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## **TEACHING IDEAS SHARED FROM SAILS TEACHER EDUCATION PROGRAMME**

Goats and Humans, resources and sustainability: what's the story's end?



*This resource has been developed through the SAILS Teacher Education Programmes (2012-2015) but was not developed as a finalized SAILS Inquiry and Assessment Unit. These materials are shared to inspire further use of inquiry and assessment of inquiry skills in the science classroom.*

<b>Author[s]</b>	Teresa Loureiro
<b>Organisation</b>	Institute of Education of the University of Lisbon
<b>Project Coordinator</b>	Dr. Odilla Finlayson, Dublin City University.
<b>Website</b>	<a href="http://www.sails-project.eu">www.sails-project.eu</a>
<b>Email</b>	<a href="mailto:info@sails-project.eu">info@sails-project.eu</a>

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## Institute of Education – University of Lisbon

### Goats and Humans, resources and sustainability: what's the story's end?<sup>1</sup>

Summary	This activity is related to sustainability and natural resources. The task seeks students to be able to recognize the connections and relationships of interdependence between the elements in a closed ecosystem represented in a cartoon.
Disciplinary areas Grade (target group) Lower Secondary	Natural Sciences 7 <sup>th</sup> grade 9 <sup>th</sup> grade
Goals	To understand the relationships of interdependence between different parts of a closed ecosystem and extrapolate this relations to the Earth ecosystem. To understand the concept of sustainability and be able to reflect about their own ambiental attitudes as citizens.
Estimated time (number of lessons)	4 lessons ( 90min each)
Resources	Computer; materials described in the task, other materials requested by students
Involved Institutions	Schools

#### Content

This activity can both be developed with primary and lower secondary students under the exploration of the following themes:

1<sup>st</sup> – 4<sup>th</sup> grade: Natural environment, Living beings of the surrounding environment, Physical aspects of the local environment; Interrelationships between spaces, Contact between earth and the sea;

5<sup>th</sup> – 6<sup>th</sup> grade: Diversity of organisms and their interactions with the environment, Water, Air, Rocks and Soil – Earth materials that support life;

7<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup> grade: Sustainability on Earth: ecosystems - Disturbances in the balance of ecosystems, Sustainable management of resources - Natural resources - use and consequences, Protection and nature conservation, Costs, Benefits and risks of scientific and technological innovations.

#### Inquiry skills

This activity aims to contribute to the understanding of inquiry process, namely systematic thinking, searching information skills, reasoning and arguing. Also it aims to

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<sup>1</sup> This activity was set up under the 1<sup>st</sup> SAILS Portuguese workshop for teachers: **Why is there so much talk about INQUIRY across Europe?** A proposal to work with the science curriculum in the classroom (May 2013). It was proposed by Teresa Loureiro and adapt to the SAILS unit structure.

the promotion of thinking skills, attitudes and values capable of providing students an active role in decision-making about socio and environmental concerns.

## Suggested Learning Sequence

### **Goats and Humans, resources and sustainability: what's the story's end?**

#### Student's document 1

#### PART I

...and there was a goat, well installed in the fence!  
It looked around, felt the breeze and the blue sky ... evaluated all that it had in the small space available ... at first glance it seemed to be in heaven!



The early story...

Illustrated by Filipe Gomes ©

Once upon a time there was a goat that lived in a paradise, its fence ... and it stayed there, and the time passed, and passed and passed...

## PROCEDURES

Carefully analyse the situation described in the text and in the cartoon.

**Goal:** Build a story about the life of the goat, over the next two months that may be incorporated into a book on sustainability and natural resources. You must use text and cartoons.

