Widening Interdisciplinary Sustainability Education

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Foreword

Sustainability is not something that can be taught. This may be an odd statement to start off a foreword to a book that seeks to enhance the capacities of academic teachers and trainers to facilitate interdisciplinary education that focuses on sustainability.

Ultimately, a more sustainable world calls upon our ability to learn to continuously respond to dynamic global challenges and our willingness to engage in such learning. Viewed as such, sustainability is a continuous search with temporary outcomes that, at best, that need to be recalibrated and reconsidered as the world changes. Sustainability is not a destiny that, once we arrive at it, invites us to celebrate and enjoy our achievement. Sustainability is a dynamic concept that from an educational perspective is attractively vague: it is a concept in search for meaning. This meaning is fluid and changes with time and place; it is highly contextual. Those who like crisp, clear definitions and require strict boundaries and distinctions, will find this challenging. Especially the world of science is dominated by people who have mastered the art of drawing boundaries, making distinctions, dissecting wholes into parts, and viewing the world as a three-dimensional clock consisting of variables and causalities whose properties and interactions can somehow be measured with statistical accuracy, which, in the end, will help "us" manage and control reality in a "responsible" way. We can call this way of thinking "positivist", empirical analytical, reductionist and cybernetic. Leaving aside the undesirable spin-offs of this "engineering mindset", this genre of thinking has made miraculous innovations possible and, for one, allows me this morning to type this foreword on my computer, before sending it via cyberspace to the editors.

The problem of today is that sustainability challenges, however ill-defined they may be, are real and urgent, and demand a WISE response. Such a response cannot be the optimisation of reductionism but rather requires a transition towards, what we might call, mindful holism. Dealing with global systemic dysfunction and making living on the planet lighter and more equitable requires that we get better in crossing boundaries, seeing connections and building relationships, but also in asking difficult and even disruptive questions like: Why is living unsustainably made so easy? What kinds of values are we teaching and marketing? What routines, mechanisms and structures are in place that make unsustainability the default, the norm? What needs to be done to transgress and transform them? What is the moral compass that guides us as we innovate, make choices about what we eat, how we move and use energy, *etc.*?

Education for sustainability or for co-creating a more sustainable world is not about adding new knowledge and information to an already infinite pile. As Edward Osborne Wilson so eloquently put it; "We are drowning in information while starving for wisdom". In the post-truth era, where alternative facts distract people from engaging in the questions raised above in order to maintain the status quo that benefits the short-term interests of only few, the education we need ought to be critical, responsive, responsible and, indeed, reflexive.

As higher education is looking beyond science for impact factors in journals and for ways to address the UN's Sustainable Development Goals, this handbook provides an excellent starting point for the kind of boundary crossing that is needed as humanity is looking for ways to live healthily, happily and equitably within planetary boundaries. Higher education in particular has a role in contributing to such a world helping young people learn, unlearn and relearn.

Clearly, sustainability education is more than adding another critical issue of new content to an overcrowded curriculum, it is also more than

educating *for* a noble cause, it is, rather, a catalyst for rethinking teaching and learning altogether with people and planet in mind. Indeed, this handbook rightfully calls for a widening of sustainability education to allow for critical engagement in the key issues of our time. Such widening does suggest that disciplines need to be connected, which is the main focus of the handbook, but even more so, that we create learning spaces and environments that allow for experimentation, interrogation, making change, as well as engagement in ethical issues and moral dilemmas. So let the widening continue and let this kind of transformative, transboundary and, indeed, transgressive education become the new norm as we stumble towards a world that is more sustainable than the one currently in prospect.

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Preface

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The final document of the United Nations Conference on Sustainable Development in 2012 (Rio+20) starts with the words "The future we want: our common vision", followed by the commitment to sustainable development, which ensures a sustainable future for our planet and for present and future generations. This document reaffirmed and renewed previous political commitments and declarations of global society towards sustainable development (SD) (United Nations 2012). In the decades since the Rio conference on Environment and Development in 1992, it has become obvious that environmental problems are not imaginary, and that they are deeply rooted in day-to-day economic, political and social activity.

Seven years before Rio+20, in 2005, education and environment Ministers from across the UNECE (United Nations Economic Commission for Europe) region adopted the UNECE Strategy for Education for Sustainable Development (ESD). The strategy aims to ensure that policy frameworks enable education for sustainable development at all levels of formal and informal learning, provide support for educators in the field of sustainable development and facilitate access to adequate teaching aids and educational materials needed. The "Learning from each other" approach and collection of "Good Practices in ESD" are fundamental in the strategy. These good practices and shared experiences described in the strategy are concrete examples of successful implementation of ESD in different fields and sectors in Europe, from the political to the school level, and including formal, non-formal and informal (United Nations 2009) learning situations. However, in order to fully implement the strategy, more emphasis on the "Learning from

each other" approach is needed. Learning from each other was the guiding principle in the Widening Interdisciplinary Sustainability Education (WISE) project which resulted in this handbook.

In January 2016 the WISE project participants – university teachers and researchers from five different European countries and representing several different disciplines – met in Warsaw to get to know each other and discuss the implementation of ESD Strategy within the project. Even though we all had a common vision: to produce teaching materials (i.e. the WISE handbook), we struggled with our various professional languages, perspectives and disciplinary driven paradigms during the project. That was the challenge we experienced, discussed and treated as good practice for working within multidisciplinary groups. Together – with a great will to cooperate and openness to learn from each other – after (only) 2 years we got to this final output.

The most important recommendation in ESD is to mainstream sustainability into the curriculum at all levels of education. After the Decade of ESD (2005-2014), UNESCO introduced The Global Action Programme (GAP) on ESD, one of the main aims of which was to enhance the capacity of educators and trainers as ESD facilitators[1]. The Roadmap for implementing GAP as well as the ensuing documents of UNESCO (2017, 2018) urge many stakeholders, also Ministries of Education and higher education institutions to engage in collaborative and transformative knowledge production towards sustainable development.

As representatives of academic faculty, we believe that particular attention should be given to raising awareness of ESD among university employees. It becomes clear with the motto: Sustainability begins with teachers!

The WISE handbook contributes to those needs, by raising the general capacity of academic teachers and trainers to conduct interdisciplinary education focused on sustainability. To address complex environmental issues, such as climate change, pollution, depletion of

[1] The GAP aims to contribute substantially to the 2030 agenda, through two objectives (1) Reorienting education and learning so that everyone has the opportunity to acquire the knowledge, skills, values and attitudes that empower them to contribute to a sustainable future; (2) Strengthening education and learning in all agendas, programmes and activities that promote sustainable development (UNESCO 2014).

natural resources or biodiversity decline, as well as the economic and social dimensions of sustainability, we need to teach students an approach to interdisciplinary thinking and demonstrate the insights through courses and programmes that derive from many different disciplines. We believe that the interdisciplinary way of teaching is required for ESD, as it refers to the integration of information, data, techniques, tools, perspectives and theories from natural and social sciences. We believe that sustainability is a meta-discipline (or way of thinking) drawing on nearly all of the existing human knowledge to support an understanding beyond the scope of one single discipline.

Among many handbooks on sustainability and education for sustainable development published over the last 10 years that we are aware of, the WISE handbook appears special in several aspects. Instead of providing more knowledge and information on sustainability itself, each chapter presents interdisciplinary perspectives on sustainability and the special paradigm of ESD. Emphasis is put on building skills in the core competencies (ESD competencies) required for successful engagement with broad sustainability issues. This handbook is based on the case method (case-based methodology – CBM) that aims to engage students and participants in solving complex sustainability problems. Instead of the wealth of academic knowledge provided by many other academic books, the WISE handbook simply gives instructions and useful educational materials with recommendations about how to manage the classroom and how to achieve a better understanding among students with difficulties of achieving solutions to complex sustainability problems. It also gives suggestions (procedures) with tips and step-by-step instructions on how to conduct each lesson.

Moreover, a unique characteristic of the WISE handbook is its usefulness for a wider audience (not only academics, who are focused on environmental problems). That is why we believe it can be treated as a manual for all kinds of teachers (trainers, leaders) who would like to introduce the case studies and problems connected to sustainability in their classes. Additionally, we envision the handbook as an open project, meaning that particular cases and their associated lesson plans (most of which are based on real-world situations) can be modified,

combined or divided in different ways to suit the purposes of a particular course or teacher. We also believe that the development of the handbook is an ongoing project to which new cases can be added, and for which improved teaching procedures may be developed as we learn how students respond to the cases and lesson plans provided within it. We are happy to continue this work in the future, so please do not hesitate to contact us with feedback or ideas.

The book comprises three parts. The first few introductory chapters delineate the interconnections and interrelations between the "three pillars" of sustainable development. The chapter "Sustainability and historical context" by Alex Koutsouris gives background information on the history and definitions of sustainability, sustainable development and ESD. The next chapter, "Sustainability and social dimensions of planning" by Katarzyna Iwińska and Michael Jones, touches the problems of social complexity, environmental democracy and a demand for citizen participation. As we know, social complexity can create "wicked problems" for sustainability and is strongly influenced by the cultural differences of stakeholders, their perceptions of problems and their interests in particular outcomes. The following chapters are aimed at the challenging task of changing the educational paradigm. The context of ESD is presented in the chapter titled: "Sustainability and an educational perspective: roots in environmental education" by Jan Činčera and Peter Aspengren. Next, Natalie Jellinek focuses on teachers' roles, their capabilities and competencies in sustainable development. The final introductory chapter is written by Clara Vasconcelos, Joana Faria and Alexandra Cardoso to present the idea of the case-based method which is used as the main strategy in the next chapters.

The second part of the handbook consists of 13 cases, each of which is presented in the form of a lesson plan with background information, additional sources, questions to answer and literature for further reading. The cases are categorised according to the five core competencies for sustainability and the sustainable development goals that the cases most clearly relate to. As mentioned earlier, these cases/lesson plans can be used exactly in the way described below or modified to meet other aims (or SD goals).

The third part aims to show WISE experiences during the testing phase of the project. Most cases were trialed among university partners; a few were also tested on different groups of students (interdisciplinary) – some of the conclusions drawn from the tests are included in the book.

The last part "Integrating education for sustainable development at the programme level…" by Peter Aspengren tells the story of successful ESD implementation in SLU. This also presents some tips and guidance for development of programmes and courses in other countries.

This book, entitled *Widening Interdisciplinary Sustainability Education*, aims to fill a gap in the literature on sustainable development through its focus on education and the interaction between students and teachers in a classroom environment that encourages them to see things from different perspectives, think "outside the box" and propose innovative solutions. We especially recommend this book to the readers, whose aim is to empower new agents of change and develop students' generic competencies for our common future.

We would like to express our gratitude to several people and institutions that directly or indirectly helped us during the project and with the preparation of the handbook. We thank the administrative staff of our universities for their kind help. We would like to thank Francisco de Calheiros and his daughter, Cristina Calheiros for hosting WISE project participants at the lovely mansion Paço de Calheiros and sharing their thoughts on sustainability. We are grateful to the managers of the Kapraluv Mlyn Scout Environmental Education Centre for providing an inspiring working environment and Codogni Company management for giving us a guided tour of the rail sorting yard and forge to start a discussion on sustainable entrepreneurship.

We also thank all lecturers invited to the WISE workshops for their insightful talks. Thank you ALL for sharing your experiences with us.

Personally, I would like to give my specilal thanks to all participants and national leaders, professors Jan Činčera, Alex Koutsouris, Grzegorz Mikusiński and Clara Vasconcelos, for supporting WISE

with their expertise and constructive, open exchanges throughout our cooperation.

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Part I

Introduction

Chapter 1

Sustainability and Education: a short introductory note

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This chapter uses the example of agriculture to present sustainability issues, reviews the history of sustainable development and the convergence between sustainable development and ESD as a means of addressing environmental issues. The urgent need for a shift towards a holistic and inclusive approach to sustainability is exemplified by the current state of the planet.

According to the Brundtland Commission (1987: 41), “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of »needs«, in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs”.

Perceptions and understanding of sustainability have changed considerably since 1987 and while the basic concepts are sound, approaches to achieving sustainability are shifting towards methods for dealing with social and environmental complexity. This shift is recognised in the UNESCO definition of Education for Sustainable Development (ESD):

> "ESD empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning

> content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society." (UNESCO 2014).

The common way of thinking about nature and the relation between humans and nature, or humans and their environment, has created conditions for the achievements of our time, but has also created the current problems. For example, it is clear that modern (productivist) agricultural systems which have been developed on the basis of the profligate use of water, energy and agrochemicals, have disrupted delicate balances through soil erosion and the pollution of water and air. Modern agriculture has become both a major source of pollution and a victim of pollution.

The Brundtland Commission (1987) identified unequal development as the root cause of environmental problems and recommended the revival of economic growth with a change in its quality. The Commission called for basic needs to be met, for populations to be stabilised, for resources to be enhanced and conserved and for technology to be reoriented, but its attempts to reconcile the environment and development and the perspectives of the North and South had limited success.

Indeed, in the era of late ("reflexive") modernity, there is a growing conviction that sustainability is an idea whose time has come; the concern for sustainability has become global. Sustainability has become a highly controversial theme; it is a powerful but vague and contested concept that is complex and full of contextual contradictions. Thus many definitions of sustainability have emerged as a result of the fact that, on the one hand, weighing up parameters (i.e. social, ecological and economic parameters of systems, entities, or phenomena) will always be subject to negotiations and trade-offs and, on the other hand, it is unavoidably related to various environmental ethics (Carley & Cristie 1992).

According to UNESCO (1997), the present unsustainable global situation may be well-defined as a civilisation crisis; a crisis that has built up from values and knowledge which have narrowly served the maximisation of economic benefits and technical efficiency on the expense of nature, complexity and diversity. For example, as aforementioned, agriculture, in its present form is not sustainable. This is related to the

so-called “agricultural treadmill” (Cochrane 1958), i.e. on the assumptions of economics with respect to human rationality or to the exclusive focus of conventional agricultural development on techno-science and economic productivity at the expense of ethical and cultural considerations. This is so since agrarian sciences have until recently been dominated by instrumental rationalist knowledge, i.e. the (dominant) paradigm of experimental – reductionist science. Despite the fact that the achievements of positivism have been dazzling, alternative proposals have flourished, since the 1970s, based on the realisation of the inadequacy of linear and mechanistic thinking in understanding the source and the solutions of problems. Nowadays, it is understood that biophysical problems are not isolated but are likely to be associated with problems of social change and stress which, in turn, means that social and ecological systems have to be treated as a single coupled and dynamically complex system. Systems thinking is a way of seeing and understanding complexity and, thus, for understanding reality. Hence the call for a complex systemic approach to both science and practice (Gallopin *et al.* 2001).

The complexity of sustainability calls for the close examination of the dynamic balance among many factors, such as political, technological, economic, ethical, cultural and environmental. Through the recognition that the present crisis is structurally anchored in society, answers are sought in working to transform the structures which perpetuate unsustainable practices.

Operationally, the list of SDG goals agreed upon by the UN Statistical Commission in March 2016 is as follows:

Goal 1: No poverty
Goal 2: Zero hunger
Goal 3: Good health and well-being
Goal 4: Quality education
Goal 5: Gender equality
Goal 6: Clean water and sanitation
Goal 7: Affordable and clean energy
Goal 8: Decent work and economic growth
Goal 9: Industry, innovation and infrastructure
Goal 10: Reduced inequalities

Goal 11: Sustainable cities and communities
Goal 12: Responsible consumption and production
Goal 13: Climate action
Goal 14: Life below water
Goal 15: Life on land
Goal 16: Peace, justice and strong institutions
Goal 17: Partnerships for the Goals (United Nations 2015).

Yet, sustainability is to be conceived as a process rather than a set of well-specified goals; a continuing process of questioning, discussion, participation, planning and engagement into appropriate action in order to modify processes in nature, the economy and society[1].

Learning is often said to be a crucial key or the locus for creating a more sustainable future (UNESCO 2004) and UNESCO (2014) found that, at the end of a ten year process of integrating sustainable development into education, the two issues were converging. The Global Action Programme (GAP) (UNESCO 2014) continues to contribute to achieving the vision put forward by the UN Decade of ESD: "a world where everybody has the opportunity to benefit from education and learn the values, behaviour and lifestyles required for a sustainable future and for positive societal transformation". The issue of learning has been focal in 'transition' studies concerned with (radical) innovations aiming at sustainable development, such as Strategic Niche Management (Caniëls & Romijn 2006; Mourik & Raven 2006; Wiskerke & Ploeg 2004) and Bounded Socio-Technical Experiments (Brown & Vergagt 2008). In particular, "social (or societal) learning" (SL) is defined as "the collective action and reflection that occurs among different individuals and groups as they work to improve the management of human and environmental interrelationships" (Keen *et al.* 2005, p. 4).

Social learning advocates an interactive (participatory) style of problem solving in which stakeholders create their vision, act and review changes, with outside intervention taking the form of facilitation (Leeuwis & Pyburn 2002) supporting multiple loop learning (Argyris & Schon 1996)[2] or adaptive learning (Webler *et al.* 1995). Social learning denotes

[1] For a review of the concept see Buttel (1998) as well as Giddens (2011).
[2] Bateson (1972) distinguished three orders of learning and change. First order or basic learning deals with matters of everyday concern, and makes no difference to the dominant

a form of network[3] seen as an active, transformative process which allows stakeholders to engage in concerted actions that lead to sustainable development. For Roling (2002, p. 35) "social learning can best be described as a move from multiple to collective and/or distributed cognition". That is, stakeholders, each with their own cognition, may develop 'distributed' cognition, i.e. a situation where ideas, values and aspirations need not be shared but overlap or are mutually supportive. Moreover, progress towards sustainable development depends ultimately on removing "inner constraints on our vision and values" (Reid 1995, p. 236).

In the same vein, Tilbury and Wortman (2004) describe the key abilities which students should acquire through education for sustainable development as follows: the ability to create visions – being able to imagine the future, assuming that if we know where we want to go, we will find it easier to plan how to get there; critical thinking and reflection – the ability to question the current belief system and to recognise the assumptions of knowledge, perspectives and opinions. This ability should facilitate learning how to study social structures, as well as environmental (local), economic and cultural ones, in the context of sustainable development; systems thinking – the ability to understand and seek links and synergism during problem-solving; the ability to build partnerships, promote dialogue and negotiations – being able to cooperate; involvement in the decision process – "empowering people".

More recently Sterling (2014) proposed critical reflexivity as a process based on a new paradigm for integrating knowing, seeing and doing as an alternative to long lists of competencies that lack the depth necessary to bring about transformational change. Seeing addresses problems of egocentrism and lack of broad vision, knowing addresses problems of overspecialisation and the inability to think systemically, and doing addresses problems of design, decision-making and influence

paradigm but uses adjustments or adaptations to ensure stability. Second order learning relates to systemic change; it concerns fundamental questioning and re-orientation of assumptions. Third order or epistemic learning relates to a complete change of worldview. Similarly, Kitchener (1983) distinguishes between cognition (learning level one), meta-cognition (learning level two) and epistemic cognition (learning level three).

[3] In the same vein, Communities of Practice (CoPs), for instance, are described as people engaged in a process of collective learning in a shared domain of interest (Wenger *et al.* 2002).

in ways that promote synergystic behaviours that add to the overall systemic well-being (Sterling 2014).

With respect to agriculture, which has served above as an example of unsustainable systems, and regarding its transformation to sustainable farming Röling and Wagemakers (1998, p. 7) underline five interlocking dimensions:

1. Agricultural practices, both at farm and higher system levels;
2. Learning those practices;
3. Facilitating that learning;
4. Institutional frameworks that support such facilitation, comprising markets, science, extension, networks of innovation etc.; and, especially
5. The management of change from conventional to sustainable agriculture along each of the dimensions.

In addition, they claim (*op. cit.*, p. 26) that sustainable agriculture further needs to pursue the following farming objectives systematically:

- The full participation of farmers and rural people in all processes of problem analysis, and technology development, adaptation and extension;
- A more equitable access to productive resources and opportunities, and progress towards more socially just forms of agriculture;
- A greater productive use of local knowledge and practices, including innovative approaches not yet fully understood by scientists or widely adopted by farmers;
- An increase of self-reliance amongst farmers and rural people;
- An improvement in the match between cropping patterns and the productive potential and environmental constraints of climate and landscape to ensure long-term sustainability of current production levels[4].

It seems, therefore, necessary to rethink development in order to find new visions and new directions for change. Theoretical debates on Beck's thesis of a "world risk society" (Beck 1995) and critiques of ecomodernism (Lash *et al.* 1996), the constructivist ethos of sociology of

[4] See also the Convention on Biological Diversity summarised in the 12 principles of the Ecosystem Aproach (Secretariat of the Convention on Biological Diversity 2004).

science and technology (Funtowicz & Ravetz 1993; Gibbons *et al.* 1994; Jasanoff *et al.* 1995), along with questions related to local responses to globalisation (i.e. participation, innovation, management strategies, etc.) provide hints to such revision / redefinition of the development process. The rise of reflexive modernisation means that people acquire the ability to reflect on social conditions and change them as a result. The possibility of a creative self-destruction of modern societies from which more sustainable alternatives could emerge should not be dismissed.

In this respect the reorientation of formal education to sustainability is a major issue; education is widely accepted as being a key policy instrument for starting the uphill climb towards sustainability (UNESCO 1997, p. 16). It is essential in providing a critical reflection of the world, promoting greater consciousness and awareness, and inventing new techniques and tools thus enabling people to make informed and ethical choices. In other words, it increases people's concern over unsustainable practices as well as their capacities to transform their visions of society and confront and master change. Especially higher education has a dual role; it concerns both research and the training of specialists and leaders in all fields (*op. cit.*, p. 29).

Chapter 2

Sustainability and social dimensions of planning

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This chapter describes the social complexity of environmental management that can make finding solutions to sustainability issues so challenging and that requires a change in practice from expert-driven to participatory problem solving approaches. Social complexity is presented as one of the characteristics of human society that create "wicked problems" for planners and decision makers. Democracy in environmental management is proposed as a way of finding solutions to "wicked problems". Participation, empowerment, facilitation and conflict management are presented as ways of enhancing democracy and social learning. ESD can contribute to creating a change in the mindset of environmental management authorities by highlighting social complexity, environmental democracy and some of the tools that can be applied to enhance democracy and social learning so that society is better able to adapt to environmental changes created by the Anthropocene.

When tackling the issue of sustainability we take into account three pillars in which ecological, societal and economic issues are treated equally. But nowadays, in the epoch called the Anthropocene (Crutzen 2002, Zalasiewicz *et al.* 2010), it is evident that human impacts on the biosphere have increased to the point where major changes threaten the future of humanity (Steffen *et al.* 2015).

The difficulties of managing environmental change were described by Rittel & Webber (1973) who coined the term "wicked problems" to define the complexity of the social dimensions of planning. Definitions of the problem and the solution for managing a particular issue are determined by culture, which shapes people's beliefs, values and cognition. This constitutes the social complexity of sustainable develop-

ment and leads to conflict in situations where stakeholders from different cultures are seeking solutions to an environmental problem. One way of dealing with social complexity are democratic regimes that introduce the new ways of understanding and dealing with the intertwined natural and human forces. Application of Sterling's (2014) model of critical reflexivity builds a democratic regime and the essence of some of these new ways are described by Wiek, Withycombe & Redman (2011) as the core competencies for sustainability.

Environmental / ecological democracy

A classical concept of democracy which is "a political system in which opportunity to participate in decisions is widely shared among all adult citizens" (Dahl 1963, p. 8), nowadays is still valid although not satisfactory for the civilisational and developmental challenges.

A strong focus in environmental democracy is put on "actions [that] are guided by understanding natural processes and social relationships within our locality and the larger environmental context" (Hester 2006, p. 4). It means that not only political processes of participation are important but also information and rights for stakeholders to act and influence the proposed changes in their local and regional landscape and environment.

The idea of environmental democracy is implemented by European environmental law (especially: Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters known as the Aarhus Convention) which includes 3 main public rights:

- access to information,
- participation in decision-making
- and access to justice in environmental matters (European Parliament 2016).

A matter of special importance is empowering minorities and underprivileged groups in democratic processes of decision making. Interested parties have the right to express their views on the protection of social security, cultural or natural heritage. Since environmental democracy protects the rights of a variety of minorities, a group that cares

for local habits and locally based interests as well as the group of environmentalists (ecological NGO), preserving the elements of the natural world are equally heard. However, in the sites of the European network of protected areas Natura 2000[1] ("Natura 2000"), the "louder" voice is on the side of the ecological and natural heritage specialists. This does not mean, however, that the voice of the minority – local residents –no longer counts. The Białowieża Forest case, which is described in Part II (Case 2), is one of many examples that show how conflict between different local stakeholders escalate. Usually, local conflicts have environmental consequences at a regional or global scale.

In general, equal rights are crucial for everyone in the environment debate. The main aim of environmental democracy is to assure a political process in which different minorities and guardians of future generations can participate and deliberate for the welfare of all. A fundamental assumption is to communicate the views and voices of various social groups: community groups, advocates, industrial leaders, workers, ecological organisations, academics, experts and local authorities, but also a wide range of interested communities (including ordinary residents, whom we can call "experts on their area of living").

It is crucial to inform and engage the broadest possible decision-making community, involving primarily groups of people who may be affected by the proposed changes or project, investment or environmental change (Iwińska & Troszyński 2014; Maciejewska & Marszałek 2011; Mason 1999). Tilbury (2011) shows that higher levels of participation (democracy) and engagement in the issues lead also to the improvement of community members' livelihoods. ESD can mobilise people's participation in sustainable development and their problem-solving capacity. "The ESD literature frequently calls for processes of collaboration in order to maximize capacity and increase engagement in learning geared to sustainable development" (Tilbury 2011: 20). In order to achieve this, more emphasis should be placed on multidimensional democracy education, conflict resolution skills and citizen science with the principles of environmental protection.

[1] "Natura 2000 is a network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right" (European Commision 2008).

Participation and Empowerment

Participation is one of the democratic means of decision-making, which is increasingly recognised "an essential mean and end to the development of the social dimensions of sustainability" (Stiglitz 2002; Finger-Stich & Finger 2003, p. 1). This way of reasoning is the basis of Agenda 21 (see chapter 8: Integrating Environment And Development In Decision-Making) (UN Documents Cooperation Circles 1992) recommending that government action toward sustainability should be formulated at the lowest effective level and effective changes can be generated by smaller groups that exercise symbolic or actual power (Bourdieu 1989, p. 21)[2]. The description of the gender roles in Shinyanga (lesson plan 3) is an example of symbolic power and the outcome of participatory approaches began to change a situation that was disadvantageous to women. Although participation is of great importance, it is also difficult to practise, because of the different and often conflicting values of many stakeholders.

Sherry Arnstein's (1969) classical typology identifies eight categories of non-participation, tokenism and participation that range from manipulation or therapy for the disempowered, to citizen control. Partnership is the basic level for participation and empowerment in decision making processes. Effective partnership requires the establishment of new organisations such as boards and committees where power, the development of rules for managing conflicts and effective decision-making are evenly distributed. A solution to a socially and ecologically complex problem is negotiated on a "give-and-take" basis. Cultivating trust through the development of rules, experiential and experimental learning about the change process, building collaborative connections with policy makers and understanding the role of power imbalances in creating conflict, are important aspects of effective participation for collaborative management (Armitage *et al.* 2009).

[2] Symbolic (or soft) power exists where the position of a dominator is maintained by the dominated in the exchange of social value between them.

Managing Conflict

Participation and empowerment cannot occur unless participants adopt facilitative actions, ideally with the support of a neutral facilitator who manages the group process and conflict. Facilitation is a practice for effective group work that encourages participants to share responsibility for the outcome of a discussion, have a collaborative attitude, practise facilitative behaviour to the group process, and to think strategically about ways of resolving conflict. Facilitation is based on three principles for effective group work and a set of supporting rules (Schwarz *et al.* 2005, p. 6).

1. Valid Information
    - Share all relevant information in a way that others can understand it, and validate it independently.
    - Continually seek new information to determine whether previous decisions should be changed.
2. Free and Informed Choice
    - Individuals define their own goals and methods of achieving them.
    - Choice is made without coercion or manipulation and is based on valid information.
3. Internal Commitment
    - Individuals feel personally responsible for their decisions.
    - Decisions are intrinsically compelling or satisfying.

In the event that conflict occurs, the facilitator first seeks to identify the issues that lead to the conflicting positions and then to identify common ground and ways of testing differences of opinion. This process is designed to change perspectives by drawing participants away from a defensive attitude with regard to their positions, towards a collaborative attitude for solving the problem on a give-and-take basis.

The principles for effective group work, together with their supporting ground rules and conflict negotiation approach, create an environment of trust within which stakeholders can speak openly, sharing perspectives and ideas that they would not otherwise mention for fear of social sanction. Good facilitation guards against disciplinary and professional hubris, which are manifestations of personal power and a mindset that

is closed to the perspectives and knowledge of others. The first phase of development in the Shinyanga case and the highly undesirable social, ecological and economic outcomes are an example of what can happen when "expert" knowledge is applied in an authoritarian manner. Subsequent restoration of Shinyanga was based on participatory processes in which local knowledge and the knowledge of technical experts blended to create a new (and so far) successful approach to development.

Good sustainability practices can be seen as a participatory approach that transcends the boundaries of academic disciplines, professional skills and the experiential knowledge of local people, creating a social environment within which conflict is negotiated and innovation can arise. This is why, we believe the comprehensive key competency is problem-solving competency (Warburton 2003; Dale & Newman 2005), which is mainly practical and prevails over the five ESD competencies (described in next chapter: Sustainability from an educational perspective).

Changing Mindsets

Sustainability in the 21st Century requires a change in the industrial age mindset that led to both the enormous success of economic development, and to the unintended negative consequences of the Anthropocene (Steffen *et al.* 2015), together with growing inequity and decline in social justice on a global scale (Raworth 2017). Such changes are based on the double loop learning theories of Argyris (1976) in which current views and underlying assumptions are questioned and tested. Mindset change within individuals can occur almost instantly, while in societies it is the most difficult change to create because it requires widespread change in large-scale and interconnected systems (Meadows 2008).

Education for sustainability has the potential to make a significant contribution to the change in mindset that is required for humanity to achieve sustainability in the 21st Century by training young professionals and academics in the approaches and competencies necessary to solve complex problems. Explicit recognition of social and ecological complexity, the adoption of a problem solving approach (Warburton

2003; Dale & Newman 2005), and development of the skills necessary to solve complex problems, is creating a paradigm shift in society. Creating participatory approaches that build trust and empower all sectors of society is a significant departure from authoritarian, expert driven approaches to solving sustainability problems.

Chapter 3

Sustainability and an educational perspective: roots in environmental education

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The roots of education for sustainability development (ESD), a driving approach applied in this handbook, lie in environmental education (EE). While EE and ESD differ in some of their aspects, they both share a focus on shaping a human's ability to deal with various issues endangering a sustainable future. In this chapter, we briefly describe how environmental issues are reflected in EE theory and practice, and how some of the EE approaches formed the basis for ESD. Then, we focus on the basic principles of ESD and the way it is implemented in higher educational institutions.

The increase in people's awareness of the worsening of various social and environmental problems has found its response in educational movements since the early 1970s. In the Tbilisi declaration (1977), one of the founding documents of EE, it is stated that the purpose of EE should be to raise people's awareness of the economic, social, political, and ecological interdependence of things and to "emphasize the complexity of environmental problems (…) to develop critical thinking and problem-solving skills".

This effort was followed by the development of a large number of specific instructional / learning strategies or methods for dealing with global and local environmental and social issues. In the context of EE or global (development) education, discussion activities, simulation games and role-playing games have become popular tools, and they have been described in many educational publications (e.g. Pike & Selby 1988; Jiménez-Aleixandre & Gallástegui-Otero 1995; Meadows *et al.* 2000; System Dynamic Society 2016).

Besides discussion-based activities, further instructional / learning strategies have been developed. In the Issued Investigation and Action Training Model (IIAT) and in the Extended Case Study Model which were developed in the 1980s by Hungerford, Volk, Marcinkowski and others, students learnt to differentiate between environmental issues and the skills needed for their investigation. In the following stage, they practised the acquired skills by investigating a real-life issue of their choice, presented their findings, and – if they were interested in doing so – prepared an environmental action project (Ramsey & Hungerford 1989; Hungerford & Volk 1990; Marcinkowski 2001, 2004; Bardwell, Tudor & Monroe 1994). Both these models have been repeatedly evaluated and confirmed as to their effectiveness in terms of students' intention to act, locus of control, perceived action skills, knowledge, and other variables (Hungerford & Volk 1981; Ramsey 1993; Culen 1994; Hsu 2004; Volk & Cheak 2005).

In the 1990s, Jensen, Schnack and other authors (Jensen & Schnack 1997; Mogensen & Schnack 2010; Breiting & Mogensen 1999) suggested replacing the prevailing behaviouristic orientation of EE by the *action competence approach*. The authors suggested that EE focus primarily on empowering students by teaching them the competence they would learn and practise through taking action, i.e. students should not only learn *about* environmental issues but should do so *through* participating in actions intended to change something in the real world, through the process of learning by experience.

The concepts of the competence approach and of action-based education have become the core of the emerging concept of education for sustainable development (ESD).

Education for Sustainable Development

Education for Sustainable Development is a vision of education that "seeks to empower people to assume responsibility for creating a sustainable future" (UNESCO Jakarta 2016). Although the intentions and values of ESD have been discussed (McKeown & Hopkins 2003) and questioned by some scholars (Robbotom 2007; Kopnina 2012; Kopnina

& Cherniak 2016), it has evolved into an educational approach that is now used worldwide.

Although the goals, content and methods of ESD are not strictly defined, some features tend to dominate in its theoretical reflection and practice. ESD seeks to achieve societal transformation and meet global challenges, including climate change, the loss of biodiversity, disaster risk and others (UNESCO 2016a, b). Rather than setting specific objectives, ESD promotes general competences relevant for empowering people to take responsible action. So far, the specification of ESD competences is still a matter of discussion, but several different lists of ESD competences exist (Wiek *et al.* 2011; Rieckman 2014, 2015; Barth *et al.* 2007).

However, as we could see from a comparison of some of the competence models, while there may be differences in highlighting particular competences in different lists, there are also many similarities. In addition, individual competences sometimes interact and overlap with some of the others (see Table 1). Because of this, while we decided to use the set of competences defined by Wiek *et al.* (2011) in this handbook, we assumed that the outcomes of the presented cases could easily be linked and compared with other sets.

De Haan "Gestaltungskompetenz" Shaping competence (Barth *et al.* 2007)	(Wiek *et al.* 2011)
Foresighted thinking (B)	A – Systems-thinking competence
Interdisciplinary work (A, C, D)	B – Anticipatory competence
Trans-cultural understanding and cooperation (C, E)	C – Normative competence
Participation (D, E)	D – Strategic competence
Planning and implementation (D)	E – Interpersonal competence
Empathy, compassion and solidarity (C, E)	
Self-motivation and motivating others (D, E)	
Reflection on individual and cultural models (A, C, E)	

Table 1. Comparison of de Haan's and Wiek's list of ESD competences

Although the ESD competences bring new insights into the field, in some cases their meaning is very close to the general competences that had already been recommended for Higher Education Institutions (HEI's) without any "sustainability" connotations (e.g., critical thinking). We should also mention that the "competence approach" includes the necessity of subject knowledge (e.g., learning about sustainability).

In light of this, we call for a flexible approach in HEI's educational practice so as to focus more on the interpretation of the meaning of a particular competence and the way it shapes the educational unit rather than spending much time on looking for its precise definition. The competences to be learned by students from an ESD perspective and the competencies required of educators to work with students in the ESD paradigm are discussed in Chapter 4.

Although ESD points to global issues, it is often based on local needs (UNESCO Jakarta 2016). Rather than awareness-based, it tends to be action-based. Students are encouraged to identify the unsustainable patterns in their community, to formulate a vision of the community's sustainable future, and to take action towards the vision's fulfillment. The difference between teachers and students becomes blurred: ESD resonates with concepts of the participative, emancipatory approach in which teachers become facilitators rather than truth-holders (Wals *et al.* 2008). ESD is also often connected with community-based programmes that draw on the concept of social learning in which community members learn from one another in the process of seeking resilience (Wals *et al.* 2012).

In practice, ESD is based on the concept of the three pillars of sustainability – environmental (or ecological), social and economic – and it is enhanced when education programmes include activities with a local/global perspective in an interdisciplinary setting.

ESD at the Higher Educational Institution

Higher educational institutions (HEI's) have become one of the leading drivers for the transformation of educational systems towards sustainability. International initiatives like the UNESCO Chair in "Reorienting Teacher Education to Address Sustainability" or the UNESCO Chair of

"Higher Education for Sustainable Development" have put a lot of effort into promoting networking among HEI's and organising common projects and meetings (UNESCO 2016c). The process of the transformation of HEI's has been discussed by many scholars (e.g. Barth *et al.* 2014; Biberhofer *et al.* 2014; Dlouha *et al.* 2013; Mader *et al.* 2013; Ramos *et al.* 2015; Holm *et al.* 2015; Lozano 2014, 2016). Because the role of universities for ESD will be further elaborated on the following chapter, we would like to briefly identify the place this handbook may have in this effort.

From the early stages when ESD tended to be rather an element that was incorporated into HEI curricula and organisation, there has been a shift towards more integrative efforts. This effort encompasses "whole-of-university" approaches and "community outreach" (Barth *et al.* 2014). In community outreach, students merge their in-class lessons with service learning and community-based projects, typically identifying a local sustainability issue and learning through the process of tackling it. For example, at Leuphana University, all the Bachelor's-level students participate in an Education for Sustainable Consumption course. After a three-week phase of theoretical input and reflection, they are encouraged to find their own service-learning project with partners in the community (e.g. a coffee shop) and then reflect on the process and the results (Barth *et al.* 2014; Biberhofer *et al.* 2014).

The "whole-of-university" approach calls for a complex transformation of the HEI environment. As we could see, the community outreach approach resembles in many aspects the older EE approaches, focusing on developing students' competence for dealing with environmental issues. Such a transition assumes that all the HEI's key players are engaged and share SD values, that the HEI's vision, documents, and strategies are oriented towards ESD, the management and organisational structure support sustainability and are reasonably efficient (e.g. greening the campus, school cafeteria etc.), and that culture of collaboration is supported (Mader *et al.* 2013; Lozano *et al.* 2014; Mcmillin & Dyball 2009).

However, this shift has still not taken place at the majority of HEI's in the world as they continue to struggle with various barriers preventing them from adopting one of these approaches (Lozano 2006). In light

of these trends, the “cases” presented in this toolkit offer some help with a relatively moderate but still an important first step for transforming HEI’s towards ESD. From another perspective, they also reflect some of the methods typical for older EE approaches (role-playing games, discussion activities), while they also incorporate the competence approach typical for ESD discourse.

On the basis of our experience with the EE/ESD approaches described above, we conclude that the cases can be used to help students construct knowledge and also develop ESD competencies. Although our cases may provide a good opportunity for investigating a large variety of SDG-relevant issues, they could also be used as inspiration for original, locally-relevant learning units allowing students to launch their own “outreach action” based on service learning or community-based projects. This can be the next step towards changing university culture and launching the “whole-of-university” approach.

Chapter 4

Sustainability and the teaching context: the role of university educators

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"There is strong evidence of the importance of good quality and equitable education and learning in supporting social change, as well as the role of education as a cross-cutting means of advancing the 2030 Agenda" (UNESCO 2016).

This chapter discusses the role of teachers and teaching in Education for Sustainable Development (ESD), and the need to reorient educational programmes so that those engaged in higher education programs are empowered with the knowledge and skills that will enable them to adopt a holistic and inclusive approach to sustainability issues. This discussion includes the competences that should be acquired by students, the competences that teachers would need in order to empower students, as well as teaching considerations, including the learning environment, working across disciplines and matters of "intersectionality" where gender, ethnicity, class and other aspects of inequality intersect and affect teaching and learning.

Educators are powerful change agents, and higher education is an important platform through which we prepare today's students to become tomorrow's ethical leaders, decision makers, and professionals who will ultimately implement sustainable solutions to today's problems. In this context, Education for Sustainable Development (ESD), with its focus on both subject competence and teaching practice, plays a critical role in aligning today's educational programmes to the goals of Agenda 2030.

Using education as a bridge between worldwide goals such as the Sustainable Development Goals (SDGs) and in-classroom practice opens up questions regarding the pedagogical consequences of incorporating these perspectives into teaching. What role can educators

play, specifically through their teaching practice, in helping to achieve these goals? What kind of teaching will challenge today's students to become responsible problem solvers? How does ESD consciously translate into the teaching and learning aspects which shape the classroom? What kind of perspectives are important to consider and how do we foster an inclusive learning environment?

These are some of the questions one can have in mind when embarking on a teaching and learning journey informed and inspired by the pillars of ESD. These are also some of the questions that I have chosen to address in this text: the first section discusses ESD and links it to the teaching context, including student competences; the second section takes a closer look at the implications for teachers in terms of cross-cutting competences; the third section discusses teaching considerations and highlights student-centered teaching, the importance of the learning environment, and interdisciplinarity – all while underlining the importance of a gender and intersectional approach.

It is important to note, however, that there are no easy answers nor is there a one-size-fits-all model; on the contrary, appropriate practices very much depend on the context and target groups they are aimed at and should therefore be developed and adapted with this in mind. The following discussion and reflection provides some guiding ideas and parameters which might be helpful in this process.

SDGs and Education for Sustainable Development: the teaching context

The pivotal role of education in creating a more sustainable world is highlighted in SDG 4, which calls for providing "inclusive and equitable quality education and promot[ing] lifelong learning opportunities for all." Some of the more detailed targets within this goal outline actions by universities in particular, and several key points have direct implications for teaching and learning practices across higher education. In addition, and while education is the main focus of only one goal, it is very closely related to the other remaining sixteen outcomes and is an essential part of their successful implementation. This is because, as UNESCO argues, "quality education leads to improved development outcomes for individuals and, thus, communities and countries" (2011).

These include but are not limited to "better access to gainful employment, better nutrition and health, reduction of gender disparities, greater resilience in disasters, more engaged citizens, and so on" (UNESCO 2011).

Educating for the implementation of the SDGs is intimately aligned with the broader and well-established field of education for sustainable development (ESD); much can be drawn from already existing experiences related to this field. There are various definitions and interpretations of the term; according to Waas *et al.* (2012), ESD is considered to be:

> "…a transformative and reflective process that seeks to integrate values and perceptions of sustainability into not only education systems but one's everyday personal and professional life; a means of empowering people with new knowledge and skills to help resolve common issues that challenge global society's collective life now and in the future; a holistic approach to achieve economic and social justice and respect for all life; a means to improve the quality of basic education, to reorient existing educational programmes and to raise awareness…"

Several key points from this definition should be highlighted and further examined. One is the link and connection to personal and professional life: it is not enough to consider educational systems to be important for these policies; it is the integration of values and perceptions into the everyday decisions and individual doings that is vital. Secondly, students and their teachers should both be empowered to make a difference, that is, to develop their agency so that they seek to change and improve existing structures at the local, national, and global levels.

