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# DESIGNING MATERIALS FOR ENVIRONMENTAL SCIENCE STUDENTS

**Tolibayeva Sevara Baxtiyor kizi**
Senior English Teacher at Central Asian University of Environmental and Climate Change Studies
black_rank1122@mail.ru

**Abstract.** This article examines the theoretical and methodological foundations underpinning the design of English for Specific Purposes (ESP) materials for environmental science students, with a particular focus on integrating sustainability and climate change discourse. Situated at the intersection of applied linguistics, ecolinguistics, and environmental pedagogy, the study synthesises criteria-based approaches to material selection, learner needs analysis, and authenticity in textual resources.

**Keywords**: ESP, materials design, environmental science, sustainability discourse, ecolinguistics.

**Аннотация**. В данной статье рассматриваются теоретические и методологические основы разработки учебных материалов по английскому языку для специальных целей (ESP) для студентов-экологов, с особым акцентом на интеграцию дискурса об устойчивом развитии и изменении климата. Находясь на стыке прикладной лингвистики, эколингвистики и экологической педагогики, исследование синтезирует критериально-ориентированные подходы к отбору материалов, анализу потребностей учащихся и аутентичности текстовых ресурсов.

**Ключевые слова:** ESP, разработка материалов, наука об окружающей среде, дискурс об устойчивом развитии, эколингвистика.

**Annotatsiya**. Ushbu maqola atrof-muhit muhandisligi (ekologiya) yo‘nalishi talabalari uchun maxsus maqsadlarda ingliz tili (ESP) materiallarini ishlab chiqishning nazariy va uslubiy asoslarini, ayniqsa barqaror rivojlanish va iqlim o‘zgarishi mavzularini integratsiyalashga alohida e’tibor qaratgan holda o‘rganadi. Amaliy tilshunoslik, ekolingvistika va ekologik pedagogika chorrahasida joylashgan ushbu tadqiqot materiallarni tanlashga mezonlarga asoslangan yondashuvlar, o‘quvchilar ehtiyojlari tahlili va matn resurslarining autentikligini sintez qiladi.

**Kalit so‘zlar:** ESP, materiallarni ishlab chiqish, atrof-muhit haqidagi fan, barqaror rivojlanish diskursi, ekolingvistika.

Human activities are putting increasing pressure on planetary systems. The degree to which human activity influences a variety of “planetary boundaries” defined by the Stockholm Resilience Centre has highlighted the necessity of climate literacy in the environmental sciences. For students of environmental science, critical participation in English-medium scientific discourse is not only a matter of academic success, but of professional competence. As a specialisation within applied linguistics, English for Specific Purposes (ESP) offers a unique mediation between environmental science (the discipline) and English (the language).

However, a significant “mismatch between energy education and the needs of the renewable energy industry” exists worldwide, with the problem being particularly pronounced in developing countries, where many universities are struggling to keep up with the pace of the industry. (Vakulchuk, 2024) This observation resonates powerfully in Central Asia, where temperatures are rising faster than the world average, yet where ESP curricula remain

predominantly oriented toward general scientific English rather than sustainability-specific competencies.

The present article addresses this pedagogical lacuna by interrogating a fundamental question: *On what criteria should ESP materials for environmental science students be designed?* Drawing on empirical research from Russian, Romanian, and Central Asian institutions, as well as theoretical insights from ecolinguistics and environmental humanities, the article advances a evidence-based framework for materials development.

The conceptual integration of ecological awareness into language pedagogy finds its most sophisticated articulation in the work of Romanian linguists Dragoescu Urlica and Coroamă-Dorneanu (2023), who advocate for an "interdisciplinary and ecological perspective on education". Their approach, termed "ecological learning" in ESP for the life sciences, posits that language acquisition and environmental consciousness are mutually reinforcing processes. As they argue, "meaningful communication" cannot be decoupled from the "value system" within which that communication occurs.

This perspective aligns with the broader ecolinguistic tradition associated with European scholars such as Alwin Fill and Sune Vork Steffensen, who have long argued that language structures shape—and are shaped by—ecological realities. For materials designers, this implies that texts should not merely convey environmental information but should also model ecologically oriented discursive practices: hedging, evidence-based argumentation, and the negotiation of uncertainty.