1. Identify the different natural resources present in the cartoon.
2. Rearrange those resources in two different groups according to the concept of renewable and non-renewable resources, considering that a renewable resource is one whose replacement occurs at a rate consistent with the life cycle of the living being who's consuming it.
3. Distribute each identified natural resource by the different terrestrial subsystems.
4. Considering the space inside the fence as an ecosystem, identify biotic and abiotic factors present in the image.
5. Identify the various interactions between the goat and the environment that surrounds it.
6. Develop a food chain that includes the goat.
7. Attempt to identify what is expected to happen after one month. Build a cartoon, based on the first one, which illustrates the evolution of the goat on the fence at the end of the first month. Complete your cartoon with a small narrative.
8. Attempt to identify what is expected that will happen at the end of the second month. Build a cartoon, based on the first one, which illustrates the evolution of the goat on the fence at the end of the second month. Complete your cartoon with a small narrative.
9. Identify the causes of those events predicted by you.
10. What would you propose to the goat to avoid that situation?
11. Prepare a list of the main conclusions achieved.

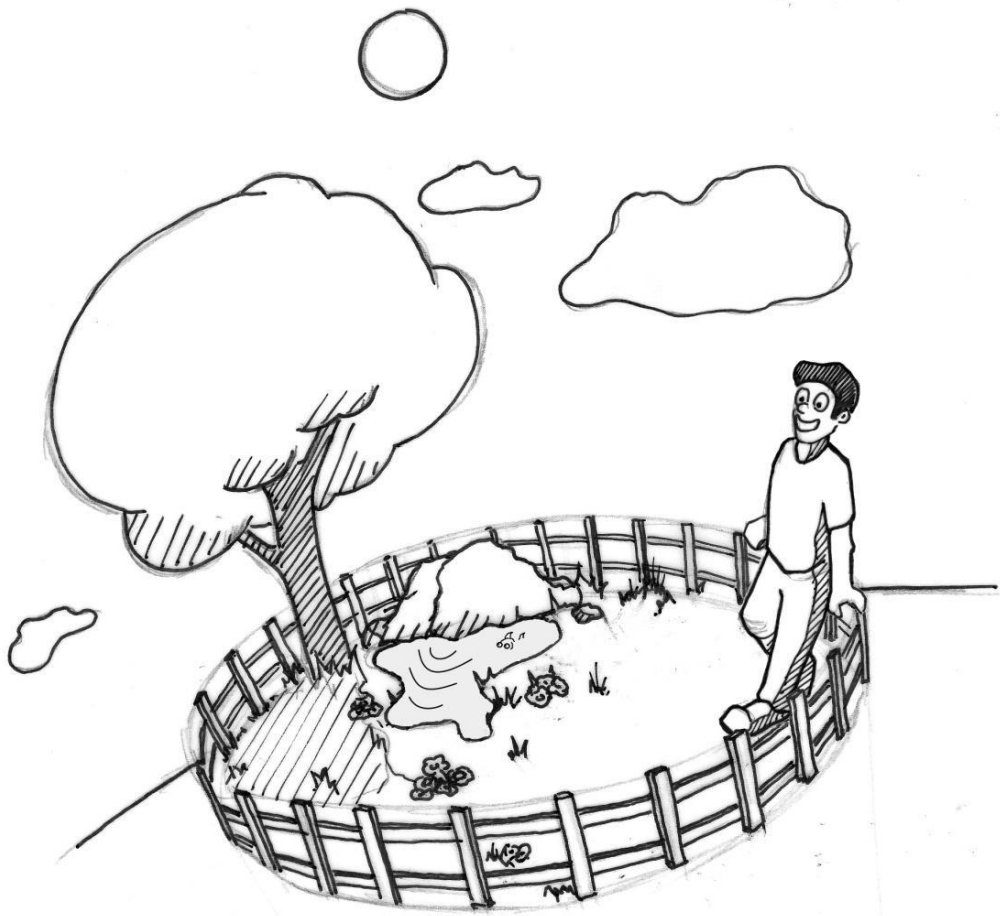
**Goats and Humans, resources and sustainability:**

## What's the story's end?

### Student's document 2

#### PART I

...and there was a man, well installed in the fence!  
He looked around, felt the breeze and the blue sky ... evaluated all that he had  
in the small space available ... at first glance it seemed to be in heaven!



Illustrated by Filipe Gomes ©

The early story...

Once upon a time there was a man who lived in a paradise, his fence ... and he stayed there, and the time passed, and passed and passed...

