2* and *Text 3* mitigated this form of erasure by explicitly referring to ecological specificity, conveying stronger ecological positionings. *Text 2*, while preserving the formal coherence of governmental discourse, reduced incongruence in syntactic and semantic formulation, enhancing clarity and readability and promoting a more sustainable view while maintaining alignment with readers' expectations. *Text 3*, on the other hand, elicited a stronger pro-environmental positioning, but diverged substantially from programmatic norms, showing reduced formal consistency and employing more emotive and ideologically salient language. While this radical framing was generally effective in eliciting stronger environmental concerns, in a few cases, it prompted respondents to interpret “human action” positively, as a proactive intervention to fix the current situation, thus leading to slightly lower NEP scores for some items. The peculiar effect of the transformative framing was evident in some participants' free comments. One respondent wrote:

The text mentioned altering nature, including the reconstruction of tidal flats. In my previous two responses, when I encountered the phrase “altering nature”, I associated it with destruction and did not extend the meaning toward enhancing the environment's carrying capacity. Guided by the text, I came to realize that alteration

could also imply improvement, which led me to change some of my answers.^{38,39}

These findings demonstrate how lexical and grammatical reframing can influence readers' environmental perceptions, expanding readers' interpretive horizons and redefining how environmental interventions are semantically constructed. They indicate that policy discourse functions as an active cognitive agent which, through grammar and lexicon, structures how ecological issues are perceived, prioritized, and evaluated.

From a methodological standpoint, a major contribution lies in integrating generative AI into re-storying practices. Although research on generative models and NLP in linguistics is rapidly expanding (Ray, 2023), applications to environmental discourse and text evaluation remain scarce. This study demonstrates that generative AI (ChatGPT 4o), when provided with clear sets of variables and instructions informed by ecolinguistic analysis, is highly effective in re-storying practices, successfully generating highly technical governmental documents, introducing alternative narratives while preserving coherence, fluency, and adherence to genre-specific conventions.⁴⁰ Notably, the authenticity or naturalness of AI-generated texts was never questioned during the research, attesting to the outputs' linguistic quality and contextual appropriateness. The use of AI enabled the generation of multi-layered, nuanced, and fine-grained variations of the same text, differing only in slight nuances conveyed by syntactic or semantic structures. Crucially, such an outcome would be hardly achievable through manual rewriting, as human authors typically introduce broader semantic or stylistic shifts.

This carries two main implications. First, in the domain of policy writing, generative AI can be used as an experimental tool to test how targeted linguistic shifts influence readers' interpretations and ecological positionings, enabling environmental policy entrepreneurs to shape public discourse. Second, in ecolinguistics, AI complements human analytical capability by systematically generating minimally different framings, enabling researchers to isolate the interpretive effects of specific lexical and syntactic features with a degree of precision rarely achievable through traditional methods. If used ethically, with

³⁸ 文字中提到了改变自然，包括重建滩涂等，在前面两次回答中，提到改变自然我联想到的是破坏，没有往提高环境承载力的方向上延申。在文字的引导下，想到了改变还有可能是提高，改变了我对一些问题的答案 翻译成英文 (*Wénzì zhōng tídao le gǎibiàn zìrán, bāokuò chóngjiàn tāntú děng, zài qiánmiàn liǎng cì huídá zhōng, tídao gǎibiàn zìrán wǒ liánxiǎng dào de shì pòhuài, méiyǒu wǎng tígāo huánjīng chéngzài lì de fāngxiàng shàng yánsēn. Zài wénzì de yǐndǎo xià, xiǎngdào le gǎibiàn hái yǒu kěnéng shì tígāo, gǎibiàn le wǒ duì yìxiē wèntí de dá'àn.*)

³⁹ This understanding is aligned with a regenerative framing, whereas humans act “for” and “with” nature to regenerate social-ecological systems. On the regenerative paradigm, see Reed (2007), Foggin et al. (2021) and Buckton et al. (2023).