Last but not least, and much of what is the focus of this chapter, is indeed the need for a reorientation of educational programmes. This fundamental issue encompasses content and methodology and brings forth questions about how to raise awareness around critical issues for both our students and our university staff – notably, the competences that learners need to develop become of utmost importance.

The issue of learners' competences are further discussed in target 4.7 of the SDGs, where Education for Sustainable Development is explicitly named:

> "By 2030, ensure that all learners acquire knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human

> rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development" (United Nations, 2014).

Higher education's engagement with Agenda 2030 goes therefore further than looking only at teaching about sustainable development challenges: it presents teachers with an opportunity to work with students as partners in analysing how at the individual, local, national and international levels we can all become better in leading more sustainable lives. ESD is therefore about more than teaching about the content of the SDGs and instead about preparing today's students to tackle unresolved social, political, economic and environmental issues. Educators have a responsibility to engage students with today's global challenges, putting local issues in a global perspective in order to bring forward what could be considered a new way of "learning".

Students' competences from an ESD perspective

The type of learning outlined below should allow the learner not only to understand the content and context of the SDGs, but also critically reflect upon one's own choices and their possible impact on societies at both a local and global level. The upcoming section will address in more detail what working with these competences at the student level might entail for those involved in teaching them.

UNESCO (2011) outlines what these new ways of learning could be seen as:

- learning to ask critical questions;
- learning to clarify one's own values;
- learning to envision more positive and sustainable futures;
- learning to think systemically;
- learning to respond through applied learning; and,
- learning to explore the dialectic between tradition and innovation.

The new ways of learning might in themselves not be new; yet, it is their combination and interdependency which makes them a key contribution to the development of ESD. Clarifying one's own values for

one's self is central to understanding others and empathising with their struggles. Asking critical questions about the world we live in is what will allow our students to propose new ways of doing and being, envisioning a more positive and sustainable future.

The risk of not exposing our students to such questions and such "learning" is too great. Otherwise, "through a lack of opportunity for learners to question their own lifestyles and the systems and structures that promote those lifestyles [students could be] reproducing unsustainable models and practices" (UNECE 2011).

In their work, and very much related in tune with the work of UNESCO, Wiek *et al.* (2011) compared different ways of describing what could also be considered key competencies for sustainability. As discussed in detail in Chapter 3 by Činčera and Aspengren, these key competences are: systems thinking competence, anticipatory competence, normative competence, strategic competence, and interpersonal competence. For a more detailed description of what each competence entails, see chapter 3. The meaning and implication of these competences is context dependent: therefore, their definitions and use should be adapted and interpreted to reflect the local, national and/or university environments. One example of such an interpretation is an analysis by Lönngren *et al.* (2016) examining systems thinking competence as a tool to solve wicked problems in engineering education for sustainable development.

SDGs and cross-cutting competences for teachers

What competences do educators need in order to work with students within the ESD paradigm? A United Nations Economic Commission for Europe (UNECE) expert group outlined in 2011 a useful framework for such competences, which includes four learning domains and three different key axes for educators involved in ESD (see figure 1).

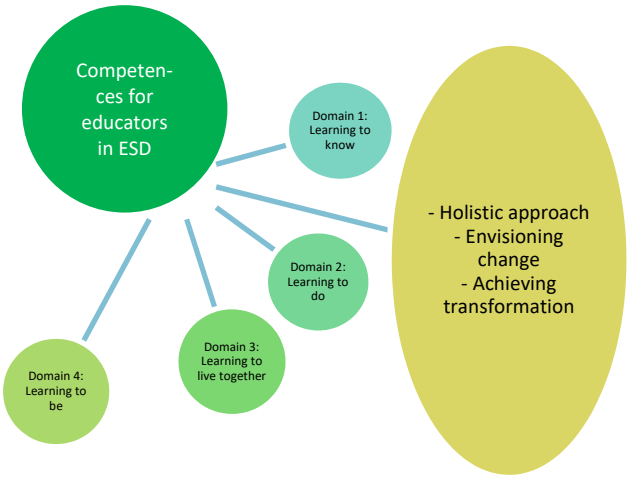

Figure 1. Different key axes for educators involved in ESD V, adapted from *Learning for the future: Competences in Education for Sustainable Development* (UNECE 2011).

The competences include the following domains:

Domain 1: ***Learning to know***, is defined as "understanding the challenges facing society both locally and globally and the potential role of educators and learners".

Domain 2: ***Learning to do***, is defined as "developing practical skills and action competence in relation to education for sustainable development".

Domain 3: ***Learning to live together*** "contributes to the development of partnerships and an appreciation of interdependence, pluralism, mutual understanding and peace".

Domain 4: ***Learning to be***, "addresses the development of one's personal attributes and ability to act with greater autonomy, judgement and personal responsibility in relation to sustainable development" (2011).

These four domains are each subdivided and organised based on key characteristics of ESD:

- a Holistic approach;
- Envisioning change; and

- Achieving transformation, which serves to change the way people learn and the systems that support learning.

A holistic approach

Under this category, competences sought are linked to integrative thinking and practice, inclusivity, and dealing with complexity. Integrative thinking includes having a systemic approach and being aware of the interdependence of generations. It also means being inclusive of different disciplines, cultures and perspectives while creating opportunities for exchange. Also important from an educator's perspective is allowing learners to connect their local and global spheres of influence while engaging them with conflicts and dilemmas. One such way of doing this in practice (as is the case with this handbook) is to work with real-life cases and problems, if possible from their local communities. By doing so, students are able to discuss the roles of likely stakeholders and apply a systems approach, highlighting how global decisions can have local impact.

Envisioning change: past, present and future

Under this category, competences covered relate to three dimensions: learning from the past, inspiring engagement in the future, and exploring alternative futures. The key to creating awareness and action is an understanding of key concepts such as sustainable development, including their many facets and connections – for example, an appreciation of the root causes of unsustainable development. Given the urgency of the challenges at hand, educators should work towards raising students' awareness of their own unsustainable practices as individuals in order to improve them and engage others to do the same. In addition, students should be encouraged to use scientific evidence to seek new pathways for future development and problem solving.

Achieving transformation: people, pedagogy and education systems

In this category, the focus is on transformation: of what it means to be an educator, of pedagogy and approaches to teaching, and of the educational system as a whole. Key to changing what it means to be an educator is the expectation that teachers should increasingly become

conscious reflective practitioners who are not afraid to admit they do not have all the answers, but on the contrary embark on a learning journey with their students. Transformative pedagogy entails engaging in open dialogue with students, empathising with them, and building on their experience to develop content and methodologies. Much related to the upcoming section, it also entails taking a critical look at the learning environment and its implications. Finally, this axis also focuses on change at the educational system level so that, as structures, they will support more sustainable models of development.

The UNECE framework is useful in presenting comprehensive competences applicable to a variety of contexts and disciplines: it presents a meaningful set of categories that reflect a wide range of learning experiences. Many of the cross-cutting competences discussed above manifest themselves even more clearly when looking at decisions made inside the classroom – these are discussed in more detail in the section below, Teaching considerations.

Teaching considerations

Teachers make daily choices which impact what and how they teach. In this section, I have chosen to look at some the key factors at play shaping the many teaching and learning considerations and decisions faced by teachers.

First and foremost, it is important to bear in mind what student-centred teaching entails and the consequences this concept has on the way teaching is designed and carried out. Secondly, decisions should be shaped by asking how we create a conducive learning environment that is characterised by respect and dialogue, but also by a transdisciplinary exchange. Finally, the consequences of applying a gender and intersectionality perspective, which permits everyday practices, are discussed.

The learner at the centre

Within this ESD paradigm, educators are expected to engage and activate students through a student-centered curriculum. As Biggs summarises social constructivism, “learners construct knowledge with

their own activities, building on what they already know; teaching is not a matter of transmitting but engaging students in active learning, building their knowledge in terms of what they already understand" (2007, p. 21). Engaging students with real-world problems and allowing them the time and space to reflect and discuss issues makes for more active and involved learners. Working collaboratively, peer learning and discussions allow students to also learn from each other.

Another way of ensuring student voices are represented in the curriculum is to actively engage them in the co-creation of the curriculum and educational materials that support learning on the SDGs (SDSN Australia/Pacific 2017). Promising practices regarding the inclusion of students as partners in the development of the curriculum are available in the Uppsala University "Active Student Participation" page.

The learning environment

Much related to integrating a gender and intersectionality perspective into teaching is the broader issue of fostering an inclusive environment. Ensuring that the needs, opinions and voices of all students, regardless of race, ethnicity, religion, sexual orientation or age, are heard and taken into account is imperative in promoting open and respectful exchanges among students.

Self-awareness and understanding of one's own expectations and culture as an educator are the first step in being able to engage in a fruitful dialogue with students. Getting to know them and learning about their realities, challenges, and needs is useful not only in the design of the curriculum in order to make sure it reflects all students' experiences, but also in creating productive exchanges. Learning must be a window towards knowledge for all students, providing an opportunity to explore and ask questions about things they are unfamiliar with (IGLYO 2015). As identified by the The International Lesbian, Gay, Bisexual, Transgender, Queer & Intersex (LGBTQI) Youth and Student Organisation, students often lack accurate knowledge on issues regarding sexual orientation, gender identity and gender expression. As discussed earlier, this may be a factor in students unintentionally reproducing unsustainable practices and patterns of behaviour.

Working in and across disciplines

As is the case of this handbook, and is outlined by the competences highlighted above, approaches with ESD should attempt to break disciplinary silos in order to foment interdisciplinary, multidisciplinary or transdisciplinary dialogues (Lozano *et al.* 2014). In her internationalisation framework, Leask (2015) discusses the importance of moving and in and across disciplines while also consciously reflecting upon dominant and non-dominant paradigms in one's own subject area and tradition. Indeed, today's global challenges increasingly require inter multidisciplinary approaches in order to be successful. One such example is the development of courses and research across overarching themes and topics.

Applying a gender & intersectionality perspective

Gender inequalities are a persistent feature of education systems in the Council of Europe member states (Council of Europe 2014). Despite serious advances and strides in the fight for equality, movements such as the #MeToo campaign bear witness to the pervasive discrimination and harassment that women still face today, irrespective of geographic location. Figures on social inclusion, employment rates and job quality indicators show that women remain at greater risk of social exclusion, unemployment and low-quality jobs in the EU ("Education" 2017). Women also remain, on average, slightly more likely to be unemployed than men with the same level of education. In Sweden, a national governmental initiative launched in 2016 mandates all state-funded higher education institutions to report on their gender mainstreaming activities. The purpose of the initiative is for the higher education sector to contribute towards the nationally declared gender equality objective of women and men having equal power to shape society and their own lives.

Applying a gender perspective means looking at the world around us and the statistics discussed above and reflecting and problematising what we take for granted: what information are we receiving and what information are we not? Who is talking and who is not? What notions of gender are disseminated consciously or unconsciously through the texts, pictures and opinions we are exposed to? Facts also

need to be questioned: who decided on the facts? Facts according to whom? (*A gender perspective – what does it mean? Swedish Secretariat for Gender Research* 2017). Asking ourselves and others questions such as these helps bring to light the fact that the societal norms we take for granted are socially constructed, and as such, can be changed.

These relationships translate directly into the educational setting. Despite legislation and policies put in place at the national and local levels, often times at the university level as well, gender stereotyping continues to influence the way we teach and select content. The narrative and norm presented to our students continues to build on stereotypes. A revision of the way we introduce and highlight the work of women and men, boys and girls is necessary in order for our students not to reproduce patterns of discrimination and exclusion.

As the European Institute for Gender Equality (2017) outlines: Studies show that many of the school textbooks used in European countries include stories and images that reflect a stereotyped portrayal of the role and activities of women and men, girls and boys. Men are still more often represented than women; vocabulary is in contradiction with the principle of gender equality; and the main characters are mostly males.

A gender perspective can be applied to different aspects of our lives: movies and TV shows, commercials, print media, daycare, images in metro stations, design of cities and transportation, clothing lines, to name a few. Yet, it is the educational system that is in a privileged position to change some of the statistics mentioned earlier, help students to unveil what we take for granted, challenge normative conceptions of gender. By asking ourselves questions, we can increase our own understanding of how we contribute to recreate gender (AIGE 2017), while also with our actions directly contributing to the implementation of the SGDs.

Furthermore, similar questions can be asked in relation to ethnicity, class, or sexuality. As Nina Lykke writes, “the specific manner in which individuals “do” gender cannot be separated from the manner in which they “do” ethnicity, class or sexuality, for example. Our identity is not divided into different compartments: gender, ethnicity, class, sexuality, etc.” (2012). The word denoting the idea of looking at the crossroads of gender with other equally important aspects of identity was coined by

Kimberlé Crenshaw (1991): the term "intersectionality" requires that we "pay attention to the interplay that is created when a »gender road« meets, for example, an »ethnicity road«". As a concept, intersectionality has been useful in civil society movements as an effective way to illustrate and address different types of inequality in today's societies.

Educators interested in infusing ESD into their curricula must consider how gender and intersectionality aspects are reflected in the choices they make: what content they cover and how the teaching practice and methodology is conducive to *everyone's* learning. Examining representation and lack thereof is an important aspect when encouraging students to reflect upon and question existing norms hindering everyone's equal access to participation and enjoyment of human rights.

Beyond the classroom: Concluding thoughts

Higher education plays a vital role in stimulating critical and creative thinking and generating and disseminating knowledge for social, cultural, ecological and economic development (UNESCO 2016). This chapter has discussed how in addition to covering content related to the SDGs, in order to successfully infuse curricula with ESD, educators must also consider the link to their pedagogy and teaching practice: not only what but also how they are teaching in order to develop the next generation of problem solvers.

In addition, creating long-lasting and substantive change requires a holistic approach at the curricular level. It is key to consider issues of progression when working with curricular development: how do courses link up to one another? How are competences developed from one course to the other? Where in the programme are competences assessed? One way to ensure these issues are taken up by course leaders is by engaging faculty at the programme level. One such example is the SLU initiative which offered ESD-related training to programme study directors and course coordinators. The university dictated that all programme study directors and 75% of all course coordinators would take a course focused on the integration of Education for Sustainable Development (ESD) before the end of 2017. More information about the lessons learned from this initiative are detailed in Part 3 of this handbook.

Educators can and should rethink their teaching strategies and more closely align them to the competences we wish to develop in our students. Rethinking the way we design programmes brings us one step closer to further evaluating and holistically assessing the way higher education can contribute to the effective implementation of Agenda 2030 and therefore to the development of better and more just societies.

Chapter 5

Sustainability and case-based methodology

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This chapter describes and provides a justification for the case-based method of Education for Sustainable Development as an alternative to transmissive teaching or problem-based learning. In contrast to transmissive teaching which is focused on what the teacher knows and passes on to students, the case-based method is focused on students, and strengthens their ability to learn for themselves using previously acquired knowledge to solve problems.

The cases are based either on a real-world situation and/or on things students have experienced as a part of their daily life. This assumes some (even if only superficial) knowledge that is relevant to a situation, which allows a first approach to solving the problem. The strategies involved in solving the problems will lead students to develop new knowledge, to reflect on the previous familiar knowledge and to reconstruct original understanding in a new perspective on sustainability. Case-based teaching is intended to foster learning for competence, deep level understanding and provide opportunities for vertical and horizontal integration of any syllabus.

Although problem-based learning and case-based learning share the common goals of enabling students to solve real world problems, each methodology possesses specific characteristics. In problem-based learning the problem drives the learning process, whereas in case-based learning students are required to recall previously learned material so as to solve cases. While case-based teaching requires a prior knowledge of the subject, to develop the lesson, it does not require the teacher and student to build new knowledge before exploring a particular issue. Instead, it provides students with the opportunity to effectively relate their previous knowledge to new, real-life situations that

are relevant to a specific subject. This methodology is based on the idea that new knowledge is built upon previous knowledge, by adding experience to it (Harrington & Garrison 1992; see also chapter 4).

Case-based teaching was initially implemented at law and business schools at Harvard University, about 100 years ago, when a newly appointed dean, Christopher Langdell, started to refer to real cases in his classes, breaking away from decades of transmissive teaching. In science education, case-based teaching was only implemented approximately 25 years ago (Çam & Geban 2016; Herreid 2013), but it was a significant revolution in teaching, that made the learning process much more active (Garvin 2003). The case-based method is now established and has been widely implemented in various disciplines. A large majority of studies report favourable results in its application in science, especially in areas such as biology (Pai 2009), chemistry (Yalçınkaya *et al.* 2012), engineering (Flynn *et al.* 2015), maths (Kogan & Laursen 2014), interdisciplinary approaches of biology and geology (Vasconcelos & Faria 2017) and medicine (Bhardwaj *et al.* 2015; Datta *et al.* 2016).

The case-based method is a less time-consuming approach to learning (at least in its initial stage) and it enables the development of thought and arguments. The 17 Sustainable Development Goals of the 2030 Agenda for Sustainable Development, that were adopted and came into force on 1st of January 2016, require the adoption of a new learning framework that leads learners to be more active, more engaged with the future of the planet and to be more responsible and accountable. The aim of this handbook is to present cases that are both authentic and challenging, encouraging students to think critically, be more productive, and to have a deep understanding of action towards sustainability. Indeed, the case-based method is expected to develop the ability of students to make a diagnosis of a situation, to evaluate and discuss different solutions, and to make a final decision, all of which are critical for any citizen in the 21st century. Additionally, this methodology is expected to promote curiosity, to improve motivation, and to develop self-directed learning, critical thinking and mutual respect among students.

It should also be noted that the use of real cases facilitates memorisation by providing students with mental anchors for facts, concepts

and principles that are meant to be studied and assimilated (McNaught *et al.* 2012).

The cases can be:

(1) presented as examples;

(2) presented as an opportunity to practise analysis, assimilate different perspectives and contemplate action; and

(3) presented as a stimulus for personal reflection.

According to Vasconcelos and Faria (2017), the design of the case must observe the following principles:

- The case is real (taken from real life or historical);
- The case rests on careful research and study;
- The case fosters the development of multiple perspectives;
- The case is meant to be interactively explored by students;
- The case directs students towards a conclusion by providing them the resources and the context to discuss issues dynamically.

Built on a constructivist epistemology, students are generally asked to work in groups so that they are exposed to several viewpoints and ideas. Students are also asked to evaluate each other's opinions. The exploration of a case generally finishes with a plenum discussion. This approach develops students' collaborative competences and their communication competences.

Teachers are the facilitators who promote class debates, ask questions and assess students at the end of the class. These actions help students to relate their knowledge with their decision-making competences (Giancalon 2016). The process of case-based methodology is illustrated in figure 1.

The teacher can resort to different strategies so as to explore the case. In order to better understand the use of these strategies the following propositions must be considered:

(i) perspectives that deal with general philosophies of teaching (e.g. socio-constructivism);

(ii) methodologies that deal with more practical issues and suggest a certain type of strategy (e.g. case-based method), while giving a theoretical background; and

(iii) strategies that deal with specific actions (e.g. role-playing activities) and are the best plan chosen by the teacher to guarantee that students achieve success.

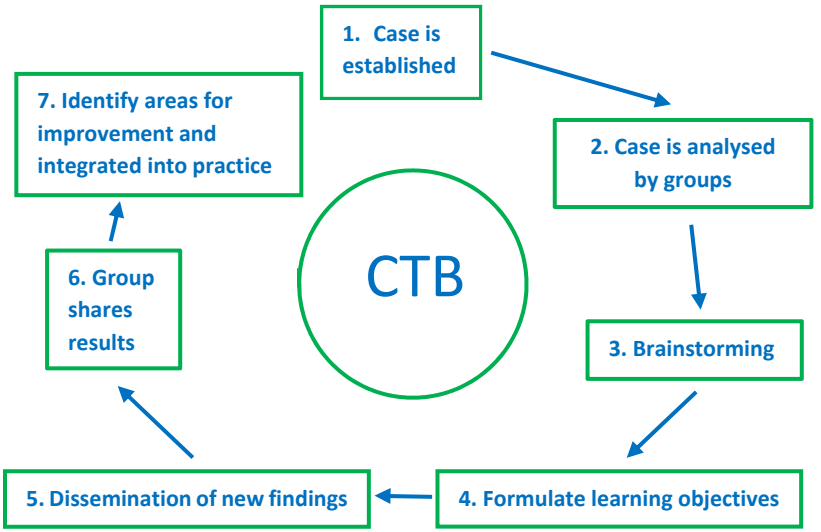

Figure 1: The case-based teaching process (adapted from Williams 2005, p. 578).

Among the strategies commonly used in case-based methodologies and reported in published papers are: modelling activities, field trips, laboratory work, computer work, practical work, debates and role-plays, simulation games, teamworks projects and follow-up discussions.

In addition, there are the teaching and learning strategies that are specifically designed to lead students through a case, involving suitable questions, time allocation to group discussion and appropriate assessments of both group and individual outcomes. They also provide students with insight to alternative solutions from various points of view.

Part II

Cases for widening
interdisciplinary sustainability education

Introduction

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The aim of this chapter is to provide a concrete tool in the form of cases that instructors can use and adapt to the needs and contexts of their own classrooms. The cases are interdisciplinary in nature: they move across the spectrum of different disciplines to target global challenges based on the interconnectedness of today's world.

Cases connect to the key 17 UN Sustainable Development Goals (SDGs) and to key competencies for sustainability (Wiek *et al.* 2011):

Systems thinking competency: the abilities to recognise and understand relationships; to analyse complex systems; to think of how systems are embedded within different domains and different scales; and to deal with uncertainty.

Anticipatory competency: the abilities to understand and evaluate multiple futures – possible, probable and desirable; to create one's own visions for the future; to apply the precautionary principle; to assess the consequences of actions; and to deal with risks and changes.

Normative competency: the abilities to understand and reflect on the norms and values that underlie one's actions; and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions.

Strategic competency: the abilities to collectively develop and implement innovative actions that further sustainability at the local level and further afield.

Interpersonal competence: the ability to motivate, enable, and facilitate collaborative and advanced skills in communicating, deliberating and negotiating, collaborating, leadership, pluralistic and transcultural thinking, and empathy. The capacity to understand, embrace, and facilitate diversity across cultures, social groups, communities, and individuals is recognised as a key component of this competence for participatory sustainability research and problem solving.

There are 13 cases prepared by research teams from WISE Partner Universities: Agricultural University of Athens – AUA (Greece), Collegium Civitas – CC (Poland), Masaryk University Brno – MU (Czech Republic), Swedish University of Agricultural Sciences – SLU (Sweden) and University of Porto – UP (Portugal). Each case can be used separately depending on the educational need of the class: they differ by topics, main disciplines, activities suggested, comptences to be developed and the SDG that they cover. Most of them have an informative function and address different aspects of education about sustainability, which means the aim is to develop awareness, knowledge and understanding about human-environment interaction (Tilbury 1995: 206). Nevertheless in each case there are elements of pupil-centred and activity-based learning that are intended to engage students' emotions rather than simply being descriptive, which could be treated as "an education in sustainability". We believe however that all cases can be easily adopted as education FOR sustainability with teaching aims "to develop a sense of responsibility and active pupil participation in the resolution of environmental problems". This requires a holistic outlook and global and interdisciplinary approach towards the study of environemental problems (Tilbury 1995).

Cases are prepared as lesson plans and a teacher/trainer can follow suggested procedure, but also can modify it for different teaching aims depending on the level of education, learning aims and competences to be developed, teaching practice or other needs. All the cases relate to various aspects of sustainable development and concern the three sustainability pillars on different levels – it is for the teacher to decide how much attention should be put on each aspect of the sustainability dilemma.

To address the complex dimensions of sustainability, a multitude of scientific disciplines needs to be employed. Yet we believe that a multidisciplinary approach, which would mean experts from numerous disciplines

working with each other, each employing their expertise and discussing the problem from their individual perspective (Stember 1991), is not sufficient. To be able to "learn from each other" – an interdisciplinary approach is required, where according to Koutsouris (2009), knowledge, methods and tools from different approaches are synthesised to be able to jointly formulate the problem, hypothesise, analyse and interpret data, which can lead to new perspectives of the problem and developing new methodologies[1]. That is why we structured the interdisciplinary based cases described in this part in relations to topics and SDG.

Firstly, we placed the cases that are rooted in the classic conflict between environment and human activity – the tropical forest case and the dead wood case. The leading question for those two is whether economic interest is more important than the survival of a nature. The consequences of such an approach are being discovered by case participants. Next, there are three cases related to agriculture and the organisation of rural areas – the story of the Shinyanga Region in Tanzania, the rural tourism case and organic farming, the last two from Greece. Those three cases are good examples of a struggle which sometimes is undertaken by local communities to revive the region and increase the quality of life. The next two cases – remodelling an ancient farm in Portugal, and a local production company from Poland are cases where sustainability is analysed from the perspective of a small business entrepreneur. In contrast, the next two cases investigate the dillemas of large investments (the Castromill gold mine in Portugal and lignite surface mining in the Czech Republic) which inevitably lead to the involvement of numerous actors, increasing the complexity of the problem.

Further follow two cases from urban areas – an issue of air pollution in Warsaw and the location of the Brno railway station. Similarly, urban greenery is a case on the verge of economics and environment, where two conflicting needs of inhabitants compete for a limited space within the urban environment.

[1] The more advanced unification of the perspectives and an even more close cooperation would be a transdisciplinary approach, which according to Choi and Pak (2006: 359) "Integrates the natural, social and health sciences in a humanities context, and in doing so transcends each of their traditional boundaries".

Finally, there is a case related to sustainable food consumption where participants have to negotiate with themselves and their own habits. The table below presents the list of cases: their main aims and keywords which are useful for choosing a topic (key words) and relevant literature (see: Glossary and References).

Note that the cases presented in this handbook reflect many different aspects of complexity in sustainable development. Perspectives on the critical points and takeaway lessons from each case will vary with the worldview of individual teachers and students. We prepared a summary table of critical points made in the case studies to help teachers find material relevant to their particular interest in sustainable development (Table 1). We believe that it can be useful as a suggestion for teachers and trainers and note, however that the case's focus can be modified according to the participants' needs.

Table 1: Critical points in sustainability addressed by cases

Case	About	Critical Point	Take Away
1. The tropical forest	Simulation of impacts of multiple uses of tropical forests	Identify social processes responsible for deforestation	Social processes are complex and can lead to unintended negative consequences
2. The Bialowieża forest	Conflict between ecological, social and economic perspectives of natural resource management in an ancient forest of high biodiversity value	Use of scientific evidence, communication and negotiation	Communication and knowledge sharing are critical parts of the management of planning dilemmas, otherwise legal action may be sought to resolve political stalemates
3. The Shinyanga region	Collapse and renewal in a long-term rural development process in Tanzania	Introduction to the core competencies of SD as a set of skills for creating new trajectories of change in development interventions	a) Development is a complex and long-term process that works well when using participatory approaches that engage the beneficiaries as equal partners b) Development can have unintended negative consequences c) Ecological health of soil, water and forests is essential for sustainability
4. Rural tourism	Innovation for sustainable tourism development in Greece	Negotiation of differences arising from normative values to create an agreed vision of the future	The value of communication in achieving a common vision of future development that meets the needs of all stakeholders
5. The organic farming policy in the EU	Organic farming subsidies and price premium for the organic food policy	Complexity of policy examined from the perspective of farmers, consumers, policy-makers and taxpayers	a) Knowledge of organic farming b) The value of reasoning and communication skills in changing the opinions of others

6. Emodeling an ancient farm	A landowner seeks to remodel an ancient farm and manor house for tourism in a manner that maintains its cultural heritage.	Balancing the three pillars of sustainability in decision-making and the interrelationships between ecosystem services	The difficulties of decision-making in complex situations that take multiple perspectives into account
7. Transformation of a medium-sized business	Overcoming gender bias in the search for a new business model that enhances social responsibility and long-term sustainability	Critical reflection on a business strategy for enhancing sustainability	a) Difficulty of changing deeply entrenched gender bias b) The ethical dilemmas of maintaining financial viability in a competitive business environment and being a socially responsible employer
8. Castromil gold mines	Addressing the geoethical dilemmas associated with the reopening of a gold mine	Managing the extreme toxicity of chemicals used in mining and processing gold- bearing ore. The need for independent evaluation of the mining proposal to adequately weight the costs and benefits in financial, social and ecological terms	Weighting the risk of pollution with potentially high social and ecological costs that arise from mining, against the social and economic benefits is a contested process, open to corrupt practices
9. Ecological limits to lignite mining	Conflicts arising from proposals to lift the limits imposed on opencast lignite mining. The social and economic benefits of mining are weighed against the social and ecological costs of opencast lignite mining	Application of Schwartz's theory of universal values to understand the values of actors from an analysis of their public statements about a controversial issue	a) Use of theory to understand the role of normativity in complex decision-making processes b) The role of power dynamics and questionable practices in development processes
10. Smog in Warsaw	The health hazards of smog in cities and the changes required to address the problem	Engaging citizen action to promote and create change	Enhancing the role of civil society in creating change that has social, economic and ecological benefits through teaching basic problem solving and skills for practical action
11. Relocation of the Brno railway station	A public referendum to decide whether to relocate the Brno railway station or to modernise the existing station	Managing the many conflicting interests in planning transportation infrastructure	Careful consideration of the circumstances in which a referendum might be a good way to resolve a complex problem and steps required to provide all the relevant information
12. Urban green space and housing development	The need to maintain urban green space for human well-being, biodiversity and education values *versus* the need for housing, a case from Sweden	Planning dilemmas created by the conflicting needs to reduce urban sprawl and to save green space	Housing development and conserving urban green space are mutually exclusive. Can stakeholder deliberation lead to an optimum solution?
13. Reducing food waste	Enabling people to make the connection between food consumption habits and the environmental costs of food production	Personal choices with regard to food consumption and their effects on sustainability	Stimulating individual action to reduce food waste as a contribution to averting environmental crisis

The cases can be used to develop main ESD competencies:

Name of the case	Spatial scale	Main activity	Competences to be developed				
			Systems-thinking	Anticipatory	Normative	Strategic	Interpersonal
1. The tropical forest: an analysis of social and economic reasons of environmental degradation	Global issue	Simulation game, follow-up project, discussion game, presentation	x		x	x	x
2. Dead wood in Białowieża Forest – the unravelling complexity of biodiversity conservation	Local example (regional & global issue)	Presentation, individual / group work, debate	x	x	x	x	x
3. Sustainable development in the Shinyanga Region, Tanzania	Local	Small group discussion and role-playing	x	x	x		x
4. Rural tourism development: the case of Plastiras Lake, Karditsa, Central Greece	Local / regional	Discussion method in conjuction with text analysis	x	x			x
5. Organic farming and public support in the EU – the Greek case	EU / national	Role-playing, group debate			x		x
6. Remodelling an ancient farm in Portugal	Local example (global issue)	Role-play, group work, discussion	x	x	x	x	x
7. Transformation of a local production company into a sustainable business.	Local	Presentation, discussion over a draft strategic plan based on a SWOT analysis	x			x	x
8. The Castromil gold mines' geo-ethics dilemmas	Local example (global issue)	Group work, inquiry, discussion	x	x		x	x
9. Territorial ecological limits to the lignite surface mining in North Bohemia	Local example (regional issue)	Discussion, text analysis and follow-up discussion			x		x
10. Smog – high concentration of air pollutants in a large city. The example of Warsaw	Local example (regional & global issue)	Text analysis, presentation, project team work, possible to use flipped-classroom method	x	x			x
11. Local referendum about the relocation of the railway station	Local	Role-playing and follow-up debriefing		x		x	x
12. Urban greenery – how to include urban green areas in cities that are in desperate need of housing?	Local	Text analyses, Role-playing, debate, reasoning, discussion	x			x	x
13. Sustainable food consumption – mitigating food waste	Global issue (individ. persp.)	Open discussion, teamwork	x		x		x

The cases are also divided by SDGs, that they thematically cover:

Sustainable Development Goals / Name of the case	1. No poverty	2. Zero hunger	3. Good health and well-being	4. Quality education	5. Gender equality	6. Clean water	7. Affordable and clean energy	8. Decent work and economic growth	9. Industry, innovation and infrastructure	10. Reduced inequalities	11. Sustainable cities and communities	12. Responsible cons. and production	13. Climate action	14. Life below water	15. Life on land	16. Peace, justice and strong institutions	17. Partnerships for the goals
1. The tropical forest: an analysis of social and economic reasons of environmental degradation								x							x	x	
2. Dead wood in the Białowieża Forest – unravelling the complexity of biodiversity conservation			x				x	x			x				x		
3. Sustainable development in the Shinyanga Region, Tanzania	x		x	x	x		x				x			x	x		
4. Rural tourism development: the case of Plastiras Lake, Karditsa, Central Greece			x					x			x	x				x	x
5. Organic farming and public support in the EU – the Greek case			x			x					x	x	x		x		
6. Remodelling an ancient farm in Portugal			x						x		x				x		
7. Transformation of a local production company into a sustainable business					x			x	x	x		x					
8. The Castromil gold mines' geoethics dilemmas			x			x		x			x	x			x		
9. Territorial ecological limits to the lignite surface mining in North Bohemia			x				x	x	x				x				
10. Smog – high concentration of air pollutants in a large city. The example of Warsaw			x	x			x				x		x				
11. Local referendum about the relocation of the railway station									x		x						
12. Urban greenery – how to include urban green areas in cities that are in desperate need of housing?			x								x				x		
13. Sustainable food consumption – mitigating food waste		x	x	x						x		x					

All cases have the same structure which we called “lesson templates” and they contain additional readings for teachers and/or students. The reader can find the list of the cases’ abstracts in the appendix.

As we believe the cases can be further developed and there are many ESD cases that could not be included in this book, we hope to get feedback from readers, based on their experiences with lesson plans in this handbook and other ESD cases[2].

[2] If you want to contribute in any way (i.e you may want to include important new material), please contact the editors: kiwinska@civitas.edu.pl, mkraszewska@civitas.edu.pl or michael.jones@slu.se.

Case 1

The tropical forest:
an analysis of social and economic reasons of environmental degradation

Jan Činčera
Masaryk University, Brno (Czech Republic)

Keywords: tropical forests, deforestation, nature protection

Relation to Sustainable Development Goals (SDGs):

Strategy: Simulation game, follow-up project, discussion game, presentation.

Time required for classwork (in minutes): 240.

Students' preparation for the class (in minutes): 240.

Aim: To increase students' awareness of deforestation in tropical areas and to develop system thinking competence.

Learning outcomes:
After completing this case, students are able to:

- identify the social processes responsible for the deforestation of tropical forests, namely to identify the stakeholders and their mutual interconnection;
- compare the gaming scenario with real-world situations;
- investigate the issue and present their results.

Question to address:

- What social processes are responsible for the deforestation of tropical forests?

Data sources

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Procedure

1. The Hipbone Game. The aim of this activity is to help students to focus on the interrelationships between tropical forests and their own consumer lives. The activity develops students' system thinking competence and frames the meaning of the main activity. For the rules for this part, see Appendix 1. This part takes about 30-40 minutes. A board with a game matrix and three markers are needed.

2. The Simulation Game. This is the main activity of the programme. The aim of this activity is to help students to experience the social processes responsible for deforestation, e.g. agriculture, palm oil production, logging, and the efforts for their protection, e.g. environmental campaigns, sponsorship by pharmaceutical companies, sustainable development. The activity may be highly emotional and demanding for some of the students. Two or three leaders are needed to run this 120-to-150 minute activity. You will need a big room allowing an arrangement of candles (in a 9x9 square), data projection, sitting around, walking, and being loud. For the rules, see Appendix 2.

3. A Debriefing Session. This activity helps students to reflect on and share their feelings and findings from the previous activity. One leader and approx. 20 minutes of time are needed.

a. At the beginning, ask the groups to reflect on the experience from the perspective of their roles.
b. Then, when all groups have shared their reflections, ask them to discuss in their teams which aspects of the game (role description, interaction among roles, emerging social processes) corresponded with reality and which did not. Write their ideas up on the board.
c. Finally, ask students to formulate any questions about deforestation that have been inspired by this experience and that they would like to investigate further.

4. A Follow-up Project. This activity allows students to practise their own critical thinking and investigating skills. It is based on the students' questions that emerged during the debriefing session. Give students adequate time (a week, at least) to conduct their independent investigation.

5. Presentations. Students present their findings about the investigated aspects of deforestation. At the end, ask students to formulate what they have learned as a part of this programme. You may ask them to work in groups of 3-4 people, reflect on their learning, and then present for each of the groups. This activity takes about 40-90 minutes, depending on the number of students.

Props and arrangement for the simulation game

Sixty-one candles (in cups) of one colour and twenty of another colour, a bell, some plastic or some other kind of protection of the floor, matches, wooden skewers, two dice, fake money, thirty cards white on one side (soil) and black on the other side (eroded soil), thirty cards with the picture of a palm tree, fifty pawn pieces, a recording with rainforest sounds, a presentation with photographs, a computer and a data projector, a name tag for each participant with the name of his or her particular group. Two or three instructors are needed to lead the game. The number of students should be between 13 and 30.

Arrange the candles in an area of about $1m^2$ and in rows 9x9, with the rare "species trees", representing a forest with a particularly high conservation value, (taller candles) roughly in the middle (see Fig. 1).

The participants sit at one end of the room so as to be able to see both the tropical forest and the screen.

Figure 1. Arrangement of the forest

Appendix 1
Tropical Forests: The Hipbone Game

Recommended procedure:

1. Divide the students into two groups. If there are more than 16 students participating, it would be better to split them into four groups and run the activity sequentially, with two groups playing at a time, or run it simultaneously in two different rooms, with two groups in each room.
2. Ask two volunteers to play the role of a jury.
3. Invite the students to the very old Hipbone Game – a game that was played by medieval alchemists. The alchemists had to be able to see invisible interconnections among different aspects in their world. This will be the students' task right now.
4. In the game, two groups of students compete with each other. The group that gets more points, wins.

5. The points are given for each new interconnection that the students can identify and explain. For each of the new connections, they get 0-2 points. The classification is decided by the activity leader and the jury.
6. When a group takes a turn, it must put any word (or a concept expressed in 2-3 words) in to any empty cell in the Game matrix (see Image 2). If the new concept is directly connected (by a line) with any of the words already in the filled cells, the group must explain all of the newly emerged interconnections (e.g., for the word put in cell 1, three new interconnections may emerge). Each of the new interconnections is independently evaluated and classified by the jury.
7. The group has 30 seconds for discussing their move and 30 seconds for explaining each of the newly emerged connections. After classification by the jury, the other group starts its move.
8. The group that starts the game will be given one extra move to the last filled cell (to provide the same number of evaluated moves as for the other group).
9. Each of the groups will be given one secret word. The group must use this word in the game or it will be penalised by 10 points. The classification of all of the interconnections with any of the secret words is doubled (that means that an interconnection of two secret words may bring up to 8 points). The secret words are "tropical forests" and "well-being".
10. The classification should emphasise non-trivial interconnections, adequate for university students. Obvious connections should be classified by 0 points. Only a really clever and hidden interconnection, well explained by students, should achieve 2 points.
11. When the game is over, calculate the points and congratulate each of the groups. Give them time for a short reflection – what interconnections did you find most interesting? Looking at the matrix as a whole system, what does it say about our world? Specifically, how are we connected with tropical forests?

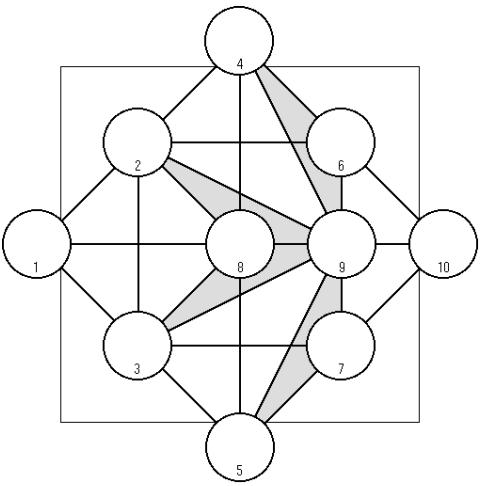

Image 1. The Hipbone Game Matrix

Appendix 2
Tropical Forests: The Rules of the Game

Welcome to the Tropical Forest. This Tropical Forest used to be vast and take up the whole space in the room we are in at the moment. Now all that is left of it is what you can see. Each burning candle is one living mature tree. In reality, it would not be just a single tree, but a whole forested area – but to keep it simple, let's think about the candles as trees. If it is burning, it is alive. When you blow it out, you cut down a tree and destroy all the living space provided by it. In a Tropical Forest, there is of course a large variety of tree species, but again, to keep it simple, there are only two species here – a common species and a rare species which is represented by a different candle. Together, we will now try to create a simplified story of what happens in tropical forests. It is a certain kind of communal theatre play, and we will all be the actors.

You will have a particular role in the play. Please act as realistically as you can, regardless of whether or not you personally agree with the

goals and the procedures that characterise this role. Most of the roles can be played in a group of several actors. Your goal is to fulfil the goals of your role as well as possible.

To make the theatre play go smoothly, we are going to follow some rules. Each group has its own set of rules. In addition, we are all going to follow some common rules that express the mechanisms that will help you achieve your goals:

1. **Time.** The stay in the Tropical Forest is divided into individual rounds. Each round has three phases. The duration of each phase is irregular and is determined by the game leader. The players do not know how many rounds the game will have and the game leader will end the game based on her or his own assessment of the developments. The phases:
    a. In the first phase, you can make plans, discuss things, and go talk to the other groups. This phase is the longest one. In this phase it is also possible to hold a governor election.
    b. The second phase begins when the game leader gives the agreed upon signal. All players have to stop negotiating. Not following any set order, the game leader then calls on each group. The groups give reports on whether they are conducting any activities in the Tropical Forest in this round (cutting trees, planting new trees, establishing reserves, etc.). Simultaneously, the game leader implements the decisions (e.g., blowing out some candles). If the players' decisions have resulted in some side effects (e.g., a forest fire, the dying out of an indigenous tribe), the game leader announces these effects. At the end of this phase, the game leader also summarises how many trees have been cut down and how many are left in the Tropical Forest.
    c. In the third phase, one member of each group goes to the bank (which is supervised by the game leader or the assistant leader) to balance the group's obligations (mainly to deposit the living minimum and to withdraw the income for the activities in the Tropical Forest). At the end of this phase, the players can begin the next round.

