



## The Sustainability Race



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# STEAM4Climate Teacher's Guide to Project-Based Climate Education

**Project: The Sustainability Race**

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# Table of Contents

Introduction .....	4
1. Learning Overview.....	4
2. Learning Objectives & Methodology .....	5
Methodology .....	5
3. A “Low Floor, High Ceiling, Wide Walls” Approach.....	6
Materials.....	7
4. Game elements .....	7
5. Game Mechanics – Pedagogical Rationale (for Teachers) .....	9
Explanation of abstract values .....	10
Activity Instructions.....	12
6. Pre-Activity Preparation .....	12
7. Activity Execution .....	13
Post-lesson follow-up & summary .....	14
8. Discussion Topics.....	14
9. Assessment.....	15
10. Extensions .....	16

# Introduction

## UN Sustainable Development Goals



## 1. Learning Overview

**Sustainability Race** is an educational board game that introduces learners to sustainability challenges through decision-making related to everyday consumption, with a particular focus on food systems. During gameplay, students explore how individual and collective choices influence environmental indicators such as **carbon footprint** and **water footprint**, and how these impacts vary depending on production methods and context.

The game is designed to develop **systems thinking** by confronting players with trade-offs between environmental, economic, and social factors. Rather than promoting simple or idealized solutions, it reflects real-world sustainability dilemmas in which choices often involve compromises and unintended consequences. This makes the game a useful tool for discussing the complexity of climate-related decisions and resource management.

**Sustainability Race** functions best as a facilitated learning activity, combining gameplay with guided discussion and reflection.

**Key Concept:** Sustainability trade-offs in food systems; carbon footprint and water footprint of food; systems thinking and decision-making under environmental constraints.

**Duration:** 45 – 90 minutes per session (depending on group size and depth of discussion)

**Number of Sessions:** at least one for understanding the gameplay and one for creating own deck of cards

**Target Age Group:** high school, 15+

## 2. Learning Objectives & Methodology

Students participating in this project will:

- understand the concepts of **carbon footprint** and **water footprint** in the context of food production and consumption;
- analyze how individual and collective food-related decisions influence environmental impacts and resource use;
- identify trade-offs between environmental, economic, and social aspects of sustainability;
- develop **systems thinking** by recognizing interconnections within food and climate systems;
- practice evidence-based decision-making and reflect on the consequences of different sustainability choices.
- co-create educational content by translating acquired knowledge into new game elements;
- develop collaboration, critical thinking, and reflective skills.

### Methodology

The project follows a **game-based and participatory learning** approach. Students first engage in a structured board game simulation in which they make decisions about food systems and sustainability within defined constraints. Gameplay is followed by guided discussion and reflection, linking game outcomes to real-world concepts and data presented in the Handbook, particularly those related to the carbon and water footprint of food.

In the final phase, students are invited to **co-create their own deck of game cards**, designing new scenarios, challenges, or decision options based on knowledge gained during the activity. This co-creation step reinforces understanding, encourages creativity, and supports knowledge transfer by positioning students as active contributors rather than passive learners.

### 3. A “Low Floor, High Ceiling, Wide Walls” Approach

In STEAM4Climate, we adopted an approach that empowers students to meaningfully engage with sustainability and food system challenges, regardless of their background.