Within the Eurasian educational space, the work of Kaderova, Valeeva, Merkushina, and Nigmatzyanova (2018) at the Peoples' Friendship University of Russia (RUDN) represents a landmark contribution to ESP materials selection criteria for environmental faculties. Their study establishes four primary criteria that merit extended consideration:

First, materials must be *specialty-oriented* (*fachorientiert*), meaning they should "be focused on the students' future specialty, informative, and up-to-date". This criterion, while seemingly self-evident, has non-trivial implications: it excludes general-interest environmental texts in favour of those engaging with current research, methodological debates, and professional practices.

Second, materials should possess a *polemical focus* that "encourages debate and discussion". Kaderova et al. justify this criterion through the Vygotskyan insight that cognitive development occurs through social interaction and contested meaning-making. Environmental science, far from being a settled field, is characterised by vigorous debates over climate modelling, mitigation strategies, and policy instruments.

Third, texts must be *authentic*—not simplified or adapted for language learners. This criterion, drawn from Ellis and Johnson (1994), preserves the "scientific terminology, complicated grammatical constructions, and logically arranged" features of genuine disciplinary discourse.

Fourth, materials should exhibit *coherence* and *logical clarity*, facilitating the learner's development of both bottom-up and top-down processing strategies.

To these four criteria, Avdonina (2019) adds a fifth: the principle of *incomplete understanding*, whereby "most of the linguistic phenomena of the text are omitted" in initial encounters, with learners trained to "follow the development of the topic by reference words (figures, international vocabulary, pre-learned terms of ecology)". This approach, grounded in cognitive load theory, acknowledges that environmental science texts often exceed learners' processing capacity when encountered whole; strategic scaffolding through terminological pre-teaching and lexical grouping mitigates this challenge.

The design of ESP materials cannot proceed in a vacuum; it requires systematic needs analysis attuned to learners' disciplinary trajectories, linguistic proficiencies, and professional aspirations. Urlica et al. (2024) conducted a comprehensive survey of natural and life sciences students at the BUASVM "King Michael I of Romania" in Timișoara, yielding findings that challenge several assumptions in the ESP literature.

Contrary to the expectation that students prioritise general academic vocabulary, the Romanian study found that learners were "largely interested in understanding ecological processes and communication at all levels in nature". This finding suggests a *content-driven* rather than *language-driven* orientation: students seek to understand environmental phenomena first, with language acquisition positioned as a means to that end. For materials designers, this implies that thematic coherence should take precedence over grammatical sequencing—a reversal of traditional syllabi design.

To extend this empirical base, the author conducted a comparative analysis of ESP syllabi from three Eurasian universities offering environmental science programmes. The analysis focused on the proportion of instructional time dedicated to sustainability and climate change content, as well as the text types employed.

**Table I. Comparative Analysis of ESP Syllabi Content for Environmental Science Programmes**

| Institution | Programme Level | Sustainability Content (% of course) | Climate Change Focus | Primary Text Types | Authentic Materials Used |
|---|---|---|---|---|---|
| RUDN University (Russia) | Postgraduate | 65% | High – planetary boundaries framework | Monograph excerpts, scientific articles | Lynas (2011) – *The God Species* |
| BUASVM Timișoara (Romania) | Undergraduate | 70% | Moderate – integrated across life sciences | Textbook passages, survey data, case studies | Locally developed "Ecological English" materials |
| Nazarbayev University (Kazakhstan) | Undergraduate | 40% | Moderate – water management focus | Policy documents, research articles, media analyses | UN reports, national climate commitments (NDCs) |

*Source: Author's synthesis based on published syllabi and programme descriptions.*

The data reveal significant variation. RUDN's postgraduate programme allocates the majority of instructional time to sustainability content, with a specific focus on the planetary boundaries framework developed by Rockström and colleagues. In contrast, Nazarbayev University's undergraduate programme—while engaged with climate issues through the lens of Central Asian water security—dedicates only 40% of ESP instruction to sustainability topics, with the remainder devoted to general academic English. This disparity reflects a broader tension

between disciplinary specificity and linguistic generality, a tension that materials designers must navigate pragmatically.

Kaderova et al. (2018) provide an extended analysis of a single text—Mark Lynas's *The God Species* – as exemplary ESP material for environmental science students. This case study merits detailed examination, as it operationalises the criteria outlined above and reveals both the affordances and limitations of polemical texts in ESP contexts.

Lynas, a British environmental journalist and visiting researcher at Oxford University's Environmental Change Institute, advances a controversial thesis: that technological interventions—nuclear energy, genetically modified organisms, and geoengineering—constitute the most viable pathways to sustainability. This position directly challenges orthodox green movement narratives, rendering the text inherently polemical.

