



(prototype layout)

Materials
supporting the
game

ResourceRation

Teaching materials for preparation and follow-up

A project of



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True to the principle “Playing helps to understand”, ResourceRation gives the opportunity to grasp the complexity of the world using the example of resource issues.

Grouped in different generations, the players buy resources for the survival of their fictional company. On an abstract level, they choose between more sustainable or less sustainable options.

Their decisions affect the consumption of resources, which in turn reflects back on the players welfare over all generations.

Which strategy works best? And what happens when the commonly used resources run out?

Learning objective

Many of today's environmental challenges like climate change share a basic principle – the tragedy of the commons. This simulation game aims to make this principle, which essentially revolves around the effects of many individual decisions on a jointly used resource and their repercussions on the community, tangible.

This experience and the understanding it promotes are central to solving many environmental problems and questions of international and intergenerational justice. This understanding also helps to clarify questions such as "Why is the world the way it is?" or "Why is it so difficult as a society to solve environmental problems when we actually already know a lot about them?", which arise more and more frequently as the state of the world seems to be worsening from day to day.

It is also important to understand that the resources, which our planet makes available to us to a more or less limited extent, are currently required for almost all human activities. This means that everywhere in our everyday lives we encounter the tragedy of the commons in one form or the other.

Didactic embedding

With the supplementary interactive learning materials and through the explanations and examples during the game, these topics and situations are made visible and are linked with suggested solutions from the literature or from the creative treasure of the participants. As a result, the participants should later be able to recognize patterns of unsustainable resource use in their environment and their own potential for action for a correspondingly more sustainable design.

Target group

The game is aimed at school classes in secondary level I & II who deal with the topics of resources, the environment and / or justice. It can be used in subjects such as economics, environment, ecology or social studies.

Number of players

The game has a modular structure in "generations" so that there is no fundamental upper limit on the number of players. 3 to 6 participants per generation and 3 or 4 generations are ideal. So 12 to 24 participants are ideal, with a minimum of 9.

Time needed

The time required to carry out the game is 1.5 to 3 hours, depending on the evaluation made at the end. The topic of resources can be dealt with comprehensively with the supplementary teaching materials in around 8 lessons of 45 minutes each.

Accompanying teaching materials

Elaborated teaching materials on the topic of resources are available for preparation and follow-up of the game.



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Content and Structure

This dossier contains all the necessary informations and materials for the realisation of eight lessons on the topic "Resources". It is structured as follows:

- Learning goals (Page 3)
- Recommended process (Page 4)
- Beschreibung der Module (Page 5 – 12)
- Arbeitsblätter Druckvorlagen und Lösungen (Page 13 and following)

Description of the contents

Im Folgenden werden Informationen für die Lehrperson, Verweise auf Arbeitsblätter und Methoden (aufgeteilt in analog und digital) wie folgt gekennzeichnet:



Method analog



Method digital



Reference to worksheets

Additional materials

In addition to this dossier, you will need a beamer, a blackboard, Internet access and at least one device for every two participants in your classroom (preferably notebook, mobile phones are possible as well).

Learning goals

Learning goals for the preparing class materials

The participants...

...can explain what a resource is and recognise the difference between tangible and intangible resources (K2).

...can name three examples of their own daily needs and describe which resources are necessary to fulfil them (K2).

... can name three examples each for finite and renewable resources and be able to explain the difference (K1, K2).

... can give three examples of resources that are particularly rare or already overused and can explain why these resources are being overused (K1, K2).

... can give two examples of ecological developments, which are caused by the use of resources and which are endangering the prosperity of humans (K1, K2).

...can give two examples of resources, which have negative effects on the environment when they are used. The participants can explain why these resources become problematic for people if they are used too much (K1, K2).

Learning goals for the follow-up group work

The participants...

...can compare different strategies to fulfil the needs of society without overuse of resources with their advantages and disadvantages (K4).

...can assess the applicability of these strategies and identify possible challenges in the implementation of these strategies (K5).

...can develop their own model for sustainable use of resources in a company (level 6).

...can plan their own individual actions that will help them to use resources sensibly in their daily lives (level 6).

Suggested procedure

The following lesson plan shows a suggested structure. The various modules can also be carried out individually or in a different sequence. The described duration of the modules is calculated for a total of 8 lessons of 45 minutes each (3 for preparation, 2 for the game and 3 for follow-up). The contents, the red thread and the time periods of the individual modules are explained in the next section.

Time	Topic	Didactic implementation	SF*	Material
Preparation: Introduction on resources				
15'	What are natural resources?	self-study with video and text	I	worksheet, Internet access
30'	Resources fulfil needs	Collecting needs and resources by Think, Pair, Share. Followed by the creation of a mind map to link a resources to needs.	PL G	Flipcharts and Marker, Post-its
60'	Different resources, different problems	Expert panel with four subjects about the use of different resources	G	worksheets, Internet access
20'	Limitations of the planet's resilience	Video and conversation	PL	worksheet, Internet access
10'	Conclusion: My resource promise	Letter to future self	I	Writing paper and envelope
Game: Experiencing the tragedy of the commons				
15'	Explanation Game	Execution according to game instructions	PL	see game instructions
45'	Execution Game	Execution according to game instructions	PL	see game instructions
30'	Evaluation Game	Evaluation according to game instructions	PL	see game instructions
Follow-up: Group work on solutions to the problem experienced before.				
60'	Solutions and actions	Expert panel on various solutions and actions to the tragedy of the commons	G	worksheets, Internet access
45'	Development of business models or project ideas	Gruppenarbeit zur Ausarbeitung von Businessmodellen für nachhaltige Ressourcennutzung oder Projektideen für die Klasse	PL	Business model canvas and other aids
30'	Presentation of business models / project ideas	Presentations of the group works	PL	Projektor, Flipchart, Blackboard

* Social Form (SF): Individual work (I), group work (G) or Plenary (PL)

Module 1: What are natural resources?