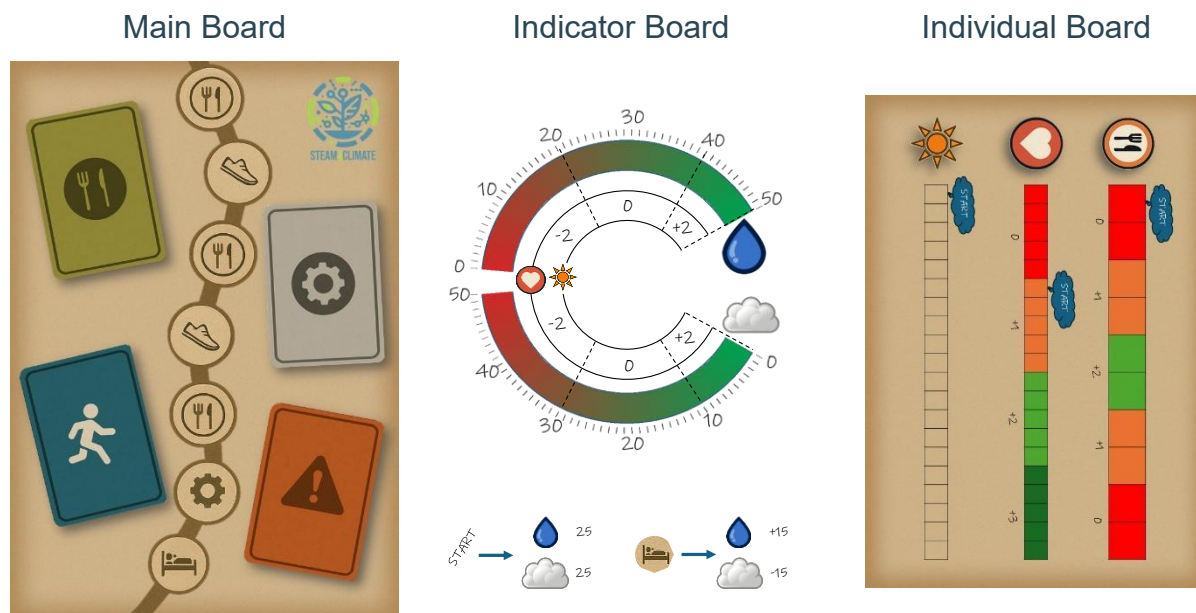
- **Low Floor:** Students can participate immediately by playing the game using the standard rules and prepared cards. No prior technical knowledge is required, and learning begins through direct experience, discussion, and observation of the consequences that emerge during gameplay.
- **High Ceiling:** More advanced learners can extend the activity by generating their own batches of game cards using the provided digital tools and reference materials. These cards may introduce new food products, environmental impacts, or decision scenarios informed by data on carbon and water footprints, allowing for deeper analysis and abstraction.
- **Wide Walls:** Students are encouraged to explore multiple creative pathways by modifying the game structure itself. This may include creating new rules, constraints, or contextual adaptations – for example, introducing national or regional food systems, assigning advantages or limitations based on geographic origin, or redefining winning conditions to reflect alternative sustainability priorities.

# Materials

## 4. Game elements

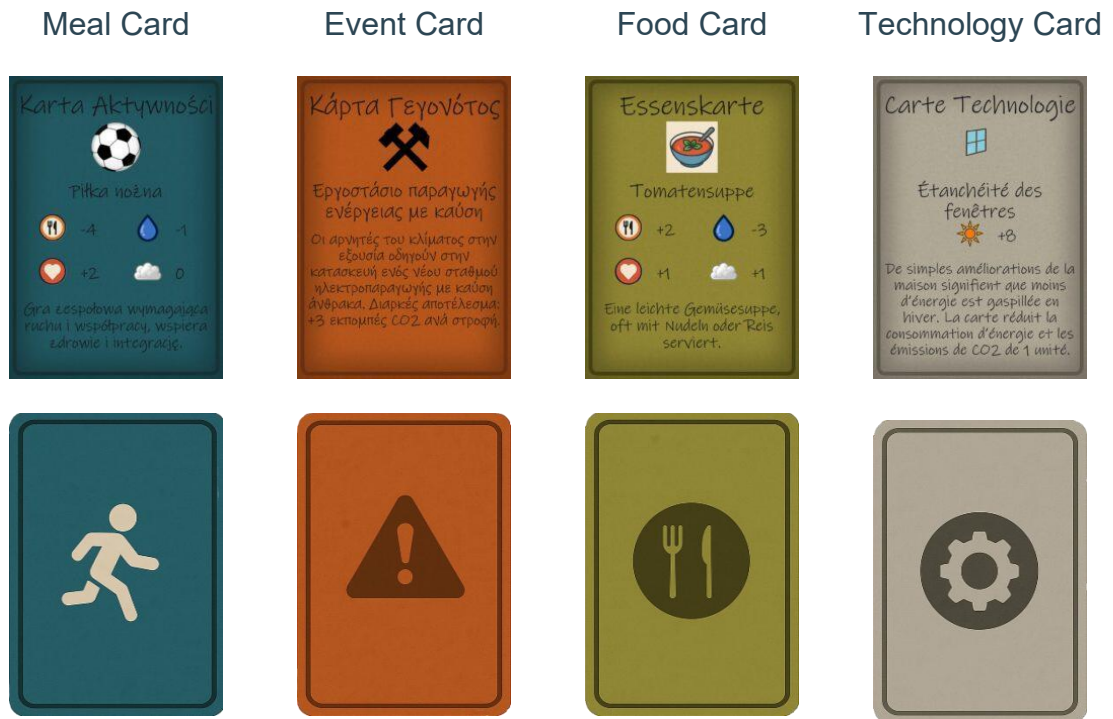
The game consists of the following elements, which should be printed in the required number for the group size.