2. **Money.** The groups have varying amounts of money and different options available to them. Unless the rules for the group state that the group is exempt, in the c) phase each group has to pay its living minimum. If the group is not able to pay, the game leader may impose some sanctions on it (e.g. revoke the group's logging licence, proclaim the group has been removed from the game, etc.).
3. **Power.** The power of each group to pursue its goals depends on the group's strategy as well as on its resources. A key role is played by the Governor of the Tropical Forest area:
    a. The Governor is one of the players who stands as a candidate and is elected by majority vote. Each group has a different number of votes.
    b. When elected, the Governor is no longer a member of his or her original group and receives his or her own rules to follow. The Gubernatorial elections take place in every odd round (phase a).
    c. The Governor can support or suppress particular groups or activities in the Tropical Forest, has his or her own financial resources, can employ players in the State Service, etc.
    d. At any time in phase a), the Governor can announce her or his orders and regulations. If a group breaks these orders and regulations, the Governor can punish it (by a fine, revoking the group's licence, etc.).
4. **Natural resources.** Some of the groups can cut trees in the Tropical Forest. However, it is possible to only cut trees that are on the Tropical Forest's edge or that are accessible by a road. Any group can plant new trees. The price for planting a common species tree is 150 USD and for planting a rare species tree it is 500 USD. It takes a long time for the trees to grow and the tree planting does not affect the current state of the Tropical Forest (i.e. the number of mature trees).
5. **Information.** At the beginning of the game, the players do not know the available options and the goals of the other groups. Getting quickly oriented in the situation, finding potential allies,

and forming shared-interest blocks can be essential for succeeding in the game.

The game is flexible, and in case something is not clear, the game leader decides what to do.

The Indigenous People

Group size: 2-3 players.

According to the myths passed on from generation to generation, your tribe has lived in the Tropical Forest "since the beginning of humankind". You have survived here thanks to your tribal knowledge and the skills of the tribal members to use the amazing natural resources in the Tropical Forest to obtain food, build shelters, and prepare medicine. 85% of your food is produced by crop rotation: You clear a suitable area by the river, and for a few years you grow banana trees, maracuja, corn, beans, and manioc. When the soil becomes depleted and the yields are lower, you move to a new place and the abandoned fields are soon transformed into a Tropical Forest again. In a Tropical Forest, it is possible to farm only a few years in a row because the soil is poor and the layer of fertile soil is very thin. Most nutrients are preserved in the plants whose leaves and roots also protect the thin layer of soil from being washed away by regular heavy rains. You cut down selected kinds of trees and you use their wood to build shelters and to make weapons and tools. However, you use most of the wood as fuel for heating and cooking.

Your relationship with the Tropical Forest is complex. The Tropical Forest is your home, and it provides your food, clothing, and construction material, but it also kills you. You believe that the Tropical Forest is inhabited by the feared spirit Kurupira who lives on human meat. More than thirty years ago, your tribe came into contact with the representatives of a civilisation that has gradually been cutting or burning its way closer to your tribe's territory. At first, these representatives were scientists, explorers, and government ambassadors who brought you some of the achievements of their culture – medicine, weapons, tools. Some of you have even started to produce electricity from gener-

ators that run on petrol and you have started to use electrical appliances. These new tools have changed your way of life and they have pitted the younger generation against the older generation. The older ones, the upholders of tradition, the tribal leaders – they are afraid of the changes because they are afraid of losing their prestige. In contrast, the younger ones are fascinated by the new opportunities and yearn to discover the new, so very enticing world. Thanks to the new things that have appeared, in the last ten years the number of people belonging to your tribe has increased significantly (at present, about 80,000 people live in the Tropical Forest). Your life has become a bit easier, but you are now also more demanding in relation to your environment: the constant collecting of firewood has been depleting the Tropical Forest resources, especially near large settlements.

From time to time, groups of prospectors looking for precious metals or rare minerals, representatives of logging companies and other entrepreneurs come through the Tropical Forest, and sometimes you get into conflict with them. You do not trust these strangers – two years ago one of them shot dead a member of your tribe. Lately, you have started talking about the gradual disappearance of the Tropical Forest in your surroundings. More and more often when you hunt, you come upon new farmers or loggers, and more and more often you discover new logged areas, and the wild animals have started to disappear, too. You are not unified in what to do next: the older people want to proclaim war against the loggers, while the younger ones dream about leaving the Tropical Forest and experiencing the magic of civilisation…

Money

- You do not have a regular yearly income or any money to start with.
- Every year, you have to cut down 1 tree to make a living or just to make up the 100 USD that you will pay to the bank.
- To survive, each member of your group needs a Tropical Forest consisting of 10 trees. If the number of the living trees in the Tropical Forest is smaller than the number of members in your group times ten, one of you has to either move to a different group or die of hunger.

Power

- In the elections, each member of your group has 1 vote. Any member of your group can stand as a candidate.

Changing groups

- Any member of your group can move to the Farmers' group if they accept him or her.
- Any member of your group can be employed by the Governor and become a State employee if he or she pays (or the group pays for him or her) 800 USD to take a requalification course and if the Governor approves the move.

State Employees

Number of players: 0 at the beginning of the game, later the Governor determines the number.

Promoting and implementing the Governor's policies requires competent and dedicated employees. Nature conservation in particular has become an important and dangerous area. Every year, conservation officers protecting endangered animal species die in their fight against poachers. Other employees try to fight against the wide-spread burning of the Tropical Forest to gain farming land. Actually, it is the forest fires that have become one of the main causes of deforestation. However, in some regions the State nature conservation officers are corrupt and focus more on protecting the interests of the large logging companies.

Your task is to help the Governor, and to fulfil the tasks you are assigned by the Governor as best you can.

Money

- Every year, you have to pay 400 USD as your living minimum. The Governor pays this amount for you. If this does not happen, you have to move to a different group that will accept you or you have to start a new company – Mining or Forest Forever.

Power

- In the elections, each member of your group has 1 vote. This is not a requirement, but it is expected that you will vote for the

Governor if she or he runs again, and that you will not run against your Governor.

The National Logging Company
Number of players: 2-3 at the beginning of the game.

You are representatives of a prosperous logging company that employs 1,500 people and that supplies wood to the USA, France and China. Especially the last of these countries keeps increasing its demands and requirements. These countries then use the wood mainly to make paper: the consumption of paper in the developed world keeps rising, but at the same time the level of the protection of their own forests has been going up. Thus the paper industry has to intensify its efforts to find suppliers in countries where the environmental protection by law is less strict. Apart from paper-making companies, your customers include some companies that produce disposable chop sticks, and several construction companies. In the last five years, the yearly sales have increased by 125%, but the profits have remained low, primarily due to the necessity to import heavy logging machinery from producers in the USA and other countries.

You do not care which kind of trees you cut down, you are paid "by size". Nevertheless, lately you have been pressured by the Government and by some international organisations toward more sustainable forms of logging. Even though you have your powerful supporters in the Government, you realise that it is not in your long-term interest to log out the whole Tropical Forest. The best scenario for you would be to transform the Tropical Forest into a "factory" for growing more timber – to plant new, fast-growing trees in the place of the cut down trees, and then harvest them again within a few decades (but sometimes it takes less than twenty years). You are also open to negotiations about the introduction of more advanced technologies that would decrease the amount of your "wood waste" – currently, this waste is one third of the wood from the cut down trees.

You do not get along very well with "the primitives" who live in the Tropical Forest and who steal your things, and you have already shot

at several who were particularly bothersome. You also do not like to see other competing companies in the Tropical Forest.

Money

- At the beginning of the game, you have 300 USD in your account.
- The yearly operating costs for your company are 400 USD.
- For cutting down 1 tree, you will get 200 USD.
- During one round of the game, you can cut down a maximum of 5 trees.
- At any point, you have the option to buy new, technologically more advanced machinery that will allow you to get 300 USD for each tree. The introduction of new technology costs 1000 USD.

Power

- Your group has altogether 5 votes in the elections. Any member of your group can stand as a candidate.
- If your group fails to observe some of the Governor's orders and regulations (e.g., if you log in the reserve that the Governor has set up), the Governor can revoke your logging concession. If this happens, your group dissolves (it stops its activities in the Tropical Forest), and the members of your group have to (all together or individually) move to a different group or establish a new group.

Changing the group

Any member of your group or even your group as a whole can decide to take on one of these other roles:

- Farmers. You can move to this group if the Farmers' group agrees.
- Palm Oil Producers Alliance. Any member of your group can move to this Alliance if she or he pays the entry fee of 300 USD for establishing a new plantation.
- State employees. To take on this role, you need only the Governor's approval.
- A new branch of the National Logging Company. It costs 500 USD to start this company.
- Mining, a prospecting company that searches for precious metals and other raw materials in the Tropical Forest. It costs 200 USD to start this company.

- Forest Forever (Association for the Sustainable Use of the Tropical Forest). It costs 500 USD to start this association. This association establishes tree plantations (preferably with native species) in the Tropical Forest from which it harvests wood and other raw materials sustainably, in a way that does not lead to the destruction of the Tropical Forest.

Tropical Forest Conservation Society
Number of Players: 2 at the beginning of the game

You are representatives of an international non-government organisation that is funded by donations from the general public and industrial companies. Your central interest is mainly to prevent the destruction of tropical forests. Your group has been given the task to try to persuade various groups living and working in the Tropical Forest to decrease their demand for wood and new agricultural land and support a programme designed to reclaim the deforested areas.

Your campaign is based on the following opinions:

- The Tropical Forest is the inheritance of all people on Earth and its significance reaches beyond the borders of the state in which it is located. In the Tropical Forest, there live unique animal and plant species that will die without it. The Tropical Forest can be useful to people – it can become a source of valuable medicine as well as other important information about the natural world.
- The current burning of the Tropical Forest to obtain farming land as it is practised by the Farmers is responsible for regular forest fires that destroy the Tropical Forest.
- Logging in the Tropical Forest should take place only on a limited scale and in a sustainable manner as it is done for instance by companies for sustainable tropical forest use that practise selective logging and compensate for it by planting new trees. The wood that is obtained in this way is then sold with one of the existing certifications (e.g. FSC).
- It is an unjustifiable luxury to log rare tree species, and these species should be unequivocally protected.

- Building roads through the Tropical Forest usually leads to the fragmentation of forest, to a faster encroachment of other business activities, and thus to a faster destruction of the Tropical Forest.

Money
- At the beginning of the game, you have 200 USD.
- Every year, you get an income of 100 USD.
- You do not pay any living minimum.
- In every round, you can ask (in the bank) for a grant (you will throw a dice). If it is 5-6, you will get 50 times the amount you have thrown.

Power
- You have two votes in the elections. Any member of your group can stand as a candidate.
- The Governor can decide to make your activities more complicated, for instance by requesting you to fill out various activity reports etc. If you do not comply, the Governor has the right to place a hold on your group's activities.

Changing groups
- Any member of your group can move to a different group if all the members of the other group agree.
- State employees. To take on this role you need only the Governor's approval.

Her or His Excellency, the Governor of the Tropical Forest Area
The number of players: 0 at the beginning of the game, the election takes place during the first round of the game, phase a).

Congratulations, you have just been elected Governor of the Tropical Forest Area. You have far-reaching powers. The state capital city is far away, and no one is likely to check on what you are doing. The only thing to worry about is losing your voters' support. Now you have the opportunity to promote and implement your ideas regarding the fate of the Tropical Forest. What is expected of you and what means do you have in your hands?

Duties

- Once in each round of the game, the Governor should publicly present her or his orders and regulations concerning the use of the Tropical Forest. The presentation does not necessarily have to include any special limitations.

Money

- You can collect money from the other groups through gubernatorial taxes.
- Every round of the game, you get 400 USD from the State budget.
- Every round of the game, you get 100 USD from international organisations to protect the Tropical Forest.
- You can ask for a special contribution from a grant agency. If the dice turns to 4-6, you will get a 100 times the amount thrown.

Power

- To set the maximum logging quota for each group, possibly to prohibit some or all of the groups from logging.
- To collect gubernatorial taxes, from some or all of the groups, possibly to introduce a tax for each cut-down tree.
- To block the activities of some of the groups, e.g. by revoking the logging concession (the National Logging Company, Wood International, Mining), obstructions (e.g. requesting reports from the Tropical Forest Conservation Society or from Medica, and, if they do not comply, banning all their activities), or taking some group members into prison for breaking the orders and regulations (the Indigenous People, the Farmers, the Palm Oil Producers Alliance). You can revoke a permit or a concession only if the given group breaks any of the Governor's orders and regulations.
- To hire State employees who will help you negotiate with the other groups. For each State employee, you have to pay the bank 400 USD every year.
- To financially support any groups you choose.
- To organize discussions, conferences, and to negotiate with the other groups.

- To plant new trees at a low cost – it costs 100 USD to plant a common species tree and 250 USD to plant a rare species tree.

You are elected to serve as Governor for two years – at the beginning of the next odd round of the game, there will be another election. You can run again in this election.

Wood International

Number of players: 2-3 at the beginning of the game.

You are representing a daughter company of a multinational company that has branches all over the world. You specialize primarily in the manufacturing of luxury furniture which you then sell to China, the United States, Europe, and other countries. You have branches in Africa, Southeast Asia, as well as South America. To make high-quality furniture, you need high-quality wood – and while you are able to use wood from common trees, you do not make as much profit from that.

You are convinced that the international market for wood should not be regulated in any way. People who have become rich thanks to their work deserve luxury and you are able to provide that for them. Moreover, your company is socially aware. At your branches, you give jobs to the local people and thus contribute to decreasing poverty. In the places your workers come from, you often establish schools, put in water and sewer lines, and you try to make your employees happy.

Since you consider your type of business to be important, you want to protect it from potential threats. In addition to your efforts to persuade the local people through investments and financial rewards, you also try to gain the necessary political support, whether it be by legal means or by means that fit the complex regional context in which you can use your financial resources.

You regard the idea of "sustainable use of the natural resources" as rather a fashionable utopia – no resources can be used for ever, of course! While to manufacture goods that will be sold in environmentally more aware areas (the European Union) you use wood obtained through sustainable logging (and with the appropriate certification), for other, less environmentally aware customers with higher requirements

for luxury goods you need to log "the classical way". The Tropical Forest is just the place meant for the use of the classical way of logging methods.

Money

- To start with, you have 2000 USD at your disposal.
- For your operation, you have to pay 900 USD every year.
- For 1 cut-down common-species tree, you will get 300 USD. For 1 cut-down rare-species tree, you will get 600 USD.
- You can cut down a maximum of 7 trees per 1 year.

Power

- Your group has 1 vote. Any member of your group can stand as a candidate.

Changing groups

- A new branch of Wood International. It costs 2000 USD to start a new branch. This scenario can be considered in case the existing branch loses its logging concession due to breaking one of the Governor's orders or regulations.
- Forest Forever (Association for the Sustainable Use of the Tropical Forest). It costs 500 USD to start this association. This association establishes farms in the Tropical Forest from which it harvests wood and other raw materials sustainably, in a way that does not lead to the destruction of the Tropical Forest.
- Mining (A Prospecting Company). It costs 200 USD to start this company. The company focuses on searching for raw materials in the Tropical Forest. When they succeed, they announce the discovery to the Governor and, after the trees are logged out, the company receives a share of the profits.
- State employees. To take on this role, you need only the Governor's approval.

Medico

Number of players: 1-2

You are representatives of a large company that was founded in the United States and that has branches in developed European and American cities. Your company specialises in manufacturing medicine. A number of pills

that are commonly used today are based on the research of Tropical Forest plants. Many experts are convinced that it is among these plants that new, effective medicine can be found for quite a few of the most serious illnesses, including cancer, heart diseases, and respiratory diseases. The discovery of the sources of these effective medicinal compounds would be a significant contribution to the pharmaceutical sciences, and for your company it would mean substantial profits.

Your research team strongly protests against the logging of the Tropical Forest as thousands of known as well as still unknown species of plants are being destroyed and other sensitive forest ecosystems are being disturbed. Your company has provided you with the financial means to launch a campaign against the inconsiderate destruction of tropical forests. The aim of the campaign is to slow down the pace of the destruction until your research has been concluded.

Money

- You have a grant of 700 USD at your disposal.
- Your yearly income depends on the size of the Tropical Forest (and thus the potential usefulness for the sponsors of your research). At the original size of the Tropical Forest, your yearly income is 200 USD. For every ten trees that are cut down, your income decreases by 50 USD.
- If a road is built through the whole Tropical Forest, your yearly income will decrease by half, as the division of the Tropical Forest into two relatively isolated parts will cause large-scale dying out of plants and animals in both parts.
- In each round of the game, you can choose to ask the WHO for a special grant. Throw the dice: if the turn is 5 or 6, you can get fifty times the amount thrown.
- New trees are of no value to you because it will take hundreds of years for the original species diversity to return to the newly planted areas.

Power

- Your group has 1 vote in the election. Any member of your group can stand as a candidate.

The Farmers

Number of players: 3-5

You represent about 150,000 poor farmers who moved to the newly logged out area in the Tropical Forest five years ago. It was your choice to move because you lost the possibility for farming in the place where you used to live due to ongoing military conflicts. The Government Officers for transmigration promised you enough land to make a living, and also job opportunities with the logging companies. At first, these promises were fulfilled, and it seemed that the piece of land you were allotted could feed your family. However, in most cases you have not been able to get a steady job – usually, you were offered only temporary work when the given company was short of labour force, and often this meant that the men had to leave their families for an extended period of time.

Many traders realised that this was a good opportunity to get rich quickly and they opened supermarkets with inflated prices. In the first two years, you were able to get high yields on the recently logged out land, but then the yields dramatically dropped and many of you fell into poverty again. Most of you try to get new land by burning the Tropical Forest. In this way, you obtain land that is very fertile for the first few years, but later its fertility sharply decreases and you have to move to a different place. Moreover, the burning can cause forest fires that spread and get out of control.

Money

- You can grow crops on the land that you have cleared by burning or that had been logged by someone else. For one cultivated field (in the area of one tree), you will get a yearly income of 100 USD. You have to have access to the fields that you cultivate.
- Please mark the cultivated fields by a white piece of paper. You can farm one field only for two years. After that, the quality of the soil sharply drops and it does not bring you any yields. Please place a black card on the place of the degraded soil. New tree seedlings can be planted in this spot. You can burn a maximum of 9 trees in 1 year.

- The living minimum for each member of your group is 200 USD a year.
- The burning of the forest can cause forest fires. The leader of the game determines the appearance and extent of these fires randomly in phase b). As a result of a forest fire, another 1-6 trees can die.

Power

- Each member of the group has 2 votes in the election. Any member of your group can stand as a candidate.

Changing groups

- Mining (A Prospecting Company). It costs 200 USD to start this company. The company focuses on searching for various raw materials in the Tropical Forest. When they succeed, they announce the discovery to the Governor and, after the trees are logged out, the company receives a share of the profits.
- State employee. Any member of your group can be employed by the Governor and become a State employee if she or he pays (or the group pays for him or her) 300 USD to take a requalification course and if the Governor approves the move.
- Leaving for the city. Any member of your group who pays 1000 USD can leave for the city and start her or his own business there. By this move, the player leaves the game, but he or she can support the Tropical Forest Conservation Society if they accept her or him in their group.
- Palm Oil Producers Alliance. Any member of your group who will pay the costs of 300 USD can establish her or his own palm plantation and join the Alliance.

A Representative of the Ministry of Defence

Number of players: 1.

You work for the Ministry of Defence, Department of Fighting against International Terrorism. For many years now, you have tried to build a road from East to West, through the centre of the Tropical Forest, for military purposes. This road is supposed to speed up the transport of army vehicles from your base to the border area of the country which

is filled with tensions and in which the fundamentalist organisation, the Fist of God's Anger, has been active for ten years. In the last few years, this organisation has organised several terrorist attacks various civilian targets in the country (at restaurants, hotels). At present, from 8 to 9 months out of the year, this border area can be accessed only by air. You are convinced that national security is an absolute priority, and nature conservation interests have to be subordinated to that priority.

Therefore, your goal is to create at least 1-tree-wide road through the whole Tropical Forest (from the upper right corner to the lower left corner). You believe that the road will also bring other benefits to the whole area. The area will become open to logging companies, which will attract more job opportunities and prosperity. Farmers will gain space for more fields and pastures. That is why it is to your advantage to support logging groups, farmers, and palm oil producers, or initiate the establishment of prospecting companies.

You are aware that there is a strong opposition against your road project from the local inhabitants as well as from international conservation groups that, in your opinion, do not understand the local context. Since the Defence Minister does not want to risk a drop in popularity before the election, your task is to proceed diplomatically and not to reveal your true aim to the public. Therefore, the best scenario would be if other companies logged the space for the road, and you could then just use the logged out area to build the road. People often do not know what is in their best interest, but in retrospect, they will certainly appreciate your efforts.

Money

- You have at your disposal financial resources of 3000 USD that have been approved by the Government.
- If things develop well and the outlook is promising, you can try to ask your Government for special support: throw the dice and if the turn is 4, 5, or 6, you will get a 100 times the amount thrown.

Power

- Since you are a registered citizen of a different province, you do not have any vote in the elections and you cannot stand as a candidate, either.

Mining, a Prospecting Company

The size of the group: 0 at the beginning of the game. The maximum number of players in the group: 1.

The goal of your company is to search for deposits of precious metals, oil, natural gas and other valuable raw materials. Previously unexplored parts of the Tropical Forest where there could be many of such rich deposits are especially attractive to you. Your job involves tough work full of danger, and it is suitable only for tough men and women who are not afraid to deter "the Indians" with a gun in hand and to fight your way through the jungle... The results are uncertain, but if things work out well, it is worth it...

Money

- To start a new Mining group, it costs 200 USD.
- The living expenses for one member (including the expenses for cutting down a tree) are 50 USD.
- In each round of the game, you can cut down 1 tree anywhere in the Tropical Forest. Then please throw the dice. If the turn is 6, there is a deposit of precious raw materials underneath the cut down "tree". The financial value of the deposit will be determined by your next throw of the dice – it is the number that you get times 300. When you get 6, you can throw again. However, you will get the money from the bank only after there is a road from the edge of the Tropical Forest to the discovery site (it can also be at the edge of a field, plantation, or logged out area).

Power

- You have 1 vote in the elections and you can stand as a candidate.

Changing groups

- You can move to the Indigenous peoples' or the Farmers' groups if they accept you.

- You can establish a new association, Forest Forever for the Sustainable Use of the Tropical Forest. It costs 500 USD to start this association.
- You can establish a new branch of the National Logging Company. It costs 500 USD to start this company.
- You can become a State employee, if the Governor employs you.

Forest Forever – Association for the Sustainable Use of the Tropical Forest

Number of players: 0 at the beginning of the game. The maximum size of the group: 2.

Your association establishes farms in the Tropical Forest from which it harvests wood and some other materials (oil for aroma-lamps, photographs of the Tropical Forest) in a sustainable manner which does not lead to the destruction of the Tropical Forest. An important source of your income is also eco-tourism – organising trips for small groups into primeval nature. For your work, you need to set aside a sufficiently large area of undisturbed Tropical Forest in which no logging or prospecting will be taking place. Your work is a source of small but steady income for you.

Money

- You have to get the Governor to set aside for you (e.g. by using wooden skewers) an area of the Tropical Forest with as many trees as possible. This area has to be protected from logging or burning and all other activities that disturbs it (if any of the other groups cuts down one of your trees, you do not make any profit).
- The Governor will probably want you to pay for renting this protected area, the estimated rent should be around 10 USD for every rented tree. The maximum allowed size of the protected area is 10 trees.
- The profit from each rented tree is 50 USD a year.
- Your yearly operating costs are 250 USD a year.

Power

- You have 1 vote in the elections and you can stand as a candidate.

Changing groups

- You can move into the Indigenous peoples' or the Farmers' groups if they accept you.
- You can establish a new Mining company. It costs 200 USD to start this company.
- You can establish a new branch of the National Logging Company. It costs 500 USD to start this company.
- You can become a State employee if the Governor employs you.

Palm Oil – Palm Oil Producers Alliance

Number of players: 0 at the beginning of the game.

Your parents came from the city years ago to farm the fields and raise cattle at the edge of the Tropical Forest. Despite their efforts, they did not become rich and their life was filled with poverty and hard work. A better prospect has opened for you. The logged out areas of the Tropical Forest are suitable for palm trees from which you can harvest good quality oil. You then sell this oil, with profit, to the European Union, the United States, Japan, Australia, and other countries.

Palm oil is well suited for use in cosmetics and also as a food ingredient (for instance in various children's treats and ice cream), and it can be used to fry chips etc. Further, palm oil is well suited for the production of biofuels which have started to become popular in some countries as a climate change mitigation measure. The growing of palm trees has dramatically increased your standard of living and it helps your whole community to grow in prosperity. Thanks to higher profits, you have recently built a school and a sewer system in the village.

This gives your children a chance to have a better childhood than you. Lately, you have detected a drop in your customers' interest that is related to some criticism of the use of palm oil. You think that this criticism is mainly due to lack of proper understanding of the poor people's living conditions at the edge of the Tropical Forest. You consider your palm woods as beautiful and natural in their own way, and you do not see why dangerous wilderness that brings no one any good should be preserved.

Money

- It costs 300 USD to start your group.
- The living minimum for each member of your group is 200 USD per 1 year.
- To establish a plantation, you need to cut down at least 4 trees next to one another. In their place, please put a palm symbol. For each palm tree, you will get 100 USD every year.
- Since demand for palm oil is predicted to increase and more and more people have been growing palm trees, you have to extend your plantation by at least half in comparison with the previous year (that is, after starting a plantation, your plantation can have 4 palm trees, next year 6, next year 9, etc.).

Power

- Each member of your group has 1 vote and can stand as a candidate in the elections.

Changing groups

- You can move into the Indigenous peoples' or the Farmers' groups if they accept you.
- You can establish a new association, Forest Forever for the Sustainable Use of the Tropical Forest. It costs 500 USD to start this company.
- You can establish a new mining company. It costs 200 USD to start this company.
- You can establish a new branch of the National Logging Company. It costs 500 USD to start this company.
- You can become a State employee if the Governor employs you.

Case 2

Deadwood in the Białowieża Forest – the unravelling complexity of biodiversity conservation

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Keywords:
conservation conflict, sustainable forestry, environmental attitudes, Poland

Relation to sustainable development goals (SDGs):

Strategy: presentation, individual/group work, debate

Time required for classwork: 60 minutes (introductory meeting) + 120 minutes (final meeting).

Students' preparation the class: 180 minutes during 1-2 weeks.

Aims:

- To develop students' awareness of the complexity of biodiversity conservation.
- To develop skills in gathering the evidence needed for discussion of complex environmental issues.

- To improve communication skills through presentation activities and debate.

Learning outcomes:

After completing this lesson, students will be able to:

- Argue for the importance of ecological processes in achieving conservation goals in forest ecosystems using conservation of deadwood as an example;
- Discuss dilemmas of forest biodiversity conservation in the frame of sustainability.

Case description

Introduction

The natural science perspective

Deadwood, also called coarse woody debris (CWD) is a crucial component of natural forest ecosystems worldwide. Originating from dying trees, it provides substrate and habitat to a myriad of different species that are fully dependent on its presence. As such, deadwood is necessary to maintain biodiversity in forest ecosystems and thereby has an important role in securing ecological sustainability. However, the maintenance of high amounts of deadwood in productive forests is very difficult due to competing interests with timber production. Therefore, biodiversity linked to deadwood is usually threatened and forests with large quantities of deadwood are rare.

The ancient Białowieża Forest (BF) located on the Polish-Belarus border is in this respect unique. There you can find a massive occurrence of large and old trees, large amounts of deadwood and natural dynamics of forest stands. Large and old trees both as living specimens and as deadwood are supporting hundreds of different specialised species ranging from birds and mammals using cavities or building nests in the canopy to lichens, fungi and microbes dependent on different stages of tree life and its decomposition. It is not surprising that BF

has been an invaluable reference area for biologists and other scientists interested in natural characteristics of European forests.

Figure 1. Deadwood in Białowieża Forest | **Photo:** Grzegorz Mikusiński.

It is widely acknowledged that the BF's future as one of the most valuable forests of Europe should be protected from changes that negatively affect its biodiversity including the reduction of deadwood. At the national level, some 20% of the total area of BF (the Polish side) is protected as Białowieża National Park[1] and, in addition, many smaller strict nature reserves have been created in the most valuable forest stands outside the park. In 1979 a core area of the Białowieża National Park was added to the UNESCO World Heritage List. In 1992 the site was extended to encompass a large part of the Belovezskaya

[1] Białowieża National Park, https://bpn.com.pl/index.php?Itemid=178&id=104&option=com_content&task=view&lang=en.

Pushcha National Park in Belarus and thus became a transboundary World Heritage site[2]. A large extension of the site on the Polish part of BF took place in 2014. Consequently, the total area of this World Heritage site covers 141,885 hectares on both sides of the border between Poland and Belarus. In addition, since 1976 a part of the Białowieża Forest in Poland has been protected under the Man and Biosphere (MAB) Programme of UNESCO as a Biosphere Reserve (extension in 2005)[3]. Moreover, the Polish side of the forest has been included in the European Natura 2000 network[4].

The social science perspective

In the very heart of this ancient forest there are several villages inhabited by some 2500 people. The first settlements were founded in the 15th century; the permanent villages were located by the Polish kings about 400 years ago. The task of the settlers – orthodox Ruthenians and catholic Mazovians – was to protect the forest and the animals for royal hunting and to produce charcoal, tar etc. Subsequent modernisation and industrialisation changes only supported the idea of "protecting", "caring", "looking after" the BF in the consciousness of the inhabitants, as well as the ethos of work connected with the wood industry.

This specific "human" attitude towards the "natural" forest, (i.e. the belief of human responsibility for nature as a part of it), connected with some sense of interdependence in isolated conditions ("in the middle of wilderness"), as well as the still multi-religious and multi-ethnic character of the local population, make up the cultural heritage and cultural identity of the local community. Because of its unique natural (BF) and cultural (architecture, cuisine, ecumenism, historical buildings etc.) heritage, the few villages today are also developing touristic centers.

[2] Białowieża Forest, World Heritage List, https://whc.unesco.org/en/list/33.
[3] Biosphere Reserve Information Poland Bialowieza, http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=POL+02.
[4] NATURA 2000 – STANDARD DATA FORM, Puszcza Białowieska, PLC200004, http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=PLC200004.

Figure 2. People's past and present in Białowieża | **Photo:** Xymena Bukowska.

The issue

There has been a long-term conflict about the fate of the Białowieża Forest, focused around the debate over whether this forest may maintain its value without human intervention. Foresters with the support of the majority of the local population view the forest as their responsibility that requires continuous care in the form of silviculture measures that "protect" the forest from undesirable changes, like accumulation of deadwood, lack of desired regeneration and visible changes affecting forest appearance, like dying trees perceived synonymously with a dying forest.

These aesthetic and ethical arguments are accompanied by anxiety about the future of the local community – not only economic (deadwood as firewood; deadwood as a danger/repulsive for tourists etc.), but also existential (in terms of potential "full ecologisation" of the whole area

of the BF, including villages surrounded by it). On the other hand, environmentalists and scientists praise the value of the Białowieża Forest, based on biodiversity values linked to natural processes that in large degree are based on the ageing and death of trees.

The presence of deadwood in the managed part of the Białowieża Forest is one of the issues. The current outbreak of bark beetles killing old spruce trees gives foresters an argument for a large increase of logging of this forest. The very limited cutting and removal of trees according to earlier regulations is proposed to be increased by the factor of 6 in order to stop the spread of the beetle and the increased creation of deadwood.

The actors and their messages

The ongoing conflict concerning the way that the Białowieża Forest should be managed and how to deal with the infestation of spruce trees by the bark beetle involves many actors. The "ecological side" includes the majority of scientists, different pro-environmental NGOs, liberal media and the international community including major newspapers like "The Guardian" or "Le Monde". The message from this side of the conflict is clear – the ecological processes shall be allowed to act in the Białowieża Forest so natural dynamics of the forest would be enhanced with long-term positive outcomes for its biodiversity and sustainability. The adversaries i.e. "foresters and allies" include State Forest Holding managing the area, part of the local population, the Ministry of the Environment and the conservative media. Their message is also quite clear – the Białowieża Forest must be protected against the infestation by the bark beetle using all possible means with logging and removal of attacked or threatened spruce trees as the most important silvicultural method.

The list of arguments supporting both ways of protecting the Białowieża Forest is long on both sides and it seems that compromise may be difficult to reach. Interestingly, some of the arguments of the opposing sides are just a different interpretation of the same phenomena (see Box 1).

Box 1. Arguments used in the discourse

Ecologists and allies	*Foresters and allies*
• Uniqueness	• Uniqueness
• Forest must be saved	• Forest must be saved
• Species must be saved	• Species must be saved
• Forest must be left alone	• Forest must be helped
• Forest with a lot of dead wood is very valuable	• Forest with a lot of dead wood is simply dying
• Forest with a lot of dead wood is beautiful	• Forest with a lot of dead wood is horrible
• Priceless natural heritage	• Priceless cultural heritage
• Dead wood as opportunity	• Dead wood as waste
• Attraction	• Danger

Questions to address by students:

1) What are the most important/relevant arguments in the debate and why?
2) What stakeholders should have decisive voice concerning the fate of deadwood in the Białowieża Forest and why?
3) How to manage deadwood in the Białowieża Forest in a sustainable way?

Additional possible topics to be considered by students

- How unique is the Białowieża Forest? What are the aspects of its uniqueness?
- How much deadwood is enough and why?
- Who is "right" in this discourse and why?
- Attitudes to the issue at local, national, European, global levels
- Short-term and long-term perspectives in the conservation of the Białowieża Forest
- May the forest "take care" of itself and naturally regulate the amount of deadwood?

- "Sustainable" amount of deadwood in forests from the ecological, social, and economical perspectives
- Changing attitudes of people to forest values

Data sources

Internet resources

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Procedure

This exercise encompasses several steps allowing for achieving its aims. It may be performed with groups of 5-30 students and entails two meetings and independent work of students (individual or in small groups). Below, we suggest a possible scenario of the exercise.

1. Opening the issue. Introduce the main question of the case e.g.: "Should the forest "take care" of itself and naturally regulate the

amount of deadwood or should the amount of deadwood be strictly managed by humans?" Form groups of students (per 3-5 students). Ask them to formulate 3-5 most important questions associated with your main question (e.g. What amount of deadwood is naturally manageable? What are the consequences of not harvesting the deadwood?). After 5 minutes of work, ask them to present their ideas.

2. Introduce the issue of BF (based on a teacher-prepared presentation according to info provided in the case). Be as neutral as possible. Finish with the main issue, i.e. "Should deadwood from the Białowieża Forest be removed or not?"

3. Students' independent investigation. Provide students 1-2 weeks for their independent investigation (they can work in teams). Ask them to a) find their answers to any of their initial questions they find relevant for the BF case, b) on the basis of their findings, to formulate their evidence-based opinion on the issue;

4. Briefly introduce the stakeholders of the issue and their opinions (see point 7 below). Prepare paper cards with their names and distribute them among the classroom. Ask students to take a chair close to the stakeholder card they share their opinion with. If the students groups are too big for discussion, divide them into smaller teams.

5. Ask student teams to discuss the following questions and then to present their answers to other teams:

a. To formulate their statement and arguments for supporting the point of view of the stakeholder with whom they agree. They are supposed to clearly answer if the deadwood should be removed or not, and under what conditions.
b. To identify the possible environmental, social, and economic consequences of their preferred solution. For both points, ask them to provide a good evidence-based argument.

6. After all of the presentations, ask students to discuss in their teams and let them present their answers:

a. What arguments in the debate are the most important and why?
b. What stakeholders should have the deciding voice concerning the fate of deadwood in the Białowieża Forest and why?

c. How to manage deadwood in BF in a sustainable way? (for this questions, write the suggested options on the board and identify how they are supported by students).

You can finish with a wrap-up, summarising the most frequently mentioned students' answers (for a and b) and the decision (c) with the prevailing support.

7. Debriefing. Ask students to discuss in pairs and then to present:

a. How difficult it was for you to analyse relevant information, prepare your own opinion, and communicate it with the others?
b. How effective have you been in influencing other students by your arguments?
c. What would you, on the basis of this experience, like to change in the way you analyse scientific information and communicate your opinion on complex issues with the others in the future?

- Ecological NGO's requiring protection of forest from humans;
- Ecologists (scientists) claiming necessity of maintenance of natural dynamics in BF;
- Foresters (scientists) claiming necessity of human intervention in order to maintain the BF value;
- Local foresters claiming that the BF values originated from human work;
- Inhabitants of settlements in BF interested in:
  - extended protection;
  - continued exploitation;
- Decision-makers from the Ministry of Environment.

Learning outcomes assessment:

Short questionnaire to the students asking for a list of new insight into different dimensions of sustainability.

Case 3

Sustainable development in the Shinyanga Region, Tanzania

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Keywords:
agricultural development, forest landscape restoration, local knowledge, participation, soil conservation, trypanosomiasis

Relation to Sustainable Development Goals (SDGs):

Strategy: Small group discussion and role-playing

Time required for classwork: 120-360 mins depending on the ESD competencies to be addressed and student/teacher choice.

Students' preparation for the class: 60 minutes.

Aims: Introduce students to the complexity and uncertainty of rural development, and use a long-term study of forest landscape restoration to introduce students to the application of core competencies for sustainability.

Learning outcomes:
After completing this case, students are able to:

- Describe change in a complex system over time (ESD Systems Thinking Competence).
- Analyse the ecological and economic trade-offs in the choice of ecosystem services to be produced from a landscape (ESD Normative Competence).
- Synthesise knowledge of change processes to develop scenarios of alternative futures (ESD Anticipatory Competence).
- Review and discuss their abilities to work effectively in small groups to complete the exercises in this lesson plan (ESD Interpersonal Competence).

Case description

Shinyanga Region

Shinyanga region covers approximately 50,000 km^2 of north-west Tanzania, on the southern shore of Lake Victoria. The population is more than 2.8 million people with an average annual growth rate of 2.8%. Per capita income is estimated at 180 USD per year and approximately 22% of the people live below the food poverty line. The high population density (56 people per km^2) combined with the people's agro-pastoral land use system of livestock production with subsistence and cash cropping, exacerbated already serious land use problems.

The area is predominantly semi-arid with an average annual rainfall of 600-800 mm. Rainfall is erratic and poorly distributed with high variability, meaning that arable farming is risky without access to irrigation, and the region is expected to suffer more extreme drought and rainfall events as climate change progresses. The natural vegetation in Shinyanga historically consisted of extensive Miombo and Acacia woodlands.

The area was inhabited by the Sukuma people who followed a subsistence agro-pastoralist lifestyle that was well adapted to the ecological conditions of the region. Land ownership and use rights were governed

by customary law designed to set aside land in enclosures or "*Ngitili*" to ensure conservation of grazing land for drought years.

Development and Collapse

Development of the Shinyanga region began in the 1920s with a programme that aimed to eradicate the tsetse fly by clearing woodland to create better conditions for people, their livestock and arable agriculture. Tsetse flies are the vector of a debilitating and ultimately deadly *Trypanosome* parasite that infects people and livestock, limiting land use and human and livestock populations. Before the advent of measures to control the tsetse fly, people avoided *trypanosomiasis* by avoiding tsetse fly invested areas. Most of the woodland clearing was done between 1925 and 1947.

As the woodlands were cleared, agriculture changed from relatively limited and primarily subsistence farming of crops like millet and sorghum, to large scale cultivation of cotton and tobacco. Livestock numbers increased, and as cattle have a vital role as a source of status, exchange, draught power, milk, meat, and insurance against hard times, eventually led to severe overstocking. Loss of woodland resulted in a shortage of domestic fuelwood, meaning that women had to walk over 10 km to harvest wood and increasingly made use of twigs, crop residue and animal manure for cooking and heating water. The supply of "minor forest products" such as medicinal plants, fruit, nuts, edible leaves declined drastically, removing an important source of supplementary food, which was particularly valuable when crops failed in times of drought.

The other major development intervention that added to the waves of change following woodland removal was the introduction of the *Ujamaa* Villagization Act of 1975. This legislation created new settlements around social service centres and required the relocation of people from their traditional homes. *Ngitili* and the traditional system of governing land use were abandoned, breaking down established conservation practice that ensured sustainability in the long term. By the early 1980s, very few *Ngitili* remained.

The combined effects of woodland clearing, increases in livestock and the expansion of cash crops together with the breakdown in traditional

land use practice led to a decline in soil fertility, soil erosion, and the ecological collapse of the Shinyanga region. The region was declared to be "*The Desert of Tanzania*" by the President of Tanzania in 1985.

Restoration and Development

Recognition of the degraded state of the Shinyanga ecosystem led to an extensive, long term forest restoration programme under the name Shinyanga Soil Conservation Programme or *Hifadhi Ardhi Shinyanga* (HASHI) in Swahili. The programme was funded by the Government of Tanzania with support from the Government of Norway and ended in 2004 when the landscape was transformed to a mosaic of woodlands, savannah and agricultural land without the tsetse fly. When HASHI started there were just 600 ha of *Ngitili*, when HASHI ended, there were more than 350,000 ha of woodland across 833 villages, and the benefits from restored woodlands were estimated as being worth an additional 14 USD per person per month to local incomes on average.

HASHI represented a change in policy from government imposition to acceptance of local knowledge stimulated by participatory processes and a long term (25 year) approach to restoration. HASHI depended on local knowledge of traditional land use practice and participatory planning that included women's groups, youth, village government and farmers, enabling adaptation and change. This was in marked contrast to earlier failed attempts by government to restore trees to the region. The government tree planting programme was implemented in a top-down manner according to central government policy and offered exotic trees species that were unknown to local people.

One of the outcomes of the HASHI project was the development of 1,500 small nurseries for local trees species as small enterprises that supplied trees to farmers and village governments for the restoration of *Nigitili*. As the forest returned, small enterprises based on herbal medicine, honey and fruit emerged contributing to improved diets and healthcare. Herbal medicine is critical in treating some diseases that are believed to be curable only by herbal medicine. Nitrogen fixing legumes are being used to restore soil fertility and as fodder for livestock. The water table has risen and dry season springs

have returned making water more readily available. Timber and thatching grass are available for the construction of homes, schools, general stores and public offices.

One villager said that "Trees gave birth to livestock," as sales from tree products allowed him to buy livestock. A Sukuma lady described how her *Ngitili* saved many hours of work, "I now only spend twenty minutes collecting fuelwood. In the past I spent between two to four hours collecting fuel".

The reduction in time taken to collect forest products were a major benefit to women and were in the region of:

- Fuelwood – 2 to 6 hours;
- Poles – 1 to 5 hours;
- Thatching grass – 1 to 6 hours;
- Water – 1 to 2 hours;
- Fodder – 3 to 6 hours.

On the negative side, vermin in form of wild animals has caused considerable damage to crops while some carnivores (mainly hyenas) have frequently killed livestock. Population growth and parallel growth in livestock numbers pose a risk for a second collapse if land use again exceeds the ecological potential of the restored land. The carbon market may be one way of avoiding this risk by providing farmers with an alternative to livestock and crops as an income source. It was estimated that *Ngitilis* stored 23.2 million tons of carbon by 2011 with a value of approximately 213 million USD at that time.