Time: 10 – 15 minutes

Material: Worksheet, internet access



Worksheet 01: What are natural resources?

The students watch the video on natural resources in self-study. After a short story as an introduction, the video explains the most important facts and definitions around the topic. Afterwards, the students answer the questions on the worksheet.

This module can also be given as homework.

Link to the video on Youtube:

<https://www.youtube.com/watch?v=zYq8Rx1XnSo>

Module 2: Resources fulfil needs

Time: 30 - 45 minutes

Material: Flipcharts and Marker each group with three students (or projector if done digital)

Through the "Think, Pair, Share" method, human needs are collected first and then possible resources to meet these needs. Then the students link different needs with different resources.

Method «Think, Pair, Share»

"Think, Pair, Share" means, that the students first search for answers to each key question on their own for 2-3 minutes, then spend 2-3 minutes discussing the answers with their neighbour. Finally, in the plenary session, all together collect and discuss different answers. In the second step "Pair", the answers can also be written down on post-its under.

Gathering of the needs

In a first step, needs from daily life are collected. With the leading question **"What needs do we humans have?"**, the students list all possible needs.

If the question is not understood, various examples can be given:

- the need for food
- the need for social relations
- the need for sleep
- the need for fun
- etc.

Gathering of the resources

The teacher explains that resources are needed directly or indirectly to fulfil most needs. Therefore, under the guiding question **"What resources do you know?"** all possible known resources are collected. Non-material resources such as work, time or motivation may also be mentioned here. In a next step the resources mentioned are divided into material and non-material resources. Furthermore, all natural resources can be highlighted. The following examples can be given: Wood, oil, soil, metals, clean air, water, money, energy, skills, creativity, relationships, health, etc.

Linking needs and resources

In groups of 3 to 4 students choose two to three needs and resources each. The group then creates a mind map in which the needs are linked to the resources through intermediate steps. These intermediate steps can have to do with the manufacture of products or the conversion of energy.

Examples of these can be found on the next page.

Each group then presents an example of its mind map in the plenary session.

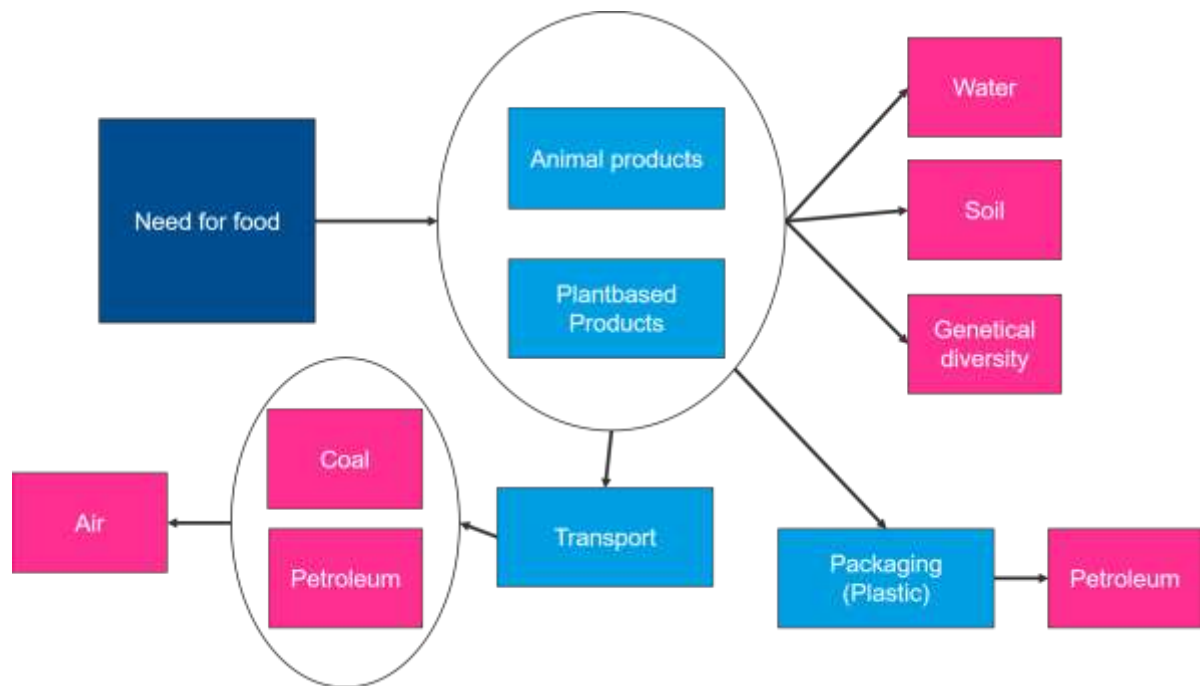


The mind map of the group work will be drawn on a flipchart.



The mindmap of the group work is created in an online tool for creating mindmaps. For example „Miro“

Example for Mindmaps (in Miro / Powerpoint):



Comment: The combustion of coal and petroleum does not directly consume the resource air. However, it does affect air quality.

Module 3: Different resources, different problems

Time: 60 minutes

Material: worksheets, internet access each group



Worksheet 02: Wood: renewable but limited

Worksheet 03: Mineral oil: non-renewable and climate damaging

Worksheet 04: Concrete: energy- and CO2-intensive

Worksheet 05: Soil: limited and variable in use

Worksheet 06: discussion about the problems of resources

Using various examples, students learn about different problems of using resources and discuss how these could be solved.