#### PROCEDURES

Carefully analyse the situation described in the text and in the cartoon.

**Goal:** Build a story about the life of the man, over the next 2 months that may be incorporated into a book on sustainability and natural resources. You must use text and cartoons.

1. Identify the different natural resources present in the cartoon.
2. Rearrange those resources in to different groups according to the concept of renewable and non-renewable resources, considering that a renewable resource is one whose replacement occurs at a rate consistent with the life cycle of the living being who's consuming it.
3. Distribute each identified natural resource by the different terrestrial subsystems.
4. Considering the space inside the fence as an ecosystem, identify biotic and abiotic factors present in the image.
5. Identify the various interactions between the human being and the surrounding environment.
6. Develop a food chain that includes the human being.
7. Attempt to identify what is expected to happen after one month. Build a cartoon, based on the first one, which illustrates the evolution of the human being on the fence at the end of the first month. Complete your cartoon with a small narrative.
8. Attempt to identify what is expected to happen at the end of the second month. Build a cartoon, based on the first one, which illustrates the evolution of the human being on the fence at the end of the second month. Complete your cartoon with a small narrative.
9. Identify the causes of those events predicted by you.
10. What would you propose to the human being to avoid that situation?
11. Prepare a list of the main conclusions achieved.
12. Indicate to what extent your fence can be compared to the planet Earth.
13. Indicate the relationships that may be established between this task and the concept of sustainability.

14. Propose topics for a group discussion entitled: "Goats and Human being - discover the differences!" that will occur in the next class.

### **Teacher document**

**Title:** Goats and Human Being, resources and sustainability: what's the story's end?

**Context:**

School level: This task might be applied in the last years of primary education or in the first years of secondary education. However it can be used in other school years if you pull up or down the level of demand, and even in other curricular contexts.

- Curricular content: Natural Sciences, Geography, Mathematics (curricular areas where sustainability and the relationship between human beings and natural resources are focused).

Curriculum components: Interactions between living beings and the environment; energy flows and cycles of matter; ecosystems, natural resources - use and consequences; protection and conservation in Nature.

**Goals:** Recognize and identify different natural resources, relating them to the different earth subsystems.

Reflect upon the resources, use and consequences of the use of different renewable and non-renewable resources.

Recognize the interdependence associated with different natural resources.

Conceptually organize the relationship between natural resources and earth subsystems.

Understand that the dynamics of ecosystems results from the interdependence of living beings, natural resources and bio-geo-chemical processes.

Reflect on environmental issues, including the need to properly manage resources in order to survive.

Promote knowledge about the natural world and the importance of its preservation.

Develop awareness and respect for the environment.

Understand the impact of Humans on the ecosystem balance.

Recognize that the capacity for managing available resources is proper of Humans.



Understand that there are consequences in practice of unsustainable uses of natural resources.

Develop and propose solutions / measures for sustainability on Earth.

Develop a holistic view of reality where everything is interconnected and interdependent.

Extrapolate conclusions about "the fence" for the planet Earth, which will allow you to feel and internalize the essence and relevance of the concept of sustainability.

- **Skills:** reflective thinking, critical thinking, decision making, reasoning, oral communication, collaborative and cooperative work.

### **Activity**

*Classification: problem solving and decision making held in working groups of 3-4 students. Debate and construction of a cartoon/animation, along with a narrative.*

*Estimated time: 6 lessons (classroom work) and extra-class work.*

*1<sup>st</sup> Lesson:* Introduction, distribution of document 1 (Goat) by the groups, contextualization and explication of the task goals.

*2<sup>nd</sup> Lesson:* Development of the task initialized at the first lesson.

*3<sup>rd</sup> Lesson:* Completion of the task related with document 1 and presentation of results to the class.

*4<sup>th</sup> Lesson:* Development of the task related with document 2 (Human Being).

*5<sup>th</sup> Lesson:* Completion of the task related with document 2 and presentation of results to the class.

*6<sup>th</sup> Lesson:* Debate: "Goats and Human Being – pointing out the differences!"