During a poverty survey of the Busongo village in Shinyanga in 2006, poor women revealed that wealthy men were rapidly acquiring land to create private *Ngitili*. Not enough land was being set aside for communal *Ngitili* to meet the needs of households with little or no land. Inequity was a problem before the HASHI project and was partially addressed by the creation of new *Ngitili* through reforestation and allowing preferential access to resource poor households. With economic growth, successful farmers are increasingly able to privatise common land. If left unchecked, this "*elite capture*" of the benefit of land improvement will lead to great inequity in a community that will come to consist of a relatively small number of farmers with relatively large landholdings, and a large number of landless people living in extreme

poverty. This implies the need for new local institutions and governing bodies at a village level that are accountable to village members. *Elite capture* of economies and the ever growing gap between rich and poor is a common and universal problem that is recognised as a system trap that keeps people locked in poverty.

Gender Aspects

Societal norms that stem from tradition and contribute to poverty include a patriarchal system, the custom of paying bride price (with cattle) by men, the expectation that women do household work and can be prevented from engaging in income generating activity. Decision-making power resides with the man in a household who has control over high value resources such as cattle and cash crops. Power may be enforced through beating.

Cultural norms and values determine the division of labour between men and women. Cultivation of high value crops is a shared responsibility but men market the crops and control the income. Male drunkenness after the sale of cash crops i.e., cotton and tobacco or the sale of cattle is a behavioural contributor to poverty.

Cultivation of low value crops is left to the women who are also responsible for household chores, including fetching water and collecting firewood.

A comparison of men's ranked criteria for wealth with women's criteria revealed major differences:

- money was ranked high by men; women do not rank money at all;
- a wife was ranked second highest by men; women did not rank a husband at all;
- household utensils were ranked highest by women; men ranked them very low;
- men ranked a plough, a cart, a milling machine, a shop, a sewing machine, a bicycle and a radio higher than household utensils; women did not list these items as important;
- men ranked cattle sixth while women ranked them second last.

The reason for the different ranking of cattle is that men decide how milk is used and when cattle can be slaughtered for consumption. Men

also have power over goats, while women only have power over chickens. Women who defy men's authority over cattle may be beaten, driven from the household or killed.

Keys to Success

A critical factor in the success of HASHI was the programme leader who deliberately adopted the new approach of participatory development to empower local people, as an alternative to the usual top-down and expert driven approach. The participatory approach enhanced the use and development of local rules and organisation for their enforcement; it increased the trust and collaboration between villagers and development agents, and enhanced the adaptive capacity of those involved in the programme. Primary stakeholders in the development process were the villagers, village-level government officials, community groups and NGOs. Participatory processes with women's groups revealed major power, wealth and work load differences between men and women (see gender aspects described above) and in some cases resulted in the formation of new rules for relationship and the redistribution of benefit and responsibility within the family.

Learning and Adaptation

Learning and adaptation was a central theme of the HASHI project, much of it related to the local knowledge and traditional rules for land use of the Sukuma people. Ownership of the programme was put into the hands of local people who wanted to restore their land in their way, fostering a culture of learning by building on what they knew, and adapting as necessary.

The phases of development and learning were:

Phase 1: Woodlands are cleared to remove a major health hazard and impediment to economic development. Rapid changes in land use occur that exceed the ecological potential of the land and the system collapses.

Lesson learned: trees are important for ecologically healthy landscapes in this region of Tanzania.

Phase 2: The government of Tanzania attempts to restore tree cover under a command and control policy that requires villagers to plant

mostly exotic trees. This fails as villagers resist the government programme.

Lesson learned: Respect local people, their knowledge, rules and their desires for a better life.

Phase 3: HASHI support for natural restoration and tree planting using species people wanted, respecting local institutions, and ensuring that such knowledge and institutional systems are respected by government, leads to successful restoration of land and livelihood for many people. The problems of elite capture that were never fully addressed re-emerge.

Learning: New rules and organisations are required to reduce the equity gap at a village level.

Phase 4: Is currently unfolding and the outcome is uncertain.

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Questions to address:

1. What role do global markets for cotton and tobacco have in promoting a cash crop economy in the developing south?
2. What are the consequences of cash crop farming on the long-term sustainability of ecosystem services and human well-being?
3. What do you think drove people to use land in the Shinyanga region beyond its ecological potential?
4. What changes to land use and human well-being do you think might occur if women had the same access to power and resources as men?

5. What kinds of land use rules do you think could be applied to prevent a second collapse of the Shinyanga region[1]? Consider the potential for gender equity to form the new rules.

Procedure

Depending on student/teacher choice this case can be used in three different ways to develop four of the core competencies for sustainability (systems thinking, interpersonal, anticipatory and normative). The order in which the exercises are applied reflect a progression from an analysis of a complex sustainable development problem to the development of scenarios that describe plausible alternative futures for the people of the Shinyanga region.

1. Systems analysis of case evidence

Suggested procedure:

a) After reading and discussing the case, groups of 4 or 5 students make a short presentation including a mental map or systemic chart that describes the main "drivers of change" that (a) led to the "desertification" of the Shinyanga Region; and (b) led to the restoration of woodlands and customary land use practice.
b) The student groups consider which four of the SDGs are most important in the context of the Shinyanga region and which SDGs conflict with the four selected presenting arguments to support their choice.
c) The student groups use the evidence in the case to present a reasoned argument for what they think will be the outcome of the fourth (current growth) phase of the economy in the Shinyanga region. Alternatively, students can complete a scenario analysis (below).
d) Students review and discuss their ability to work together, reach a common understanding of the problems of Shinyanga, and agree on an outcome of the current trends in the region.

[1] Answers to this questions require some knowledge of reinforcing and balancing feedback that can be found in Ch 2. Meadows 2008.

2. Trade-off negotiation through role-play

Students play roles to negotiate the trade-offs between the livelihood strategies of different stakeholders in a "typical" Shinyanga village and the sustainable use of ecosystem services. The aim of the role-play is firstly to explore the extent to which self-interest and power struggle can lead to undesirable outcomes; and secondly, to find a land use solution that meets the livelihood and well-being needs of all the stakeholders over the long term.

Roles within the village community include:

Chair of the village council: seeks to balance conflicts within the village and develop rules for land and resource management that maintain this balance over the long-term. Depending on his ethics, the chair of the village council may use his position to further his personal wealth at the expense of the community as a whole. Long-term sustainability depends on his ability to balance the different interests in the village with the ecological potential of the land.

Agricultural marketing agent: buys cotton and tobacco from farmers, transports it to a central market, advances credit for seed, fertiliser, pesticides and herbicides. He is an agent for corporations that trade these agricultural commodities on the global market and earns a commission on all the transactions that he makes. He is an accomplished salesman and loyal to the corporations that he serves.

Wealthy farmer: seeks to increase his landholding for cash crops, livestock numbers and access to *Ngitili*, while resisting attempts by his wife to have more access to family income so that she can improve the quality of life in her household. He uses chemicals to increase cash crop production. He justifies his accumulation of wealth by claiming to provide employment to poor people in the community.

Wealthy farmer's wife: wants a greater share of the family income to improve the quality of life for herself and her household including: more children to assist with household chores, good food, good health, good clothes, schooling for her children, and good marriages for her elder children. She may use her position of relative power to form collaborative arrangements with other women in the community and advocate for social reform.

Poor farmer: has access to sufficient land and livestock to become successful but spends much of his income on women and alcohol. He is in debt to the agricultural marketing agent and blames others for his misfortunes, including his wife, his wealthier neighbours and the village council. Apart from indulging his vices, he seeks maximum gain for minimum effort.

Poor farmer's wife: suffers from domestic conflict and seeks to improve her well-being through her children, support from her neighbours and access to *Ngitili* for minor forest products that she will use for food, medicine and selling.

Woman without land or husband: in many respects she is the poorest of the poor who is dependent on her children for help with household chores, wealthy neighbours for wage labour and access to *Ngitili* for minor forest products that she might use for handicrafts, traditional medicine and food. Although materially poor, she has control over her household and any income that she earns. She might be willing to engage in a social reform movement.

Suggested procedure:

a) After reading the case and being assigned their roles, students are instructed on the difference between arguing to uphold a position, exploring the underlying issues that formed that opinion, and seeking ways of meeting their common interests. In the real world, people vary in their ability and willingness to seek solutions to meet common interests and students can decide what approach they wish to take to problem-solving. Alternatively the teacher can assign negotiating styles to particular roles.
b) After a discussion and negotiation round, the students step out of their roles and:
    a. reflect on what, if anything, was resolved; and
    b. the likely long-term consequences of implementation of the new agreements and rules for governing village life and access to land.
c) Students may then enter a second round of negotiation, where each strives to find ways of meeting their common interests, as

opposed to getting only what they want, regardless of the consequences of the other.

d) At the end of this round, students reflect on what has been resolved, the long-term consequences of implementation of new agreements and compare this outcome with the outcome of the first round of negotiation.
e) In addition, students review and discuss changes in the manner in which they negotiated in the first and second rounds.

3. Alternative future for Shinyanga

After completing the role-play exercise, students apply a simple qualitative approach to scenario planning (Biggs *at al.* 2010, pp. 267-273) to develop two scenarios that illustrate alternative futures for the people of Shinyanga.

Suggested procedure:

a) Ask the same student groups who participated in the role-play to prepare a short presentation of two alternative futures for Shinyanga bearing in mind the current tensions between actors, ecosystem services and future uncertainties.
b) Students use the outcome of the system analysis and role play negotiation to:
    a. Discusss and agree on two alternative trajectories of future change. Use key uncertainties as a basis for thinking about alternative ways in which the Shinyanga could evolve.
    b. Create stories that describe each scenario[2]. Each story should track key indicators such as poverty, land use change and rural economics in Shinyanga and should complement each other, forming a coherent, thought-provoking pair of alternatives.
    c. Test the scenarios for consistency by comparing them with the negotiated needs of stakeholders defined during the role-play. The dynamics of the stories must be plausible.

[2] Students may create pictures instead of stories to illustrate the scenario if they prefer.

   d. Create a set of 3 to 5 key policy recommendations for rural development agencies, based on the lessons the students learned from working through the Shinyanga case.

c) The tendency towards land privatisation by the emerging elite is the subject of one scenario.
d) The second scenario is a reflection of the agreements negotiated in the role-play.
e) Additional factors to consider in both scenarios are:
   1. a growing human population;
   2. changing climate;
   3. return of the tsetse fly and associated health risks for people and livestock.

Learning outcomes assessment

Ask students to review and discuss what they learned from the case in relation to the four core competencies for sustainability that this case and lesson plan illustrate and question aspects they had difficulty understanding.

Potential for wider use

The Shinyanga case is a good example of the application of adaptive management in response to the unexpected and undesirable changes that can occur in a complex system as a consequence of a development intervention that is unaware of the effects of ecological limits on economic development.

Further application

The Shinyanga case could be used to compare similar rural cases from the developing world and the developed world, to explore the effects of social and ecological context on development outcomes and future trajectories towards sustainability.

Case 4

Rural tourism development: the case of Plastiras Lake, Karditsa, Central Greece

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Keywords:
rural tourism, innovation, sustainable rural development, (local) conventions

Relation to Sustainable Development Goals (SDGs):

Strategy: The lesson comprises an initial group discussion, text analysis, and follow-up discussion aimed to reformulate students' initial conceptual understanding

Time required for classwork (in minutes): 90.

Students' preparation for the class (in minutes): No preparation to the class needed.

Aims: Development of anticipatory competence; integrating elements from different subjects or fields in analysing a situation.

Learning outcomes:
After completing this case, students are able to:

- Identify the social, economic, and environmental aspects of the issue;
- Reason that many problems (environmental, economic, socio-cultural) are created by people;
- Create a vision and plan for sustainable tourism;
- Develop communication and team skills.

Questions to address:

- What are the factors (or the challenges) that have to be taken into account when planning rural tourism with a view to sustainability?
- How can tourism development relate to the other sectors of the local economy?

Case description

Sustainable tourism is defined as tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities.

The case of Lake Plastiras represents an example of sustainable tourism development in central Greece over the previous decades. Lake Plastiras is located on a mountainous plateau in the Regional Department of Karditsa, about 350 km north of Athens. It is an artificial lake, which was constructed during the period 1958-1962 in order to produce electricity, irrigate the plain of Thessaly and supply water to the city of Karditsa and another 38 plain towns and communities. Moreover, under the European Union's Agricultural Policy, the region around Lake Plastiras has been designated as a "Less Favoured Area", due to its geographical, topographical and socio-economic constraints.

The census data reveals that, during the period 1961-2001, the Lake Plastiras area experienced a population decrease of 18.6%. In particular, from 1961 to 1971, the population displayed a significant decrease by 32.3%, that can be mainly attributed to emigration, as the lake's construction isolated villages that were previously close to each

other, causing great travel distances, and also covered hectares of previously fertile agricultural land, causing a decline in farming jobs. Thus, in the period 1971-2001, the number of farm holdings and cultivated land reduced by 50% and 60% accordingly. In general, the small and fragmented holdings as well as the steeply sloping land are the main causes of low productivity. Furthermore, the livestock sector in the area is characterised by traditional, labour-intensive production methods with low rates of capital investment which mostly relies on EU subsidies.

As far as the secondary sector is concerned, only enterprises of traditional cafes, restaurants or even food stores (a type of mixed family businesses) were found in all villages, while some families run small-scale traditional businesses such as distilleries, weaving, carpentry and smithing.

Given the presence of the lake, the high mountain peaks, the prevailing forest species of fir, oak and chestnut trees, the alpine grasslands as well as a variety of rare, endangered and protected fauna and flora species, the Lake Plastiras area is considered a landscape of great scenic beauty and is a designated NATURA 2000 area. Nevertheless, the tourism sector was not developed in the region before 1987, when a local development project adopted by the Prefecture of Karditsa proposed sustainable tourism as the vehicle that would reinforce the local primary production and provide alternative sources of household income. After the completion of the first hostels (1992-93), the tourist demand progressively increased, resulting in further investments in the tourism infrastructure mainly funded by the local LEADER Programme[1] (a European Union initiative to support rural development projects). Nowadays, the Lake Plastiras area is one of the most renowned mountainous tourism places in Greece.

AN.KA., the Development Agency of Karditsa, played a significant role in the development of the tourism sector in the Lake Plastiras area. AN.KA., created by local authorities and cooperatives in 1989, aimed to co-ordinate initiatives and implement integrated development programmes taking into account sustainability, co-operation and self-governance. Moreover the Agency represented the Local Action Group

[1] The local Leader Programmes (Leader II and Leader+) were the EU initiatives that promoted a bottom up approach.

(LAG) of the LEADER Community Initiative in the Prefecture of Karditsa that designed and applied local development programmes.

Although the rapid development of tourism in the Lake Plastiras area was at first seen as an opportunity for improving the income and in general the residents' life quality, concerns about the environmental, socio-economic and cultural consequences of such a (tourism) growth also arose. Within this context, AN.KA. supported an innovative organisational scheme, the Local Quality Convention (LQC).

The LQC comprised the common vision for "quality tourism" envisaged by entrepreneurs through a series of meetings that were arranged and supported initially by the Agency. The overarching aim of the LQC was the improvement of the standards of living of local people through the protection of the anthropogenic and physical environment and the upgrading of tourism services.

Two distinguishable groups of entrepreneurs can be found in the area, the "new businessmen" (largely, the quality tourism entrepreneurs) and the local ones. The first group is characterised by a higher educational level, great entrepreneurial knowledge acquired mostly outside the region and is concerned about the long-term viability of enterprises, along with environmental protection and the prosperity of the local society in general. On the other hand, the local entrepreneurs are the local people who entered into the tourism sector but who lack entrepreneurial spirit, have showed primary interest in their own short-term profit and can hardly understand notions like innovation and sustainable development.

During the first meetings, AN.KA. acted as animator and facilitator encouraging participants to share their concerns, identify problems, as well as to recommend ideas and potential solutions. Afterwards, the entrepreneurs took the lead, set out the LQC's rules and submitted new proposals for funding from the Leader Programme. The LQC gained more members and was considered as a great example of successful innovation.

On a later stage local entrepreneurs also joined LQC. Nevertheless, personal interests and different perspectives on the LQC and the type of tourism to be promoted created conflicts and disagreements among

tourism entrepreneurs which resulted in instability and eventually the interruption of the LQC scheme.

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Procedure

A discussion method is applied in which students try to explore, understand and assess the factors that can boost rural tourism development ensuring at the same time adherence to sustainable values. The exercise begins by posing the two introductory questions and asking students to express their broad and general view on the topic. Afterwards, the teacher introduces the case and relevant literature to help students to clarify the facts and the role of actors involved, as well as to identify different perspectives and needs.

Additional questions that are addressed to the students are:

- Why did LQC fail?
- Why was the innovation (LQC and sustainable tourism) not adopted by the local population/local entrepreneurs?
- What is the role of women in rural tourism?

- How is gender included/not included in local development planning and how can women be empowered?

Through the study of the written materials and discussion students put their own questions, defend their views and acknowledge opposing ones, formulate their positions and revise them while receiving feedback and critiques from the others. Finally, they are able to propose a draft of a sustainable tourism plan.

Final product: Draft of a sustainable tourism plan.

Learning outcomes assessment:
Comparison of initial and final views on (sustainable) rural tourism development; quality of draft of a sustainable tourism plan; communication skills.

Further application

The battlefield of development – the case of Santorini
The island of Santorini is located in the southern Aegean Sea, in the island complex of the Cyclades, approximately 128 nautical miles south-east from Piraeus (Athens' port). Santorini is the remnant of a volcanic cone, whose central part was blown up by the Minoan eruption that took place in 1613 BC, resulting in the creation of the world famous caldera of Santorini.

The volcanic soil of Santorini favours the cultivation of grapevines, which are adapted to the hot and dry conditions prevailing in the island. Historically, winemaking on the island is placed at the end of the 5th millennium BC. There are twenty-five indigenous grape varieties to the island that are totally resistant to the phylloxera insect; thus Santorini is one of the few places in Europe with its original ungrafted vines. Vines are self-propagated through layering in a disorderly manner and pruned with two distinctive traditional methods adapted to the climatic conditions of the island (i.e. hot and dry summers, strong winds), resulting in a unique agricultural landscape.

Although at the beginning of the 20th century, vineyards covered 3,500 ha, accounting for 84% of cultivated land, over the years more

than half of the vineyards' area has declined, amounting to just 1,492 ha in 1997. Based on the 2013 available data, the total area covered by vineyards is 1,300 ha.

Agriculture was the main economic activity for the population of the island until the 1970s, when tourism emerged as the dominant economic sector. Tourism development competed for agricultural land and labour. The increasing tourism activity required new constructions creating an urban continuum on the large part of the island which, degraded the agricultural landscape. Furthermore, farmers preferred to get engaged in tourism businesses and related activities that provide higher, easier and more stable income.

Since 1970 Santorini's wines were assigned the Appellation of Origin label, protecting the reputation of Santorini quality wines. Later on when Greece joined the European Union they were nominated as VQPRD (Vin de Qualité Produit dans une Région Déterminée).

However, before 1980, most of the wine was sold in bulk to the neighbouring islands as well as to the mainland. The first attempt towards quality wine production in Santorini was initiated by one of the largest wine-making companies, located in Northern Greece, in a joint effort with local bulk wine producers and the co-operative. Thereby the construction of a modern winery and an information centre (1989) along with an independent facility created by the local co-op (1992), whose membership counted 2,500 vine cultivators, were the key factors that stimulated the development of a niche market for Santorini wines.

In addition to tourism expansion, another pressure on the landscape comes from the development of the global market for quality wines that commands a shift towards the homogenisation of the taste and the creation of "international wines". In this respect vine growers aiming to enter this new market should restructure their vineyards in terms of the grape variety cultivated, propagation methods and pruning techniques thus influencing/changing the island's landscape.

Two measures of the EU's rural development policy applied on the island of Santorini provide financial incentives (subsidies) to vine growers in order to maintain the traditional pruning system of vineyards and the continued cultivation of the traditional vines respectively.

Currently in Santorini the actors involved in the wine sector are divided into two groups who perceive the notion of quality differently. The first group seeks quality through the entrance of Santorini's wines into the global market; thus, in order to be more competitive, changes are needed at the expense of tradition and landscape. The second group acknowledges that the fame of Santorini's wines stems from the traditional vine varieties along with its unique 'terroir'; thus they support and protect the traditional pruning and planting methods simultaneously preserving the agricultural landscape.

Question to address:

- What are the environmental, socio-economic and cultural effects of tourism development on a local community?

Data source

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Case 5

Organic farming and public support in the EU – the Greek case

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Keywords: agricultural policy, organic farming incentives, public goods provision, interest groups (stakeholders)

Relation to Sustainable Development Goals (SDGs):

Strategy: Role-playing, debate

Time required for classwork (in minutes): 270.

Students' preparation for the class (in minutes): 90.

Aims:
Appropriately handling situations that are ethically ambivalent, complex or conflictive; showing comprehension and consideration towards the requirements, interests and positions of others; reconciling contrasting stances in seeking satisfactory alternatives.

Learning outcomes:
After completing this case, students are able to:

- Evaluate the environmental, economic and social aspects of organic farming as an approach towards sustainability in agriculture/rural space.
- Analyse and criticise the rationale of organic farming support.
- Work collaboratively with others and develop decision-making skills.
- Improve communication skills and critical thinking abilities.

Case description

The International Federation of Organic Agriculture Movements (IFOAM) defines organic agriculture as a production system that sustains the health of soils, ecosystems and people. It relies on biodiversity, ecological processes and cycles adapted to local conditions, rather than the use of inputs that may have adverse effects. Consequently, organic agriculture as a holistic approach of sustainable farming is according to IFOAM, meeting society's demand for environmentally-friendly farming practices and higher quality food products. Moreover, it encourages the provision of public goods contributing to environmental protection and animal welfare. The environmental claims of organic agriculture include improved soil health, reduced risk of soil erosion, water quality, enhanced biodiversity and climate change mitigation.

According to data of the Hellenic Ministry of Rural Development and Food, the total agricultural area under organic farming in Greece has increased during the period 2009-2015 with an average annual growth rate of 11.8%. Between 2009 and 2011 organic farming decreased by about 35%, followed by a sudden increase in 2012, when it reached its peak (462,618 ha), and seems to be stable from 2013 to 2015. The significant decrease in organically farmed areas during the period 2009-2011 coincides with the beginning of the economic crisis in Greece, while the sharp increase in 2012 can be attributed to the launch of the organic farming measure of the Greek Rural Development Programme 2007-2013. Figure 1 presents the evolution of total organic farmland in Greece.

Organic farming in Greece consists of arable land crops (such as cereals, fodder plants, fiber plants, oilseeds, vegetables, pulses, medicinal-

aromatic plants and herbs), permanent crops (such as fruit trees, nuts, citrus, vines and olive trees), as well as pastures and grassland.

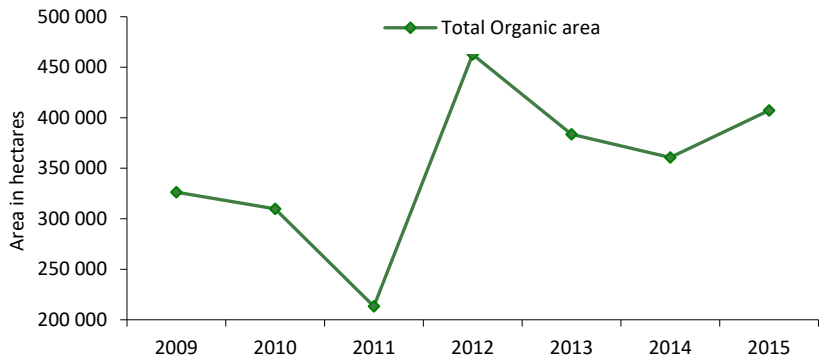

Figure 1. Evolution of organic agricultural area in Greece 2009-2015

Source: http://www.minagric.gr, elaborated by the research team.

In terms of extent (excluding the pastures), arable land is the most extensive area farmed organically between 2009 and 2015, with cereals and fodder plants being the most important crops. When considering permanent crops, olive trees and vines seem to be of particular importance (Figure 2).

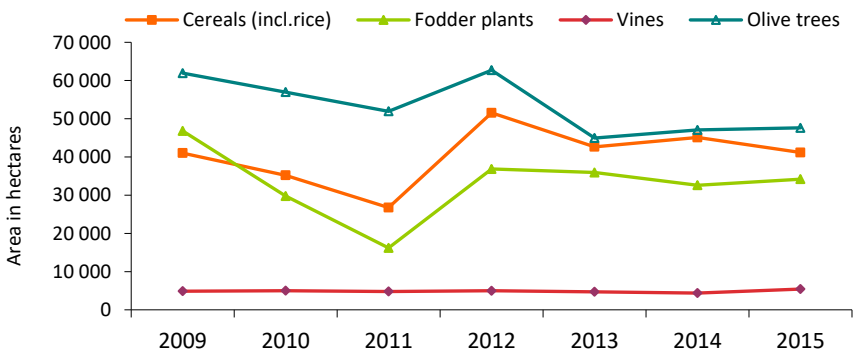

Figure 2. Organic agricultural area under major crops in Greece 2009-2015

Source: http://www.minagric.gr, elaborated by the research team.

The organic livestock production in Greece seems to follow the same trend. According to the data available, the total number of animals organically reared has slightly increased between 2009 and 2015, with an average annual rate of 5%, while the most important animal species seem to be sheep and goats. The evolution of organic livestock production in Greece is depicted in Figure 3.

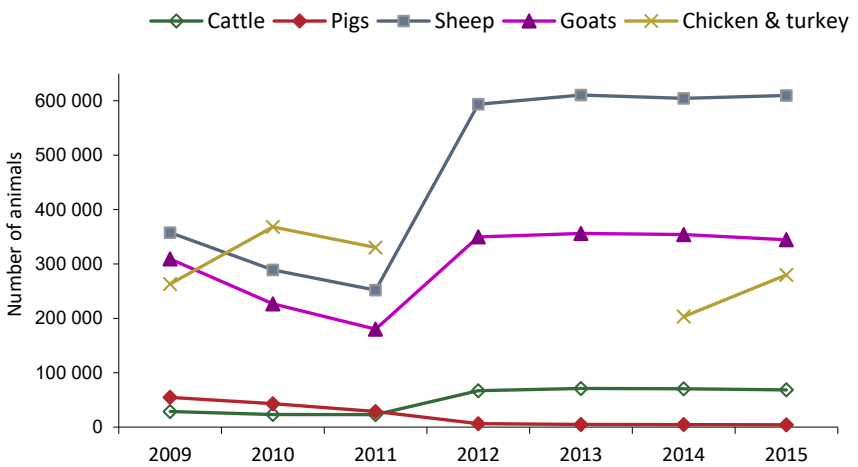

Figure 3. The evolution of organic livestock production in Greece 2009-2015

Source: http://www.minagric.gr, elaborated by the research team.

Organic farming is currently supported under both pillars of the Common Agricultural Policy. Organic farmers receive an additional 5% of the 1st pillar payments, while under the Rural Development Programmes provide incentive payments to farmers who voluntarily adopt organic farming systems. Support is given to compensate for income forgone and increased costs due to compliance with stringent farming practices required for organic farming. Out of the €4.7 billion of the Greek Rural Development Programme for the current programming period (2014-2020), €600 million are allocated to organic farming, thus accounting for 12.74% of the total public funds.

In addition to that, on the Greek market, the organic products are sold at prices higher than conventional products by a range of 20% to 50%.

Price premium paid to organic products is often legitimised on the grounds of them being differentiated goods. Different products command different prices. The rationale for such a differentiation is usually based on food quality, consumer health and safety claims.

Food quality can be judged on objective (e.g. energy content, proteins, vitamins) or subjective (it tastes nice to me) grounds. Although nothing can be said on the subjective argument of food quality, there are many research papers (and meta-analyses) that do not support nutritional differences between organically and conventionally produced goods.

As far as food safety is concerned, conventional food products bear the risk of having chemical residues (pesticides) above the allowable safety limits i.e. Maximum Residual Limits (MRLs). However, if producers followed good agricultural practices and comply with safety regulations, MRLs are not exceeded. Hence there is no risk element. On the other hand, organically produced goods by default have negligible risks of chemical residues, but increased probability of other risk elements (e.g., mycotoxins) cannot be excluded[1] .

Questions to address:

1. Do you agree with the EU policy to provide financial support to organic farming?
2. What are the reasons for which subsidies are provided to organic farmers?
3. On which grounds are price premiums to organic products justified?

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Procedure

A role-playing debate will be applied. There are four interest groups/ stakeholders addressing environmental, social, economic and ethical concerns:

1. Farmers
2. Consumers
3. Policy makers
4. Taxpayers

Each group should explain their positions, formulate arguments and justify their decisions concerning the questions listed above.

Moreover groups should consider the following issues:

- Farmers: What motivates farmers to adopt or reject organic farming?
- Consumers: Why do consumers purchase or refuse to purchase organic products?
- Policy makers: Should policy design, e.g. organic farming subsidies, be based on foregone income or rather on the delivery of positive externalities from this farming system?
- Taxpayers: Should taxpayers bear the cost of organic support?

If there is enough time to allow for both lecturing on organic farming and role-playing (approx. 6 hours; 45 min/hour), the flow of activities of the exercise is as follows:

- In the first stage, students are presented with a comprehensive lecture on organic farming in order for them to acquire the basic information on organic farming principles, certification, labeling and financial support. Afterwards, students are divided into groups and background information and support materials are distributed and further sources indicated.
- In the second stage, students do their own research, group meetings and preparation (depending on the time available, e.g. with two weeks' interval).
- In the last stage, students participate in a role-playing exercise: group presentations in class, discussions among and within groups, concluding statements/positions and joint decision-making (based on their mutual agreement).

If there is sufficient time, next steps can also be followed:

Step 1: Each group presents its view on the three specific questions given; only clarification questions are allowed by the rest of the groups.

Step 2: Each group discusses additional questions to be addressed to the other three groups (farmers formulate questions to consumers and/or taxpayers and/or policy makers/ consumers to farmers and/or taxpayers and/or policy makers, etc.).

Step 3: The questions are addressed to each specific group. The facilitator should be ready to add questions in case any of the groups is short of questions

Step 4: Each group discusses the questions received and agrees on the answers.

Step 5: Each group responds to the questions addressed to the group.

Step 6: Following a general question is addressed to all: "Did you change any of your views after the discussion?".

Furthermore, depending on the size of the class and the time available, before steps 1 and 6, a human continuum activity may also be used. For example, at the 1st step before the groups' presentations, the teacher (facilitator) may ask students to stand along a continuum according to how much they agree or disagree with the statement "organic farming should be subsidised". Likewise, at the 6th step, the teacher

may ask students to stand along a continuum depending on whether they have changed their initial position.

Final product: Group work presentations and discussion output.

Learning outcome assessment: Quality of group presentation and discussion.

Further application

Water management and EU policies – the case of Larissa, Central Greece

Larissa is one of the four regional departments (NUTS3) of Thessaly. It is mostly a plain area, where agriculture has been traditionally the main economic activity. The previous 'coupled' Common Agricultural Policy (CAP), commodity support schemes led farmers to shift towards highly intensive cropping patterns, in which cotton predominated, thus causing significant pollution in surface and ground water.

One of the first Agri-environmental Measures implemented in Greece in 1995 (under Reg EEC 2078/92) aimed at combating water pollution caused by nitrates originating from agricultural sources. The Nitrate Reduction Scheme was initially targeted at Thessaly, a Nitrate Vulnerable Zone (NVZ) designated under the Nitrates Directive (EEC/91/676), and then expanded to other NVZ areas. The scheme was designed to provide incentives to farmers in order to introduce or maintain nitrate-reducing farming practices concerning irrigated arable crops in areas with high concentrations of nitrates in their groundwater or in NVZs under Directive EEC/91/676. The stated objectives of the Nitrate Pollution Reduction Scheme were: protection of water resources from exhaustion, restoration of the quality of ground water and improvement in soil fertility. Therefore the specific action aimed to reduce water use and the application of fertiliser as well as to create ecological compensation areas.

On the other hand, cross compliance is a key instrument for integrating major environmental concerns into the first pillar of the CAP

and consists of compulsory environmental requirements and obligations that farmers should abide by in order to receive CAP subsidies. In particular, farmers being in a NVZ area should comply with obligations defined in their Local NVZ Action Plan as well as with other specific cross compliance legislative measures.

Question to address:

1) Comparison of the environmental, economic and social effects related to the implementation of a regulatory policy measure (cross compliance) and an incentive provision project (agri-environmental measure).

Case 6

Remodelling an ancient farm

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Keywords:
ecosystem services, cultural heritage, rural tourism

Relation to Sustainable Development Goals (SDGs):

Strategy: role-play, group work, discussion

Time required for classwork: 120 minutes.

Time for students' preparation for the classwork: 30 minutes.

Aims: Development of knowledge and competences related to the remodelling of open spaces in a sustainable and traditional perspective, taking into account the tradition and cultural heritage of the population of the area.

Learning outcomes:

- To develop interest and motivation in the development of sustainable projects.
- To discuss the values of the three pillars in an example of a Sustainable Development project.

- To demonstrate the relevance of each pillar of Sustainable Development in the process of reaching a decision for the reconstruction of an old farm.
- To evoke knowledge related to ecosystem services.
- To improve communication skills through presentation activities or debates.

Competences:

- Anticipatory;
- System-thinking;
- Normative;
- Interpersonal;
- Strategic.

Questions to address:

- What pillar of Sustainable Development should be more relevant to the sustainable development of this farm and the manor house?
- Which decision would be more profitable and would sustain the farm for the upcoming generations?
- Which arguments can be used to support your decision?
- Which values do you think are more important to be preserved (cultural, historical, environmental, social, economic…)?
- Is there a sustainable decision to remodel the house and the farm?

Case description

Paço de Calheiros is a manor house located in the North of Portugal, close to the medieval town of Ponte de Lima. It is classified as a Monument of National Interest and its surroundings are classified as Historic Gardens by the Association of Historic Gardens of Portugal.

It is a 13-hectare property, placed on a hill in a white wine production region. Several elements are identified in the property such as: a chestnut grove, old mill, the vineyards, archaeological findings and old stables. Water runs in several fountains and tanks in the property. There is also a vegetable garden situated near the house.

Figure 1. Farm and Manor House of Paço de Calheiros, Ponte de Lima, Portugal (1905-1930)

Built in the 17th century by the Calheiros, a recognised family since the beginning of our nation, the manor house has 9 bedrooms and a wine cellar. The family was faithful to all Kings of Portugal and made an effort to preserve the originality and culture of the region. Paço de Calheiros is an 18th century manor house, built of granite and wood.

Figure 2. Postcard of the Main Entrance of Paço de Calheiros, Ponte de Lima, Portugal (1905-1930).

Currently the Farm is owned by the Count of Calheiros, Francisco de Calheiros e Menezes, who is looking for a sustainable way to run the house and promote its development in a region full of tradition and with a strong commitment to promoting tourism.

Data source

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- Visit Portugal. Ponte de Lima. https://www.visitportugal.com/en/NR/exeres/FD8C91D2-0347-4A8B-8C50-024BCFEC663B.
- Quinta do Paço de Calheiros. http:// www.calheiros.eu.

Procedure

A role-play will be performed after work development in small groups (each team is a group) for 15 minutes (much of the work has to be done before the class). The role-play will promote a discussion so that every group can present arguments to support their decision. It is expected that the mediator (a member from team 5) facilitates the discussion

allowing each team to present arguments to support their own points of view. In the end, the team that has the role of the stakeholder (team 5) will present a PowerPoint presentation with the final, sustainable made decision.

Roles of each team:

Each team has to find arguments to support its decision and it is possible to use some resources, like a PowerPoint presentation (with a maximum of 3 slides) to synthetise and present its opinions during the discussion.

Team 1 – these four members belong to EER (Ecocentric Environmental Relationships) an ecologic association that devotes their lives to support the idea that humans must have an ecocentric relationship with the environment. They define themselves as a political and ethical movement that seeks to improve and protect the quality of the natural environment.

Team 2 – these four members are not associated to any group. They represent the movement of citizens interested in defending the inclusion of immigrants in the country. They have informal activities which focus their concern in social or political issues. They carry out, resist or undo a social change.

Team 3 – they are four members of the Town Hall of Ponte de Lima interested in preserving the cultural and historical aspect of the region. The touristic development and the conservation of the cultural heritage is the most important mission to be accomplished.

Team 4 – the four members are economists with a background in Agriculture Sciences and are interested in finding a place to produce good wine to sell to foreign countries in order to make the best profit possible without compromising the sustainable development of the region.

Team 5 – the four members (stakeholders) belong to Calheiros family and want to find the best sustainable decision to remodel the farm and the manor house so as to be able to preserve its identity for future generations.

Further application

The Terramonte mines are located in the Castelo de Paiva municipality, about 20 Km SE of Porto, Portugal. The mine is crossed by the Ribeira da Castanheira which flows into the Douro River, upstream of the

Crestuma-Lever dam. Lead (Pb), zinc (Zn) and silver (Ag) were extracted from there, at one time, one of the most important mines in Europe. Recently, Terramonte was mined by Minas de Terramonte, SA (MITEL), between 1966 and 1973, when the mine was abandoned with no recovery plan until the year of 2007. Mine waste was accumulated in three heaps, two upstream the mining facilities and one downstream, in the valley of Ribeira da Castanheira. This one supported by two walls, but in the 80's one of them collapsed and the materials started being transported along the Ribeiro da Castanheira to the Douro River (Figure 3).

Figure 3. Heap after the collapse.
Photo: Alexandra Lima

In 2007, the Mining Development Company, SA (Empresa de Desenvolvimento Mineiro, SA), started rehabilitation works of the mining area, but the efforts did not prevent the waste being carried by the waters from the heap, which still remains on the banks of Ribeira da Castanheira without any intervention. The high levels of the metals in the water and the land are harmful for the surrounding ecosystems, damaging its flora and fauna. These metals are responsible for nervous system disorders and cancers in humans.

Question to address:

Imagine that you have the power to decide about the recuperation of the area and indicate the best way to rehabilitate it in a Sustainable Development perspective. Please, consider three perspectives:

1. Promote tourism for the citizens in the area.
2. Help the area recover from an environmental perspective by sealing the heaps and replanting flora.
3. Continue the mine exploitation with suitable plans to minimise the risks. Justify your final decision, supporting it with three valid arguments.

Case 7

Transformation of a local production company into a sustainable business

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Keywords:
gender gap, sustainability, innovation, sustainable management

Relation to Sustainable Development Goals (SDGs):

Strategy: presentation, discussion over a draft strategic plan based on a SWOT analysis

Time required for classwork (in minutes): 90.

Students' preparation for the class (in minutes): 120.

Aims:

- to illustrate challenges that a medium-sized company faces while aiming to grow with respect to sustainable development (SD) goals (for example, company development, internationalisation, sustainability in the company's operations, and partnership with local communities);

- to find suggestions of possible solutions to challenges associated with work of a medium-sized company in the SD context;
- to apply basic leadership strategies;
- to catalyse the synthesis of new knowledge of the relationship between the economic, social, and environmental aspects of a local production company;
- to determine the priorities;
- develop critical and innovative thinking skills.

Learning outcomes:
After completing this case, students are able to:

- better evaluate the strengths, weaknesses, opportunities, and threats of a firm, using SD goals and concepts;
- craft a strategic plan to grow a company while creating societal and environmental benefits;
- appreciate, consider, and leverage the capacities of an individual belonging to a demographic minority.

Case description

An example of a medium-sized company located in the Central Europe aiming to grow in a sustainable way.

The company was founded in 1990 during the wave of economic transformation after the collapse of the Soviet-imposed socialist system, initially as a factory producing metal products but also as an intermediary in the trade of food products. In the mid-1990s, the company eliminated its food-related operations and focused on manufacturing grinding balls used in ore-enrichment plants in raw material mines and the power industry. In 1997, the company gained the status of a protected workplace[1], as over half of its employees have disabilities.

[1] Protected workplace is an enterprise that employs people with disabilities. In order to get the status a company's team needs to consist of minimum 50% of people with disabilities. The main purpose of such a company is to gain profits (as any other regular company) as well as the professional activation of people with disabilities who would not manage to compete on a regular job market. A company that holds the status receives subsidy and some tax/loan ease but also needs to face strict requirements.

Currently, the company employs 70 people; and is located in Eastern Poland, the so-called eastern wall, or the poorer and less developed part of the country. The majority of the employees work in the production and transportation departments. Seven employees work in an office and two persons, including the owner, work in a newly opened office in the capital city.

The company's headquarters are divided into two locations seven kilometres apart. The first site is the location of an office building, material storage area, finished product warehouse, car base, and transportation and welding departments where the first stage of production begins. The whole property is located in a former greenhouse area that was adapted for the needs of grinding ball production. The second site is located at a local power plant and it includes three forging lines.

Picture 1. Stage of production | **Source:** Company property.

Production processes are partially automated. The first step is purchasing the material (scrap rail) and its selection at the first site. Railhead size determines diameters of grinding balls that can be further forged. A rail consists of 3 parts: railhead, rail-neck, and the footer. The last two parts are usually separated from the railhead as one T-shaped part during the first stage of the process.

Workers cut the rail themselves or set up gas cutting machines that automatically cut the rail. Only the railhead is transported to the forge and the rest of the rail is stored and then sold as scrap (the T-shaped bottom part of a rail is not being used in our forging process).

The forge lines' location and arrangement enables the creation of the final product in a single sequence. The railhead is preheated; cut into pieces that are later heated up to the temperature of forging, and forged into balls in presses in closed matrices. A second press cuts off the flash left at the junction of moulds when a ball is cast. Balls are hardened and cooled in a water tank, and, finally, the ready product is packed and delivered to clients.

The primary motivation in setting up this process was to make it simple and to keep costs reasonable. For example, at its heart is recycling scrap material. The entire process plan includes an energy saving strategy based on heating the material once, but in two stages (preheating and then heating up) instead of heating it twice, as it is done elsewhere.

Picture 2. Rail re-use process | **Source:** Company property.

The company was the forerunner of this production method. Over time, other companies in Poland started to use this approach as well. Until now, the company has been operating mainly in the domestic market, although, for a few years, a growing percentage of its revenue has also come from exports.

At present, the company has a new owner who is challenged by the fact that she has never worked in the metal product business before. The present owner aims to introduce a new strategy for the company's

development, which takes into account the UN sustainable development goals.

Inheritance of the company and the decision to actively lead it a new owner has led to the unprecedented situation where a woman steps into an area traditionally reserved in Poland almost only for men. There are very few businesses operating in the region, whose owners are women. There are only 5 women working in the company that employs over 70 people. Among the majority group is the person directly managing the company, a man with technical education.

Another challenge is the fact that most of the employees, especially the senior ones, have worked at the company for decades (some even almost 30 years). The new owner entered a world with a grounded order and an established division of roles in the enterprise that has been operating in its own mode for years. Some employees perceive the new owner through the prism of their memories, in which they remember her as a little girl or a teenager who was accompanying her father at the company. Any proposal of change and development is considered to be an unnecessary nuisance. It is important to emphasise that the new owner encouraged employees to comment on the development plans and to participate in the decision-making process. This however, resulted in resistance and distrust. Ideas for hiring consultants who could introduce innovations in the organistion of work, even in the administrative area, were met with mistrust.