In a first step, students are asked to think about the key question "**What comes to mind when we talk about 'resource use problems'?**". The answers (depletion of resources causes environmental pollution, resources are scarce, use of resources produces greenhouse gases, etc.) can each be related to the resources collected with an example.

Methodology Expert group

Students will be divided into four expert groups. In this group, they spend 30 minutes using a worksheet and online sources to acquire knowledge about the problems and solutions for using a resource. Each student takes notes so that they can explain the topic to others. The groups are then remixed so that each of the new groups has an expert on a resource and can talk about the problems and solutions. In the exchange groups, each expert summarises the most important points of the resource for 3 minutes. Afterwards, similarities and differences are noted. Distribution of the students: For example, if there are 24 students, there are 4 expert groups of 6 students each and 6 exchange groups of 4 students each.

The four topics are:

- **Wood**: renewable but limited
- **Mineral oil**: non-renewable and climate damaging
- **Concrete**: energy- and CO2-intensive
- **Soil**: limited and variable in use

A detailed worksheet is provided for each topic.

For the exchange round there is also a worksheet available.

Solutions and comments on the worksheets are at the end of this document.

Module 4: Limitations of the planet's resilience

Time: 15 - 20 minutes

Material: internet access, projector

This module is moderated by the teacher. The goal of the module is to look at the problems caused by overuse of resources from a different perspective. It starts with the question: "**How many planets would we need if everyone lived as we do in Switzerland?**" The students write down a number for themselves. Afterwards, some estimates are collected. **The correct answer is 2.9 Earths.** The teacher briefly explains that we only have one planet and therefore have to live in such a way that we can get by with the resources it provides.

Together we watch the following Film provided by FOEN on YouTube:

"The Planetary Boundaries and what they mean for the Future of Humanity"

<https://bit.ly/3nryDOK>

Questions from students will be answered. The students are now asked to think briefly about how they would explain the planetary load limits to someone - for example, their siblings, parents, grandparents. The answers can be written down and then corrected by the teacher to see if the students have understood the concept.

Module 5: Conclusion: My resource promise

Time: 10 minutes

Material: writing paper and envelopes

At the end of the course, the students are given the task of making a resource promise to their future "I". The teacher explains that if we overuse the resources of our future, i.e. ourselves and the coming generations, we are taking away the foundations of life. The students should therefore make a resource promise which they will receive at a later date. In return, the students consider which activities they want to do in the future to conserve which resources and what they have to do to achieve this. For example: "When I buy clothes, I want to pay attention to how much water is used for production. To do this, I want to find out about the water consumption of garments on the Internet.»

They write their promise on a piece of paper, put it in an envelope and write their name and, if necessary, their address on it. The promises are collected and kept by the teacher. After a certain time (half a year or a year) the teacher gives the promises back to the class or sends them home by post. The students can then reflect on what they have learned in the meantime and where they stand with their promise.

Module 6: Game RessourceRation

Time: 90 Minuten

Material: see game instructions

The game is played according to the game instructions.

Module 7: Get to know about Solutions and actions

Time: 60 minutes

Material: worksheet, internet access each group



Worksheet 07: Instructions Expert panel - Measures and solutions

In the game the students experienced the tragedy of the commons. Now, in the evaluation, certain solutions and measures (in the following only solutions will be mentioned) to prevent the overuse of resources have already been discussed. In this module, these solutions will be examined in more detail. For this purpose, a **panel of experts** (see module 3) will be conducted again, in which each group of experts will spend 30 minutes researching a possible solution for the overuse of resources.

The following basic principles for solutions can be examined:

- Sufficient consumer behaviour
- Efficient processing of resources and technological solutions
- Circular economy and use of alternative resources
- Political regulations, incentives and sanctions

For each solution the following questions should be answered:

- What is the underlying principle of this solution?
- How does this solution contribute to resource conservation?
- What are the social, economic and environmental advantages and disadvantages of this solution?
- What framework conditions are needed to implement this solution?
- Do you consider this solution to be realistic? Why? Why not?

The answers can be written on a worksheet.

Afterwards, the students discuss the different solutions for 20 minutes, guided by the worksheet. In the last 10 minutes the most important findings of all groups are collected in the plenary session.

Suggestions for solutions and comments on the four basic principles can be found at the end of this document.

Alternative task for advanced students:

Economist Elinor Ostrom has studied the tragedy of the commons in depth and has outlined principles for the sustainable use of community resources in her book "The Constitution of the Commons: Beyond the Market and the State". As an alternative task in the expert panel, advanced students could summarise the eight design principles she has identified and present them in a comprehensible way. The design principles are summarised on the Wikipedia page of Elinor Ostrom.
(https://de.wikipedia.org/wiki/Elinor_Ostrom).

Module 8: Development of business models or project ideas

Time: 45 minutes

Material: worksheets, internet access



Worksheet 08: Our sustainable business model

Worksheet 09: Our sustainable project idea

After the students have become acquainted with various solutions to the resource problems, they are now to develop their own idea for a sustainable company or a project to promote sustainable resource use in groups of 2 or 3.

The development of a sustainable business model is about innovative and creative ideas for a fictitious company. The project idea should represent a concrete option for action for private individuals, which could be implemented by the students individually or in class. This includes communicative projects in which students can pass on their knowledge about sustainable resource use.

We recommend that the groups are free to choose which option they wish to work on.

A worksheet is available as a guide for both variants.

Module 9: Presentation of business models / project ideas

Time: 30 minutes

Material: projector, flipchart, blackboard, worksheet



Worksheet 10: Evaluation of ideas

Each group has three to five minutes to present their idea. The form of presentation can be given by the teacher or chosen freely. For each presentation, a different group evaluates the idea of the presenting group according to the worksheet and then gives feedback.