- Main board (1 per playing team of 3-4 students)
- Global resources board (1 per playing team)
- Individual boards (1 per player)



- Decks of cards: (number of cards in the initial version of the game)
  - Meal (20)
  - Activity (20)
  - Event (13)
  - Technology (13)

Please note that all cards are available in languages: EN, PL, GR, DE, FR



- Empty cards of each type (as many as necessary for each team/student)

Borads and cards can be downloaded from the project website:

<https://project-spaces.eu/s4c/steam4climate-toolkit/steam4climate-toolkit-sustainability-race/>

Additionally, an online card generator can be used for final co-authored cards.

<https://steam4climate.lovable.app>

- Indicators – any artefact with the appropriate size that students want to use (a coin, toy, stone):
  - one on the main board (moving along the main vertical path)
  - three per player on the individual board (moving back and forth on horizontal scales)
  - two need-like for global resources indication (for example, a barbecue stick)

**The details of each element and game rules with exemplary play are provided in the attached Student worksheet.**

## 5. Game Mechanics – Pedagogical Rationale (for Teachers)

While students experience **Sustainability Race** as a strategic board game, its mechanics are intentionally designed to surface key sustainability concepts **implicitly**, through experience rather than direct instruction.

First, the game structure reflects the logic of the **tragedy of the commons**. Individual decisions – especially those focused on short-term gain – directly affect shared resources and, consequently, the outcomes of other players. This interdependence is not announced to students in advance; instead, it becomes apparent through gameplay, supporting deeper understanding of collective responsibility in food systems and climate-related challenges.

Second, progress in the game depends not only on individual strategy but also on the ability of players to **share knowledge, assumptions, and perspectives**. Students who communicate, compare reasoning, and negotiate common approaches are more likely to reach sustainable outcomes. This design choice highlights the importance of shared worldviews and collective understanding in addressing complex environmental problems, without framing collaboration as a moral requirement.

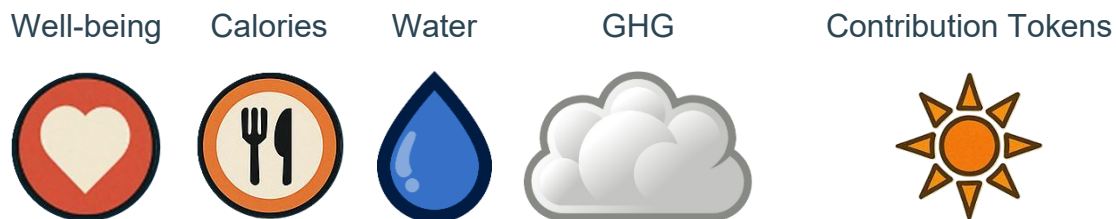
Third, early failure is a **deliberate and valuable feature** of the game. Initial rounds often end quickly, creating a safe space for experimentation, mistakes, and reflection. Students learn that failure is not a sign of poor performance, but a necessary step toward refining strategies and understanding system dynamics. Teachers are encouraged to explicitly frame restarting the game as part of the learning process.