The team responds with outright aversion to any change plans. Business advisors are perceived to be superfluous and unfamiliar with the specifics of this type of enterprise. On the one hand, the old team has no ideas for work improvement and company development, which is the owner's most important agenda now, on the other hand, the team is reluctant to cooperate with external advisor who could assist them through the process.

The product

The company manufactures forged steel balls (grinders) of a diameter in the range ø 60 to ø 100 mm and hardness in the range 56-62 HRC (and diameters that could be produced due to machines that are in the plant: ø 30 to ø 120 mm). As a basic material for the production, the company uses the head of scrap "ST90PA" railway rails instead of a newly produced material (steel rods from smelters).

Picture 3. Steel balls (grinders) | **Source:** Company property.

Each transport receives its standardised forging attestation confirming the quality parameters of their product. The certificate is prepared in accordance with the standard for grinder production # PN-H-94057. The annual production capacity is approximately 9000 tonnes.

Balls are used in processing and power plants that use ball mills in their processes. These brief videos illustrate how products are used in mining operations:

- https://www.youtube.com/watch?v=VAiCiFD-Rjg
- https://www.youtube.com/watch?v=62-yS0uXBb0

Company Business Concept – look at the website: www.codogni.com

Main goals to achieve by 2020

- to internationalise the company by increasing exports of our product;
- to further develop production line, possibly qualify for subsidies, and build a fourth forging line;
- to become more innovative and create new products that might be produced from the portion of the scrap rail that currently cannot be used to produce balls. This presently unusable portion of the rail constitutes 60% of the material that is purchased, and it must be sold again as scrap. The Company hopes to work with academics and designers to find a way to use this material to diversify the company's offerings.

- to achieve the business goals described above while also meeting goals related to sustainable development goals. In other words, to be even better connected with local communities (local authorities, local business, education and local community services), to improve conditions of work for our employees, and to further reduce environmental harms and possibly become environmentally restorative.

The Company's current situation

- very good financial performance; the company has savings to support new investments, the company has no debt, and it is enjoying a period of stability;
- long term business partner relationships with clients and suppliers and very good knowledge of the market;
- employees that have been working with the company for many years (some for as many as 28 years, and for some it is the first and only job they have ever held). The team have been working in their own rhythm with no interruptions, changes, nor challenges for years. The team is not likely to be receptive to radical changes, formulating strategy, or carrying out an audit; it is likely that all of these steps will be perceived as indicative of a lack of trust in them on the part of the new owner. The team is reluctant to think about introducing innovations and expanding to produce a more diverse set of products in the plant;
- lack of expertise on the local market;
- the entire company relies on the expertise of one person, the Director of Manufacturing Processes & Engineering, who is managing the entire team starting from the production line, to management of the production line team, to transportation, welding, and finishing, to authorising all financial transactions of the company.
- the new owner is an academic who decided to take over her family business 6 months ago and faces the challenge of managing an enterprise operating in a sector traditionally dominated by men.

The new owner started her work with the team with a meeting and presentation at the headquarters in May 2017. The presentation included a Mission and Strategy draft and explanation, a presentation of the new proposed goals and work schedule of the new office in Warsaw, and mention

of a EU funding application. At the end of the session the owner and team completed a SWOT analysis, the result is included below.

Table 1. The SWOT (Firma Codogni) based on the first attempt to engage the company's management and administration into creating the strategic plan

	Strengths	Weaknesses
Internal origin	**Human capital:** · Employee working for 10-28 years; · Experts in the field; · Knowledge of the market; · Knowledge of the competitors; · Expertise in engineering (the director); · Liability; · Modesty; · Paying attention to good relations with contractors; · Family-like elations among the team; · Good results of TAX authority control at the company.	**Location;** · Far from clients; · Bad quality roads; · Hard to reach the headquarters; · No site plan; · Scrappy area of 1st site; · Headquarters are not representative.
	Services: · Timely delivery; · High quality of the product; · Focus on good relations with contractors; · Long term business partnerships; · Good reputation on the market; · Diverse clients.	**Product:** · Only one product; · Small range of ball diameters; · We don't produce all the diameters that we could.
	Technology: · Unique settings of production lines in the forge; · Low production cost.	**Supplies:** · Undiversified source of supplies.
	Money: · Stable financial situation; · Savings available.	**Management:** · New owner has no experience in the business.
	Opportunities	**Threats**
External origin	Polish rails – constant modernisation. EU funds. Numerous unexplored markets.	Low profitability of the business. High risk of money transfer hold-up. Uncertain currency rate (risk in case of postponed payments). New technologies development in the mining industry.

The company is working on an expansion in Sweden (Scandinavia), the Former Yugoslav Republic of Macedonia, Spain (and potentially Portugal) and possibly with one project in Germany in 2020.

Questions to address:

1) How can the company become more sustainable? What does sustainable development mean for this particular enterprise? What benefits would it bring the organisation? (Sharing knowledge with new employees, saving energy – production and company organisation, being more eco-friendly, being a part of a local community).
2) How can employees grow with the company, how can they be engaged in the work of setting the company's new goals, and how can expertise be shared within the team so that the company is less dependent on one person? How could employees be helped to understand that the new company strategy is aimed at development and improvements and creating benefits for all stakeholders, and does not reflect a lack of trust from the new owner?
3) How can the new owner overcome barriers she faces in company management, which are connected with the grounded position of the previous management system, perception of female roles in the company, and outright aversion of the team towards any change?
4) Which direction of development should the company take? Which arguments can be used to support your decision, and what critiques might you expect, and from what sources?
5) How can the new owner expand and promote the potential for further sustainable development of the company? How can the company, by embodying best practices, encourage sustainable development in the region and among customers in a situation when some may not really care about it, in contexts where groups are used to certain assumptions and means of operating that may not be conclusive with sustainable development?
6) What barriers in the implementation of the recommended strategy can you identify, and how would you overcome them?

Data source

Poland, Competitiveness Report 2016, The Role of Economic Policy and Institutions (2016) (ed.) Weresa M.A. Warsaw: World Economic Research Institute, SGH Warsaw School of Economics. http://kolegia.sgh.waw.pl/pl/KGS/struktura/IGS-KGS/publikacje/Documents/Raport_POLAND2016.pdf.

How raw material mines operate:

- https://www.youtube.com/watch?v=VAiCiFD-Rjg.
- https://www.youtube.com/watch?v=62-yS0uXBb0.

Balkan Mining Summary Overview:

- http://energylawgroup.eu/itrfile/_1_/ec3ac8b45225bf4d309aaf08733b1894/Balkan%20Mining%20Summary%20Overview%20.pdf.

Procedure

First part

Students read materials provided in the case and do more research online to familiarise themselves with the context of the case (e.g., the region, management, leadership in production companies, gender gap, stereotypes, sustainable business).

Second part

Each group is given a task (questions above) – group work on strategy for the company. All together start a group discussion on the questions above.

Third part

Use Sustainable Development Concepts.

Instructions: discuss how the following concepts are manifested in the case, and how each could be applied in planning the company's new strategy and tactics. Use these terms and concepts when answering the questions on the next page.

The following links lead to content on the UN Sustainable Development Goals (SDGs):

- http://www.un.org/sustainabledevelopment/blog/2017/05/worlds-most-powerful-job-creators-small-enterprises-vital-to-achieving-global-goals-un-official/.

- https://www.sdgfund.org/sites/default/files/business-and-un/SDGF_BFP_HKSCSRI_Business_and_SDGs-Web_Version.pdf.
- https://www.ihrb.org/pdf/state-of-play/Business-and-the-SDGs.pdf.
- https://www.forbes.com/sites/bobeccles/2015/10/20/un-sustainable-development-goals-good-for-business/#f0414c32b50c.

Sustainability: Do you accept the Brundtland Report's definition that sustainability means to meet the needs of today while allowing for meeting tomorrow's needs? Do you think a different definition is more useful?

Sustainability (or Triple Bottom Line) Reporting: Is the process of collecting data on environmental, economic, and societal impact potentially useful? Is it also potentially useful to meet with stakeholders to decide what impacts are most important? Finally, do you see value in publishing the outcomes of stakeholder meetings and data about your environmental, economic, and societal impact, plus your company's governance?

Zero Net Impact: There are companies that have made progress toward the goal of achieving net zero environmental harms, such as Interface and Unilever. Is it conceivable that setting such an ambitious goal and visibly making progress towards achieving it could create tangible business benefits in terms of finding and eliminating waste and attracting new clients, investment, and employees? Could it lead to higher profits and new opportunities?

Backcasting: Organisations can fail when they act exclusively on current or historical information, rather than setting a goal and working backward to determine next steps. Tesla's strategy for bringing electric vehicles to the mass market is a good illustration.

Fortune at the Bottom of the Pyramid: As illustrated by the example of microcredit in the developing world, it can be profitable to provide a product or service to the poorest in society – commercial opportunities,

counterintuitively, may exist in examining the needs of those with the least in terms of resources.

Cradle to cradle: re-engineering of product lifecycles into infinitely re-usable or biodegradable goods and processes (a material or product that is recycled into a new product at the end of its life, so that ultimately there is no waste).

Gender equality: Gender equality is a broad concept that refers to a situation in which both women and men are granted equal opportunities to develop their personal abilities and to make choices without being constrained by gender roles and stereotypes. It does not mean that women and men have to become the same, but that their behaviour and aspirations are equally valued and that their rights, responsibilities and opportunities do not depend on their gender. (Sustainable development from a gender perspective. A glossary. http://www.wecf.eu/download/2013/May/glossray_sus_dev.pdf)

Final product: A draft of a sustainable development strategic plan for the company

Here is a suggested outline of a sustainable development strategic plan:

I. Provide a comprehensive list of stakeholders of the company (all those affected by the firm, e.g. employees, neighbours, etc.)
II. List all side effects (both positive and negative externalities) – these can be divided into:
    a. Direct (e.g. providing employment to the challenged individuals – a positive direct externality)
    b. Indirect (e.g. pollution from employees commuting to work – a negative indirect externality)
III. A plan for engaging all stakeholders to learn about stakeholders and externalities and ideas for improvement:
    a. Stakeholders' greatest concerns and bottlenecks
    b. Suggestions for how to eliminate problems and increase positive effects

c. Ideas for "metrics of success" – what can be measured and reported to show improvements over time
d. A life cycle assessment, including what happens to products after their use:
    i. For example, where does the material in the balls go after customers are done with them?
    ii. Identification of where spent or scrap material or waste heat could somehow be used or sold to other firms

IV. Based on all of the above, a plan with specific steps that the company could take, including:
    a. An overall vision statement with an ambitious goal (ideally that inspires and is developed with employees and other stakeholders – such that it is authentically supported by others): e.g. is the idea of being "the first manufacturing firm in the region to be net zero environmental impact" interesting to employees? Are they proud, and would like to further build on the company's reputation, such that they can say that they helped build "the leading firm in Poland in providing meaningful employment to the disadvantaged, and in the arena of industrial materials repurposing"?
    b. Specific identification of how steps to enhance positive side effects and reduce harms would somehow boost revenue or morale, etc., or reduce waste?
    c. Which of these changes to the core business process make sense, even from just a conventional business decision-making perspective?
    d. Which changes involve:
        i. no investment of money
        ii. the most immediate results? The goal of this step is critical: to get a buy-in from those who doubt that sustainability-related changes make sense for the organisation. A classic step is "just turning off the lights." To paraphrase a founder and CEO who explained how to prioritise changes: "the greenest kilowatt is the one you never use."

e. Prioritise changes based partially on how immediately you will be able to show results (and explain: are there restricting factors or obstacles that you can foresee that would change your prioritisation). As best as you are able, set:
    i. specific deadlines for action, and specific steps to be taken
    ii. measurable outcomes – metrics of success
    iii. when these effects will be measured, and when and how they will be reported (publicly? Or just to interested stakeholders?)
    iv. when and how management will consult with stakeholders on "lessons learned" and next steps.

Learning outcomes assessment:
Group presentation and application.

Case 8

Castromil gold mines' geoethics dilemmas

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Keywords:
geoethics, mine exploration, mine exploitation, natural resources

Relation to Sustainable Development Goals (SDGs):

Strategy: group work, inquiry, discussion

Time required for classwork: 120 minutes.

Time for students' preparation for the classwork: 30 minutes.

Aims: Create awareness of geoethics dilemmas in mining and the urgent need for a sustainable ore mining.

Learning outcomes:

- To identify the social, environmental and economic implications of mining activities;
- To evaluate the consequences of human action on ecosystems and public health based on a holistic understanding of nature;
- To construct charts and graphics to help predict different real-life scenarios;

- To analyse problems and their causes through an overall, medium and long-term approach;
- To develop collaborative work;
- To improve communication skills through presentation activities or debates.

Competences:

- Anticipatory;
- System-thinking;
- Interpersonal;
- Strategic.

Questions to address:

- Describe some economic impacts (positive and negative) of mining activities.
- Describe some impacts or risks that mining activities have on public health and health-associated economic impacts.
- Based on data from the table below, what is the expected impact, in Castromil, of the arsenic and lead contamination on public health? And on the ecosystems? Create a line graph using data from the table (use minimum, maximum and mean values in ppm).

Table 1. Summary statistics (mean, standard deviation, range and quartiles) of major, minor and trace elements in soils of Castromil | **Source:** Adapted from: Ferreira da Silva *at al.* 2004b, p.17.

Variables	Mean	SD	Min.	Q1	Median	Q3	Max.
Ag (ppm)	0.9	2.3	0.05	0.2	0.3	0.8	22.0
As (ppm)	820	1269	31	140	273	958	6909
Au (ppm)	1	-	1	1	1	-	6
Ba (ppm)	82	34	13	58	81	101	209
Bi (ppm)	4.8	7.4	0	1.7	2.7	4.6	57
Co (ppm)	4	3	1	0.6	5.0	6.0	15
Cr (ppm)	17	6	5	13	17	20	47
Cu (ppm)	59	39	8	32	50	76	206
Ga (ppm)	8	4	1	4	8	10	14
La (ppm)	30	9	12	24	30	34	57
Mn (ppm)	230	184	1	33	210	377	612
Mo (ppm)	7.1	14.6	0.2	1.2	2.7	6.7	126.9
Ni (ppm)	9	5	1	6	8	12	31
Pb (ppm)	403	776	5	88	173	394	6295
Sb (ppm)	2.9	3.9	0	0.8	2.0	3.0	25
Sc (ppm)	3	0.94	1	2.1	2.6	3.30	7
Sr (ppm)	17	7	3	11	16	21	36
Th (ppm)	11	5	4	8	10	13	26
U (ppm)	19	23	3	11	15	20	238
V (ppm)	73	66	15	33	48	84	323
Zn (ppm)	86	45	9	50	95	118	172

- Is it possible to exploit gold deposits in a sustainable way?

Case description

Portugal was one of the privileged sites for the Mining of the Romans. It is now known that the Romans preferentially exploited copper, gold, and iron. The Romans were true masters of the mining arts, taking advantage of methods and techniques previously used by other people, but giving them remarkable innovations. The Castromil mines, located in Northern Portugal, in the Porto district, stands out as an example of a Roman mining site. This site is especially important due to its gold ore deposits.

The Romans used underground exploration or open pit mining. In Castromil, Roman galleries were left as a mark of this ancient activity.

Figure 1. Castromil mining site with "Roman galleries" | **Photo:** Alexandra Lima

These mines were abandoned after Roman activities until 1941, when the company "Minas do Ouro do Douro" began exploration at the site. The work stopped in 1946, it seems, due to lack of funding. In 1964, however, a Canadian company – Noranda of Canada – also began prospecting work, which ended in 1966, due to falling gold prices. Many years later, around 1994, Connary Minerals industries, whose Portuguese branch was based in Castromil, carried out a very deep exploration study in the area (about 82 km^2), which included the Castromil

mining site. From this study it was possible to conclude that the exploitation of the gold deposit was economically viable. This company submitted a proposal for the exploitation of the ore deposit to the Portuguese State, which was refused by the Ministry of the Environment in 2000, for environmental reasons.

Mining impacts

It is undeniable that the mining industry of geological resources has a leading position in technological progress. However, it is also undisputable that negative factors can arise from this extraction, especially at an environmental level. So, the strategies implemented in the pre and post extraction to ensure the sustainable use of resources and environmental remediation of the site are crucial in the conservation of geodiversity. The exploitation of mineral deposits leads to several environmental problems. Contamination of surface and groundwater, a change in morphology and landscape, air and noise pollution and soil impoverishment and contamination are to be noted. In addition, mining may have consequences for public health and cultural heritage. Environmental impact and feasibility studies of a mining project in the Castromil mines were carried out by Connary Minerals. In these studies, the conditions of the areas prior to the mine opening were analysed and the positive and negative impacts associated with a possible exploitation of the deposit were reviewed (see Table 2).

Positive impacts	Negative Impacts
- Reduction of soil pollution	- Modification of topography
- Creation of jobs	- Creation of a waste landfill on site
- Improvement of access infrastructures	- Visual impact
- Landscape recovery of a degraded forest area	- Possibility of residual contamination
- Reduction of the presence of contaminated water	
- Increase in the value of land	
- Decrease in gold imports in the country	
- Making use of a natural resource	

Table 2. Mining impacts listed in the Connary Minerals report | **Source:** adapted from: Castromil Mines: Virtual Visit, http://www.fc.up.pt/pessoas/allima/Castromil/content.html.

As a reaction to this environmental impact study, the population of Castromil produced a document ("Expositions and complaints of the population of Castromil" – March 30, 1998) which presented the reasons that led to the opposition to the project of exploration of the proposed gold mine by Connary Minerals. This document described some of the population's criticisms of the positive impacts listed in the environmental study. There were also many gaps in the treatment of currently contaminated soil. As far as employment is concerned, the increase in the number of jobs offered by Connary Minerals would be made at the expense of the occupation of agricultural land, which would reduce the professional activity of the local population engaged in agriculture. The reduction of water contamination (surface and groundwater) proposed by Connary Minerals also seemed a bit contradictory, because the opening of galleries and the construction of heaps seems to alter the surface water flow and the underground flow. In addition, the chemical contamination of surface water and aquifers by the discharge of effluents and oils and hydrocarbons used in the maintenance of the machines does not contribute to the reduction of water contamination.

The problem of arsenic and lead contamination

Although Connery Minerals had defended their position that the negative impacts of the exploitation would be minimal, there is in fact some degradation existing in the landscape caused by old mining works like spoil heaps, wells and galleries, mostly without any type of fence or protection. There is also a problem of chemical contamination of some groundwater from natural sources but the most important problem are the soils of the Castromil site. These soils have concentrations of arsenic and lead much higher than the permissible maximum value established for the quality of a soil. The existence of this contamination is a direct consequence of soil mineralisation by arsenic and lead from the old Roman mining works existing at the site.

The present days

Finally, we should refer to the latest experience Researches from Porto University had with company Medgold Resources in Castromil Mines, which wanted to explore gold in the mine. This company decided to implement open meetings with local people twice a year, in order to inform them about the research developments and new works on the exploitation project. Awareness meetings started in 2015 in Castromil, but soon changed to Limarinho (Boticas, Northern Portugal), a site where the company had undertaken test drilling work during 2016.

A research project conducted by Porto University intended to collect data from a random sample of the local population to better understand their position. On the one hand, the exploitation works could be endangered, since the survey would revive previous environmental issues. On the other hand, the existence of a plant nursery in the area was, in itself, an obstacle to the collection of data, since the exploration works could jeopardise the survival of a family's business. Furthermore, and in spite of the efforts of disseminating information, the population was still insufficiently informed which did not guarantee the attainment of informed and sufficiently impartial answers. Lastly, since the inquiry could lead to a disruption in the works of geological sampling (and its continuation), company Medgold Resources withdrew its offer of assistance to carry out the survey. Considering that this would be the least painful decision for both the population (not yet fully informed) and for the company (which had financially invested on an activity that had positive social and economic implications), the collection of data was not done.

This situation highlights an ethical problem that should be debated: is it preferable to collect data so as to better inform the population, or rather to mitigate financial problems that the application of a survey might bring about during an exploitation phase?

Data source

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- Green Facts: Arsenic. http://www.greenfacts.org/en/arsenic/.
- International Programme on Chemical Safety: Arsenic and Arsenic Compounds. http://www.inchem.org/documents/ehc/ehc/ehc224.htm#1.8.
- National Centre for Biotechnology Information (NCBI): Environmental Source of Arsenic Exposure. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4186553/.
- National Centre for Biotechnology Information (NCBI): Heavy Metals Toxicity and the Environment. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4144270/.
- Sustainable Development of Mining Mineral Resources. http://www.sciencedirect.com/science/article/pii/S2300396015300446.
- How can mining become more environmentally sustainable? http://www.miningfacts.org/Environment/How-can-mining-become-more-environmentally-sustainable/.
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Procedure

In groups of 3-4 students develop and produce a line graphic containing the major, minor and trace elements in soils of the Castromil area (see Ferreira da Silva *et al.*, 2004), showing the mining impact on soils and water contamination of residential and agricultural sites. After that, they have to compare the As and Pb values of Ferreira da Silva *et al.* (2004) with the ones from Appendix 2 of the *Guideline for use at contaminated sites in Ontario*, Ministry of Environment and Energy, 1996 (access through link https://archive.org/details/guidelineforusea00ontauoft) and conclude on the conditions of soil and water at Castromil's residential and

agricultural sites. (Note that ppm is numerically equivalent to µg/g). The discussion raised by the elaboration and analysis of graphics will allow students to be acquainted with the information and competences required to answer the questions posed by the lesson plan.

Further application

Roşia Montană is a community of Alba County in the Apuseni Mountains of Western Transylvania, Romania. The rich mineral resources of the area have been exploited since Roman times, the earliest people to set up a permanent settlement for the slaves and colonists working in mines, establishing the first big gold and silver mines in the area. They were the first to set up the initial extraction galleries, using very sophisticated and efficient mining techniques for that period.

Today, only parts of the Roman galleries are still preserved, because the additional exploitations held during the ninetieth and twentieth centuries were done by extending and widening the existing Roman galleries. Most of them vanished in 1970 when a quarry was excavated in the Cetate area that destroyed an entire system of ancient roman galleries, without conducting any research, inventorying and in-situ conservation (Roşia Montană Gold Corporation, 2015).

Figure 2. Roșia Montană mining site | **Photo:** Alexandra Lima

Throughout the years, the area developed significantly because of mining activities. “The gold fever” attracted people from various parts of

Europe. Thus, communities of Romanians, Hungarians, Germans, Slovaks and Jews settled in Roşia, for whom churches and schools were built (Roşia Montană Gold Corporation, 2015). At that time, almost the entire population was involved in mining activities, even women and older children.

Underground operations at Roşia Montană ceased in 1985, but open-pit mining continued until 2006 (when Romania joined the EU), leaving an obvious effect on the mountain landscape (figure 2). In 1999, the concession license for exploiting the gold and silver ore from the Roşia Montană area, Alba County was transferred to Gabriel Resources (latter renamed Roşia Montană Gold Corporation – RMGC).

In 2000, RMGC paid 20 million USD for a pre-feasibility study which estimated 8 million ounces of gold. The company wanted to invest USD 250 million USD (raised from different entities like banks, mutual funds or even through the stock market) and promised to create 25,000 jobs within three years.

The power of people

The Roşia Montană project of Gabriel Resources/RMGC would have become Europe's largest open-pit gold mine operation. But it faced a widespread opposition. In this open-cast mine thirty times more sodium cyanide would be used to treat the extracted gold than the entire quantity that is currently being used in Europe. Over the 17 years, 240,000 tons would be deployed in the industrial operation, i.e. the equivalent of 600,000,000,000 lethal doses for an adult (Salvati Roşia Montană, n.d.).

The court challenges by Alburnus Maior, a local community group, made the Romanian government cease the approval process for the project in 2007, forcing Gabriel Resources to reconsider its mining plans and hold back its activities. Community groups have successfully halted the mining ever since. In 2013 the Romanian Parliament rejected the mining projects once again.

From 2002 to 2006, RMGC drafted some feasibility studies, including studies concerning the initial conditions for the Environmental Impact Assessment (EIA). But in October 2008, a Romanian court ruling agreed with a Ministry of the Environment decision to suspend the

Environmental Impact Assessment and the permitting process for the Roşia Montană project. Later in that month, Hungary's Prime Minister Gyurcsany Ferenc declared that Hungary is continuously opposed to the Roşia Montană mine proposal.

In 2010, the Ministry of Environment reconsiders the evaluation procedure of the Environmental Impact Assessment Study on the Roşia Montană Project.

In September 2013, thousands of people went to the streets of Romania, protesting the government's decision to approve the development of the Roşia Montană project. In response to the protest, the government has decided to establish a commission to review legislation and make a final decision on this subject. The project was rejected after being debated and voted on in the Chamber of Deputies (Roşia Montană Gold Corporation, 2015).

The present day

After the rejection of the project in 2013, Gabriel Resources didn't give up and filed an official letter to the President and Prime Minister of Romania calling for amicable resolution of the permitting dispute.

However, in 2016, the village of Roşia Montană was considered a UNESCO World Heritage site, in a radius of two kilometres where the mining activities are prohibited.

The mining company has not yet admitted defeat and is still trying to get a license to exploit the area.

Questions to address:

- Refer some impacts or risks that the use of cyanide in mining activities has on public health.
- Debate the "power of people" mentioned in this example.

Case 9

Territorial ecological limits to the lignite surface mining in North Bohemia

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Keywords:
lignite surface (open-cast) mining, territorial ecological limits, Schwartz's theory of universal values, North Bohemia

Relation to Sustainable Development Goals (SDGs):

Strategy: discussion, text analysis and follow-up discussion

Time required for classwork (in minutes): 90.

Students' preparation for the class (in minutes): No preparation to the class needed.

Aims: To develop students' normative and interpersonal competences.

Learning outcomes:
After completing this case, students are able to:

- identify actors, analyse their case-relevant positions and attitudes, identify their underlying values according to Schwartz's theory of universal values, and apply the same procedure to other issues;

- identify and formulate their own case-relevant positions, attitudes, and values;
- identify and discuss the environmental, social, and economic aspects of the case of territorial mining limits in the Czech Republic.

Questions to address:

1) Who are the actors involved in the case of mining limits and what are their positions?
2) What are the underlying values behind actors' positions?
3) What are the environmental, social, and economic aspects of the case of territorial mining limits in the Czech Republic?

Case description

Biophysical characteristics

Coal has been one of the most important energy resources in the Czech Republic since the industrial revolution. It has been a fuel for the Czech economy in which heavy industry played an important role – through the 1920s and also after the Second World War.

There are two main areas in the Czech Republic where coal is extracted. In the Northwest, in the foothills of the Ore Mountains, there are reserves of lignite. In the Northeast, in Silesia, steam coal is extracted. Each kind of coal has a specific character which requires a specific method of extraction and a specific use. While (since the 1950s) lignite has been extracted in open pits and used mainly for heating (because it has a lower density of carbon), steam coal is extracted in deep mines and used also in metallurgy etc.

The North Bohemian Basin (in the foothills of the Ore Mountains) consists of a 1420 km^2 area. In the whole area there are 9.3 billion tonnes of coal, out of which 742.5 million are coal reserves potentially exploitable in the mines that are currently operating. Coal mining could therefore continue until 2045, and if the territorial and ecological limits – the government restriction on coal extraction protecting

the existing settlements – are allowed to be broken, then coal mining could continue until the end of the 21st century (Pešek & Sivek 2012).

Figure 1. The Landscape of North Bohemia, Zámek Jezeří | **Source:** http://poznejte-cesko.eu/.

Historical development

Coal has been extracted in the area of the present Czech Republic since the 15th century. It became especially important in the 20th century as industrialisation had changed the requirements regarding the fuel that was needed and as it increased the extent of the extraction.

For example, the extraction of lignite gradually grew from 1937 up to the peak of 100 million tonnes of extracted coal in 1984. The reason for this growth was the new mechanisation available and the method of open-cast mining. Since 1984, the extraction of lignite has been declining, down to 38.5 million tonnes in 2014. The peak of the production was tied to the structure of the industry (Bejdová, Jaroš & Ruml 2013). During the period of the former Czechoslovak Socialist Republic, the metallurgical and energy industries were controlled and directed by the state. The production was characterised by a high level of energy inputs, low efficiency, and major environmental pollution. Surface mining of lignite destroyed 300 square kilometres of Northern Bohemia and 78 towns and villages. The people were forced to relocate from the affected places to enable the mining operations. Libkovice was the last demolished village in 1991, even though no coal has been mined at this place since then.

The socio-economic transition that occurred after the fall of the socialist regime in 1989 has changed the coal industry. In 1991 the government established the so-called territorial ecological limits for mining, which were meant to protect the settlements in those areas and to improve the devastated environment. These limits have restricted exploration, mining and other lignite mining-related activities beyond certain spatial limits. The limits were enforced in four different mining localities: the Czechoslovak Army mine (ČSA), J. Šverma, Vršany and Bílina. These limits protect the village Horní Jiřetín that is located within the area of the ČSA mine. Since the establishment of the limits, there have been many fierce political debates about their enforcement.

The limits have been under pressure from the side of the mining companies, labour unions and politicians. In 2005, the inhabitants of Horní Jiřetín – a village endangered by mining extension – organised a local referendum and the result was clear – the vast majority (96%) of voters (with a huge 75 % attendance) were against the breaking of the limits. Another referendum, organised by the local NGO Kořeny, took place in Litvínov in 2006. Even though the vast majority of voters were against the plans for the extension of mining activities, the participation was not high enough to make the results legally binding (Černík, 2015).

Another milestone after 1989 was the great transformation of the property relations of the mining companies. The state-owned mines and mining companies were privatised under unclear legal conditions. The privatisation of the mining company MUS (Most Coal Company) followed the typical path of many other industrial companies after the economic transition. The financial assets were sold much cheaper as the new owners let the company go bankrupt, which allowed them to gain the given company with an enormous value almost for free. The result was the creation of new financial elites and the loss of state power in mining companies. The process of privatisation was characterised by illegal actions and litigation.

At the same time, the private companies changed their names, their subsidiaries split off, and other changes took place, which makes it hard to get orientated in the ownership structure. There are now several mining companies operating in the region. Firstly, it is the national company ČEZ which mines in the Tušimice and Bílina

coalmines and which burns the coal in the Počerady power plant. Then there is the company Severní energetická (SevEn) which operates at the ČSA mine.

The most recent political and public discussion about the enforcement of the territorial mining limits took place in 2015. The Minister of Industry and Trade proposed to break the limits at the Bílina and ČSA mines. The following four options were discussed:

1) Upholding the existing limits;
2) Breaking the limits at the Bílina mine and upholding them at the ČSA mine;
3) Breaking the limits at the Bílina mine and breaking them only partially at the ČSA mine so that only part of the village of Horní Jiřetín would need to be demolished;
4) Complete breaking of the limits at both localities.

The debate about the decision lasted for 10 months and involved all the actors, including political parties, labour unions of workers, environmental NGOs and the local inhabitants. At a special plenary session in Ústí nad Labem the government eventually decided to break the limits at the Bílina mine and uphold them at the ČSA mine so that the village of Horní Jiřetín would not have to be demolished. The final decision was motivated by the needs of the Czech heating energy industry, by considerations regarding the energy security of the country, and by efforts to maintain a certain number of jobs. The decision made an additional 100-120 million tonnes of lignite from the Bílina locality available for mining, with the conditions that the lignite be used primarily in the Czech heating industry and that cast mines remain at least 500 metres away from the village. The Ministry of Industry and Trade is required to annually evaluate the fulfilment of the goals and measures of the State Energy Plan until the year 2020, and it is also required to present to the government an analysis of the needs to mine more lignite (Slámová, 2015).

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Procedure

The group size and the number of the actors to be analysed will be determined according to the size of the class.

1. Introductory activity (10 min)

Students will be shown 2 photographs. One with the demonstrators supporting the upholding of the limits and the other with the demonstrators supporting the repeal of the limits.

a. Students will be asked to write down the attitudes and feelings that the photographs invoke in them (5 min.).
b. Students will discuss their attitudes and feelings in groups (5 min.).

Figure 1. Demonstrators supporting the upholding of the limits | **Source:** http://poznejte-cesko.eu/.

"Us or the coal?"
"Do not economise on the health of people from North Bohemia."
"We want decent politicians not agents of the coal lobby."

Figure 2. Demonstrators supporting the repeal of the limits | **Source:** http://poznejte-cesko.eu/.

"No more miners fired due to the limits"
"Miners for the cheap heat"
"Ecoterrorism does not keep us worm"

2. Introduction to the case (15 min.)

The lecturer will briefly present the history of the case and describe the actors involved (see below).

Another option is to provide students with the materials in advance, so they can familiarise with the case before the lecture.

Actors involved in the conflict

- **Coal mining companies**
  - **Severní energetická** This company is owned by Czech billionaires – Dienstl and Tykač. The company is located in Most,

and it is an important employer in the region. The company runs the ČSA mine. Its profit was 23 billion CZK in 2015.

- **ČEZ** This national energy company is involved in mining through its sister company called Severočeské doly. This company runs the Bílina mine. ČEZ is one of the most powerful companies in the Czech Republic; its profit was 210 billion CZK in 2015.

- **Labour unions** The miners' unions mainly aim to save the miners' jobs, and thus they support the continuation of the mining operations when the repeal of the limits is being considered. The unions are active organisations in the negotiations as well as in the public sphere, for example during demonstrations.
- **Local inhabitants** There are several groups of local inhabitants, each with its own interest, which are promoting their stances within the conflict. On the one hand, there are the employees and former employees of the mining companies, and people who work for the subcontractors of the mining companies. On the other hand, there are the residents who want to protect their homes and communities.
- **Political parties and politicians**
  We have selected several political parties and politicians involved in the recent debate that are among the most active according to the analysis of the media coverage (Kubala 2017).
  - **The Greens** – The party is active in the conflict on both the national and local levels. Their stance on coal mining is definite disapproval. On the local level, especially in the town of Horní Jiřetín, this stance has brought the party the support of most of the inhabitants, which was demonstrated during the municipal elections. The mayor of the town is a member of the Green party. On the national level, the Green party consistently stands against the extension of coal mining beyond the ecological limits while supporting the expansion of renewable sources of energy. However, the Green party does not have political representation in the national Parliament, and only some of its members were elected as senators.

- **Social Democratic Party (ČSSD)** – Generally the party is in favour of the extension of mining operations. Their argument in favour of more mining is mostly energy security and employment in the region. The current Minister of Industry and Trade for the Social Democratic Party – Jan Mládek – was pushing the breaking of the ecological limits even further in the national energy conception. Also, at the regional and local levels, the party members support the continuation of mining operations because they consider the coal mining companies to be important employers in the region.
- **Communist Party of Bohemia and Moravia (KSČM)** – The Communist Party has historically supported coal mining, even though at the local level the position of the party towards coal mining is not uniform or predictable. There have been occasions when Communist party members voted against the repeal of ecological limits in order to protect the village or town against destruction, for example in the town of Litvínov, where the coalition agreed on keeping the ecological limits. On the other hand, at the regional level, the regional governor from the Communist party strongly supports further extension of mining.
- **ANO** – This party is an ambiguous actor in the conflict. The mayor of the city Litvínov – Kamila Bláhová – has promised keeping the ecological limits and cooperating with Horní Jiřetín. On the national Government level, this political party also defends the limits mildly, mostly because of the financial costs of relying on coal. However, their position on the topic can change easily for populist reasons – if the majority of voters are in favour of one option, ANO will probably not go against their opinion.
- **President of the Czech Republic – Miloš Zeman.** Miloš Zeman has been very active in the debate about the territorial ecological limits, supporting the complete repeal of the current limits. He has expressed the view that employment in the region should be prioritised over the fate of the village Horní Jiřetín.

- **Minister of Industry and Trade – Jan Mládek.** The Ministry of Industry and Trade is the key government body for energy policy in the Czech Republic, and it was the current Minister, Jan Mládek from the Social Democratic Party, who opened the debate in 2015 by announcing that he will submit a proposal to the Government to repeal the limits at the Bílina and ČSA mines. Afterwards he became the leading voice of this agenda, and he framed the discussion as a dispute over whether the Czech Republic needs the lignite located beyond the limits at the Bílina and ČSA mines in terms of the security of the heat and electricity supply.
- **Minister of the Environment – Richard Brabec.** The question about the future of the territorial ecological limits belongs also to the agenda of the Ministry of the Environment, so the current minister, Richard Brabec from the ANO party, took part in the debate. Actually, the proposed adjustment of the limits at the Bílina mine and the upholding of limits at the ČSA mine that was accepted by the Government was formulated by the Minister of the Environment.

- **NGOs**
  - **Greenpeace.** This international environmental organisation is an active supporter of the affected communities in the region, on the national as well as the international levels. Greenpeace has conducted various analyses that show some of the possible development scenarios of the Czech energy supply without further mining and use of coal (e.g. Energy (r)evolution, 2012). In addition, Greenpeace has organised civic events in the coal mining regions and in other cities too. They have also directly entered a mining pit and stopped an excavator and are involved in lawsuits against the mining companies.
  - **Hnutí DUHA.** This environmental organisation started its activities during the direct action campaign against the destruction of the village Libkovice – the last village that was destroyed due to coal mining in Northern Bohemia. Since that time Hnutí DUHA has supported the local resistance against

coal mining, especially in the town of Horní Jiřetín. They provided help with the dissemination of relevant information in the media and also with management skills.

- **Kořeny.** This is a local NGO from Litvínov, a city potentially affected by the extended open-cast mine if the limits are repealed completely. The NGO's main goal is to protect the city and the people's houses against the extension of the mining activities. The NGO is politically independent, which means that they do not support any political party during the campaigns and vice versa. They are also involved in the legal/administrative processes (e.g. EIA) concerning the mining operations.
- **Limity jsme my.** This is an anti-coal civic group in the Czech Republic. In 2015 they collected signatures for "a promise of civil disobedience" in which people asserted that they would block the mining extension with a direct action if necessary. Around 3,000 people signed this statement. The group has organised several public events in support of the ecological limits on coal mining in 14 cities in the Czech Republic. More than 1,000 people gathered in these cities to commemorate the villages destroyed due the extension of open-cast mining in the past.

3. First exercise – matching the quotes with the actors (20 min.)

a. Each student will receive a set of anonymous quotes (see below) about the case, with the task to match the quotes with the actors described in the presentation. A list of the actors will be displayed during the activity (10 min).
b. When printing the quotes for use by students in the classroom, the teacher must obscure the names of the actors that are struck out in the text below with a black marker so that the source of the quotes remains anonymous to the students.
c. Students will discuss their matched pairs in groups and agree on one common solution for the whole group. The correct pairs will be presented by the lecturer (10 min).

Materials to be used:

Quotes from the actors:

- **Coal mining companies**
  - **Severní energetická.** The Chair of the Supervisory Board of Severní Energetická, Jan Dienstl, said in April that revoking the limits on lignite mining at the ČSA mine in the Most area would make it possible to prolong profitable mining there by 150 years. According to Dienstl, the mine would provide employment for up to three thousand people, and another five thousand jobs would be provided in the companies linked to the mining. If the limits are not revoked, the mining will stop in 2022.

Source: http://ekonomika.idnes.cz/hornicke-odbory-zadaji-o-prolomeni-limitu-tezby-na-mostecku-plb/ekonomika.aspx?c=A131127_131218_ekonomika_spi

  - **ČEZ** "As far as Bílina is concerned, I can't imagine at all that we wouldn't also mine out the coal that today is beyond the line set by the territorial ecological limits," the General Manager of ČEZ, Daniel Beneš. His argumentation was based on the assertion that the mining in the area is not a problem for anyone there: "We have bought the land, we have the support of all the villages and towns in the area, and we have signed agreements of cooperation with them."

Source: http://ceskapozice.lidovky.cz/vlada-posvetila-rozsireni-tezby-zatim-jen-na-lomu-bilina-peu/tema.aspx?c=A151022_123711_pozice-tema_lube

- **Labour unions.** "In any case, it should be this Government, this Government is not political, it should decide systematically about what this country needs. And lignite is something that this country definitely needs," Sábel (the Chair of the Mining Union).

Source: http://ekonomika.idnes.cz/hornicke-odbory-zadaji-o-prolomeni-limitu-tezby-na-mostecku-plb/ekonomika.aspx?c=A131127_131218_ekonomika_spi

- **Local inhabitants**
  - Ondřej Hogen, Horní Jiřetín. "My family has lived in Horní Jiřetín since back in the 19th century. We are never going to sell our home, and most of my neighbours see it the same way. The Prague guys have no business destroying our town, especially not for coal that is not needed."

- Hana Čermáková, Horní Jiřetín. "I have already had to move three times due to coal. First I lived in Most, then Janov u Litvínova, and then Dolní Jiřetín. The old town of Most and Dolní Jiřetín gave up their space to the mine, Janov was demolished and in its place they built apartment complexes for the people from the other villages affected by the removal. Now they wanted to force me away for the fourth time. I worry about what will happen to us, and memories of the previous displacements often come back to me. Recently I have had several strokes and I walk on French crutches. But I am definitely not going to give up fighting for our home."

Source: http://www.greenpeace.org/czech/cz/Kampan/klima_a_energetika/zit-nebo-tezit/Horni-Jiretin-zije/

- **Political parties and politicians**
  - **The Greens.** "People keep making the argument that the resolution regarding the limits has been fulfilled and that it no longer makes any sense. The limits were set as firm boundaries beyond which strip mining is not to encroach, but they were also an extremely important tool for the growth of the villages and towns. If it were not for the limits, no permits would have been issued for new construction in the protected deposit areas and on mining land. All those villages and towns, altogether 24 of them, would have stagnated, would not have been able to build and renovate their infrastructure. If the limits are revoked, these villages and towns will stop land and spatial planning, land development. And the effects of that are only negative for that region." Vladimír Buřt (mayor of Horní Jiřetín).

Source: http://www.zeleni.cz/vladimir-burt-limity-byly-stanoveny-neprekrocitelna-hranice/

  - **Minister of Industry and Trade – Jan Mládek (ČSSD party).** "The decision regarding the repeal of the limits is primarily a political decision, two fundamental points are unemployment and securing a coal supply for heat power stations." According to Mládek, the limits are, in a certain sense, redundant: "It is true to say that in 1991 the limits were approved because there was no environmental impact assessment, EIA. It looks like revoking the limits means mining coal."

Source: http://www.ceskatelevize.cz/ct24/ekonomika/1496234-mladek-limity-castecne-prolomeny-byt-mely-otazkou-je-zda-i-na-lomu-csa

- **President of the Czech Republic – Miloš Zeman.** "I have listened to the views expressed by the owners of the mining companies as well as by the Union members. And, of course, I have familiarised myself with the stance of the leaders of the Ústecký Region. The biggest problem of the Ústecký Region is the above-average unemployment rate, which is higher then in all the other Regions in the Czech Republic. It is necessary to tackle this unemployment rate and to adopt certain measures even if they are regarded by some as unpopular." [...] "I believe that I have received sufficient information about the quality of the coal that is deposited today under the village of Horní Jiřetín and others."