Well thought-out project ideas can of course be implemented afterwards.

Templates for printing

The following worksheets can be sent directly to the students as PDF or printed out. We recommend printing on recycled paper. All worksheets can be printed in black and white without any problems.

For a class of 20 students we recommend to print the following number of worksheets:

Worksheet 01: What are natural resources?	20
Worksheet 02: Wood: renewable but limited	5 of each
Worksheet 03: Mineral oil: non-renewable and climate damaging	(per member of the group 1)
Worksheet 04: Concrete: energy- and CO2-intensive	
Worksheet 05: Soil: limited and variable in use	
Worksheet 06: discussion about the problems of resources	20
Worksheet 07: Instructions Expert panel - Measures and solutions	20
Worksheet 08: Our sustainable business model	5
Worksheet 09: Our sustainable project idea	Canvases should be printed A3
Worksheet 10: Evaluation of ideas	20

What are natural resources?

This worksheet is about what a resource is in general and what natural resources are.

Exercise 1: Watch the film "Resources, what is it really?" by Pascale Eichholzer.

Enter this link or scan the QR Code: <https://www.youtube.com/watch?v=zYq8Rx1XnSo>



Exercise 2: Now try to explain in your own words what a resource is. Write your explanation on the back of this page.

Exercise 3: What natural resources are you aware of (other than those mentioned above)? Write down at least 7 examples.

Wood: renewable but limited

Through this worksheet you will be trained as experts in the field of wood. Make notes on the different aspects for the following exchange. You must be able to explain the topic to other students on your own.

Exercise 1: Read the following text and try to "translate" the quote into modern language.

Wood is a regrowing and therefore renewable resource. However, it is crucial that only as many trees are felled as can grow back again, so that the forest is saved in the long term.

Inspired by a large shortage of wood, Hans Carl von Carlowitz introduced the definition of sustainability in 1713:

"Will the greatest art/science/diligence and institution of the local countryside be based on it / like a sothane conservation and cultivation of wood / that there is a continuous, constant and sustainable use / because it is an indispensable thing / without which the country cannot remain in its food (in the sense of essence, existence, the author)". (pp. 105-106 in the "Sylvicultura Oeconomica").

Original in German: roughly translated from German to English

Switzerland has one of the longest and strictest forest protection laws in the world. As a result, the forest area in Switzerland remains constant or is even growing. Worldwide, however, the forest area is in some cases decreasing dramatically.

Exercise 2: Read the sections on the following text passages, from the article "Threatened Forest - Forests Worldwide". Mark important sections in colour and note the main causes of forest loss and growth in keywords.

Annual loss of forest:

For decades the world has been losing large areas of forest. Brazil is currently reporting sharply increasing forest losses again. Over the past five years, the rate of global forest loss has slowed down. According to the FAO Forest Report 2020, 10 million hectares of forest have been lost annually since 2015. In the five years before that, the figure was 12 million hectares of forest.

Forest continues to shrink

Despite global reforestation, the global forest area has shrunk by 4.7 million hectares since 2010, and by 178 million hectares since 1990. In Asia, Oceania and Europe, forest cover has increased over the last decade. In Africa and South America it continues to shrink. (FAO 2020)

Causes of forest loss:

The main cause of forest losses is the conversion of forest land into arable land. On the other hand, there is forest growth through afforestation, reforestation and the natural spread of the forest. Between 2000 and 2010, the forest area in East Asia increased by an average of 2.78 million hectares per year. This was more than in any other region. In Europe (excluding Russia), too, the forest cover increased in the same period - by 694,000 hectares per year. Between 1990 and 2000, the corresponding figure was 3.40 million hectares per year. In relation to the period 2000 to 2010, China (plus 2.99 million ha), the USA (plus 0.38 million ha), India (plus 0.30 million ha) and Vietnam (plus 0.21 million ha)

accounted for the largest shares of forest growth. A large part of global forest growth is due to the increase in forest plantations. The area of forest plantations increased by 4.29 million ha annually between 1990 and 2010. The average annual growth was highest in China (plus 1.93 million ha), the USA (plus 0.81 million ha), Canada (plus 0.39 million ha) and India (plus 0.25 million ha). In contrast, South America (minus 4.00 million ha), East and South Africa (minus 1.84 million ha), West and Central Africa (minus 1.54 million ha), Oceania (minus 0.70 million ha) and South and South-East Asia (minus 0.68 million ha) had the largest annual forest losses between 2000 and 2010. The 10 countries with the highest forest losses between 2000 and 2010 alone lost 6.04 million hectares of forest annually. Brazil (minus 2.64 million ha), Australia (minus 0.56 million ha) and Indonesia (minus 0.50 million ha) were at the top of the list. The annual forest loss of 2.64 million hectares in Brazil corresponds to an average loss of 5.0 ha per minute. Five hectares in turn correspond to an area of about seven football pitches.

Exercise 4: Watch this video on forests and climate protection.

Describes in 3-4 sentences why sustainable forest/wood consumption is positive for the climate.

Enter this link or scan the QR code: <https://bit.ly/2WygDGZ>



Exercise 5: Think for a moment about it and discuss in the group another resource that has similar characteristics and problems as the wood / forest. Make a note of how they resemble the wood / forests and how they are different.

Mineral oil: non-renewable and climate damaging

Through this worksheet you will be trained as experts in the field of petroleum. Take notes on the different topics for the following exchange round. You must be able to explain the topic to other pupils independently.

Exercise 1: Do you know how oil is generated? The video explains it to you. Afterwards, note down the three points that surprised you most about the production of oil.