Finally, the game introduces technological solutions and efficiency measures as supportive tools rather than universal fixes. While certain cards or strategies may offer technological advantages, these alone are insufficient to guarantee success. The core drivers of outcomes remain **human choices, priorities, and values**, reinforcing the idea that technology can enable change but cannot replace responsible decision-making.

## Explanation of abstract values

The game operates with five key value types. Each represents a real-world dimension, translated into a simplified scale to keep gameplay manageable while preserving meaningful relationships and trade-offs. Quantities are expressed through coarse, discrete scales of +/-4. This design choice: avoids excessive calculation; supports comparison and discussion; keeps attention on **decision-making and systems thinking**, not arithmetic.

Teachers may emphasise that these values function as **structured approximations**: realistic enough to be meaningful, but simplified enough to allow exploration and reflection. This framing also supports the **card co-creation phase**, in which students justify categories and relative values rather than reproduce precise data.



### 1. Calories

Calories represent energy intake from food, grounded in real nutritional value. In the game, foods are grouped into low, medium, and high energy categories rather than measured in kilocalories. For example, a small snack may provide +1, while a more energy-dense meal, such as a burger, may provide +4. The values express *relative contribution to meeting basic needs*, not exact dietary recommendations.

### 2. Well-being

Well-being refers to the overall quality of life, encompassing health, comfort, stability, and social factors. It is influenced by food quality, environmental conditions, and access to resources.

The scale reflects relative impact on living conditions rather than medical or psychological metrics.

### 3. Contribution Tokens

Contribution Tokens represent a **currency of cooperation**. They reward players for balancing their own well-being while also protecting shared environmental resources. Tokens are earned both individually, for maintaining personal stability, and collectively, when the group keeps common resources within safe limits.

This mechanism highlights that sustainable outcomes depend on **aligning individual choices with collective responsibility**, and that cooperation enables solutions that cannot be achieved alone.

### 4. Water

Water use and pressure on water resources are represented by water. Values are based on relative differences between products and practices (e.g. water-intensive vs low-water foods), not on liters or cubic meters.

The scale allows students to reason about scarcity, regional differences, and hidden resource use embedded in everyday choices.

### 5. Greenhouse Gases (GHG)

GHG values represent relative climate impact, grounded in real-world emissions associated with production, transport, and consumption. Instead of calculating CO<sub>2</sub>-equivalent emissions, items are classified into low, medium, or high impact categories, reflected by small integer values. This keeps the focus on comparative impact and trade-offs rather than technical accounting.

# Activity Instructions

## 6. Pre-Activity Preparation

Prepare the game sets in advance by printing the game boards and cards, cutting them out, and sorting them into appropriate groups. In addition, print empty card templates for students to use during the co-creation phase of the activity.

Students are strongly encouraged to complete Activities 1 (Initiate a discussion about the environmental impact of food) and 2 (Calculating the Carbon Footprint of Different Meals) from the Handbook prior to playing the game. Familiarity with Activity 3 (Food Supply Chain Analysis) is also recommended, as it provides additional context and supports a deeper understanding during gameplay.

## 7. Activity Execution

### Game preparation

Divide students into groups of **3-4 players**. Ask each group to read the game rules, set up the board, and prepare the cards. The teacher should ensure that all groups understand the basic mechanics before starting the game.