Source: http://zpravy.idnes.cz/zeman-podporil-prolomeni-limitu-tezby-hnedeho-uhli-fhn-/domaci.aspx?c=A131024_133207_domaci_kop

- **Minister of the Environment of the Czech Republic – Richard Brabec (ANO party).** But should not ~~the Minister of the Environment~~ vote against the breaking of the mining limits even just out of principle? "Theoretically, you are right. But I knew that it would have gone through even without my vote. And I was leaning toward the view that in such a situation, voting against would have been self-serving, to put it mildly. Even though I would have been able to wash my hands over it and say I voted against it. But I didn't want that. Moreover, the suggested resolution that was approved was mine, and it would have seemed strange not to vote for it."

Source: http://usti.idnes.cz/ministr-zivotniho-prostredi-richard-brabec-o-prolomeni-limitu-na-dole-bilina-181-/usti-zpravy.aspx?c=A151014_2198488_usti-zpravy_alh

- **NGO´s**
  - **Greenpeace.** "According to scientists, if all the negative consequences during the whole mining period were included in, the resulting damage would reach an unbelievable 900 billion. The Ministry of Industry takes into consideration only a fraction of this amount, but even that is more than enough: according

to the numbers that the Ministry has come up with, the state as well as the taxpayers would lose substantially. In contrast, Mr. Tykač and Dienstl would profit royally. It would be hard to find a better example of privatising the benefits and socialising the costs. Political representatives from the Social Democratic Party, ANO, and the People's party would be pressed very hard to explain to their voters a similarly »advantageous« decision." – Jan Rovenský.

Source: http://www.zelenykruh.cz/bily-slider-na-hp/tezba-uhli-za-limity-se-nevyplati-vyplyva-to-z-nove-studie-ministerstva-prumyslu-a-obchodu

- **Hnutí DUHA**. "The territorial ecological limits were established in 1991. They were set in such a way so that the supplies would continue for some time (a quarter of a century) and the energy sector would have time to gradually adjust. The heating power stations have known for eighteen years what amount of fuel they can count on. They have been adjusting their plans and investments accordingly for a long time now. It would be hard to imagine that the owners would keep a general manager in charge of their company if the manager had known that the supplies would run out, had been waiting stoically for two decades, and then at the last minute had started to talk about not having anything to burn. Hnutí DUHA has outlined a way how to free the Czech heating industry from its fatal dependence on fossil fuels in the Programme for Energy Independence. The proposal combines investing in insulating houses, solar panels and biomass heat stations, and it presents new standards for developers as well as for temporarily supplying heat power station with coal from the existing mines at Bílina or Vršany".

Source: http://www.chytraenergie.info/index.php/chytra-energie-novinky/dopravafosilni-zdroje/151-cena-tepla-s-limity-nesouvisi

- **Limity jsme my.** "For a whole quarter of a century, the limits have served their purpose. Thanks to the courage and determination of the inhabitants of Horní Jiřetín or Litvínov as well as the support from people across the country, the limits have resisted (with the unfortunate exception of the Bílina mine) repeated attempts to break them. However, the situation has

changed over time. The continuing mining and burning of coal no longer endangers only the homes and the health of the people in northern Bohemia. Given their destructive effects, the mining and burning of coal are one of the immediate causes of climate change. That is why we want to mark this anniversary by adding something new: The mining limits themselves are no longer enough".

Source: http://limityjsmemy.cz/prohlaseni-k-25-vyroci-limitu-limity-tezby-samy-uz-nestaci-chceme-konec-doby-uhelne/

4. Second exercise – the values of the actors (30 min.)

The groups will be provided with the scheme from Schwartz's theory of values and with definitions of each value (see below).

a. Each group will draw a quote from one of the actors from the previous exercise. Afterwards they will analyse the quote and match it with the values from the scheme (10 min).

b. Each group will present only the values that they have selected for their quote, without revealing the quote (5 min.).

c. The groups will move around the class in order to identify other groups with similar or close values to the ones they are representing. Clusters of the groups will present their common values and reveal their actors' identities (15 min.).

Schwartz's theory of basic human values

Openness to change

STIMULATION: Excitement, novelty, and challenge in life.

SELF-DIRECTION: Independent thought and action – choosing, creating, exploring.

Self-enhancement

POWER: Social status and prestige, control or dominance over people and resources.

ACHIEVEMENT: Personal success through demonstrating competence according to social standards.

HEDONISM: Pleasure or sensuous gratification for oneself.

Conservation

TRADITION: Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide.

CONFORMITY: Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms.

SECURITY: Safety, harmony, and stability of society, of relationships, and of self.

Self-transcendence

UNIVERSALISM: Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature.

BENEVOLENCE: Preservation and enhancement of the welfare of people with whom one is in frequent personal contact.

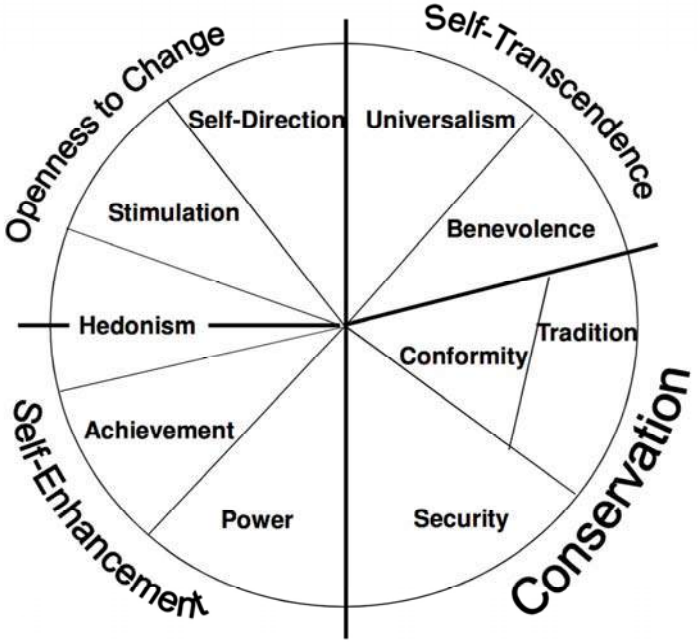

Figure 1. Theoretical model of relations among ten motivational type values from Schwartz, S.H. (2012). An Overview of the Schwartz Theory of Basic Values. *Online Readings in Psychology and Culture*, 2(1). https://doi.org/10.9707/2307-0919.1116.

5. Reflection (15 min)

The discussion will be facilitated by the lecturer.

a. Students will reflect upon the analysis of the values of the actors involved in the case.

b. Students will reflect on the whole case about territorial mining limits in the Czech Republic and discuss the environmental, social, and economic aspects of this case.

Case 10

Smog – high concentration of air pollutants in a large city. The Warsaw example

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Keywords:
air pollution, smog, health effects, air quality management

Relation to Sustainable Development Goals (SDGs):

Strategy: Text analysis, presentation, teamwork project, possible to use flipped-classroom method

Time required for classwork (in minutes): 90.

Students' preparation for the class (in minutes): 120.

Aim: To illustrate the problem of air pollution, increase the awareness of its effects (including health) and develop strategic/management skills.

Learning outcomes (micro-perspective, students' achievements):
After completing this case, students are able to:

- Discuss the problem of air quality in large cities;

- Describe the influence of the most important sources of air pollutants emission on the air quality;
- Indicate the health effects of air pollutants and poor air quality as a social problem;
- Analyse decision-making processes regarding the air quality management and its improvement.

Case description

Poland is a country with 38 million inhabitants located in Central Europe. Its energy system is based mainly on coal burning that caused many air quality problems, especially in the 1970s and 1980s. After the economic transformation many industrial installations collapsed and the remaining ones together with power plants and combined heat and power (CHP) plants have been thoroughly modernised and the emission of air pollutants decreased significantly. At present, however, emissions from individual households using solid fuels, as well as the transportation sector, are still a problem causing air pollutants emission.

Air quality in Poland is now a serious problem that has to be considered in several dimensions: medical and social as well as reputational, legal and administrative. Due to some of the highest concentrations of particulate matter pollution (PM_{10} and $PM_{2.5}$), and the highest concentrations of polycyclic aromatic hydrocarbons (PAHs) among all European Union countries, Poland is a polluted country (see also: (https://www.euractiv.com/section/climate-environment/opinion/smog-plagued-poland-tries-to-escape-tag-as-europes-china/). According to 2017 European Environment Agency (EEA) report "Air quality in Europe" concentrations above the PM10 and PM2.5 annual limit value were observed mostly in Bulgaria and Poland (*Air quality in Europe – 2017 report* 2017: 27-31).

Poor air quality in Poland is an extremely important social problem and obvious challenge for the government. On one hand, the high emissions of air pollutants from households and transportation are partly due to the people's low awareness – people simply use the cheapest,

and simultaneously the worst-quality fuel and cars with low environmental standards. Burning low-calorie coal and wood and often also municipal waste, the use of which in home furnaces causes significant emissions of very harmful substances are common practices. The widespread use of relatively old private cars (characterised by higher emissions comparing to modern cars), large traffic volumes generating numerous traffic congestions and low level of active transportation systems (e.g. cycling) is partially responsible for the low air quality in cities.

On the other hand, the problem of poor air quality affects the whole society, each year causing about 45-50 thousand of Poles to die prematurely because of high exposure to air pollution, especially fine particulate matter. Pollution also promotes respiratory system diseases, cardiovascular system diseases, but also cerebrovascular diseases (i.e. stroke). Air pollutants are responsible for the exacerbations of bronchial asthma and chronic obstructive pulmonary disease. They are a serious problem for children and the elderly as well as people suffering from the above-mentioned diseases.

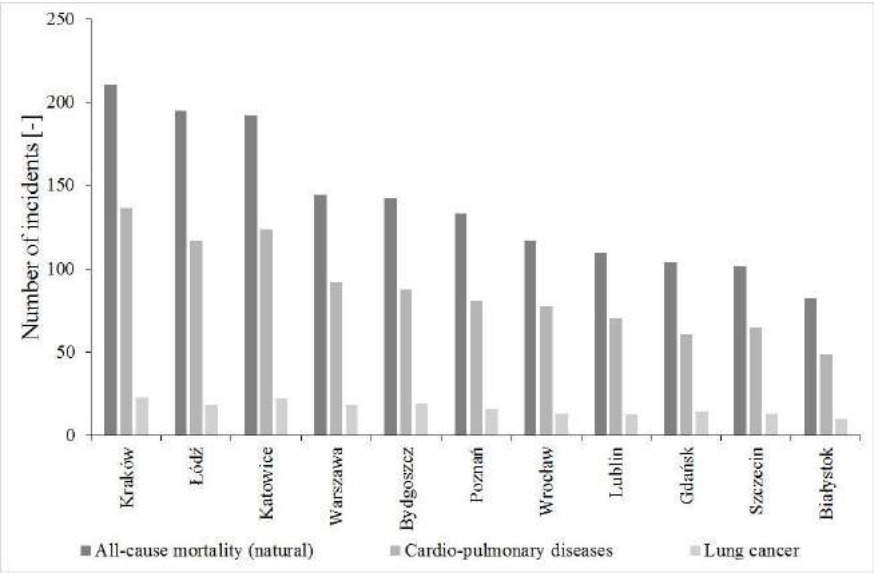

Figure 1. The average all natural causes, lung cancer and cardio-pulmonary mortality per 100,000 inhabitants attributable to ambient $PM_{2.5}$ in Polish cities in the period 2006-2011 | **Source:** Badyda, Grellier, Dąbrowiecki 2016.

The estimation of the proportion of mortality from lung cancer and cardiopulmonary diseases that can be attributed to exposure to $PM_{2.5}$ in ambient air in selected Polish cities indicated that it is directly proportional to $PM_{2.5}$ concentration in the ambient air in those cities[1]. It varies significantly between cities reaching the highest values in Southern Poland (Cracow and Katowice) and the lowest in North-Eastern Poland (Białystok) as well as along the Baltic coast (Gdańsk and Szczecin).

The most common causes of death attributable to exposure to $PM_{2.5}$, particularly in the case of lung cancer and cardiopulmonary diseases concern cities characterised by the highest concentrations of this pollutant (Cracow and Katowice). Comparable rates were recorded in Łódź, where the concentration of $PM_{2.5}$ are noticeably lower. Other factors that increase mortality, such as age (the risk factor most associated with mortality from cancer and cardiovascular disease) clearly play a role in increasing the number of attributable cases.

Moreover, Łódź, which used to be an industrial city, may reveal the effects of exposure to high concentrations of air pollutants that occurred in the city during intense activity of light industry (this is due to the lack of taking into account the latency period). Visibly lower rates concern Warsaw, however this city was still on the fourth place of Polish cities with the highest mortalities attributable to ambient $PM_{2.5}$ and moreover it has the largest population.

The highly elevated pollution levels in Polish cities are also a legal and administrative problem. The widespread use of coal in households and social poverty makes air quality management in Poland particularly difficult. There is no appropriate legislation that would effectively eliminate the possibility of low-quality fuels trading, as well as their use in obsolete installations. There are also no regulations that would prohibit urban traffic vehicles that do not meet the strict emission standards. There are over 28 million vehicles registered in Poland; 21 million of them are passenger cars. Out of 1.15 million vehicles which are registered in Warsaw only 30 % are less than 5 years old, 55% are at least 10 years old and over 25% older than 20 years. About 30% of

[1] Research conducetd by Artur Badyda from the Warsaw University of Technology, James Grellier from the Centre for Research in Environmental Epidemiology from Barcelona and Piotr Dąbrowiecki from the Military Institute of Medicine in Warsaw.

passenger cars (both in Poland and in Warsaw) are vehicles powered by diesel engines, which are responsible for the emission of substances which have a proven carcinogenic influence on humans.

Introduction of activities aimed at improving air quality, requires huge financial investment including subsidies for the purchase of modern heating equipment, improvement of fuel quality and the introduction of incentives for those who decide to buy low-emission vehicles. There is also a need to decrease the intensity of individual transport (i.e. use of personal cars), especially in the central districts of Warsaw and decrease the number of vehicles passing the borders of the city every working day.

The popularity of public transport in Warsaw is rather high in comparison to many European and other Polish cities. According to the latest Warsaw Traffic Measurement in 2015, the percentage of journeys made using public transport reached the level of 46.8%, while individual cars were used in 31.7% of cases. There is also quite a high share of pedestrian's journeys (17.9%). Use of bikes is not very high (only 3.1%), but was actually the highest in the whole history of traffic measurements in Warsaw. To compare these results with Cracow it is worth noting that public transport is used in this town in 36.3% of journeys, individual cars in 33.7%, pedestrian's travels in 28.4% and bikes are used in 1.2% of journeys (*Warszawskie Badanie Ruchu 2015* 2016). Unfortunately, the usage of public transport indicated in Warsaw in 2015 was the lowest since such measurements have been conducted (in the years 1980, 1993, 1998 and 2005), and the share of using individual cars is the highest. There is great need an educational campaign but the Warsaw municipality treats this as an additional action, which is not a priority.

The Warsaw Municipality

The city's current actions aimed at reducing air pollution concentrations include the following activities and plans that are considered:

1. Regarding the limitation of individual traffic in the city centre:
    a. The introduction of a ban and traffic restrictions for heavy goods vehicles in the central city area (in force since 2006, as amended in 2010);

b. It is currently impossible (national regulation) to introduce restrictions on the movement of individual vehicles not meeting the most restrictive emission standards;
c. Further investment is needed in the development of public transport – the city is currently investing in the expansion of the second metro line; public transport is being rejuvenated for both buses and trams. Within the procedure for purchasing new buses, low carbon vehicles are being bought, including the development of electric buses (the first batch of 10 vehicles has been running for several months, the tender for the delivery of the next batch has been resolved and in the near future a further tendering procedure for buses is planned);
d. The City Office has introduced a narrowing of some streets in the centre of Warsaw in order to reduce traffic congestion, and further plans to narrow other streets to discourage car usage in everyday job commuting;
e. To increase the use of public transport by young people and their parents, the municipality has introduced free periodic tickets for schoolchildren;
f. A similar goal is to introduce a reduction of ticket prices in the city centre in June 2017 to encourage commuters from Warsaw to make more use of public transport (currently around 700,000 drive around Warsaw daily), mostly from suburbs (this is also partly a political decision connected with local government elections);
g. The development of P+R (park&ride) car parks (as well as bike&ride: B+R) is also used to limit the movement of individual vehicles in the central parts of Warsaw (especially for cars commuting from the suburbs). However, these are costly investments, which require large areas of land, and so far car parks are able to meet about 1% of the needs in relation to the number of vehicles exceeding the daily limits of Warsaw.

2. Other actions aimed at limiting car traffic are:
    a. Carpooling plans (which should be implemented soon). In this system, a fleet of short-term rental vehicles is available as needed. Some of the worldwide solutions are fully automated from the user's perspective – the location of the closest car is identified by a smartphone, which also serves to rent and start the vehicle. Some of the systems are based on electric vehicles; and such a system is being considered for implementation in Warsaw. This makes it possible for people who do not have cars to rent a car, for example, for a few dozen minutes, or a few hours if needed;
    b. The city is planning to encourage the use of car-sharing solutions. This is a solution, which is to give free seats to a commuter, e.g. to work or school in the same direction;
    c. The emergence and dynamic development of the public bicycle rental system (popularity is higher than expected) and the expansion of bicycle transport infrastructure. Some implementations are criticised as not really thought through, such as bicycle paths that unexpectedly end up being made from the wrong road surface, a tree grows in the centre of the path, or the path partially goes up the stairs. However, such situations are becoming less frequent. There is still a lack of developed bicycle parking, the provision of which could contribute more to the popularity of bicycles (there are also car parks created by individual employers);
3. Activities related to the reduction of emissions from communal-living sources
    a. Boiler replacement allowances in individual households for low-emission appliances (in particular change to gas boilers);
    b. Plans to increase the amount of areas with air quality monitoring (urban measurement system);
    c. Organising a system of air quality control by the municipality police (special measuring devices are used for random interventions during heating seasons) and household inspections in order to prevent illegal waste burn;

4. PR and educational activities:
    a. Educational materials for residents;
    b. Training for directors (managers, heads) and teachers from preschools and schools in Warsaw on air quality issues and methods of protecting children from excessive exposure to air pollution.

Inhabitants of Warsaw

The main problem is that still there is low awareness of the problem of high concentrations of air pollutants in the city, although media are nowadays more increasingly covering the topic (especially after the smog from the beginning of 2017, when the concentration of pollutants reached an unprecedented level in at least 10 years).

- Lack of education and information: the residents do not know that some (most?) of them contribute to poor air quality (using more and more fuel from road transport or burning solid fuels in home furnaces).
- Residents do not want to give up using cars as it is the main means of transport, mainly because they are reluctant to give up comfortable transport in the city, sometimes due to the limited availability of public transport (from suburbs and some districts of Warsaw). This is evidenced by the low popularity of the "Day without a car", but also low use of free public transport provided during periods of particularly high concentrations of air pollution.
- Residents (like NGOs) would welcome the introduction of completely free public transport in Warsaw, although it is difficult to assess the extent to which such an action could motivate people who use cars to change to public transport. The cost of introducing such activities is relatively high (although the introduction of free transport eliminates the need to print tickets, maintain their distribution points, control systems, or metro gates).
- Reducing the use of individual transport by residents could also be used by employers who would promote the use of bicycles by their employees (by creating adequate infrastructure) or by public transport (e.g. raising ticket costs) while limiting the number

of parking spaces available at workplaces, especially in the central part of the city.

- A certain reduction in the use of not only cars, but also in the number of journeys in peak periods, could be achieved by introducing flexible working hours (also in public administration) or to increase the popularity of work at home.

NGOs

Expectations of non-governmental organisations are largely identical to the expectations of the inhabitants, because there are in particular local NGOs with inhabitants of Warsaw as members. However, awareness of the problem of low air quality among NGO members is obviously much higher than among the average citizen. They implement plans toward air improvements and claim that municipality actions are too slow for the dangerous situation that exists in Warsaw today.

1. First of all, according to non-governmental organisations, the actions of officials aimed at reducing the problem are insufficient and should be significantly intensified. Their expectations boil down to the following propositions:
    a. The city should already introduce restrictions on individual traffic in the city centre, as well as some streets should be narrowed, which today encourage the intensive use of individual transport;
    b. Public transport should be for free;
    c. Officials should use public transport instead of business cars to work;
    d. City centre buildings should have fewer parking spaces to discourage the possession of cars, especially those living in the area;
    e. A similar proposal concerns office buildings where a large number of parking spaces encourage commuting to work by car;
    f. In general, there should be few parking spaces in the city centre;
    g. Parking fees should increase (nowadays, in many cities, the upper limit of the permissible rate is in force, although the

legislative path is now a bill that is three times higher; those are, however, unpopular decisions);

h. Centre parking fees should be higher than in other parts of the city (there is no legislation to do this, but the above-mentioned bill provides for such a solution);
i. Boiler replacement fees should be lower; there should also be a subsidy for the use of low-carbon fuels, especially among the poorer parts of society, which cannot afford to use alternatives e.g. relatively expensive natural gas.

2. Some NGOs provide educational training for residents or teachers.
3. The actions of Warsaw Smog NGOs are diverse and some of them are maintained by the actions of national and international polish NGOs that complaint to the EU about the toxic smog:
    - "Poland has Europe's highest airborne concentrations of the carcinogen benzopyrene – norms are exceeded fourfold – breaching both Polish and EU laws" – Piotr Cykowski, an activist with the Action Democracy NGO – told AFP at the European Commission branch office in Warsaw.
    - "This is why we're filing a formal complaint to the European Commission which could formally sanction Poland for inaction in fighting lethal smog", he added.
    - "We were expecting the introduction of a ban on the sale of the lowest quality coal for domestic heating purposes. However, new draft regulations change nothing" said ClientEarth Poland lawyer Agnieszka Warso-Buchanan, noting that the government admits that "a ban would harm the coal industry" (*Poland's people seek help from EU over national air pollution failure* 2017).

Experts from Warsaw University of Technology

The project "Development and implementation of the Warsaw Air Quality Index (WAQI) and information and analytical system of air quality" is being implemented in recent months (together with the Warsaw municipality). This system is intended to increase the level of informing the inhabitants of air quality (in the next stages the network of urban air quality measurement points will be developed, which will allow

access to current air quality information in many places in Warsaw – currently the measurements are conducted in 7 stations).

The Warsaw Air Quality Index will, in turn, be a synthetic measure of air quality without the need to analyse the concentration of pollutants and their value to the permissible concentrations. WAQI recommendations will also be related to proposed actions (e.g. recommendation to use public transport) or refrain from other activities (e.g. intensive outdoor sports), and separate recommendations will be directed to particularly vulnerable social groups. The risk of untreated health events (children suffering from bronchial asthma, the elderly, people with respiratory diseases, people with cardiovascular disease).

Experts strongly recommend to carry out some educational activities and well prepared communication on the topic.

Previous activities were poorly communicated – residents were either unaware of the existence of these activities or did not read them in the context of traffic congestion and thus reduce the concentration of air pollution in the city. Even if the main purpose of these activities is not to limit traffic, they can achieve this effect and this should be communicated appropriately. It is also necessary to significantly increase the intensity of public awareness that the air pollution in Warsaw is largely due to the actions of the inhabitants of the city and the suburbs (city's commuters): intensive use of individual transport (though Warsaw's public transport travels show that almost 47% of journeys take place by public transport, compared to 2005 or 1998, the share of mass transit traffic has fallen from 54% and 51% respectively, while cars increased from 24% and 28% respectively) throughout the year and use of solid fuel (coal, wood) from autumn to spring especially in peripheral districts and many towns around Warsaw.

Questions to address (1-6):

- How to make changes within the city to improve air quality?
- How to improve the understanding of air quality in the city among different stakeholders including the general public? What can be done by: Warsaw authorities, Warsaw citizens, NGOs?
- How to make Warsaw a more sustainable city?

- Is there any data on gender perspective towards air pollution? (who is mainly fighting with smog?)
- Is gender included/not included in the decision-making process concerning smog?

Data source

- http://energydesk.greenpeace.org/2015/06/25/polands-smog-crisis-europes-most-polluted-country-in-trouble-with-the-eu-but-wont-cut-coal-emissions/.
- https://www.ft.com/content/6712dd66-c91d-11e6-8f29-9445cac8966f.
- https://qz.com/882158/with-air-pollution-skyrocketing-warsaw-is-severely-hit-by-polands-smog-problem/.
- https://www.nytimes.com/2017/01/14/world/europe/warsaw-air-pollution-smog.html?_r=0.
- How 6 cities are attempting to deal with dangerous air pollution: http://www.cbc.ca/news/world/smog-air-pollution-cities-1.3383313 (6.06.2017, posted: Dec 29, 2015).
- *Poland's people seek help from EU over national air pollution failure* (2017) https://www.clientearth.org/polands-people-seek-help-eu-national-air-pollution-failure/.
- *Warszawskie Badanie Ruchu 2015* (2016) http://transport.um.warszawa.pl/wbr2015.

Procedure

Teachers can use these materials and organise a round table discussion with stakeholders involved in the development of a sustainable city (with better air quality). This material can also be background information to use the flipped-classroom method:

1. In-class work: Opening the issue. Introduce the main question of the case e.g.: "What can ordinary people do to make a city less air polluted?" Let students discuss their ideas in pairs and then present them.
2. Flipped classroom (assignment): Ask students to go through the presentation about air pollution in Warsaw (or their city) provided

on the Internet (and in the materials above). Ask them to: a) identify 5 of the most effective actions for reducing air pollution in Warsaw and b) organise them in an xy chart in such a way that x represents the level of effectiveness of an action and y represents its cost. Then c) try to identify the best suitable action for supporting community-based projects.

3. In-class work: Ask students to present their suggestions for the best sustainable action. Encourage critical reflection. Then select 1-4 actions with the highest students' support and ask students to make smaller teams to plan an action-relevant community-based project.
4. Provide students with a template for planning the action-relevant community-based project (action plan). Emphasise the importance of planning their action as realistically as possible, as it could be conducted by ordinary people, like them. Give them enough time to prepare their plans (it may be accomplished as another home assignment).
5. Let students present their action plans. Encourage critical reflection.
6. If possible, encourage students to choose one of their action plans and conduct it on their own.

Community Action Plan Template

Please consider the following template as you develop your Plan. When you are creating the plan, keep in mind that the project needs to be both sustainable and achievable. **Focused and realistic action steps are preferred.**

Step 1:

PROBLEM IDENTIFICATION and PRIORITISING:

- What are the problems (scope, burden, context)?
- What data sets have been analysed and what does the data suggest?

Step 2:

STRATEGIES, OPTIONS and TRADEOFFS:

- What approaches and actions are most suitable to deal with problems?
- What is the community's shared vision around the project?
- What/who are the priorities?

Step 3:

PLANNING FOR IMPLEMENTATION:

- Briefly describe the planning to date as part of an initial action step.
- Who does what, when and how, and how to get it going? Use the table:

Action step(s)	Person(s) responsible	Date to be completed	Resources required	Barriers or resistance	Collaborators
What will happen?	Who will do what?	Timing of each action step	What is needed and what's available?	Risks and a plan to overcome barriers	Who else should know about this action?

Step 4:

MONITORING:

- How is it working and what can we learn?
- What are the prospective opportunities, as well as constraints, associated with the project?
- Both in terms of process and outcomes, how will strategies be measured?
- How will results be shared with the community?

References

Badyda, A., Grellier, J. & Dąbrowiecki, P. (2016) Ambient PM2.5 exposure and mortality due to lung cancer and cardiopulmonary diseases in polish cities. *Advances in Experimental Medicine and Biology*, 944, pp. 1-9. DOI 10.1007/5584_2016_55.

Air quality in Europe – 2017 report (2017) EEA Report No 13/2017. https://www.eea.europa.eu/publications/air-quality-in-europe-2017.

Case 11

Local referendum about the relocation of the railway station

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Keywords:
railway station, local referendum, public participation, decision-making

Relation to Sustainable Development Goals (SDGs):

Strategy: the lesson is based mainly on the experiential education approach. Learning is assumed to arise as a result of participating in a role-playing game and follow-up debriefing

Time required for classwork: 120 minutes.

Students' preparation for the class: no need for preparation

Aims: Ultimate goal of this case is to develop students' strategic thinking competence. While receiving brief information about the plan to relocate the railway station, students should be able to argue during group debriefing about the role of a local referendum in urban sustainable development.

Learning outcomes:
After completing this case, students are able to:

- analyse the process of local referenda, identify its pros and cons, and compare it with other methods of decision-making processes;
- identify the social, economic, and environmental aspects of the issue based on the plan to relocate the main train station in Brno (Czech Republic) from the city centre to the southern, rather industrial, part of the city.

Case description

Brno is the second largest city of the Czech Republic (approx. 380,000 inhabitants). It is the city where the Highest Court and other important Czech institutions are situated. It is the home to 14 universities with approx. 83,000 students, many theatres, and historical places. Brno is one of the core urban centres of the Czech Republic. It is also easy to reach from Prague (2.5 hrs) or Vienna (1 hr) by train or bus.

Nowadays, the Brno main railway station is situated in the city centre (see Image 1). However, this situation is a matter of ongoing discussions.

Image 1. Comparison of the current location of the railway station and the proposed relocation
Source: http://nadrazi-pod-petrovem.netstranky.cz/dostupnost-nadrazi-a-k-cemu-je-nadrazi.html, retrieved April 13, 2018.

In the middle of the yellow circle we can see the current location of the train station. The circle depicts 15 minutes walking distance from the centre of the circle. The white circle depicts the 15 minutes walking distance from the proposed relocation of the railway station. The white lines depicts proposed development of the area.

The city has been developing rapidly since the socio-economic transition in 1989. The growing number of new inhabitants as well as the growing number of companies and businesses in the city calls for a (new) city development plan. Reconstructing the railway station in order to improve the connection not only to regional settlements but also to other European countries has become an important priority.

With the transformation of the former state-planned economy to the market economy, an opportunity for development companies as well as for real estate retailers occurred. Thus the development of the city is a process of negotiation among various stakeholders, due to the differing views on how the city should develop.

The first local referendum was organised in 2004. The result was a clear disapproval of the proposed relocation, as 86% of voters agreed that the local government should take all steps to modernise the main railway station within its current location. However, the quorum (50% of authorised voters) was not reached, because the attendance rate was 25%.

According to the modified local referendum act, the quorum (an attendance threshold for a valid result of referenda) dropped to 35% of voters only. In the local referendum, only the permanent residents of the city may vote. However, the importance of the issue surpasses the city itself as the railway station is used widely by commuters, who cannot participate in the referendum.

In discussions on the issue, various arguments are used. The effort to move the railway station to another location is usually supported by the following arguments:

- it will enable further development of railway transport (current station is viewed as insufficient);
- it will merge personal and material transport in one place;
- the city centre can be enlarged by building the railway station near the bus station;

- the relocation will support the economic development of the city, its competitiveness and a modern and new railway station is a necessary condition for such development;
- it will create conditions for the still missing high-speed trail connection between Prague, Brno, and Vienna;
- it will be faster to build a new train station than to reconstruct the current one.

The critics of the relocation plan tend to provide the following arguments:

- since the current station is situated in the city centre, commuters and tourists may reach the city by public transport (and do not have to use their private cars);
- current location is convenient both for tourists and commuters,
- it is not necessary to construct a completely new building and infrastructure as a modern train station for high-speed trail connection can be constructed at the current location and it will cost less;
- people are used to the current main train station and may be largely opposed to the relocation;
- building a new train station on greenfield land might impact on the present fauna and flora as well as groundwater sources of water.

The solution to the dilemma of "to move or not to move" the main station will seriously affect lives of citizens of Brno.

Questions to answer:

- What are the pros and cons of local referenda?
- What are the specific challenges in this method of seeking for a problem solution?
- For what kind of projects is a local referendum an appropriate instrument to address sustainable development in urban areas?
- Are environmental, social and economic aspects of the proposed project addressed by various actors equally?

Data source

Brno Opens Central Station Design Contest. https://www.architectsjournal.co.uk/competitions/brno-opens-central-station-design-contest/8689620.article.

Durnová, A. (2015) *Lost in Translation: Expressing Emotions in Policy Deliberation.* In: (eds.) Fischer, F., Torgerson, D., Durnová, A. & Orsini, M. *Handbook of Critical Policy Studies.* Camberley: Edward Elgar Publishing.

Patočka, J. (2016) *Plánování, konflikt a participace: návrh empirického výzkumu případu sporu o brněnské hlavní nádraží.* Brno: Bachelor thesis, Masaryk University, Faculty of Social Studies.

Procedure

1. Human continuum: ask the group to express their opinion about the issue by choosing a place in a class. Participants could form a line where each end represents the opposite view on the statement: "A local referendum is an instrument allowing to find the best solution for sustainable development of a city." Ask participants to explain their opinion.
2. Participants sit in the circle with their eyes closed and receive their business cards. They are welcomed into their new roles – stakeholders of the current issue of relocating the main train station in Brno.
3. Participants receive the information that a public hearing about the planned relocation of the railway station starts in the town hall in 10 minutes. They are supposed to find other participants with the same opinion as theirs (i.e. their role) and discuss the arguments. The groups for and against the relocation should prepare a list of the strongest arguments for persuading members of the other groups to change their mind for the upcoming referendum. The undecided group should prepare their questions about the project.
4. The facilitator opens a public hearing and the plan for relocation is introduced (it can be introduced by the proponent and opponent of the relocation, who get more familiar with the case before the lecture).
5. Facilitator opens the floor for discussion and the participants are invited to express their arguments and questions. Stakeholders present the arguments according to their roles. Time planned for a discussion is 10 min.
6. Announce the referendum in 10 minutes after the discussion ends. Show the referendum questions. The participants who may vote

receive two small balls of different colours and a non-transparent bowl is placed below the screened questions of the referendum.

7. After ten minutes, when it is possible to discuss the issue privately and think through the decision, the secret voting starts. Only those participants, who have received cards with an explicit instruction "YOU MAY VOTE" are allowed to vote.

8. The facilitator organises the "secret vote" – i.e. nobody can see anyone else voting. The municipality must act according to the result of the referendum.

9. Let the participants discuss the result of the referendum in groups and to evaluate the consequences for the future development of Brno from the perspective of their roles.

Assessment

Let the participants reflect on the result and think about its consequences for the future of Brno. During the debriefing session participants leave their role and are encouraged to express their personal thoughts (in smaller groups of 4–5 participants):

a. What are the pros and cons of local referenda?
b. What are the specific challenges in this method of seeking for a problem solution?
c. For what kind of projects is a local referendum an appropriate instrument?
d. Are environmental, social and economic aspects of the proposed project addressed by various actors adequately?

Application

The case could be used in various themes and courses, such as conflict management, environmental conflicts, urban studies, communication.

Additional materials for the case:

1. Questions for the referendum
2. Arguments for and against the relocation
3. Role descriptions

Questions for the referendum

1) Do you agree that the city should do its best to reconstruct the railway station in its current location?
2) Do you agree that the city council should launch an open competition for a project of the railway station renovation immediately?

Main arguments for relocation

- to enlarge the city centre and to build the railway station nearby the bus station;
- to support the economic development of the city and its competitiveness and the modern and new railway station is a necessary condition for such a development;
- to prepare conditions for a still missing high-speed trail connection between Prague, Brno, and Vienna;
- to bundle together personal and cargo railway traffic.

Main arguments against relocation

- the existing station is situated in the city centre, commuters and tourists may easily reach the city and use public transport;
- people are used to the location;
- it's not necessary to build a new building and infrastructure;
- it would cost less;
- the relocated station could lead to higher use of car transport.

Materials to be used:

Participants' roles:

Mr Vorisek

You have been living in the city centre for more than 50 years. You like the way it is and do not support any changes in the city centre. Furthermore, you do not trust the huge and expansive projects managed by rich companies with no links to the place and supervised by corrupt politicians. YOU MAY VOTE.

Ms Chlebickova
You own a small company near the contemporary location of the train station. Because of this, the relocation would seriously hamper your business. You are aware that many people are in the same situation. Moreover, you want to prevent public money from being wasted. YOU MAY VOTE.

Mr Modry,
Spolek Brno
You are the member of a NGO supporting the relocation. You believe the decision-making should remain in the hands of experts, as the public have no expertise for qualified decisions. You also believe your city deserves a new and better situated train station. YOU MAY VOTE.

Ms. Moturkova
You are a big fan of high-speed trains and often criticise the fact that they are still not operated in the Czech Republic. You believe that the relocation of the main station could open a way for turning your dreams into reality. The current main station does not support speed trains, because of the residential infrastructure nearby and old technological railway solutions. YOU MAY VOTE.

Ing. Vlacek
You are a public transport expert. You believe it is possible to reconstruct the current main station to open it for high-speed trains.

Ing. Masinkova
You are a public transport expert. You believe that although it is possible to reconstruct the current main station to open it for high-speed trains, it would be more expensive because of the residential infrastructure nearby and the old technological railway solutions.

Dr Travnicek,
member of the Green Party
You believe that decision-making should be as transparent as possible and so the public should be involved. YOU MAY VOTE.

Dr Kolejkova,
representative of the Czech Ministry of Transportation
You represent a crucial investor of the planned project. However, your ministry still has not taken any position on the issue. Generally, you are

interested in saving public money but also in obtaining public support for your party.

Ing. Vyhybka,
representative of the Czech Railway Infrastructure Administration
Your company is an investor and owner of the infrastructure (i.e. the main station). You seek a consensus with the other municipal and national institutions. Your institution is highly interested in launching the high-speed rail network.

Mr Kralicek,
representative of the Czech Government
You are interested in the process of a referendum as such, as you want to evaluate how the contemporary version of the local referendum law works.

Mr Hantecka,
representative of the Brno municipality
You are personally opposed to the relocation plan. However, your task is to evaluate the arguments of both sides and respect the will of the majority of Brno citizens. YOU MAY VOTE.

Ing. Nadrazska,
representative of the Brno New Station Development Company
Your company is responsible for the current building of the railway station and renting its place. The other responsibility is the reconstruction of the building. However the company also owns some of the real estate in the area of the proposed relocation of the railway station. YOU MAY VOTE.

Mr Spilberg,
representative of the European Commission
While the investment should be supported from European funds, your task is to make sure that the process is transparent and follows democratic norms common in the EU. YOU DON'T VOTE

Ms Balounova
You are an owner of real estate in the area where the station would be relocated. The project would open the area to new development, therefore the prices of real estate would significantly increase. YOU MAY VOTE.

Doc. Litalek
You work for the university located in the city centre. As you live in a distant city, you appreciate the current location of the station, less than a 20 minute walk from your university. You believe the current location of the station is one of the best advantages of Brno. YOU DON'T VOTE

Ms Bila
You have been living in Brno for more than 20 years. You like the city but you are udecided regarding this issue. You are open to arguments you will hear at the public hearing. YOU MAY VOTE.

Mr Bily
You have been living in Brno for more than 40 years. You like the city but you are udecided regarding this issue. You are open to the arguments you will hear at the public hearing. YOU MAY VOTE.

Ms Hornicek
You study in Brno and you plan staying here after graduation. You are not sure what the best thing for the city is. YOU MAY VOTE.

Mr Vana
As a member of an ethnic minority in Brno, you do not trust the government or rich companies. However, you still have no opinion about the issue. YOU MAY VOTE.

Ms Kudryatseva
As an original immigrant who has recently gained Czech citizenship you are still not clear on what to support. However, you do want to express your interest in the future of your new home. YOU MAY VOTE.

Ms Kudrnova
You are a successful manager of an international insurance company. You need to travel to Prague, Vienna and Bratislava quite often. You would appreciate a better train connection to those cities so that you do not need to drive a car. The faster the connection, the better for you, regardless of the price of the ticket. YOU MAY VOTE.

Case 12

Urban greenery – how to include urban green areas in cities that are in desperate need of housing?

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Keywords: ecosystem services, urban sprawl, biodiversity; densification, green infrastructure, urban green health

Relation to Sustainable Development Goals (SDGs):

Strategy: text analyses, role-playing, debate, reasoning, discussion

Time required for preparation (in minutes): 120.

Time required for role-play (in minutes): 45.

Time for discussion (in minutes): 45.

Aims: To illustrate the problems in urban planning where there are two requirements that are difficult to combine, the one urging for more greenery and at the same time meeting the need for more housing and road infrastructures. To develop students' systems thinking, interpersonal and strategic competences.

Learning outcomes:
After completing this case students are able to:

- Discuss dilemmas linked to social, environmental and economic implications of urban planning of green areas;
- Understand why nature is important for human well-being, health and education;
- Understand the importance of conserving biodiversity in cities;
- Understand the complexity of combining both urban green areas of high quality and residential housing;
- Understand the landscape view of urban planning, if you affect one place it has consequences for other places. The landscape view is important for ecology as well as recreation;
- Understand how decision-making is made in city planning such as strategic plans, the reasoning of different actors such as planners, politicans, scientists and local people.

Outputs:
Text analyses and information about urban planning and urban greenery. Provide a role-play as a debate between two groups which then is followed by a discussion.

Case description

Urban greenery – how to include urban green areas in cities that are in desperate need of housing?

Overview of urbanisation and greening
There is an increasing global urbanisation trend. Within the coming 30 years more infrastructure will be built than in previous history. This increasing urbanisation leads to two major effects on the global landscape. First it densifies cities, meaning that cities get more roads, houses and general infrastructure within existing boundaries. Mainly at the costs of existing urban green areas such as abandoned areas, parks, urban forests but also in residential areas where additional

houses are built in existing gardens. Densification is used in many parts of the world to avoid urban sprawl.

Urban sprawl is described as the expansion of human populations away from central urban areas into low-density, monofunctional and usually car-dependent communities. Urban sprawl in the US has for example reduced the extent of forest by 2.1 million ha (1 ha=100x100m) and agricultural land by 1.5 million ha during 10 years. So, one strategy is to condense cities so that the surrounding landscape is not exploited by vast residential car dependent settlements. Thus, dense cities are also argued to be sustainable cities since people can easily walk, bicycle and use public transport in them. New York is seen as a good example of this and seen as a "walkable city" which allows people to use public transport such as the subway and walk.

The question is, then why do we need to have urban green space or nature in cities when there is so much of it elsewhere? Somewhat paradoxically, the best for nature and reducing of urban sprawl would be extremely dense cities including only extremely high skyscrapers. Hong Kong is one example where the average person lives on the 17th floor in a high-rise building and the metropolitan area of Tokyo is another example with 36 million people and very little green space.

These cities or the fictional future cities with only high-rise buildings will for sure leave a lot of greenery and nature outside them but also create dense areas. However, the densification trend has started to be questioned. Humans need urban green areas in order to provide numerous ecosystem services, for example when green plants lower temperatures in cities and reduce urban heat effects. Urban heat effects are when the city "keeps" heat in the infrastructure creating extreme temperatures. Urban green areas absorb carbon dioxide and mitigate extreme rainfall by allowing the water to runoff in the greenery rather than along paved roads.