Enter this link or scan the QR code: <https://bit.ly/3gU89mK>



Exercise 2: Now watch the next two videos. What are the main statements of the two videos? Write down 3 - 4 sentences per video.

Video 1:

<https://bit.ly/3oXvvnv8>

Video 2:

<https://bit.ly/3oVIH31>



Exercise 3: How would you describe the problems caused by the use of oil? Discuss amongst each other, and write down your solution afterwards. Use the terms "(not) scarce", "(not) renewable" and "climate change".

Exercise 4: Do you know how to use less oil? List alternatives for the following questions:

- How can less petrol and diesel be used in transport and mobility?
- How can the production of plastic from petroleum be minimised?
- How can the burning of oil for heating be reduced?

Exercise 5: Think for a short time and discuss in the group, which other resource has similar characteristics and problems as oil. Make a note of how they are similar to oil and how they are different.

Concrete: energy- and CO2-intensive

Through this worksheet you will be trained as experts in the field of concrete. Make notes on the different topics for the following exchange round. You must be able to explain the topic to other pupils independently.

Concrete is one of the most important building materials. However, the production of concrete causes various problems.

Exercise 1: Watch the video. Make a note of how CO₂ is produced during the concrete production. Note two steps.

Enter this link or scan the QR code: bit.ly/3ampNhx

Exercise 2: What is the energy used in concrete production? Think for a moment on your own and discuss in the group. Note keywords following the discussion.

Exercise 3: The following video shows ways to reduce energy consumption and CO₂ emissions. List them and take notes.

Sand is used for the production of concrete. Although it is thought that sand exists "like sand at the beach", sand is a scarce resource. In this video you will find more information about this.

Exercise 4: Read the article "Greed for sand" by BR Wissen. You can divide the different parts of the article in the group. Make a note of the problems that overuse of sand can cause for people.

Enter this link or scan the QR code: bit.ly/2KAmrgl

Exercise 5: How could concrete consumption in general be reduced? Think for a moment individually and discuss in the group. Then write down at least 3 ideas.

Exercise 6: Think shortly and discuss in the group another resource that has similar properties and problems as the concrete / sand. Make a note of how they resemble the concrete / sand and how they are different.

Soil: limited and variable in use

Through this worksheet you will be trained as experts in the field of soil. Make notes on the different topics for the following exchange round. You must be able to explain the topic to other pupils independently.

The soil on earth is limited. It can also be used in very different ways. Therefore soil is an important resource.

To work on the assignments, you need the various infographics of the "Soil Atlas 2015".

Enter this link or scan the QR code: <https://bit.ly/34gKrfg>



With the arrows at the bottom left you can make the graphics bigger.

Exercise 1: Have a look at the 1st graphic "About the ground and the world". Discuss in the group and then note down three problems of the worldwide use of soil.

Exercise 2: Now look at graphic 3 "Threatened fields" and answer the question:
What are large agricultural systems (i.e. agricultural land) in South-West Europe (Spain, Portugal) threatened by?

Exercise 3: Plants absorb CO₂ and store the carbon in the soil. In what kind of soil is the most carbon stored? (Figure 4)

Exercise 4: Think for a moment and discuss in the group another resource that has similar characteristics and problems as the soil. Make a note of how they resemble the soil and how they are different.

Discussion about the problems of resources

After this discussion you should all know the problems and possible solutions of the four different resources. You should identify similarities and differences between the examples.

Exercise 1: Each expert explains in 2 - 3 minutes what he/she has learned about the resource in question. Then fill in the table below together.

	Environmental Issues	Potential solutions	Similar resources
Wood			
Mineral oil			
Concrete			
Soil			

Exercise 2: Compare the various issues relating to different resources. What is the same for all the issues? Try to describe the similarities between the problems in 2 - 3 sentences.

Exercise 4: Now compare the solutions for the different resources. Try to describe in 3 - 4 sentences what is needed to realise these solutions.

Measures and solutions

As a group of experts, you are investigating a possible solution for a sustainable use of resources. Ask the teacher which research tools are available for the solution.

Exercise 1: Inform yourselves on the Internet about the appropriate solution strategy. What is the basic principle of this solution? And how does it contribute to the conservation of resources? Write down the answer in your own words.

Exercise 2: Think about the advantages and disadvantages of this solution for society, the economy and the environment. Write your thoughts in the table.

	for society	for economy	for environment
Advantages			
Disadvantages			

Exercise 3: Discusses in the group what framework conditions are needed to implement this solution. Make a note of some keywords.

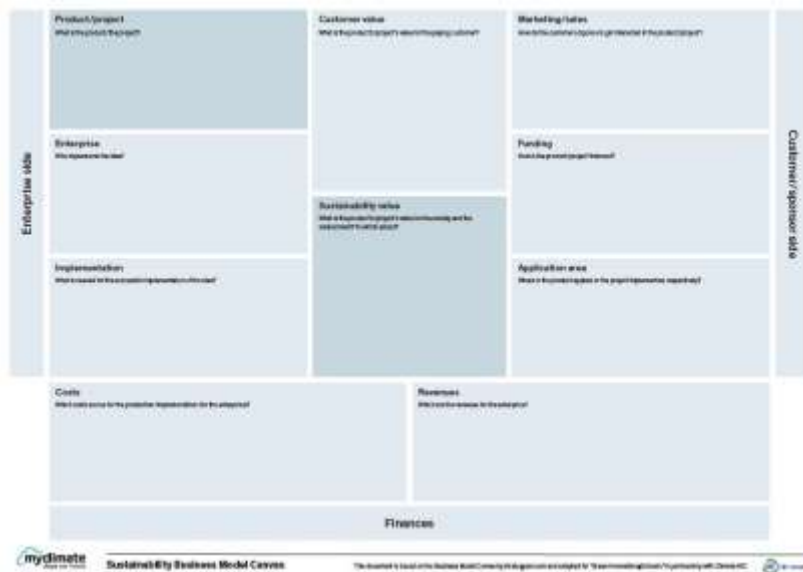
Exercise 4: Discuss in the group whether you find the implementation of the solution realistic. Write down some pro & contra points.