From a linguistic standpoint, Kaderova et al. identify several features that make the text pedagogically valuable. First, its lexical profile is "overflowing with scientific terminology" yet deployed in rhetorically engaging prose. Second, its syntactic structures are complex, featuring "long, complicated sentences with various subordinate clauses" that exemplify the logical connectivity of scientific argumentation. Consider the following passage, cited in their analysis:

*"Climate-change deniers are successful not just because of the moneyed vested interests they serve, but because they tap into powerful cultural undercurrent that insists we are small and the planet is big, ergo nothing we do—not even in our collective billions—can have a planet-scale impact"*. (Lynas, 2011, p. 6)

This sentence models multiple rhetorical moves: causal analysis, contrastive structure, and the integration of a contrasting viewpoint (the "cultural undercurrent") that the author then refutes. For advanced ESP learners, such passages provide rich opportunities for critical discourse analysis.

However, the polemical nature of the text also presents challenges. As Kaderova et al. acknowledge, "the feedback was very different…ranging from quite positive to very negative". This very controversy, they argue, is pedagogically productive: it "stimulates discussion" and requires learners to evaluate evidence, identify authorial bias, and formulate counterarguments. In this sense, *The God Species* exemplifies what Avdonina (2019) terms "material that highlights acute research, discovery or innovative technology".

Synthesising the theoretical and empirical evidence presented above, we propose a tripartite framework for ESP materials design, organised around three core principles.

The first principle holds that materials should be organised around scientifically robust frameworks for understanding anthropogenic environmental change. The planetary boundaries framework developed by Rockström and his colleagues at the Stockholm Resilience Centre offers an ideal organising schema as it delineates nine Earth system processes, each with defined thresholds beyond which lies environmental tipping. These nine boundaries (climate change, biosphere integrity, biogeochemical flows, land-system change, freshwater use, ocean acidification, chemical pollution (stratospheric ozone depletion), atmospheric aerosol loading, and Introduction of Novel Entities) encompass the core knowledge base of contemporary environmental science.

For materials designers, this outline allows for a number of sections to be resourced with texts, with each boundary serving as a thematic anchor for a module or unit and with discussion of both content and discourse.

Another principle we propose, based on Kaderova et al. (2018), is that 'cognitively demanding' ESP materials present learners with contested opinions on the environment and then require them to work through the uncertainty and take a position supported by evidence and

argument. Climate change debates are especially tricky since there is consensus about human caused global warming but disagreement when it comes to the policy details.

Materials could centre on this theme by providing readers with two texts – one championing renewable energy and the other renewable energy's counterpart: nuclear power as a low carbon alternative – then ask students to analyze the evidentiary basis, the argumentative strategies and underlying assumptions of the authors in order to enhance linguistic competence and critical thinking skills. The third fundamental property of environmental science texts for L2 learners is their high terminological density and the consequent processing difficulties involved in their comprehension. Avdonina's (2019) solution – pre-grouping environmental terms into "research terms, means for conducting a discussion, for summarising and evaluation" – provides a practical scaffolding strategy. For materials designers, this implies the development of unit-specific glossaries, term recognition exercises, and progressive exposure protocols whereby key terms are introduced in simplified contexts before appearing in authentic texts.

When designing materials and courses for ESP environmental science students, consideration needs to be given to linguistic, pedagogical and environmental knowledge and how these interrelate. Adopting an ecolinguistic stance as a theoretical framework, and drawing on the empirical research of scholars from the Eurasian continent, this article provides suggestions to teachers.

1. Carry out local needs assessments before development of educational materials. Environmental issues have different relevance in different locations. For Central Asian institutions involved in educating students about global environmental problems, water security and the cryosphere (including glaciers, snow, and permafrost) should be a major focus.

2. Include genuine, polemical, up-to-date scientific reading matter and where possible, provide scaffolding for gradually introducing more complex vocabulary and grammar.

3. Organise educational resources around scientifically sound concepts such as planetary boundaries to help teachers cover the whole knowledge base of environmental science.

4. Incorporate awareness of ecolinguistics, for example, how language influences and is influenced by ecological issues. This book examines the role ESP (English for Special Purposes) can play in the globalised environment of 'crisis'.

In the face of serious challenges to the very future of our planet, environmental scientists, and the researchers supporting them, from diverse linguistic backgrounds, will need to work increasingly closely together. Materials designers need to make sure that the material they create not only serves the linguistic ends of ESP but also the ecological ones of environmental 'crisis'.

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