The landscape perspective is important. Share or spare are two questions linked to the present urbanisation trends. Is it best to have really dense cities such as Hong Kong and spare larger urban green areas within the city? Or is it better to share, to have many small urban green areas in a dispersed city as in many US cities? It is argued that

to spare larger urban green areas is better since a larger area can provide many more possible ecosystem services. Further, it seems as dense cities have a larger effect on their surrounding landscape, meaning that people are pushing development into the peri-urban areas when they do not have green spaces in the city.

An example would be the increasing number of mountain bikers and joggers in the peri-urban landscapes when cities are densified. People seem to need a certain amount of greenery to function and if it is not in the city, they have to go to the surrounding landscape.

One of the most pronounced ecosystem services in cities may be the cultural ecosystem services linked to aesthetical values, education, recreation and human health. In Japan stressed people spend weekends in the forest to reduce their stress by taking "forest baths" or Shinrin-yoku in Japanese. It is however shown that most people conduct their everyday recreation in the vicinity of their homes and to send people out on weekend tours for stress relief, as in Japan, may not be sustainable.

Elderly people and children need urban green space reachable within short distance to be able to use them. Some studies show that this distance should be no farther than 300 meters from home. Further, research also shows that it is not any "urban greenery" that reduces stress and increases health, but it is linked to different types of green space. Forests that allow light and paths have stronger stress reduction potential than urban parks. There is even evidence that biodiversity *per se* increases human well-being. If one can see and hear more birds singing, one will have a more positive attitude towards the urban area.

The reason behind why humans feel less stress in urban greener areas is not known. One hypothesis (the biophilia theory) is that humans for a very long time have lived close to nature and thus feel linked to it. Biodiversity ranges from genetic diversity within species, to diversity of habitats (e.g. deciduous forest, coniferous forest, park, residential areas), to global diversity of biomes (e.g., rainforest, boreal forests, savannahs etc.). Interestingly humans have settled in areas with extreme biodiversity, so-called biodiversity hotspots, where the flora and fauna is unique.

Rio de Janeiro in Brazil is surrounded by the unique Atlantic forest, Cape Town in South Africa has unique fynbos flora (a natural shrubland or heathland vegetation) that only exists there, and similar ecosystems that occur around the Mediterranean sea, California, Chile and parts of Australia have a unique and highly diverse flora. All these regions are densely settled and a study conducted by Aronson *et al.* (2014) showed that the urban flora and bird fauna is still diverse in a global perspective.

Uppsala and the need of housing

In Sweden, as in many other regions globally, there is a movement from rural areas to larger cities. In China this is truly extreme where new cities for millions of people are created. In Sweden it is not as extreme but nevertheless in the city of Uppsala, where 150,000 people live, there is a trend of densification. Over the last few years 3.000 new apartments were built within the existing boarders of Uppsala each year. The municipality as a whole (200,000 people) is expected to increase by 135,000 people by the year 2050 and most of them will settle within the existing city borders. The increase is a combination of people moving from rural areas, students from the two universities who decide to stay in Uppsala, immigrants and people from Stockholm moving to Uppsala due to the high prices in Stockholm.

The problems Uppsala is facing is that all parties agreed in the long-term strategic master plan (until 2030) to keep all urban ecosystem services in the city and keep the biodiversity, since it is important for human health and making Uppsala attractive and at the same time to built thousands of houses within the existing borders. This can only be done by building on the existing green areas which contradicts the strategic master plan to keep ecosystem services. Presently, the need for housing is more important than keeping urban green space but will this create a future sustainable city?

The Eriksberg forest

One particular forest in Uppsala named Eriksbergsskogen “the forest of Erik” is under pressure from two sides, one side urges for the need of getting more houses for everyone moving to Uppsala and the other

side is saying that too much is being built and people need greenery around them. This creates numerous arguments between politicians, local people living nearby, planners, ecologists etc. who all have their own opinion of what is best. The Eriksberg forest is located on the western part of the river Fyris in Uppsala. On this side of the river the city has approximately 13% natural remnants of forests left (on the eastern sides it is 1%).

The average city in Sweden has a 20% cover of natural remnants, so Uppsala is lower than average and also lower than many cities in China that lately try to get at least 20% of forest in their outer rings. Sweden is however still unique in a global perspective, having numerous existing natural remnants in the city compared to places such as Barcelona with extremely dense areas and little green space.

The master plan of Uppsala, which is a strategic document showing how Uppsala should be planned for the coming 20 years, states that the urban green areas are important. The small and large urban green areas are equally important in the document. Uppsala and many other cities strive to have greenery within a distance of no more than 300 metres from home. Yet, the removal of another urban forest in Uppsala illustrates the problem (figure 1). In the document that described the removal of the forest, the municipality states that they depart from the masterplan... and a deterioration of availability for the nearest residents to green areas with reduced play for the youngest (figure 1).

Figure 1. The removal of a smaller urban woodland in the city of Uppsala. | **Photo:** Marcus Hedblom.

A number of ecologists were sent out to the forest to do inventories. They found numerous red-listed species on the trees. Red-listed species means that they are threatened and declining and that Uppsala

and Sweden have a responsibility to save them. However, the species are not protected by law but by international conventions such as the CBD (Convention on Biological Diversity). The ecologists also pointed out that the forest is a part of an urban green corridor that animals use to get between the nature reserves “Stadsskogen” and “Hågadalen nåsten” (see figure 7). Most species are linked to the forest, which is unique in the landscape since it has many pine trees more than 180 years old. No trees of this age are found outside the city, since 97% of the forest in Sweden is production forest and thus harvested before the age of 80.

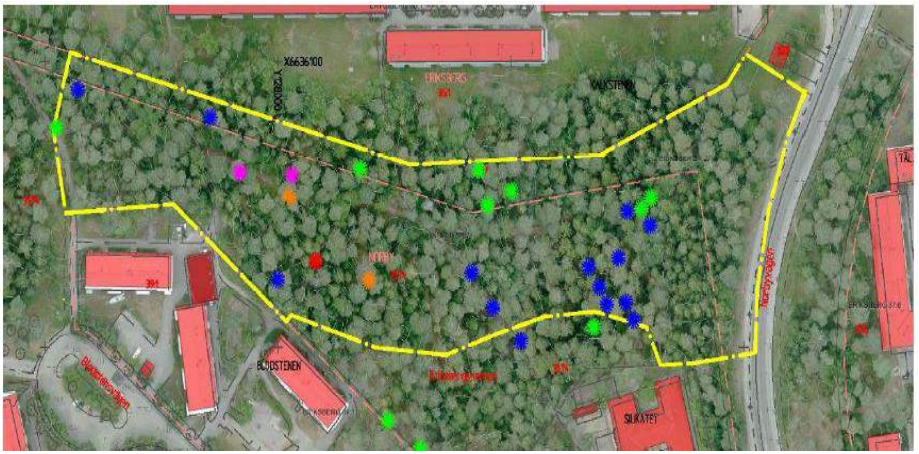

Figure 2. The different coloured dots illustrate different red-listed species. Two fungi growing on the trees and one beetle that are nearly threatened. Further, one fungus and one beetle that are threatened was found. Inventory made by Upplandsstiftelsen, Baggforsk och Conec. | **Illustration:** Karavan, White arkitekter and Sweco Architects. Ortofoto: Uppsala Municipality.

Cultural values: Further, the famous Carl von Linné used to take his students on walks in this area during the 17th century (figure 3). According to historical documents he and his students did not walk exactly in the Eriksberg Forest, which enables some to argue that there is no conflict with the housing plan. Further, there is a pacifier tree in the forest as well. It’s a place where parents together with children have a ceremony to say farewell to the use of a pacifier and hang it, creating a tree with hundreds or thousands of them.

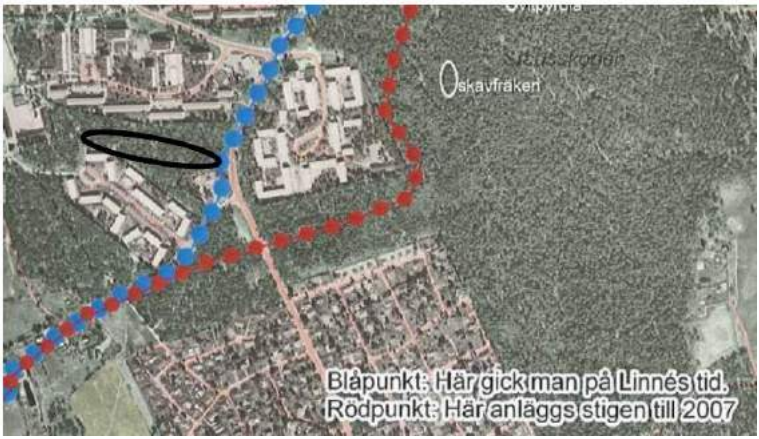

Figure 3. The area marked in black is Eriksberg Forest. The blue line is where Linné actually went walking and the red line is where a "new Linné path will be built by 2007", since the blue area is along a road these days. | **Photo:** Uppsala Municipality

Figure 4. Photo of the location of the forest in Uppsala (in yellow). The Eriksberg Forest is very close to a city forest which is a nature reserve and protected by law from exploration (seen as dark green to the right). To the left of the Eriksberg Forest there is agricultural areas and also a nature reserve, mainly for recreation. | **Photo:** Google earth illustrated by Marcus Hedblom.

Figure 5. Photos from inside the Eriksberg forest, as well as the adjacent gardens (right bottom). | **Photo:** Marcus Hedblom.

The Eriksberg Forest is used by many people. This is illustrated by the numerous paths that are in the forest (figure 5). Actually, the municipality put some effort into it and made a wooden bridge through the forest (figure 5) to help people passing through to work or for recreation.

1.200 people living near the forest signed documents and protested against the builders (see figure 6). They use their forest on a daily basis for recreation. The World Health Organization recently published a report concerning the importance of greenery and health. Green areas reduce self-evaluated stress and also actual stress, reduce obesity and type-2 diabetes, increase social inclusion, general well-being and health.

Further, in the southwestern parts of the forest there is a nursery where the children have a door in the fence that leads right into the forest and where the teachers and children go for strolls. There is increasing scientific evidence of the importance of greenery for children. It

increases their motor skills, they develop more self-esteem and they also concentrate better in school (increased cognitive skills).

Boende nära skog intill Stadsskogen vill stoppa planer på bebyggelse.
Foto: Nina Leijonhufvud

- Dölj bildtexten

Boende vill stoppa byggplan

Eriksbergsskogens Vänner har samlat ihop 1 200 namnunderskrifter i protest mot den planerade exploateringen av ett mindre skogsområde i stadsdelen Eriksberg.

Figure 6. Local people want to keep their forest. The picture is from the local newspaper where 1200 people signed a protest list. | **Photo:** Uppsala Nya Tidning.

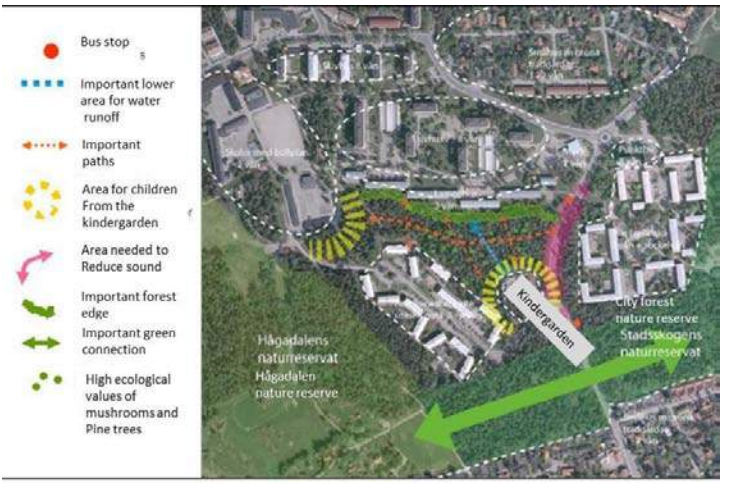

Figure 7. Overview of the Eriksberg forest area and its values. For ecological values also see figure 2. | **Illustration:** Sweco Architects.

Role-play

The idea is that students get an overview of the problem described above, including the need for housing, but also the importance of urban greenery for human health in urban planning. The students will have a role in the role-play representing one of many stakeholders that have an interest in the Eriksberg forest. The students can look into the references suggested at the end, linked to urban planning, urban greening and densification and try to get as much information as possible for their position to enable arguing for their cause. The students can further use the internet or scientific knowledge to find further arguments for the dense sustainable city and the opposite for the sustainable green city. The "scene" or "stage" is that all the stakeholders meet at a so-called dialogue meeting in a room where the municipality invited parties to discuss the future of Eriksberg forest.

It has lately become practice (in Uppsala) that the municipality invites the public to meetings to discuss the future exploration of Uppsala. So far this dialogue is halting in the way that it has more informative function because so many people have come to the meetings (information for citizens was provided rather than an opportunity for a dialogue). There have only been one or a few planners at these dialogue meetings and it is not possible to have a dialogue between them and for example, 200 citizens. The Eriksberg case is based on a real situation, where municipal authorities met together with building companies, landscape architects and ecologists to discuss what to do with the Eriksberg forest. This meeting was conducted in 2010 and was supposed to lead to building houses the very same year. However, since there was no dialogue and many different values were found, no buildings were constructed and still in 2017 no houses have been built. To make this case more interesting than is often the case in reality we have added politicians and also local people to be part of the meeting.

The people or stakeholders involved in this case are invited by the municipality. This is also important to acknowledge for the students, why are these people invited to the meeting and are any people left out? The municipality really strives to get as many people as possible, but it is difficult to invite everyone for a dialogue and only focal people were asked to come.

The houses that are to be built will be sold on the market and not be available for rent. This means that they will attract people with high income. It is known that houses in close vicinity to urban green spaces have higher property values than the ones farther away. One example that is commonly known is Central Park in New York where the surrounding properties are extremely costly.

Procedure and the different persons in the role-play

Each part could be represented by one or many persons. Also, some of the suggested roles could be merged or left out, e.g. the politicians could be merged in to one, the public could be merged in to one etc.

The procedure is that each actor(s) should provide all their arguments for why they think the Eriksberg forest should be protected or cut down, mainly state their arguments for the rest of the group. Each stakeholder is given 5-10 minutes to present. After each stakeholder has presented their opinion, the whole group needs to sit down to come up with a solution that all stakeholders can agree to. In reality a compromise is often made. One suggestion is to draw a map of the areas and discuss how it can be solved best. Use figure 7 as a background.

The politician (1) – green party – opposition

The politician (1) is in opposition with politician (2) meaning that she/he is not elected and will try to get elected next time in Uppsala. The politician for the green party understands the needs for housing and have said that he/she will increase the number of houses, but also said that it is a tricky question since she/he, as a representative of the green party also argues that it is very important to keep the city green, “at least the most important areas”. She/he also argues that the present houses are built for really rich people and not for students.

The politician (2) – social democrats

The politician is the director of the housing and building department in Uppsala and was elected mainly because she/he said that they will deliver houses. And they also fulfilled this so far with about 3000 apartments built every year. Especially for students that really lack housing

and other young people that are in need of moving from their parents to their first flat. She/he thinks that it is much more important that houses are built than green areas saved, “there are so many green areas in Uppsala already”.

Students that protest against the lack of cheap houses for rent in central Uppsala

Some of the students have spent their first year in caravans at a campsite and others live in cellars. They want an affordable flat where they can live and study. They do not want to commute to the city or need to buy a car for travelling there. They would like to have a walkable city or at least a city where you can bike (see Fig. 8).

Figure 8. Illustration of the high number of bicycles at the Uppsala railway station. The picture is from one of the smaller biking parking places. Now, the municipality is discussing how to make a 2-3 floor parking house for bikes due to the lack of space.

The director of a building company

The director argues that she/he has been given an agreement to build in this forest and plans to build really dense and high. At least 5 buildings would be built consisting of 8 floors, with parking lots and also one bigger along the road with 5-6 floors but more flats. She/he understands that “ecological” values have been found and “that some people do not like the idea” but she/he sees no problem in this. There is nothing according to the laws that forbids building the whole place without keeping any green.

The public 1 – People from the neighbourhood want the forest for recreational usage

Some people have used this area for their morning walks. Especially the lderly in the neighbourhood says that this forest is just enough for them to stroll in the morning. To go to the much larger city forest, crossing a big road and also passing through these new buildings would be too long of a distance for them. Some also say that 8-storey buildings that are now being suggested will reduce their view and shadow their gardens.

The public 2 – A teacher from the nursery is concerned where they will go with their children

Previously they could just open the gate to reach the forest where the children are familiar with huts they built. She also argued that the children can follow the yearly seasons in the forest and also that it gives shade to the children on hot summer days. If the forest is removed they have to cross a major road and walk into a nature reserve where they are not allowed to build huts and have to walk a rather long way to find a nice spot to play. This will reduce their everyday visits to a forest.

The ecologist from the Uppsala municipality claims that this forest is unique

It is not unique in the city since Uppsala has some other places with old pine trees but it is truly unique in this part of Sweden seen in a landscape perspective. Nowhere else are so many old pine trees found in a forest as here in Uppsala. Some trees are more than 180 years old. How many houses older than 180 years would be torn down she/he asks? She/he also found a high number of species that are threatened in Sweden and that the municipality should take extra care of. It is not possible to compensate this place with another due to the old trees. They have also seen bird species and bats that only thrive in older forests indicating further ecological values. It is not possible to save single trees with red-listed species because if all other trees are removed the microclimate would change and reduce the values on single trees.

The city planner from the Uppsala municipality
She/he has to follow the directives from the politicians to provide land for companies to build on, in order to fulfil the need for houses. Thus, she/he has said that the building company can build here. She/he reasons that there are so many trees and two nature reserves just nearby this forest, so there is no need to save this specific one. To provide yet another green area in Uppsala would only hamper the development of the city.

The landscape architect
She/he has been employed by the building company to design the space between the houses. The landscape architect is employed by the building company and has to listen to what they want but also needs to listen to what the municipality demands for other people in the area and the children from the nursery. She/he suggests that it would be a possibility to save some single pine trees, specifically those trees that have red-listed species on them. Further, one compromise that would increase the costs for the company but leave more green space would be to place the planned car parks under the houses instead of using vast areas of the existing forest.

Road and water infrastructure planners
Two people from the municipality that are actually working as consultants for the municipality since they lately became municipal "companies" having their own business. She/he representing road planning says that there may be an increased traffic load on the road nearby since the road is already having a lot of traffic. But she/he sees no problem other than it would affect all the other people commuting by car to the city centre or to Stockholm in the early mornings. She/he working with water and traffic comments that the place is rather rocky so in order to place car parks and water pipes underground, a lot of blasting will be needed (blowing up the existing rocks). This can be very noisy during construction and potentially making it difficult to save trees since it will change the water flows under the forest.

Questions:

1. What are the main concerns for each stakeholder? What are their situations, worries, needs and expectations?
2. Are there any stakeholders that are not mentioned in the text and that could be important for the case, e.g. other local authorities, ecologists, the ministry of environment, real estate agencies etc.?
3. Are there other interests that the stakeholders can claim outside this case study e.g. how do the stakeholders, opinions apply to the the larger scale of the whole city?
4. Can each stakeholder present three different solutions linked to economic, social and environmental aspects (use a table)?
5. Could all stakeholders agree on the optimal spatial strategic plan (based on the table in 4)?

Data sources / references

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van den Bosch, M. & Ode Sang, Å. (2017) Urban natural environments as nature-based solutions for improved public health – A systematic review of reviews. *Environmental Research* 158, pp. 373-384.

Hedblom, M., Andersson, E. & Borgström, S. (2017) Flexible land-use and undefined governance: from threats to potentials in peri-urban landscape planning. *Land Use Policy* 63, pp. 523-527.

European briefings – Urban systems (2015) Downloads from EEA homepage 5 pages pdf. about densification of cities and how it looks like in Europe. From EEA homepage you can find other related documents.

Urban green infrastructure and EEA. Download a pdf from EEA homepage. In this pdf there are further links to urban green infrastructure and the glossary itself.

If you will look at further documents from Eriksberg in specific, you can look at different documents in Swedish on this page:

- http://bygg.uppsala.se/samhallsbyggnad-utveckling/detaljplanering/avslutade-samrad-eller-granskning-2014/norby-3174/.

Case 13

Sustainable food consumption – mitigating food waste

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Keywords:
food waste, sustainable food consumption

Relation to Sustainable Development Goals (SDGs):

Strategy: data analysis, text analysis, group work

Time required for classwork (in minutes): 90 (120 in extended version).

Students' preparation for the class (in minutes): none.

Aims:
After participating in this case students should gain a thorough understanding of complex connections between demographics, food loss and waste, food production, agriculture, environment, and the well-being of societies.

Learning outcomes:
After completing this case, students are able to:

- list possible dilemmas consumers encounter in their aim to reduce food waste;

- describe how individual consumption choices influence the three pillars of sustainability;
- indicate several solutions to the food waste problem on an individual level;
- reflect on their personal consumption choices and make a commitment to change a particular consumption behaviour.

Case description

Food products come at a high price. The agriculture sector contributes vastly to environmental pollution, being responsible for 40% of world methane emissions. It also consumes natural resources to a great extent, for instance being responsible for 70% of water consumption in the world (FAO 2011). This means that agricultural production has a high cost in terms of natural resources and a burden for the environment. Consequently food products, in particular animal products, have a very high environmental impact.

Yet, according to the Food and Agriculture Organization (2016) one third of global food production for human consumption is lost or wasted, which is an equivalent of 1.3 billion tonnes of edible food. Food waste is food that was lost at different stages of the food supply chain, destroyed in transport or thrown away by consumers. In the literature a distinction is often made between "food loss" which represents loss in production and food processing, and actual "food waste" generated in the distribution and consumption stage (Stancu, Haugaard & Lahteenmaki 2016). World food loss is responsible for 8% of greenhouse gas emissions. Moreover, nearly 30% of the world's agricultural land is used to produce food that will never be consumed. Growing and producing this food consumes approx. 20% of fresh water used in the world yearly.

In developing countries losses occur mainly in harvest and processing, which can be seen as a kind of inefficiency of the agri-food sector, whereas in highly developed countries the losses occur at the retailer and consumer levels, which represent food not bought on time from the shops or discarded in the household. There are apparent differences in the contribution to overall food waste by different regions

of the world. In the developed regions such as Europe and North America approx. 100 kg of food is being wasted per capita yearly. In such regions as Southeast Asia and Sub-Saharan Africa the food waste level is in range of 5-10 kg per capita yearly.

Food loss represents not only costs in terms of natural resources and environmental impact, but also real financial costs for the economies. Food waste in the U.S. equals to 1.3% of the GDP, which is more than 200 billion USD (FAO 2016).

Food waste has a social and ethical aspect as well. More than 800 million people in the world suffer from hunger every year. Food that is lost and wasted could feed four times as many people. High food wastage patterns in highly developed countries follow certain consumption patterns typical for developed markets. In such markets, food is being purchased for a multitude of reasons apart from satisfying hunger and being nutritious. It is often being bought for comfort, excitement, pleasure or even to show social status (Vitterso & Tangeland 2015). Consumers, having already fulfilled their purchase motives (other than actual consumption), seem to care less for actually eating the food that they bought. Williams *et al.* (2012) lists several reasons for food wastage, with preparing more food than needed and not preparing food on time as the most important ones.

The above data shows a great potential for changing food-related behaviour of consumers from developed countries. Encouraging sustainable behaviour related to food might have a major impact on overcoming the environmental crisis.

References

FAO (2011) The state of the world's land and water resources for food and agriculture (SOLAW) – Managing systems at risk. Rome: Food and Agriculture Organization of the United Nations; London: Earthscan.

FAO (2016) http://www.fao.org/resources/infographics/infographics-dtails/en/c/414385/.

Stancu, V., Haugaard, P. & Lahteenmaki, L. (2016) Determinants of consumer food waste behaviour: two routes to food waste. *Appetite*, 96, pp. 7-17.

Vittersø, G., & Tangeland, T. (2015) The role of consumers in transitions towards sustainable food consumption. The case of organic food in Norway. *Journal of Cleaner Production*, 92, pp. 91-99.

Williams, H., Wikström, F., Otterbring, T., Löfgren, M. & Gustafsson, A. (2012) Reasons for household food waste with special attention to packaging. *Journal of Cleaner Production*, 24, pp. 141-148.

Data source

Land and water resources for food production

- FAO (2011) The state of the world's land and water resources for food and agriculture. Managing systems at risk. http://www.fao.org/3/a-i1688e.pdf.

Share of global population living in urban and rural areas, share of land for agricultural use

- Data on areas, inhabitants and GDP. http://www.fao.org/nr/water/aquastat/tables/WorldData-Population_eng.pdf.
- FAO Statistical Pocketbook 2015. http://www.fao.org/3/a-i4691e.pdf.

Food loss and waste

- Food loss and waste infographic. http://www.fao.org/resources/infographics/infographics-details/en/c/414385/.
- Food loss and waste facts. http://www.fao.org/resources/infographics/infographics-details/en/c/317265/.

Understanding hunger and malnutrition:

- http://www.fao.org/assets/infographics/FAO-Infographic-Nutrition-en.pdf.
- The world is thirsty because it is hungry. http://www.fao.org/assets/infographics/FAO-Infographic-water-thirsty-en.pdf.

Understanding water scarcity

- http://www.fao.org/assets/infographics/FAO-Infographic-water-scarcity-en.pdf.
- http://www.fao.org/resources/infographics/infographics-details/en/c/218940/.
- http://www.fao.org/assets/infographics/FAO-Infographic-water-food-production-en.pdf.
- http://www.fao.org/resources/infographics/infographics-details/en/c/218877/.

Procedure

Opening – 10 min (+30 minutes in the extended version)

In the opening part, the class is provided with some facts that help to establish the background to the issue of food waste – such as use of resources for agricultural production, demographic data of the world population, technological developments that allow for the increase in food production, and finally, the data about the share of production that is being wasted. With this opening a ground for further work is laid, and the extent of the subject is also demarcated.

This may be executed in two manners depending on time availability: in the first, shorter version, the list of facts is provided by the teacher and briefly discussed with students. In the second option students study handouts from FAO (see Data Source section) and key facts are elicited together. Studying the handouts can be done before the class as homework or during the class. If the latter is chosen, the additional 30 minutes should be added up to the total time of the class.

Materials to be used:

- Facts to sketch out the context of food waste.
- FAO handouts (optional).

Food waste mitigation solutions – 20 min

From this moment, the class is divided and further work is performed in groups.

- First, participants discuss in groups how the problem of a food waste could be reduced through everyday consumer choices. With this exercise, participants explore and summarise experience and knowledge that exists within the group.
- Then the entire class is presented with the list of possible consumer actions that mitigate the problem (prepared by the teacher) and groups reflect on that list based on their previous discussion.

The items from the list that were discussed in groups are acknowledged and those that were not discussed are briefly referred to by the teacher.

Additional input from each group (which was not on the list) is added to the list. After this exercise, each group has similar knowledge on possible actions that can be taken to mitigate food waste by consumers.

Materials to be used:

- List of sustainable consumer actions that mitigate food waste.

Challenges of sustainable food consumption – 20 min

The third activity aims to investigate the motives and consequences of (un)sustainable consumer choices. The groups are given descriptions of one of two kinds of consumer: Alexander who is a sustainability-oriented person; and Anna who is a consumption-oriented person. Consumer profiles are employed because discussing behaviour of others seems to increase the openness and frankness of the expressed opinions. Each group reads the profile and chooses a particular example of consumer behaviour that mitigates the problem of food waste on an individual level. A group debates the costs and benefits of this action for Anna or Alexander. In this way participants learn what the challenges for sustainable consumer choices may be.

Materials to be used:

- Profile of sustainability-oriented consumer – Alexander.
- Profile of consumption-oriented consumer – Anna.
- Table of costs and benefits of sustainable behaviour for a consumer.

Implications of consumer actions against food waste – 10 min

In this part, the implications of the particular behaviour analysed in part 3 for the environment, society and the economy are reviewed. Via this exercise, students realise how individual actions of consumers with respect to food affect the global problem of food waste.

Materials to be used:

- Table of costs and benefits of sustainable behaviour for the three pillars of sustainability.

Results presentation – 15 min

Groups present their tables to the entire class. As groups were working with different solutions to the food waste problem, the outcomes vary. Based on the results students try to identify the costs and benefits of sustainable choices for individual consumers, the environment, society and the economy.

Materials to be used: none.

Participants' individual resolution – 10 min

In the final part, students are encouraged to select one of the food-related sustainable consumer actions that they would like to apply in their lives for the next two weeks. They are also invited to share the explanation as to why this action, and if it is going to be difficult for them.

Materials to be used:

Facts to sketch out the context of food waste

The natural resources are scarce and seem to be coming to an end.

- With the increasing world population, by 2050 we are going to need three more planets to feed the population
- From the technological point of view we are capable of producing more food than ever.
- Despite this, there are major regions of the world where people suffer from malnutrition and hunger.
- Yet, 30% of the total food production is being wasted – thrown away in the production, distribution and consumption processes.
- This indicates the urgent need for changes in the way we use our land and manage the food we produce.
- A major part of this enormous waste is a waste of food done by consumers after the food is purchased. 25% of the food bought by consumers is thrown away.

List of sustainable consumer choices that mitigate the food waste problem

1. BUY ONLY WHAT YOU NEED
   a. Plan ahead
   b. Make a shopping list
   c. Be realistic about how much you need
   d. Don't overbuy foods on sale
2. EAT WHAT YOU BUY
   a. Use what spoils first
   b. Don't prepare too much
   c. Eat leftovers
   d. Ask for a doggie bag
3. DON'T TOSS IT BEFORE IT SPOILS
   a. Understand food expiration dates
   b. Know the shelf life limits
   c. Use preservation techniques: freezing, canning, pickling or drying
4. KEEP FOOD FRESH
   Learn how to store foods to keep them fresh as long as possible
5. PURCHASE SEASONAL PRODUCTS
   a. Learn about the harvest seasons of different fruits and vegetables
   b. Check the origin of fruits and vegetables
6. REDUCE MEAT CONSUMPTION
   a. Check how much water is being used to produce animal products. Compare with plant products.
   b. Decide to resign from meat one day a week. Which day would it be?

Consumer profile – Alexander

Read the profile of a consumer. Try to imagine this person. In group discussions try to define such characteristics as age, profession, family status, and interests. Try to identify values, norms, and the lifestyles of this person.

This is Alexander. Alexander is very much concerned about the environment. He hates to waste resources. Before he buys anything, he first thinks whether he really needs. Maybe he can replace it with something that he already has? Or maybe someone among friends or family has it and would be willing to lend? When deciding on some major investments (such as a treadmill for running at home, Alexander is an enthusiastic runner), he searches for used equipment. He likes the idea of giving a second life to products that have already been produced, as he

is aware that substantial natural resources have been already spent in the production process (water, electricity). He also likes to spend less. Alexander only purchases an item of clothing when the ones he has are nearly worn out. He likes good quality clothes as he plans to use them for a long time. Alexander is a passionate cook. He rarely eats out-of-home as he finds it expensive and unsustainable. He usually prepares meals at home, often making bigger quantities than necessary to eat them later. This way he thinks he spares his own time and also energy used for cooking. He saves the extra amount of food by freezing it. Alexander likes to eat meat but he is also concerned about animal welfare and the quality of meat he consumes. Struggling with himself for some time he came to a solution – he purchases meat from a local family farm. He prefers to pay twice as much for meat and eat half the quantity than to consume more poor-quality meat from industrial farming.

Alexander likes to invite friends over. He usually serves them some delicious meal that he has tried before and he knows people will like it. Sometimes he is a spontaneous cook – he looks at the ingredients he has at home and together with friends they come up with an idea for a meal. It is a lot of fun.

Consumer profile – Anna

Read the profile of a consumer. Try to imagine this person. In group discussions try to define such characteristics as age, profession, family status, and interests. Try to identify values, norms, and the lifestyles of this person.

This is Anna. Anna is all about buying. She loves to add new items to design of her home. She regularly remodels the interior. She loves purchasing new clothing items. She rarely wears anything longer than a year. Every season she changes her outfits. Anna doesn't like to be intimidated by the possessions of others, thus she makes sure to always look great, have a good watch, phone and pretty jewellery. If it is about food she tries to follow the trends. She likes fancy meals. She is an exquisite cook. When shopping for one of the parties she often throws, she goes to one of the high-quality shops. She always buys the nicest fruits and vegetables – the look is as important as the taste. She likes to have plenty of food in the fridge. She would hate to miss some important ingredient or when being asked by a guest – say she doesn't have something they want. She likes to offer her guests plenty of choices, thus she prepares several courses. After the party there is a lot of food left but as it was on a table for a few hours it may not be stored anymore. Anna throws this away. Anna eats out every day during the week because she is working too hard to cook herself. She orders what is available in a diner or a restaurant and she picks what she likes most from the course, leaving the rest.

Table of costs and benefits of sustainable behaviour for a consumer

In a group, from the list of sustainable consumer choices that mitigate the food waste problem, select one item (for instance: one day a week I do not consume meat). Discuss this particular behaviour.

- *What does it entail?*
- *How do you think, would it be easy / difficult for Anna / Alexander to accept this solution?*

Think of possible costs and benefits of the chosen sustainable choice.
Fill in the table.

Selected consumer choice: ……	
Benefits of this sustainable choice for a consumer	**Cost of this sustainable choice for a consumer**

Table of costs and benefits of sustainable behaviour for the three pillars of sustainability

Discuss the possible benefits and costs of this particular consumer choice according to the three pillars of sustainability – important for the consumers, for the environment and for the society.

	Environment	**Society**	**Economy**
Costs			
Benefits			

Assessment

Students active participation, team work in groups, presentation skills, acquiring, selection and evaluation of facts could be used.

Application

This case may be used to show how daily choices of individuals affect the environment, in particular the level of natural resources, but also the economy and society. It may also be used within the subject of climate change mitigation, waste reduction and environmental protection. It can also be a great help while discussing possible resolutions to live in a more sustainable manner.

Part III

WISE partners' experiences

Chapter 6

The Agricultural University of Athens' experience with the role-playing exercise

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Agricultural University of Athens (Greece)

In November 2016, the case „Organic Farming and Public Support in the EU" was suggested as a topic for discussion to the 7th semester students of the Department of Agricultural Economics and Rural Development at the Agricultural University of Athens. The exercise took place as a joint project of the compulsory course *Natural Resource & Environmental Economics* and *Rural Environment Protection Policies*.

Students were informed about the role-playing exercise two weeks prior to its implementation. A concise introduction to organic farming peculiarities was presented to the students, while the audience was split into four different interest groups and background material was provided to them. In turn, the groups were asked to prepare arguments for or against the issue at stake and present them before the class. Students were also advised to work as a group, researching and discussing the case from their assigned perspective.

A two day debate took place, on the 8th and on the 10th of November 2016, in which 75 students participated (21 as consumers, 16 as producers, 21 as policymakers and 17 as taxpayers). The whole procedure was recorded and lasted approximately 6 hours (45 minutes each).

"Semi-structured session"

During the first day, representatives of producers and consumers presented their arguments and positions on the subject. Presentations

were interspersed with comments, oppositions and clarification questions posed by the other three groups as well as the teacher, who clearly expressed his opinion on the case. It was a process which encouraged direct communication with questions and immediate responses, during which all groups spontaneously discussed and shared their points of view. The teacher's role was active, challenging students, as well as providing scientific knowledge and guidance when needed.

"Structured session"

The procedure during the second day was different from the one followed on the first day. The groups of policymakers and taxpayers had 15 minutes to present their perspectives and explain their position on two particular questions put forward at the end of the first day. After the presentations, groups responded to questions posed by students as individuals and not as a member of their group. Subsequently, each group had 15 minutes to prepare questions that they would like to ask the groups of policymakers and taxpayers. At this stage, the teacher also presented his questions to the aforementioned groups. After a 10 minute break for group discussion, both teams replied to the questions, along with a summary of their stance. Finally, the teacher, attempting to reach a consensus, asked the four groups whether their initial position has been shifted during those meetings, and precisely whether a conceptual or practical convergence has been achieved. It should be stressed that the teacher's role was neutral and he acted as a moderator, facilitating the discussion and keeping the time limits.

Remarks and conclusions:

- Given the size of the class, groups consisted of a large number of students. Although teachers encouraged the active participation of all members, many students were silent and were not engaged in the public discussion. Thus smaller groups of five or six students seem to be more effective, since all members would have the opportunity to speak and express their views, even the quieter /shy ones.
- Concerning the two different approaches used, students were more active and had a more passionate interaction with quick reactions, when no clear rules of the debate were given. On the

other hand, a structured and guided procedure enabled students to prepare persuasive responses and improve time management skills. Thus both approaches are complementary and may benefit students' competencies.

- In general, students seem to lack team spirit and conflict resolution skills. In the case of the taxpayers group, students presented three different positions on the topic, since they couldn't come to an agreement as a whole team. Moreover, at the end of the exercise, none of the groups were willing to reach a compromise. There is a need for improvement in students' skills to work collaboratively, negotiate and finally accomplish a shared solution. Learning activities, such as role-playing and debate may promote these social skills.
- Students' feedback on the role-playing exercise was mixed. The majority of the class seemed to enjoy the procedure and felt that it was a useful learning experience. For instance, it was the first time for some students to speak in front of a large audience and defend their opinions. However, other individuals felt that it was a waste of time, since the exercise didn't result in a solid knowledge transfer. It is a rather natural stance from people accustomed to being offered the "correct solution", when they participate in an exercise aiming at broadening their perspectives and enhancing their skills to discuss, analyse and think critically of a complex issue involving multiple aspects.

Chapter 7

Organic farming testing in Greece, Poland and Sweden

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In the framework of WISE, pilots were run in Spring 2017 in three of the project countries on the topic "Organic farming & public support in the EU" to assess the changes of students' attitudes towards the topic after having participated in a role-playing debate as well as students' satisfaction regarding the teaching strategy.

A total of 44 university students from the Department of Agricultural Economics & Rural Development at the Agricultural University of Athens in Greece, the Institute of Sociology at Collegium Civitas in Poland and the School for Forest Management at the Swedish University of Agricultural Sciences were involved in the pilots during which questionnaires had been administered before and after the case implementation.

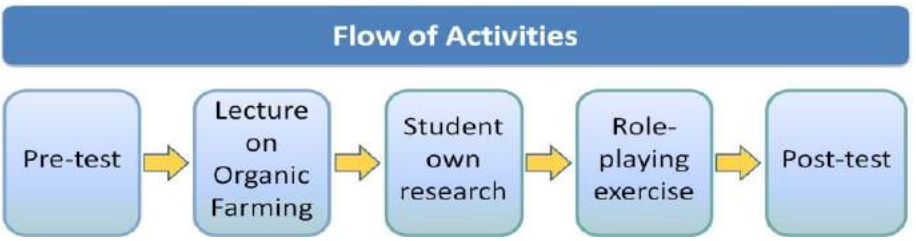

Figure 1. Pilot's flow of activities

The steps of the organic farming pilots were as follows (see figure 1): firstly, a comprehensive lecture on the topic was addressed to the students in order to provide basic information on principles and financial support.

Then, students were split into four interest groups (farmers, consumers, policymakers, taxpayers; see figure 2; Lesson Plan: *Organic Farming and Public Support in the EU – The Greek Case*); support material and further sources were provided to students. Finally, a role-playing debate took place in the class, comprising of groups' presentations and discussions among and within groups seeking mutual agreement.

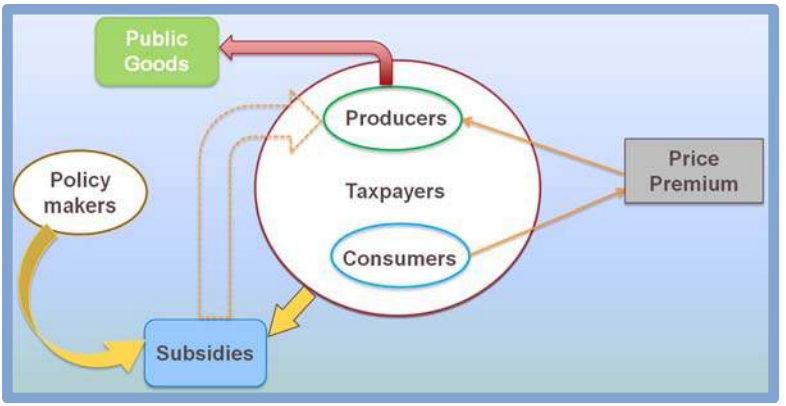

Figure 2. Stakeholders involved in Organic Farming public support in the EU

Results

Data analysis shows that, after the pilot, students:

a) exhibit more favourable beliefs and attitudes towards organic food and farming (figure 3 and table 1); and
b) are satisfied with the exercise, compared to conventional instruction (table 2).

- Organic food is healthier than non-organic food.
- Overall, organic food tastes better than non-organic food.
- Organic food contains greater nutritional value than non-organic food.
- Organic producers offer an important service to society, since they protect the environment.
- Whenever I buy organic, I support environmental protection.
- The state/EU should support organic farming in my country.
- It would be good to have more organic farms in our country.

Figure 3. Beliefs and attitudes towards organic farming and food

	N	Mean pre-test	SD	Mean post-test	SD	Z	p
All	**44**	**3.58**	**0.53**	**3.84**	**0.50**	**3.22**	**0.001**
Women	**27**	**3.49**	**0.50**	**3.88**	**0.45**	**3.44**	**<0.001**
Men	17	3.73	0.56	3.77	0.58	0.34	0.72
GR	**25**	**3.52**	**0.45**	**3.80**	**0.29**	**2.93**	**0.003**
PL	**9**	**3.87**	**0.60**	**4.36**	**0.52**	**2.52**	**0.01**
SE	10	3.49	0.59	3.46	0.56	0.40	0.68

Table 1. Tests on beliefs and attitudes scale. | The scale has good reliability (Cronbach *alpha* = 0.76). Significant differences (in red) are evident for all the respondents; women; and Greek and Polish students. Therefore, it can be argued that the pilot has positively influenced students' attitudes towards organic farming and food.

Significant differences (Kruskal-Wallis test) are evident for most of the items (in bold)[1]. Therefore, students enjoyed the pilot and indicated their preference for such learning settings, compared to conventional instruction. Additionally, when students work in groups they gain new insights from their peers, develop their interpersonal competences (including cooperation, communication, or decision-making) and have the opportunity to address issues of their own choice. In turn, learning may occur as a result of the students' actions and reflection.

	Mean GR	SD GR	Mean SE	SD SE	Mean PL	SD PL	H(2. N=44)	p
I have learnt a lot about organic farming through this exercise.	3.96	0.53	3.10	1.28	3.55	1.74		
The exercise was boring.	2.12	0.66	1.80	0.63	1.44	1.01	8.74	0.01
Cooperation with my mates was excellent during the exercise.	3.12	0.97	4.40	1.26	4.77	0.44	21.44	<0.0001
I didn't always have the opportunity to express my point of view within my group.	2.60	0.91	1.30	0.48	2.44	1.42	13.33	0.001
I have influenced the way we worked during the exercise.	3.44	0.82	4.20	0.91	3.66	0.70	6.34	0.04
The topic of organic farming was interesting to me.	4.16	0.47	3.60	1.26	4.66	0.50	7.05	0.02

[1] However, concerning the low respondents' numbers, one should be very careful about any conclusion.