Our sustainable business model

Are you looking for a sustainable business model?

Exercise 1: Start with a brainstorming session. Which product / which service should your company produce? You can note the ideas as a mind map.

Exercise 2: Now look at the canvas "Sustainability Business Model" (see picture below). It is used to clearly formulate the most relevant aspects of a product, project or business. Try to fill in all fields. Orientate yourself on the questions that will guide you.



Exercise 3: Think about how you can present the idea in the most attractive way for your company. If necessary, create a small presentation or poster about it. Practice the presentation.

Our sustainable project idea

Are you looking for a project idea to promote the sustainable use of resources?

Exercise 1: Start with a brainstorming exercise. Where do you find a waste of resources in your daily life? Where would it be easy to reduce this waste of resources? You can note the thoughts in a mind map.

Exercise 2: Now take the canvas "Ocean of possibilities" (see picture below). This canvas will help you to develop as many different solution ideas as possible. Now try to embed the ideas from the brainstorming into this canvas.



Exercise 3: Now select an idea and specify it. Ask yourself the question: who has to do what at what moment in time for the idea to succeed? Write down the first steps for planning the project.

Exercise 4: Now think about how you can present your project idea in the most motivating way. If necessary, create a small presentation or a poster. Practice the presentation.

Evaluation of ideas

You evaluate the idea of the presenting group.

Exercise: Pay attention to the following criteria:

- Effective: How much does the idea contribute to the conservation of resources?
- Motivating: How easy is it to convince others of the idea?
- Innovative: Is the idea new? Or does it combine something new?
- Implementable: What are the chances that the idea can be implemented?

Give points for each criterion from 0 = "not applicable" to 3 = "completely applicable".

Make notes for each criterion and then give feedback to the group.

Effective	
Motivating	
Innovative	
Realisable	

Answers and comments for the worksheets

Below are suggested answers for worksheets 02 to 05 and 07. The jobs are described in the pink boxes. The solutions are to be found directly below.

Worksheet 02 - Wood: renewable but limited

Exercise 1: Read the following text and try to "translate" the quote into modern language.

The greatest art in the country will be to design the cultivation and maintenance of timber construction (forestry) in such a way that there is continuous / permanent / sustainable use. Because this is an indispensable thing without which the country cannot exist.

Exercise 2: Now watch the (fictive, invented) interview with Mr von Carlowitz.

Discuss for a short moment and then write down three statements from the interview that you find interesting or important.

- Wild trees are to be replanted. "Sow, sow, sow."
- Waste and overexploitation of the forest are a problem.
- A sustainable use of the forest is important. If one does not take care of regeneration, the forest will disappear. Nature needs support.
- Learning and awareness is important.

Exercise 3: Read the sections on the following page, from the article "Threatened Forest - Forests Worldwide". Paint important sections in colour and then note the main causes of forest loss and growth in keywords.

- Forest losses: conversion from forest to farmland
- Forest growth: increase in forest plantations

Exercise 4: Watch this video on forests and climate protection.

Describes in 3-4 sentences why sustainable forest/wood consumption is positive for the climate.

Wood absorbs CO₂ from the air. Burning wood emits only as much CO₂ as the tree has absorbed while growing. (In contrast to fossil fuels.) Construction wood replaces other, energy-intensive materials. Built-up wood stores CO₂ over a longer period of time.

Exercise 5: Think for a moment about it and discuss in the group another resource that has similar characteristics and problems as the wood / forest. Make a note of how they resemble the wood / forests and how they are different.

Fish stocks: fish stocks are also renewable but limited. The world's oceans, unlike most forest stocks, do not belong to the territory of a country. It is difficult to understand who is accessing the resource and how much is being taken from the users. It is therefore even more difficult to exploit the stocks sustainably in fishery than in forests.

Worksheet 03 - Mineral oil: non-renewable and climate damaging

Exercise 1: Do you know how oil is generated? The video explains it to you. Afterwards, note down the three points that surprised you most about the production of oil.

No sample answer.

Exercise 2: Now watch the next two videos. What are the main statements of the two videos? Write down 3 - 4 sentences per video.

- Video 1: Mineral oil stocks will not be exhausted for some time to come.
- Video 2: To stop climate change, the use of fossil resources (e.g. mineral oil) must be drastically reduced.

Exercise 3: How would you describe the problems caused by the use of oil? Discuss amongst each other, and write down your solution afterwards. Use the terms "(not) scarce", "(not) renewable" and "climate change".

Oil is not (yet) a scarce resource. However, oil is not renewable either. The combustion of oil causes CO₂, which contributes strongly to climate change by the greenhouse effect. Additional information: Burning the currently available reserves of oil and other fossil resources would lead to an increase in the average global temperature well above 2°C. This means that global warming will limit the use of fossil resources "earlier" than the scarcity of these resources.

Exercise 4: Do you know how to use less oil? List alternatives for the following questions: - How can less petrol and diesel be used in transport and mobility?
- How can the production of plastic from petroleum be minimised?
- How can the burning of oil for heating be reduced?