### Playing the game

Students then play the game for the first time. It is important to note that **the initial round will likely end quickly**, as players are still learning the mechanics and consequences of their decisions. Emphasize that this is an expected part of the learning process and encourage students to restart the game and play again, applying insights gained from the first round to make more informed and strategic choices.

### Reflection

After gameplay, facilitate a **guided discussion** focused on decision-making, trade-offs, and observed outcomes. Encourage students to reflect on how their strategies changed between rounds and how these changes relate to real-world sustainability challenges, particularly those related to food systems, carbon footprints, and water footprints.

### Game co-creation – implementation of reflection

Following the gameplay and discussion, students are asked to **design their own game cards**, either individually or in small groups. These cards should reflect sustainability challenges, decisions, or impacts related to food systems, carbon footprint, and water footprint, drawing on knowledge gained during the activity.

Once prepared, students present and discuss their proposed cards **with the whole class or within their teams**. This stage encourages reflection on underlying values, assumptions, and priorities embedded in the cards, and provides an opportunity to compare different perspectives on sustainability and decision-making.

# Post-lesson follow-up & summary

## 8. Discussion Topics

The following discussion topics are intended to support reflection on the **entire activity**, including gameplay, decision-making, and the co-creation phase:

- Which decisions during the game had the greatest impact on the outcome, and why?
- How did trade-offs between carbon footprint and water footprint influence your choices?
- What strategies changed between the first and second rounds of the game?
- Which assumptions about food systems or sustainability were challenged during the activity?
- How did creating your own cards change the way you think about sustainability issues?
- In what ways does the game reflect real-world decision-making related to food, resources, and climate?
- What limitations of the game model can you identify, and how might it be improved?

## 9. Assessment

The assessment focuses on process and reflection, not on winning the game. The goal is to evaluate how students use knowledge about environmental footprints to reason, negotiate, and justify decisions within a complex system.

### Formative Assessment (during activities)

During gameplay and group work, the teacher may observe and assess:

- students' engagement and participation in the game and discussions;
- the ability to explain decisions and justify choices using sustainability-related arguments;
- collaboration within groups, including listening, negotiating, and reaching shared decisions;
- the use of evidence or concepts from the Handbook when interpreting game outcomes.

### Reflection-based Assessment

To emphasize understanding over memorization, students may respond to open questions such as:

- What factors influenced your decisions during the game, and how did these change over time?
- What trade-offs did you encounter, and how did you deal with them?
- How did creating your own game cards help you understand sustainability challenges more deeply?
- In what ways does the game oversimplify real-world food systems, and why is this still useful?
- What insights from the game might influence your real-life choices or future decisions?

## Assessing Student-Created Cards

When assessing newly designed cards, the focus should be on **reasoning and justification**, not on numerical accuracy. A card can be considered rational if students can **explain why the proposed effect makes sense** within the context of food systems.

Teachers are encouraged to guide assessment using the following questions:

- **Conceptual link:** Does the card clearly relate to at least one sustainability concept discussed during the activity (e.g. carbon footprint, water footprint, resource use)?
- **Causal logic:** Is there a plausible cause-effect relationship between the situation described on the card and its impact in the game? (Students should be able to explain *why* the effect occurs, even qualitatively)
- **Trade-offs and limits:** Does the card reflect that gains in one area may lead to costs in another, rather than presenting only purely positive or negative outcomes?
- **Transparency of values:** Can students articulate which values or assumptions are embedded in the card (e.g. efficiency, fairness, local production, technological reliance)?

During the discussion, teachers may ask students **how they estimated the values** on the card. Acceptable answers include references to:

- comparisons with existing cards,
- information or examples from the Handbook,
- logical reasoning based on everyday experience (note that this is prone to “myths”)

A well-designed card does not need to be “correct” in a scientific sense; it needs to be **internally consistent, explainable, and open to discussion**. Cards that provoke debate and require justification should be treated as strong learning outcomes.

## 10. Extensions

Students should be encouraged to expand or modify the game or to develop their own version.