AI–Environment Module Template Description

This template describes a reusable module design for an educational research network focused on AI in environmental teaching and learning. The design draws on the strengths of EREN-style modular curricula and the EDDIE A-B-C structure: modules are organized into digestible units, anchored in a real environmental question, use authentic data, and are flexible enough for instructors to adopt, adapt, or scale across institutions and student levels.

Purpose

The template is intended for modules that help students learn environmental concepts, work with data, and engage AI as a guided collaborator rather than an autonomous answer source. Every module should center human-in-the-loop learning, meaning that students and instructors actively interpret, critique, revise, and validate AI-supported outputs throughout the workflow.

Defining features

Each module in the network should include five core elements:

- An **environmental theme**, such as carbon cycling, water quality, biodiversity, land-use change, environmental justice, or ecosystem resilience.
- A **data component** built around authentic datasets, ideally from open or shared sources that can support cross-course or cross-institution use.
- An **AI-facilitated component** in which students use AI to support tasks such as question generation, code drafting, pattern identification, summarization, visualization, or interpretation.
- A **human-in-the-loop structure** in which student and instructor judgment are required at each stage, especially when evaluating AI-generated claims, code, or interpretations.
- A **synthesis and communication component** in which students explain findings to an audience such as classmates, community members, decision-makers, or other researchers.

Module design principles

All modules in the network should be built around the following principles:

1. **Question-driven inquiry**: Each module begins with an environmental question that is scientifically meaningful and suitable for student investigation using available data.
2. **Authentic data use**: Students work with real environmental data rather than toy examples so that they experience uncertainty, variation, and limits of interpretation.

3. **Scaffolded independence**: The module should move from guided work to greater student independence, following the EDDIE logic that early activities provide structure and later activities increase student choice and responsibility.
4. **Human oversight of AI**: AI use must never stand alone; students should document prompts, inspect outputs, verify claims, and revise work based on disciplinary evidence.
5. **Communication as synthesis**: The end point of the module is not only analysis, but communication of evidence-based conclusions in an audience-appropriate form.
6. **Adaptability**: Instructors should be able to teach the full module, shorten it, or substitute a local dataset or tool without changing the core learning goals.

Recommended module layout

The network can use a shared layout inspired by both EREN modular design and the EDDIE A-B-C format.

Module background

This section introduces the environmental context, the motivating question, the broader significance of the issue, and the role AI will play in the learning process. It should also include instructor notes on course fit, prerequisite knowledge, estimated time, and options for implementation at different levels.

Part A: Foundations

Part A introduces the environmental system, the dataset, the scientific concepts, and the AI workflow. Students receive high scaffolding here: background reading, orientation to the dataset, guided prompt examples, and explicit verification expectations. Instructors can use this section as the on-ramp for novices.

Typical Part A tasks:

- Explore the environmental theme and question.
- Learn the structure and limitations of the dataset.
- Practice one or two bounded AI-supported tasks.
- Use a verification checklist to compare AI output against source material or metadata.

Part B: Inquiry and analysis

Part B increases student independence. Students use data to investigate a question, employ AI for selected analytical or interpretive steps, and work collaboratively to test and refine findings. This stage should include peer discussion, comparison of approaches, and instructor checkpoints to ensure that AI support strengthens rather than replaces reasoning.

Typical Part B tasks:

- Refine or extend the research question.
- Conduct data cleaning, visualization, or analysis.
- Use AI to draft code, summarize patterns, or suggest interpretations.
- Critique and revise AI-supported outputs with peers and instructor guidance.

Part C: Synthesis and communication

Part C asks students to integrate their findings and communicate them clearly. This is where the module should explicitly include a communication product, such as a short policy brief, scientific poster, community-facing infographic, slide deck, audio explanation, or annotated notebook. Students should explain both the environmental conclusions and how AI was used, checked, and revised during the investigation.

Typical Part C tasks:

- Synthesize results and evidence.
- Reflect on how AI contributed and where human judgment mattered most.
- Communicate findings for a defined audience.
- Compare local findings with pooled or network-level results when available.

Standard components for every module

To make the network coherent, each module should contain the same core materials:

- **Module overview** with theme, question, audience, time required, prerequisites, and learning goals.
- **Instructor guide** with teaching notes, implementation options, assessment suggestions, and anticipated student difficulties.
- **Student handout** with background, tasks, prompts, reflection questions, and deliverables.
- **Dataset package** or data-access instructions, including metadata and notes about quality, scope, and limitations.
- **AI use guide** that defines what tools are used, what kinds of use are allowed, and how students should document prompts and revisions.
- **Verification checklist** requiring students to confirm facts, inspect calculations or code, and evaluate the accuracy and appropriateness of AI-supported claims.
- **Assessment rubric** aligned to environmental understanding, data reasoning, AI critique, collaboration, and communication.
- **Adaptation notes** for lower-tech, no-code, advanced, or shorter-course implementations.

Learning goals framework

Every module should articulate learning goals across four dimensions:

Dimension	Focus
Environmental understanding	Students explain the environmental system, process, or issue under study.
Data literacy	Students interpret, analyze, and draw conclusions from authentic environmental data.
AI literacy	Students use AI strategically, critique its outputs, and document how it supported their work.
Communication and collaboration	Students work with others, synthesize evidence, and communicate findings effectively to a target audience.