Use of oil for ...	Alternatives to reduce the consumption of oil
petrol, diesel	Reduction of drives, electric drives, energy-efficient vehicles
Plastic	Avoiding the use of unnecessary plastic, replacement by renewable materials, plastic recycling
Heating (fuel oil)	Renewable heating systems (heat pump with renewable electricity, solar energy, wood heating, geothermal energy, etc.)

Exercise 5: Think for a short time and discuss in the group, which other resource has similar characteristics and problems as oil. Make a note of how they are similar to oil and how they are different.

Natural gas and coal: The problems arising from the use of oil also apply to the other fossil resources natural gas and coal. The use of these fossil resources is the main driver of climate change. The main use of the three resources is different. Natural gas is mainly used for heating. Coal is used for various heat production processes and for the production of electricity.

Worksheet 04 - Concrete: energy- and CO₂-intensive

Exercise 1: Watch the video. Make a note of how CO₂ is produced during the concrete production. Note two steps.

Millions of years ago, microorganisms conserved CO₂ in lime. The deacidification of lime during concrete production releases the CO₂.

Exercise 2: What is the energy used in concrete production? Think for a moment on your own and discuss in the group. Note keywords following the discussion.

High firing temperatures in cement production require a lot of energy.

Exercise 3: The following video shows ways to reduce energy consumption and CO₂ emissions. List them and take notes.

- Addition of granulated blast furnace slag
- addition of calcined, i.e. fired clays (are fired at a lower temperature)

Exercise 4: Read the article "Greed for sand" by BR Wissen. You can divide the different parts of the article in the group. Make a note of the problems that overuse of sand can cause for people.

As the sand slides down towards the sea, sections of the coast can subside and beaches disappear. Tourism also suffers from this, as beach holidays literally fall into the water.

Exercise 5: How could concrete consumption in general be reduced? Think for a moment individually and discuss in the group. Then write down at least 3 ideas.

Longer lifetime of buildings, lightweight construction, other building materials (timber construction), concrete recycling

Exercise 6: Think shortly and discuss in the group another resource that has similar properties and problems as the concrete / sand. Make a note of how they resemble the concrete / sand and how they are different.

Metals: Most metals are very energy-intensive to process. However, CO₂ is not produced naturally in their manufacture and further processing, as is the case with concrete. On the other hand, metals are more harmful to the environment in mining than sand for concrete production, as natural landscapes usually have to make room for mines and mining areas.

Worksheet 05 - Soil: limited and variable in use

Exercise 1: Have a look at the 1st graphic "About the ground and the world". Discuss in the group and then note down three problems of the worldwide use of soil.

- Cities "swallow up" farmland
- Without soil protection it will not be possible to feed a growing world population
- Land prices rising almost everywhere
- The fight for land is getting fiercer
- The industrialised and emerging countries are satisfying their "hunger for land" in the poor world.

Exercise 2: Now look at graphic 3 "Threatened fields" and answer the question:
What are large agricultural systems (i.e. agricultural land) in South-West Europe (Spain, Portugal) threatened by?

Pollution, loss of species, water scarcity

Exercise 3: Plants absorb CO₂ and store the carbon in the soil. In what kind of soil is the most carbon stored? (Figure 4)

Wetlands, Moors

Exercise 4: Think for a moment and discuss in the group another resource that has similar characteristics and problems as the soil. Make a note of how they resemble the soil and how they are different.

Drinking water: Water also has a very diverse use and is essential for human life. Drinking water, like soil, is also very scarce, depending on the region. In contrast to the soil, water is part of a cycle. It is therefore not always "consumed" after use, as is the case with soil when it is built on.

Worksheet 07 -

Exercise 1: Inform yourselves on the Internet about the appropriate solution strategy. What is the basic principle of this solution? And how does it contribute to the conservation of resources? Write down the answer in your own words.

Sufficiency means "enough but not too much". Sufficiency therefore does not require complete renunciation, but the right amount. The aim is to use fewer resources while remaining satisfied. The focus should be on quality rather than quantity. Property should not be equated with satisfaction. In addition, things should be thrown away less, but rather repaired, borrowed or exchanged more.

Exercise 2: Think about the advantages and disadvantages of this solution for society, the economy and the environment. Write your thoughts in the table.

	For society	For economy	for the environment
Advantages	<ul style="list-style-type: none"> - Non-material needs are more in focus. - Less dependence on possessions and a smaller gap between rich and poor. 	<ul style="list-style-type: none"> - Production of more long-lasting goods with a higher quality 	<ul style="list-style-type: none"> Decreasing use of resources → Less impact
Disadvantages	<ul style="list-style-type: none"> Sufficiency is often seen as renouncement → negative association 	<ul style="list-style-type: none"> Decreasing productivity → Growth is no longer the main focus 	

Exercise 3: Discuss in the group what framework conditions are needed to implement this solution. Make a note of some keywords.

- Change in the population's perception of "less is more" → Moving away from the pursuit of ever more and steady growth towards a new perception of a "good life"
- In our growth-oriented economic system, this change towards greater sufficiency must be achieved through rules and laws of the state or even through corporate self-responsibility.

Exercise 4: Discuss in the group whether you find the implementation of the solution realistic. Write down some pro & contra points.

Pro:

- No renunciation, but conscious consumption can increase satisfaction
- Sufficiency should enable a good life for all and also for future generations.

Contra:

- Lifestyle change is a long process
- The break in habits is not accepted by all people
- The profit maximisation of companies or even marketing pursues the goal of a constantly increasing consumption and not the striving for the right measure

Worksheet 07 - Effiziente Verarbeitung von Ressourcen und technologische Lösungen

Exercise 1: Inform yourselves on the Internet about the appropriate solution strategy. What is the basic principle of this solution? And how does it contribute to the conservation of resources? Write down the answer in your own words.