*Previous knowledge: ecosystems dynamics, natural resources, earth subsystems.*

### *Material:*

Document 1 – Goat's cartoon for students to explore;

Document 2 – Human Being's cartoon for students to explore;

Teacher's orientations guide;

Assessment criteria/frames.

Task development:

The task's main goal is the development of an awareness that allow students to feel and internalize the nature and relevance of the sustainability concept. Teacher's main role is to guide students towards the acquisition and consolidation of the goals defined for this task.

It is intended that each work group builds a cartoon along with a narrative so that at the end of the task the teacher can build a small illustrated book on sustainability.

1<sup>st</sup> Lesson:

The teacher organizes the class into groups of 3-4 students. Afterwards the activity is explained, focusing in the organization and assessment of students throughout the activity. Distribution of the document 1. Guidance of the groups work throughout the task development.

Note for teachers: *None of the characters (human being or goat) may jump the fence. They are obligated to live inside it!*

PART 1

Work developed from document 1.

Estimated time: 2 lessons.

From the document 1 exploration, students will be led to the recognition that the goat does not have the capacity for sustainably manage the natural resources it has around it and eventually will self-extinct.

Finally, students will make an oral presentation of their work, showing the cartoons and the narrative they built, as well as the conclusions drawn.

PART 2

Work developed from document 2

Estimated time: 2 lessons.

From the document 2 exploration, students will be led to the recognition that only humans have the capacity for sustainably manage the natural resources around them.

Finally, students will make an oral presentation of their work, showing the cartoons and the narrative they built, as well as the conclusions drawn.

6<sup>th</sup> Lesson: Debate: “Goats and Human Being – pointing out the differences!”

The purpose of this debate is the organization of the ideas previously developed with the exploration of documents (1 and 2), a confrontation between the differences found in each of the situations analysed. Throughout the discussion the teacher should use these differences in order to lead the students to achieve the primary goals of the task and enhance the development of the following goals: *Promote the knowledge about the natural world and the importance of its preservation.*

*Develop awareness and respect for the environment.*

*Understand the impact of Humans on the ecosystem balance.*

*Recognize that the capacity for managing available resources is proper of Humans.*

*Understand that there are consequences in practice of unsustainable uses of natural resources.*

*Develop and propose solutions / measures for sustainability on Earth.*

*Develop a holistic view of reality where everything is interconnected and interdependent.*

## **Assessment opportunities**

### **Inquiry skills**

Substantive and procedural knowledge:

- Collect and record data

Reasoning:

- Interpret data
- Make inferences

Communication:

- Use scientific language
- Presenting data, through various ways
- Present and discuss different ideas

Attitudes:

- Curiosity
- Perseverance
- Creativity
- Observation capability
- Respect for evidence
- Scientific rigor

Despite all the assessment opportunities that could be achieved through this activity, it was drawn a teacher guide especially for the pilot teachers to follow the same structure, where two inquiry skills were selected. This document was built with teachers' cooperation.

### **Guidelines for the construction and application of an instrument for formative assessment**

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**Purpose:** It is intended with this task that students learn the scientific contents provided in the respective planning and develop Inquiry skills. This task allows students to develop several Inquiry skills; however, for the data collection about the assessment process it will be focus on planning and implementation skills.

#### **Teacher actions**

1. Before class
  - a. Build an assessment instrument considering that the main focus will be in planning and implementation skills;
  - b. Adapt the task to students and to the context.
  
2. In class
  - a. At the beginning of the process clarify the assessment criteria (in particular those relating to planning and implementing skills).
  - b. At the end of the process, apply a semantic differential to students for identification of their perceptions related to the assessment process.
  
3. After class
  - a. Assess students' productions having regard to the developed instrument and produce a written feedback;
  - b. Reflect on the assessment process.
    - i. An interview will be conducted in order to identify relevant issues experienced in the implementation, development and assessment of the Inquiry task.

**Note:** For evidence collection it will be required the students' productions and classroom video recording (optional).

#### **Transfer**

*Extrapolate conclusions about "the fence" for the planet Earth, which will allow you to feel and internalize the essence and relevance of the concept of sustainability.*