⁴⁰ This study is conceptually aligned with the H4rmony Project (<https://theh4rmonyproject.org>), an interdisciplinary initiative developed at the University of Gloucestershire, under the guidance of Prof. Arran Stibbe and Jorge Vallego, that explores how ecolinguistic principles can be integrated into generative AI to support the production of narratives that promote ecological awareness, relational thinking, and more sustainable human–nature interactions. In particular, the present research contributes to this emerging line of inquiry by experimentally evaluating the effects of AI-assisted ecolinguistic re-storying of policy texts on readers' perceptions of environmental discourse.

precise prompts and under human oversight, generative AI thus offers substantial methodological benefits, from time savings to discourse fine-tuning. Human–AI collaboration holds significant value, demonstrating how complementarity between human expertise and computational efficiency can advance ecolinguistic inquiry and deepen our understanding of the linguistic mechanisms that shape environmental awareness. At the same time, any methodological innovation involving AI must carefully consider the technology’s environmental footprint. On the one hand, AI promises gains in sustainability by reducing ecological footprints, improving energy efficiency, and supporting energy transitions (Wang, Li, & Li, 2024; Wang et al., 2024). Emerging research on “Green AI” explores and promotes responsible design and resource optimization as promising directions for reducing ecological impacts (Raman et al., 2024; Verdecchia et al., 2023). On the other hand, growing evidence indicates that AI models entail substantial environmental costs in energy use and water consumption, raising critical questions about the alignment of AI with ecological limits (Ding et al., 2025).

6. Conclusion

By proposing a novel application of the NEP scale to assess texts’ environmental positionings, this research highlighted the powerful role of language in shaping environmental perceptions. Furthermore, by adopting a mixed-method approach that combines human-driven and AI-assisted processes, this research also introduced innovative methodologies, opening new paths for ecolinguistic investigation.

From a methodological perspective, the adoption of the NEP scale as a text-evaluative tool offers a potential answer to ecolinguistics’ search for a replicable and scalable framework to classify environmental discourse as beneficial, ambivalent, or destructive. Furthermore, being grounded in principles of ecological concern consistent with Stibbe’s ecosophy, its application does not displace ecolinguistics from its ethical commitments; rather, it anchors them in a robust and broadly recognized framework.

Despite overall positive and significant results, limitations to this study must be acknowledged. Firstly, the sample consisted only of students from the School of Environment at Beijing Normal University; while ensuring a homogeneous and controlled sample and enabling a clearer interpretation of results, this choice limits the generalizability of the findings to broader populations. Secondly, even though participants were assured anonymity and encouraged to respond frankly on multiple occasions and through multiple channels, the reliance on self-report instruments always carries the risk of biases related to self-perception and social desirability. Future research should address these limitations by expanding the sample to include respondents of different ages, regions, and socioeconomic backgrounds to further test the robustness of the findings and clarify whether self-reporting biases significantly affect outcomes.

Two main directions for further development are envisioned. First, the methodological framework introduced here could be extended to larger, more diverse

samples and refined to more deeply explore how cultural and educational variables influence the ability to detect subtle shifts in meaning. Second, the narratives generated through the re-storying processes could be employed in a controlled experimental setting, to investigate how different lexicogrammatical and discursive configurations translate into distinct decision-making outcomes. By comparing priorities and decisions emerging from alternative discursive inputs, future research could assess how linguistic variation influences individual and collective mental models.

Ultimately, contributing to the growing body of scholarship advocating for a more ecologically conscious use of language in public discourse, this study underscores the power of linguistic choices in shaping collective futures, while demonstrating the potential of innovative, mixed-method approaches, combining corpus analysis, generative AI, and standardized evaluative frameworks, to advance ecolinguistic research and support the construction of more sustainable imaginaries.

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Author contributions

This study stems from the close collaboration of the three authors. For the concerns of the Italian academic evaluation processes, Maria Stella Burgio is responsible for Sections 1, 2.1, 2.2, 3.1, 3.2, 3.3, 3.5, and 4; Daniele Brombal is responsible for Sections 2.3, 3.4, 5, and 6; Gengyuan Liu is responsible for supervision and results validation.

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