Bei der Effizienz steht das Prinzip im Vordergrund, dass bei gleichem Input mehr Output generiert wird, sei dies bei der Stromproduktion, der Produktion von Waren oder generell beim effizienten Ausnützen einer Ressource. Dieses Ziel soll durch Innovationen in der Technik sowie modernen Produktions- und Arbeitsprozessen erreicht werden.

Exercise 2: Think about the advantages and disadvantages of this solution for society, the economy and the environment. Write your thoughts in the table.

	For society	For economy	for the environment
Advantages	<ul style="list-style-type: none"> - Lower costs for the same product - No behavior change necessary 	<ul style="list-style-type: none"> - Lower costs with higher output - Potentially increasing consumption through money saved 	<ul style="list-style-type: none"> - Conservation of existing resources
Disadvantages	<ul style="list-style-type: none"> - increased consumption due to rebound effects 	<ul style="list-style-type: none"> - Investment costs in new systems and technologies 	<ul style="list-style-type: none"> - Potential rebound effects

Comment: The rebound effect describes a frequently observed phenomenon in which the savings achieved through increased efficiency are offset or even overcompensated by increased consumption / use. Examples: The money saved is spent elsewhere and thus leads to a consumption of resources again. The "good conscience towards the environment" caused by an action leads to less environmentally friendly action in another place than before.

Exercise 3: Discuss in the group what framework conditions are needed to implement this solution. Make a note of some keywords.

- Promotion of ecological/sustainable solutions as an impetus for increasing efficiency
- Promotion of renewable energies
- Recycling regulations
- Investment in science and technology

Exercise 4: Discuss in the group whether you find the implementation of the solution realistic. Write down some pro & contra points.

Pro:

- Generally recognised and accepted
- "Logical" solution that corresponds to our mentality: improve processes, generate more output and do not change one's behaviour

Contra:

- Potentially increasing consumption due to rebound effects.

Worksheet 07 - Circular economy and Alternative resources

Exercise 1: Inform yourselves on the Internet about the appropriate solution strategy. What is the basic principle of this solution? And how does it contribute to the conservation of resources? Write down the answer in your own words.

Circular economy

In the circular economy, products and materials are kept in circulation longer by exchanging, repairing, reusing and only at the very end by recycling. As a result, fewer primary raw materials are consumed and significantly less waste is produced compared to the linear economic system.

Alternative resources

Research can help to develop materials and technologies that are not based on petroleum or other fossil raw materials, but are renewable and biodegradable (e.g. bioplastics) and can thus be kept in circulation and have less of an impact on the environment.

Exercise 2: Think about the advantages and disadvantages of this solution for society, the economy and the environment. Write your thoughts in the table.

	For society	For economy	for the environment
Advantages	<ul style="list-style-type: none"> - Less dependence on fossil raw materials - Less ownership needed through swapping and reusing 	<ul style="list-style-type: none"> - New economic sectors emerge - Lower costs over the entire product life cycle 	<ul style="list-style-type: none"> - Decreasing demand for primary raw materials - Lower CO₂ emissions
Disadvantages	<ul style="list-style-type: none"> - Rethink behaviour 	<ul style="list-style-type: none"> - Established and powerful companies lose importance - Old economic system is being challenged 	<ul style="list-style-type: none"> - In some cases, more energy is needed to manufacture products

Exercise 3: Discuss in the group what framework conditions are needed to implement this solution. Make a note of some keywords.

- Technologies and infrastructure must be available, scalable and realisable.
- Will and motivation must be present in the population to extend the life of products, e.g. by exchanging them.

Exercise 4: Discuss in the group whether you find the implementation of the solution realistic. Write down some pro & contra points.

Pro:

- Circular flow principle is well known and generally widely accepted

Contra:

- new raw materials/resources need time to become established
- Technical innovation not yet available everywhere and cost-intensive

Political regulations, incentives and sanctions

Exercise 1: Inform yourselves on the Internet about the appropriate solution strategy. What is the basic principle of this solution? And how does it contribute to the conservation of resources? Write down the answer in your own words.

The state can influence the actions of the population in various ways. These options for action are divided into the following categories:

Persuasive instruments: These include informing the population, for example, about the effects of their actions.

Cooperative instruments: These include informal negotiations and agreements.

Market-based instruments: These include government subsidies (grants) or other financial incentives.

Regulatory instruments: These include prohibitions, bans or limits.

Exercise 2: Think about the advantages and disadvantages of this solution for society, the economy and the environment. Write your thoughts in the table.

The advantages and disadvantages for the respective sector depend strongly on the chosen instrument. While persuasive and cooperative measures are still based on a voluntary basis, market-based or regulatory instruments are obligatory and have a higher degree of restriction and enforcement.

	For society	For economy	for the environment
Advantages	Clear guidelines for all	Same rules and standards for all companies	Quick and concrete goals. According to the measure, large positive impact on the climate.
Disadvantages	Encroachment on the freedom of the population (potentially low acceptance / approval)	Restrictions (potentially low acceptance / approval)	Persuasive or cooperative instruments have a relatively small impact on leverage

Exercise 3: Discusses in the group what framework conditions are needed to implement this solution. Make a note of some keywords.

- The government must enforce the consequences if the rules are violated.
- Acceptance / willingness of the population and the economy must be present so that they comply with the voluntary rules.

Exercise 4: Discuss in the group whether you find the implementation of the solution realistic. Write down some pro & contra points.

Pro/Contra:

For each measure, a balance must be struck between economic and social acceptance and positive benefits for the environment. **Danger:** If the measure is too extreme, it will meet with little acceptance. On the other hand, most widely accepted measures have little measurable positive impact on the environment.