Differences were clearly stated in the group.	3.56	0.71	2.70	1.05	4.22	0.66	12.26	0.002
All different opinions were satisfactorily explored within the group.	3.44	0.91	4.40	0.51	4.55	0.52	16.20	0.0003
I felt being manipulated by the teacher to accept his/her opinions about organic farming.	2.20	0.95	1.20	0.42	1.22	0.44	14.17	0.0008
The exercise was a waste of time.	1.72	0.61	1.80	0.91	1.22	0.44		
This way of carrying out the "lesson" motivates me to do my best.	3.80	0.64	3.90	0.99	4.44	0.52		
This way of carrying out the "lesson" does not differ from usual instruction.	2.12	0.52	2.50	1.08	2.55	1.50		
I had the chance to see different perspectives on the topic which had never crossed my mind before the exercise.	3.88	0.60	2.90	1.10	4.44	0.72	14.10	0.0009
The exercise helped me to develop new competence in dealing with sustainability issues.	3.64	0.81	2.90	1.10	4.44	0.72	12.41	0.002

Table 2. Students' satisfaction tests

Conclusion

Given that new knowledge per se does not motivate students towards pro-environmental and responsible behaviour and does not develop students' competences, the WISE project proposes the case-based methodology to address Sustainability and Sustainable Development issues in higher education. This approach is shown, according to our pilots in the framework of the WISE project, to be quite effective, mainly in changing students' attitudes towards organic farming & food and public support as well as students' satisfaction along with some positive impact on the students' interpersonal competences.

Chapter 8

The experience of the University of Porto with Cases of Education for Sustainable Development

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In the first semester of the school year 2017/2018, two cases were developed within the WISE project in the course of Education for Sustainability. The curricular unit at the University of Porto integrates the syllabus of the Master Degree in Teaching of biology and geology, which prepares teachers to teach in middle and secondary schools in Portugal. Only nine students were enrolled. The cases were solved in groups of two, and one group consisted of three participants. Given that the number of participants was low, we opted for a qualitative evaluation based on the reflection established with the participants, and the observation of the students' progress during the resolution.

The selected cases were the case of *Castromil gold mines' geoethics dilemmas (Portugal)* and the case of *Territorial ecological limits to the lignite surface mining in North Bohemia (Czech Republic).*

These were the choices, since both cases implied a reflection on the values and attitudes in geoethics, a theme explored in the curricular unit. Geoethics consists of research and reflection on the values that underpin appropriate behaviours and practices, wherever human activities interact with the Earth system. Geoethics deals with the ethical, social and cultural implications of geoscience education, research and practice, and with the social role and responsibility of geoscientists in conducting their activities (IAPG, http://www.geoethics.org/).

Regarding the case of *Castromil gold mines' geoethics dilemmas*, although it involved mining in Portugal, students were not familiar with the domain of the subject. The exploration of documents and the inquiry activity helped students to develop competences for system

thinking and collaborative work, thus creating awareness of geoethics dilemmas in mining and of the urgent need for sustainable mining in Europe. The students also discussed social and economic issues involved with mining, in particular those related with the contamination of water and soil (with elements harmful to public health) and the possibility of the creation of jobs linked to mining.

Notwithstanding the debate that ensued, students were inclined to favour the arguments of the population, that preferred to prevent mining and gave priority to the safeguard of the environmental and human issues of the region.

Sometimes students verbalised statements unfavourable to mining companies, such as “they increase employment, but they also prevent family farming which provides for many families”. On the other hand, the need to exploit natural resources for social progress and an increase in the quality of life was also addressed.

In relation to the case of *Territorial ecological limits to the lignite surface mining in North Bohemia*, since it was an unfamiliar topic (especially because it was in a different country), students understood it as a general case, that could very well affect, also, the Portuguese. The inclusion of Schwartz's theory of basic human values was new to students and led to a reflection on the social, human, cultural and ethical aspects that stand beyond the inevitable economic and environmental issues. Students considered the activity to be time-consuming and ambiguous, but still important and capable of highlighting aspects often camouflaged by financial and political interests.

The first activity, which consisted of the identification/quotes of the actors involved in the process, was rather difficult, especially due to the lack of knowledge regarding the actors involved and also because of some lack of objectivity in some statements, which is typical in political speeches, news or even in rallies.

In conclusion, both cases addressed the three pillars of sustainable development, building up from situations associated with mining. A change of attitudes and values regarding sustainable development was promoted in an interdisciplinary way by resorting to cross-cutting themes.

Chapter 9

The experience with testing the cases at the Masaryk University

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The tropical forest: an analysis of social and economic reasons of environmental degradation

The case was tested with a mixed group of university and secondary school students in March 2017. The university students were asked to fill a short pre- and post-test focused on the analysis of the development of their conceptual understanding of the issue of deforestation and its systemic complexity.

On the basis of this evaluation, we may assume the case developed students' systemic competence, particularly in:

1. raising awareness of the contribution of stakeholders to the issue and understanding the role they play ("Many groups with different preferences, background…", "also the local timber industry played its role");
2. raising awareness of underlying social and ecological mechanisms of deforestation ("burning (…) and degradation of soil (…)", "the reason is not the only desire for new plantations of palm trees but also planting soya beans (…)", "the government plans to build new infrastructure for establishing the security of local citizens (…)", "timber companies must have gained and been competitive on the global market".

Students also expressed other personal benefits connected with the case, ("I am aware of more stakeholders than I could imagine before (…) It is good to look at the issue from the point of view of groups we may not agree with", "Thinking about my role as a consumer, linking

it with everyday life. Is it possible to develop a relationship on the basis of imagining the forest?").

Generally, students appreciated the way in which the case made environmental issues clear, showed main structure elements, and explained the role of its stakeholders. They also saw the case as a strong and durable experience.

They also suggested a few changes in the case description that were largely reflected in its final improvement.

Figure 1. Testing the Forest case in Kapraluv mlyn | **Photo:** Tereza Modráková, Masaryk University.

Territorial ecological limits to the lignite surface mining in North Bohemia

We have tested the case *Territorial ecological limits to the lignite surface mining in North Bohemia* during the bachelor course on environmental conflicts in the Czech Republic in order to receive feedback and improve the structure of the case. Since only 5 students attended the

lecture, students participated in the exercises individually instead of as a group.

After short a introductory activity and brief description of the actors involved in the conflict, students were asked to match the quotes with the actors. Although they worked individually, they were actually quite successful in this exercise. We suppose it is because Czech students are familiar with the actors involved in the case, such as politicians and NGOs.

For the second exercise we had chosen only the most significant actors of the case. We participated in this activity along with the students to increase the number of actors involved. Students were surprised that even actors who are in disagreement could have similar values. They reflected on the structure of the case and gave us valuable recommendations on how to improve it.

We have adjusted the description of the actors according to their feedback and also the instructions, which they did not find clear enough.

Part IV

Integrating education for sustainable development
at the programme level

Chapter 10

Lessons learned from a workshop series at the Swedish University of Agricultural Sciences

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The Swedish University of Agricultural Science (SLU) is a university with a focus on life sciences with three main campuses, in Alnarp, Umeå and Uppsala. “SLU has a unique profile in Sweden, with responsibilities that are important to society. We create and integrate knowledge about production, the environment, animal and human health and quality of life, combining scientific excellence with competence in application-oriented issues. SLU’s sectoral role, which initially only concerned the agricultural industries, has in recent years broadened and developed. SLU works continuously to develop conditions for innovative, excellent research and research-based education. The focus is on areas of strategic importance to SLU’s mission statement and funding agreement targets for education, with the goal that SLU be internationally renowned and provide society with relevant knowledge. During the period 2017–2020, SLU intends to focus on four university-wide research domains: Bio-based materials, Sustainable and secure food supply, Economics and The significance of experiencing nature and of companion animals on human health and well-being” (SLU strategy 2017-2022, https://www.slu.se/globalassets/mw/org-styr/styr-dok/vision-strategi/slus-strategi-2017-2020-160616-en.pdf).

Education at SLU

SLU offers several courses that are unique in Sweden, for example, in agriculture, forestry, landscape architecture and veterinary medicine. A large percentage of our students study a degree programme leading to a professional qualification. SLU also offers a number of Master's programme in our strong areas of research.

The interpretation of the mission statement of SLU "SLU develops the **understanding and sustainable use and management of biological natural resources**. This is achieved by research, education and environmental monitoring and assessment, in collaboration with the surrounding community" (https://internt.slu.se/en/organisation--styrning/mission-vision-and-values/) has developed to an expanded definition of sustainability. In this new definition the core values of ecological or environmental sustainability have been accompanied by social and economic sustainability. The goals for sustainability and sustainable development that are stated in the United Nations Sustainable Development Goals (https://sustainabledevelopment.un.org/?menu=1300) can be seen as guidelines for SLU's work directly or indirectly.

Image 1. SLU's payoff (or slogan)

The Educational Development Unit

The Educational Development Unit (EPU) at SLU is a strategic resource and knowledgeable support source within educational services and IT education at SLU. The unit is responsible for providing higher education competency courses and offer beginner and more specialised courses that build upon the knowledge provided in the beginner course. Additionally, EPU provides educational evaluators to serve on docent lecture committees.

In collaboration with departments, institutions, and teaching staff, EPU supports university-level education development at SLU. EPU provides different forms of support to educators such as:

- Teacher training courses
- Seminars
- Workshops
- Educational consulting

A workshop series concerning Education for Sustainable Development for programme coordinators and course leaders was planned and is performed by EPU.

Environmental Certification

In July 2016 all university activities were environmentally certified according to the international standard ISO 14001 for an environmental management system (https://www.iso.org/standard/31807.html). During the process the decision was made to not only work with the environmental certification considering buildings, transportation, printers and paper, but also try to make sure that our education, courses and programme were carried out with environmental issues considered. Just like the widening of the notion of the environment and natural resources in SLU's mission statement, the idea was to make sure that the progression of awareness of sustainable development in the programmes were supported by teaching about sustainability in the courses.

By a decision of the vice-chancellor an environmental goal was set- all the programme study directors and 75% of the course coordinators should have taken a course in Education for Sustainable Development (ESD) before the end of 2017. The motivation behind the decision was "In SLUs education today there are many courses and programmes related to sustainable development. The purpose of this decision is to ensure that all programmes raise the question about sustainable development in a systematic way and in doing so, take the full width of the concept including social, economic and environmental aspects into account".

It was also decided that the mandatory course evaluations after all courses should contain a question concerning sustainable development. The task to revise the exiting evaluation questions has been given by the Board of Education to the student union (SLUSS) with the support of the Educational Development Unit.

The workshops

The Educational Development Unit was given the responsibility to design and facilitate the workshops. In November 2015 and in February 2016 the programme study directors (co-ordinators) (PSR) undertook

the course during a two day meeting. Between January 2016 and November 2017 the course coordinators offered 30 workshops in Swedish and 11 workshops in English. In October 2017 approx. 35% of the course coordinators have undertaken the workshop.

The learning outcomes for the PSR and the course coordinators are similar, the main difference is that the PSRs focus on the progression of sustainable development content, methods and skills on a programme level while the course coordinators are responsible for the learning outcomes, methods and skills in their own course.

Intended Learning Outcomes

After the completion of the workshop participants are expected to be able to:

- Define sustainable development in an educational context;
- Define Education for Sustainable Development (ESD);
- Examine, define and develop existing and possible elements of sustainable development in their own course;
- Discuss and assess methods to implement ESD in their own course;
- Suggest possible pedagogical methods that strengthen ESD.

The course coordinators are given an assignment before they come to the one-day workshop. In the assignment they are asked to read the UNESCO definition of Education for Sustainable Development (ESD), as an one of many different definitions. They were also asked to read: Rockström, J. *et al.* 2009: *A Safe Operating Space for Humanity*, Steffen *et al.* 2015: *Planetary Boundaries: Guiding human development on a changing planet* and Raworth, K. 2012: *A Safe and Just Space for Humanity* to get perspectives on the global reality we are living within. The course leaders also examine their courses to find existing and possible elements of sustainable development topics, dilemmas and real-world contexts on a local and global scale. They also look for generic competencies that their course is suitable to promote as a part of a programme, almost all courses are parts of programmes. The last assignment is to map the learning activities (methods, strategies) they are using in their course.

During the workshop the definitions and experiences of sustainable development and education for sustainable development are discussed with the papers mentioned above as a vivid context. All participants present their findings to the rest of the group.

It is important that the workshop is seen as taking the experience of the participants very seriously to avoid the feeling that what is taught is a top-down dictation.

The workshop has led to a widened use, with the help of examples from other course leaders, of methods suitable for Education for Sustainable Development, like different approaches to case studies.

The discussions about generic competencies in courses and programme have led to work to secure the progression in courses and programmes, not only concerning the knowledge and skill-learning outcomes but also considering the progression of generic competencies. When the existing programme are revised and new programmes are planned, this is an important task.

Lessons learned

The starting point at SLU where mainly Natural Science courses and programmes are taught is a very strong link to environmental education and the environmental aspects of sustainable development. Consequently that aspect of sustainability is taken for granted and the topics and learning activities presented at the workshops are almost always of high quality. The mission of the workshop is to add the aspects of social and economic sustainability. We have learned that the terms sustainable development and sustainability can be used in most teaching contexts with differences in how and how much.

The quantity of subject matter as an obstacle to change ways of teaching because of lack of time is often discussed, as well as if we can and should focus on activities with students that aim toward generic competences – do we really need this or is it happening in the normal process of going through a programme?

It is important to state that sustainability as a complex problem does not appear in all courses and programme to the same extent. Also that the progression of sustainability knowledge and the generic skills connected to sustainability are found on programme level.

The discussions during the workshops also challenge the idea of keeping within strict subject borders in contrast to involving the students in interdisciplinary projects that involve other subjects or even other courses. The strict organisation of our courses and our division in faculties and departments are obstacles.

The recommendations that the workshops communicate with the participants as a goal for the changes of their courses are that the following factors should be given more space in our courses and programmes:

- Values and ethical issues;
- More complex problems (including all three perspectives on sustainability);
- More interdisciplinary activities and work with themes involving people with different expertise (students and teachers);
- More activating education strongly linked to real problems and dilemmas.

The degree to which this is possible and desirable differs between courses and programmes, but all education at SLU should contain elements of the widened sustainability concept and should use materials, methods and student involvement based on the ideas of Education for Sustainable Development.

Some important practical tips in the shape of questions is discussed and serves as a guideline to how and at what speed changes can be made:

Too what degree / How much?

When changes are made it is important to consider if we change the whole programmes or if we start by changing some teaching modules.

Add and remove?

When new methods and perspectives that enhance ESD are introduced it is important to take the need to focus on new perspectives into consideration. In that process it may be necessary to exclude methods and subject matter that traditionally have been in the courses and programmes. This is often a painful process that may lead to questioning the quality of the education. In ideal cases the knowledge and skills needed can be provided by the use of new methods. In some cases the discussion about what

really is the focus of the course or programme will lead to changes in the them and to new, that will replace old ones.

Tradition and expectations?

What are the students' expectations of university education and what do the teachers see as their role? How do we handle the transition from mainly declarative knowledge to a higher degree of procedural knowledge? In the process, new roles of both the teacher and the student emerge.

The power, possibilities and resources of the programme study directors and teachers.

An institution of higher education, from the senior leadership downwards needs to give staff support, resources and infrastructure that enables them to make changes.

What? How? How do we involve the students?

These three questions can be used to define goals and plan education. They are equally important. "What do we teach?" is a question about content. "How do we teach?" is a question about methods. "How do we involve our students?" is a question about teacher/student roles, methods of teaching and planning.

Work in progress

The examples that the participants give of modules and topics in the workshops consists of a number of case-oriented methods. Based on the ideas of Case methodology and Problem Based Learning and using the environmental, social and economic perspectives of sustainability, the teachers plan and execute modules, projects and assignments linked to dilemmas of local, national and global significance. The cases in this handbook will be possible to use in many of the courses and also inspire teachers to adapt them to their course and also to produce their own.

At programme, bachelor and master level, revision is taking place where work is being done to ensure the progression of subject knowledge and generic skills through out the programme. The "red thread" in the course is developed and enhanced. If you want the students to have the systems thinking competency when leaving the programme you

have to make sure that the competency is defined, trained, used and assessed.

Beside the normal revision work around the planning of programmes there are projects on a bachelor and masters level where the progression of generic competencies is reviewed. Two new master's programmes are being planned with the support of the Educational Development Unit.

The challenge for SLU is to make sure that the individual teacher is aware of the position of the module or lecture that is taught in the course and that the course is a part of the programme.

The way forward

The process has just started at SLU and the success of the work is strongly depending on support from leaders on all levels. The university needs to find a way to create incentives for teachers and coordinators to invest time and effort in improving teaching skills and create efficient methods to plan and improve programmes and courses so that sustainable development is clearly visible in the education we offer.

In doing so we need to continue exploring Education for Sustainable Development and define how SLU courses and programmes differ from courses at other universities. We need to keep the discussion of what we teach, how we teach and how we keep our students active in an iterative process.

In doing so, the involvement of and cooperation with the students is crucial. The students need activating and relevant education that gives knowledge, skills and values needed to be professionals, researchers, decision makers and citizens building a sustainable future. They also need to be given the chance to take a more active part of the planning processes on a university and course level.

Glossary

Agricultural development

The process that creates the conditions for the fulfilment of agricultural potential. Those conditions include the accumulation of knowledge and availability of technology as well as the allocation of inputs and output.

Reference

OECD Development Centre Working Paper No. 248. http://www.oecd.org/dev/36309029.pdf.

Biological diversity (biodiversity)

This means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part of; this includes diversity within species, between species and of ecosystems.

Reference

Convention on Biological Diversity (1992) Convention on Biological Diversity. Montreal: Secretariat of the Convention on Biological Diversity

Case-based methodology

The case-based teaching methodology is a discrete approach to interactive group- based learning with the added advantage to evoke interest in students by placing them in a dilemma taken from a real- life example and motivates them for self-directed learning. A diversity of strategies can be used to develop this methodology that implies solving new problems based on the solutions of similar past problems.

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Harrington, H. & Garrison, J. (1992) Cases as shared inquiry: a dialogical model of teacher preparation. *American Educational Research Journal*, 29 (4), pp. 715-735.

Conservation

An action of conserving something and in environmental sciences usually means conservation of biodiversity. There has been gradual change from biological focus in conservation to an interdisciplinary one. One of the recent proposed definitions describes it as "(human) actions that are intended to establish, improve or maintain good relations with nature".

Reference

Sandbrook, C. (2015) What is conservation? *Oryx*, 49, pp. 565-566.

Conservation conflict

Situations that occur when two or more parties with strongly held opinions clash over conservation objectives and when one party is perceived to assert its interests at the expense of another.

Reference

Redpath, S.M. *at al.* (2013) Understanding and managing conservation conflicts. *Trends in Ecology and Evolution*, 28, pp. 100-109.

Crossdisciplinarity

The abolishment of the artificial divisions between, on the one hand, the environment and, on the other hand, economy and society in favour of the cooperation (in whatever form) of several disciplines. Within such a framework, education and research cross traditional disciplinary boundaries, i.e. they become "cross-disciplinary". Typically, collaboration that spans disciplines is classified across the continuum: multidisciplinarity, interdisciplinarity, and transdisciplinarity.

References

Jeffrey, P. (2003). Smoothing the waters: observations on the process of cross-disciplinary research collaboration. *Social Studies of Science*, 33 (4), pp. 539-562.

Lawrence, R.J. & Després, C. (2004). Futures of transdisciplinarity. *Futures*, 36 (4), pp. 397-405.

Moore, J. (2005). Barriers and pathways to creating sustainability education programs: Policy, rhetoric and reality. *Environmental Education Research*, 11 (5), pp. 537-555.

Cultural heritage

It's the legacy, tangible or intangible, that has its own values for the society, whether they are scientific, historic, artistic, or others, and should be cared for and preserved (Falser 2015). It is constituted by tangible cultural heritage, like monuments, sculptures, paintings, manuscripts, etc. (UNESCO 1972), and intangible cultural heritage, such as rituals, oral traditions and expressions, performing arts, among others (UNESCO 2003).

References

Falser, M. (2015) *Cultural Heritage as Civilizing Mission: Methodological Considerations*. In: Falser, M. (ed.), *Cultural Heritage as Civilizing Mission – From Decay to Recovery*. (pp. 1-32). Switzerland: Springer.

UNESCO (1972) Convention Concerning the Protection of the World Cultural and Natural Heritage. 17th General Conference of the United Nations Educational, Scientific and Cultural Organization. Paris.

UNESCO (2003) Convention for the Safeguarding of the Intangible Cultural Heritage. 32nd General Conference of the United Nations Educational, Scientific and Cultural Organization. Paris.

Dead wood

Parts of a tree or branch which are dead. Many different types of dead wood occurs in forests (e.g. standing, downed, coarse and fine, hard and soft etc.). Dead wood is considered as very important structural component of forest ecosystems and biodiversity indicator since it supports many different specialised, often threatened species.

Reference

Jonsson, B.G., Kruys, N. & Ranius, T. (2005) Ecology of species living on dead wood – lessons for dead wood management. *Silva Fennica*, 39, pp. 289-309.

Ecosystem services

Direct or indirect benefits that people get from ecosystems. Can be divided in to four categories:

1. Provisioning services – products directly obtained from ecosystems, such as food, water, biochemicals, natural medicines, among others;
2. Regulating services – the regulation of ecosystem processes brings benefits related to air and water quality, climate, diseases and natural hazards, for example;

3. Cultural services – nonmaterial benefits such as recreation, ecotourism, aesthetic values, etc.;
4. Supporting services – these are the basis of the remaining services, some examples are nutrient cycling, soil formation and photosynthesis. They are not used directly by people.

Reference

Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-Being: Synthesis*. Washington: Island Press.

Forest landscape restoration

The long-term process of regaining ecological functionality and enhancing human well-being across deforested or degraded forest landscapes. It is about "forests" because it involves increasing the number and/ or health of trees in an area. It is about "landscapes" because it involves entire watersheds, jurisdictions, or even countries in which many land uses interact. It is about "restoration" because it involves bringing back the biological productivity of an area in order to achieve any number of benefits for people and the planet. It is "long-term" because it requires a multi-year vision of the ecological functions and benefits to human well-being that restoration will produce, although tangible deliverables such as jobs, income and carbon sequestration begin to flow right away.

Reference

IUCN and WRI (2014). *A Guide to the Restoration Opportunities Assessment Methodology (ROAM): Assessing Forest Landscape Restoration Opportunities at the National or Sub-national Level*. Working Paper (Road-test edition). Gland: IUCN.

Geoethics

"Geoethics consists of research and reflection on the values which underpin appropriate behaviors and practices, wherever human activities interact with the Earth system. Geoethics deals with the ethical, social and cultural implications of geoscience education, research and practice, and with the social role and responsibility of geoscientists in conducting their activities".

Reference

International Association for Promoting Geoethics (IAPG) (2017) *International Association for Promoting Geoethics – Homepage*. http://www.geoethics.org/.

Green Infrastructure

The "ingredients" for solving urban and climatic challenges by building with nature. The main components of this approach include storm-water management, climate adaptation, less heat stress, more biodiversity, food production, better air quality, sustainable energy production, clean water and healthy soils, as well as the more anthropocentric functions such as increased quality of life through recreation and providing shade and shelter in and around towns and cities.

References

Nielsen, A.B., Hedblom, M., Stahl Olafsson, A. & Wiström, B. (2017) Spatial configurations of urban forest in Denmark and Sweden – patterns for green infrastructure planning. *Urban Ecosystems* 2. DOI: 10.1007/s11252-016-0600-y.

Urban green health – a review of evidence (2016) http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1.

Innovation

An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

Reference

Organization of Economic Cooperation and Development & Eurostat (2005) *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd edition, Paris: OECD.

Inquiry

It's a student-centred approach where the main objective is the development of scientific knowledge and the understanding of the scientific method. It mirrors the activities of the scientist allowing students to understand how new knowledge is constructed and to develop scientific reasoning.

Reference

Flick, L. & Lederman, N. (2006). *Introduction.* In: Flick, L. & Lederman, N. (eds.), *Scientific Inquiry and Nature of Science.* (pp. ix-xviii). Netherlands: Springer.

Interdisciplinarity

Means moving to joint problem formulation and hypothesis development, analysis and interpretation of data, and application; it provides a "mixing" of disciplines, looks for systemic outcomes and can lead to new questions and methodologies.

References

Jeffrey, P. (2003). Smoothing the waters: observations on the process of cross-disciplinary research collaboration. *Social Studies of Science*, 33 (4), pp. 539-562.

Lawrence, R.J. & Després, C. (2004). Futures of transdisciplinarity. *Futures*, 36 (4), pp. 397-405.

Moore, J. (2005). Barriers and pathways to creating sustainability education programs: policy, rhetoric and reality. *Environmental Education Research*, 11 (5), pp. 537-555.

Lignite surface mining

It's a type of mining in which soil and rock overlying the lignite (brown coal) are removed. It usually affects large areas of land and the necessity of having to relocate whole local communities (Friese, Hupfer & Schultze 1998). It also results in several environmental problems, such as the mass transfer of billions of tonnes of soil and devastation of nature (Badera & Kocoń 2014).

References

Badera, J. & Kocoń, P. (2014) Local community opinions regarding the socio-environmental aspects of lignite surface mining: experiences from central Poland. *Energy Policy*, 66, pp. 507-516.

Friese, K., Hupfer, M. & Schultze, M. (1998) Chemical characteristics of water and sediment in acid mining lakes of the Lusatian lignite district. pp. 25-45. In: *Acidic Mining Lakes*. Berlin Heidelberg: Springer.

Local referenda

Binding local referenda are not only instruments of decision-making but also modern methods of protective democracy at the local level (oriented towards the survival and future of a municipality, and local identity). The local application of a referendum constitutes a rational deepening of local democracy.

Reference

Buček, J., & Smith, B. (2000) New approaches to local democracy: direct democracy, participation and the 'third sector'. *Environment and Planning C: Government and Policy*, 18 (1), pp. 3-16.

Mining exploration

The search for metallic and nonmetallic ores or coal through direct and indirect techniques. The main objective is the definition of the extent and value of ore as well as the assessment of the viability for exploration, including economic feasibility. In mining first proper the step is to access the ore and then extract and recover the mineral of interest.

Reference

Hartman, H.L. (1992). *Elements of Mining*. In: Hartman, H.L. (ed.), *SME Mining Engineering Handbook* (2nd Ed.). (pp. 24-38). Colorado: Society for Mining, Metallurgy and Exploration Inc.

Multidisciplinarity

Entails the bringing together of independent disciplines to bear on a common problem; each discipline works in a self-contained manner.

References

Jeffrey, P. (2003). Smoothing the waters: observations on the process of cross-disciplinary research collaboration. *Social Studies of Science*, 33 (4), pp. 539-562.

Lawrence, R.J. & Després, C. (2004). Futures of transdisciplinarity. *Futures*, 36 (4), pp. 397-405.

Moore, J. (2005). Barriers and pathways to creating sustainability education programs: policy, rhetoric and reality. *Environmental Education Research*, 11 (5), pp. 537-555.

Natural resources

Resources that occur naturally, without or largely without human intervention, and that can be used for the benefit of humankind (Young, 1982). Some examples are minerals, water, coal, among others.

Reference

Young, O.R. (1982). *Resource Regimes: Natural Resources and Social Institutions*. California: University of California Press.

Public goods

Public goods are those goods that have two distinctive aspects:

1. non-excludability (no one can be excluded from consuming the public good or benefiting from it)
2. non-rivalry (the consumption of the public good by one person does not reduce the quantity available to other persons).

Reference

Batina, R.G. & Ihori, T. (2005). *Public Goods Theories and Evidence*. Berlin: Springer.

Rural tourism

Tourist activities in rural places and rural settings. It is a multifaceted concept that can include a wide range of activities, such as farm-based holidays, ecotourism, ethnic tourism, sport and health tourism, among others.

Reference

Lane, B. (1994) What is rural tourism? *Journal of Sustainable Tourism*, 2 (1-2), pp. 7-21.

Schwartz's theory of universal values

A systematic theory of the content and organisation of the value systems of individuals. This theory identifies what may be a comprehensive set of 10 different types of values recognised across cultures. It also specifies the conflicts and congruities among these values that give rise to a coherent circular structure of relations among them.

References

Schwartz, Sh.H. *et al.* (2001) Extending the cross-cultural validity of the theory of basic human values with a different method of measurement. *Journal of Cross-Cultural Psychology*, 32 (5), pp. 519-542.

Schwartz, Sh.H. (1992) Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. *Advances in Experimental Social Psychology*, 25, pp. 1-65.

Simulation games

Educational activities based on simulation of a real-world issue. Students usually play a role, allowing them to see the issue from a perspective that is different from their own. Simulation games contain aspects of case studies (i.e. they are based on real issues), simulation (i.e. the reality is simulated to allow students to be immersed into the scenario), and games (i.e. there are "gaming mechanisms", like goals and rules). There are more typologies of simulation games but usually we

differentiate between tactical decision-making games, where players solve a complex problem and experience the consequences of their decisions, and social system games, based mainly on interaction among players in the environment simulating a social system.

References

Ellington, H., Gordon, M. & Folie, J. (1998). *Using Games & Simulations in the Classroom*. London: Kogan Page.

Gredler, M. (1994). *Designing and Evaluating Games and Simulations. A Process Approach*. London: Kogan Page.

Social Exclusion

Multidimensional and reflects a combination of interrelated factors that may be manifest at a community level (geographic or social community). It could be defined through 3 main characteristics: (1) is relative to the norms and expectations of society at a particular point in time, (2) is caused by an act of some individual, group or institution (agency of a person that excludes themselves by choice or is excluded by the decisions of other people, organisations or institutions), (3) is not a result simply of current circumstances (e.g. unemployment), but also requires that the person's future prospects are limited (Atkinson 1998: 13-14).

References

Atkinson, A. (1998) *Social Exclusion, Poverty and Unemployment*. In: Atkinson, A. & Hills, J. (eds.) *Exclusion Employment and Opportunity* (CASE Paper No. 4). London: Centre for the Analysis of Social Exclusion, London School of Economics.

Atkinson, A.B., Marlier, E. & Nolan, B. (2004) Indicators and targets for social inclusion in the European Union, *Journal of Common Market Studies*, 42 (1), pp. 47-75. DOI: 10.1111/j.0021-9886.2004.00476.x.

Hayes, A., Gray, M. & Edwards, B. (2008) *Social Inclusion: Origins, Concepts and Key Themes*. Canberra: Commonwealth of Australia. http://pandora.nla.gov.au/pan/142909/20130920-1300/www.socialinclusion.gov.au/sites/default/files/publications/pdf/si-origins-concepts-themes.pdf.

Social Inclusion

The process of improving the terms for individuals and groups to take part in society by improving the ability, opportunity, and dignity of those disadvantaged on the basis of their identity to take part in society. Social

inclusion (or social integration) – as a twinned concept with social exclusion – is one of the Sustainable Development Goals (SDGs), which means an effort to help countries promote inclusive growth.

Reference

World Bank. https://www.worldbank.org/en/topic/socialdevelopment/brief/social-inclusion.

Stakeholders

Stakeholders are by definition people or organisations that have a "stake" in a matter, by being either involved in or influenced by it. In the rural development policy context, this covers all the groups concerned with policy delivery from the policymakers to (the potential) project beneficiaries on the ground.

Reference

European Network for Rural Development (2015). Improving stakeholders involvement. *EU Rural Review*, 19.

Sustainable Consumption and Production (SCP)

As defined by the Oslo Symposium in 1994, sustainable consumption and production (SCP) is about "The use of services and related products, which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations".

"It's a consumer-driven, holistic concept that refers to the integrated implementation of sustainable patterns of food consumption and production, respecting the carrying capacities of natural ecosystems. It requires consideration of all the aspects and phases in the life of a product, from production to consumption, and includes such issues as sustainable lifestyles, sustainable diets, food losses and food waste management and recycling, voluntary sustainability standards, and environmentally friendly behaviours and methods that minimize adverse impacts on the environment and do not jeopardize the needs of present and future generations."

Reference

Sustainable Food Systems Program, FAO – UNEP. http://www.fao.org/fileadmin/templates/ags/docs/SFCP/English_SustainableFoodSystems.pdf.

Sustainable Development

Development that provides economic, social and environmental benefits in the long-term, having regard to the needs of living and future generations. Defined by the World Commission on Environment and Development in 1987 as: development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Reference

Dasgupta, P. (2007) The idea of sustainable development. *Sustainability Science*, 2 (1), pp. 5-11. DOI: 10.1007/s11625-007-0024-y.

Sustainable development knowledge platform: https://sustainabledevelopment.un.org/.

Brundtland Commission (1987) *Report of the World Commission on Environment and Development*. New York: United Nations.

Sustainable forest management (SFM) also
Sustainable Forestry

"The stewardship and use of forest lands in a way and at a rate that maintains their productivity, biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil now and in the future relevant ecological, economic and social functions at local, national and global levels and that does not cause damage to other ecosystems".

Reference

https://ec.europa.eu/growth/sectors/raw-materials/industries/forest-based/sustainable-forest-management_en.

Sustainable use

This means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

Reference

Convention on Biological Diversity (1992) 1 Article 2. https://www.cbd.int/doc/legal/cbd-en.pdf.

Territorial ecological limits

The established boundaries for individual mines, may not be transgressed by open-pit mines and overburden disposal operations. These limits were gradually adopted by the government of the Czech Republic, which applied to individual areas of sub-bituminous coal basins. The aim of the assignment of these limits was emphasising the landscape and environment protection and enabling long-time planning in localities above the coal seams.

Reference

Sivek, M. *et al.* (2012) Factors influencing the selection of the past and future strategies for electricity generation in the Czech Republic. *Energy Policy*, 48, pp. 650-656.

Transdisciplinarity

Denotes the development of an overarching paradigm that encompasses a number of disciplines and (latterly) stakeholder groups; it implies different roles of stakeholders and brings together divergent worldviews (including the transcending of disciplinary boundaries) thus creating new boundaries for exploration and understanding.

References

Jeffrey, P. (2003) Smoothing the waters: observations on the process of cross-disciplinary research collaboration. *Social Studies of Science*, 33 (4), pp. 539-562.

Lawrence, R.J. & Després, C. (2004) Futures of transdisciplinarity. *Futures*, 36 (4), pp. 397-405.

Moore, J. (2005) Barriers and pathways to creating sustainability education programs: policy, rhetoric and reality. *Environmental Education Research*, 11 (5), pp. 537-555.

Urban Densification

Densification is a term used by planners, designers, developers and theorists to describe the increasing density of people living in urban areas. There are a number of methods by which urban density can be measured but here we focus on:

1) Residential density: Number of dwelling units in a given area and
2) Population density: Number of people in a given area.

Reference

Berghauser Pont, M.Y. & Haupt, P. (2010) *Spacematrix: Space, Density and Urban Form.* Rotterdam: NAi Publishers

Urban sprawl

Urban sprawl describes the expansion of human populations away from central urban areas into low-density, monofunctional and usually car-dependent communities, in a process called suburbanisation. In addition to describing a particular form of urbanisation, the term also relates to the social and environmental consequences associated with this development. In Continental Europe the term "peri-urbanisation" is often used to denote similar dynamics and phenomena.

Reference

James, P., Holden, M., Lewin, M., Neilson, L., Oakley, C., Truter, A. & Wilmoth, D. (2013) *Managing Metropolises by Negotiating Mega-Urban Growth*. In: Mieg, H. & Töpfer, K. (eds.) *Institutional and Social Innovation for Sustainable Urban Development*. Abingdon: Routledge.

Urbanization (urbanisation)

The term refers to the population shift from rural to urban areas, "the gradual increase in the proportion of people living in urban areas", and the ways in which each society adapts to the change. In the environmental perspective it creates a number of different challenges and some opportunities. Trends in urbanisation are integrally linked to sustainable development. With good planning and governance, the increasing concentration of people in urban settlements can facilitate economic and social development, while also offering opportunities to mitigate the adverse impact of consumption and production on the environment. However, rapid and unplanned urban growth threatens sustainable development when the necessary infrastructure is not developed or when policies are not implemented to protect the environment and ensure that the benefits of city life are equitably shared.

Reference

United Nations, Department of Economic and Social Affairs, Population Division (2015) *World Urbanization Prospects: The 2014 Revision*, T/ESA/SER.A/366. https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf.

List of Abstracts

1. The tropical forest: an analysis of social and economic reasons of environmental degradation

Jan Činčera Masaryk University (Czech Republic)

Keywords: *tropical forests, deforestation, nature protection*

Abstract
This case allows students to experience and analyse the systemic interconnectedness among various groups affected by the process of deforestation in tropical areas. Participants are supposed to play a role, reflect on their experience, and compare the gaming scenario with reality in the follow-up investigation.

2. Dead wood in the Białowieża Forest – unravelling complexity of biodiversity conservation

Grzegorz Mikusiński Swedish University of Agricultural Sciences SLU (Sweden)
Xymena Bukowska Collegium Civitas (Poland)

Keywords: *conservation conflict, sustainable forestry, environmental attitudes, Poland*

Abstract
This case pertains to the conservation strategy for the renowned Białowieża Forest (BF) in Eastern Poland. There are two main visions for the forest. The first is based on the assumption that forest biodiversity may be maintained without human intervention with ecological processes as the key factors. The second is based on the assumption that the maintenance of forest biodiversity in regions highly affected by humans needs active silvicultural management. The advocates of both visions proclaim the same goal: to save the Białowieża forest for future generations.

The conflict around the conservation of forest biodiversity in BF has been recently focused around the outbreak of the spruce bark beetle – an insect that kills the spruce and creates a lot of dead wood. Many different stakeholders are involved in the conflict around BF and this exercise (case) aims to increase the awareness of the complexity of biodiversity conservation among participating students.

3. Sustainable development in the Shinyanga Region, Tanzania

Michael Jones Swedish University of Agricultural Sciences SLU (Sweden)

Key words: *agricultural development, forest landscape restoration, local knowledge, participation, soil conservation, trypanosomiasis*

Abstract
The Shinyanga case is based on a long-term study of agricultural development and its consequences in Tanzania. The history of social and environmental change in the Shinyanga region illustrates how development can lead to poverty if the ecological capacity of the land is exceeded, and how this situation can be reversed if local knowledge and rules for land use are applied to manage forest and grazing land as commons. The case provides deep insights into gender inequity and the potential for elite capture and privatisation of land. The challenge for residents of Shinyanga (and students who follow the lessons plans based on this case) is to develop a set of rules that ensure an equitable distribution of benefits to all Shinyanga residents and maintain the ecological potential of the land to support human well-being.

4. Rural tourism development: the case of Plastiras Lake, Karditsa, Central Greece

Alex Koutsouris, Alexandra Smyrniotopoulou, George Vlahos, Athanasios Kampas Agricultural University of Athens (Greece)

Keywords: *rural tourism, innovation, sustainable rural development, (local) conventions*

Abstract
In this case, students investigate the ongoing discussion about sustainable tourism development in Greece. Students reflect on their knowledge and experience, and compare them with the case at hand in the follow-up investigation. The views of the main stakeholders are reviewed so as to allow students to develop a vision for sustainable tourism and, therefore, a relevant draft development plan.

5. Organic farming and public support in the EU – The Greek Case

Alexandra Smyrniotopoulou, Athanasios Kampas, George Vlahos, Alex Koutsouris Agricultural University of Athens (Greece)

Keywords: *agricultural policy, organic farming incentives, public goods provision, interest groups (stakeholders)*

Abstract
The case introduces an ongoing discussion in the EU about the subsidisation of organic farming. It simulates the process of the stakeholders' dialogue as the means of public participation in decision-making. Students are expected to discuss the pros and cons of this policy instrument from the perspective of different stakeholders.

6. Remodelling an ancient farm in Portugal

Clara Vasconcelos, Cristina Calheiros, Luís Calafate, Isilda Rodrigues, Joana Faria University of Porto (Portugal)

Keywords: *ecosystem services, cultural heritage, rural tourism*

Abstract
Focusing on sustainable remodelling of an ancient farm to increase tourism and preserving its cultural identity, the students are engaged in role-playing exercise that intends to develop knowledge and competences giving special attention to cultural heritage. Five teams take on different roles, thus different needs and interests have to be performed

according to role descriptions given to each team. Students must play their roles within the team and find arguments to support their decisions and points of view. Promoting collaborative work and discussion, this case seeks to integrate and balance the three dimensions of sustainable development: economic, social and environmental. Specific development goals and targets are raised as well as relevant competences for empowering students to take future sustainable actions.

7. Transformation of a local production company into a sustainable business

Paulina Codogni, Katarzyna Iwińska, Katarzyna Błaszczyk
Collegium Civitas (Poland)
Adam Sulkowski Babson College (USA)

Keywords: *gender gap, sustainability, innovation, sustainable management*

Abstract
In the case students are presented with an example of a local production company operating in Southern-Eastern Poland. Founded in 1990 during the wave of economic transformation, recently the enterprise is being challenged by the inevitable changes, the need to develop and start investments in order to keep its current position. The problem is presented from the perspective of the new female leader functioning in a traditionally male-dominated business and trying to respect SD goals as the company and the employees grow. Students will be involved in a discussion about the management challenges and work on a strategic development plan for the company. They will use SD concepts provided in the case while proposing new tactics.

8. Castromil gold mines' geoethics dilemmas

Clara Vasconcelos, Joana Faria, Isilda Rodrigues, Luís Calafate, Cristina Calheiros University of Porto (Portugal)

Keywords: *geoethics, mine exploration, mine exploitation, natural resources*

Abstract
Mining has been, and may still be, one of the most important activities in society. As the mining process interferes with the geosphere and many other Earth's subsystems, several ethical questions emerge that are taken into consideration. The case presents students with the real scenario of Castromil gold mines, obliging them to reflect about the advantages and disadvantages of mining exploitation. Due to the geoethics dilemmas that emerge, sustainable ore mining ends up being a major possibility to engage citizens in responsible action. Through inquiry strategies, students must work in groups and discuss possible economic and public health impacts and risks, and sustainable ways to exploit raw materials. At the end students must reflect on sustainable economic growth that stimulates the economy while not harming the environment.

9. Territorial ecological limits to the lignite surface mining in North Bohemia

Mikuláš Černík, Tomáš Chabada, Jan Činčera, Veronika Chvátalová
Masaryk University (Czech Republic)

Keywords: *lignite surface (open-cast) mining, territorial ecological limits, Schwartz's theory of universal values, North Bohemia*

Abstract
The case presents ongoing discussion about breaking the territorial ecological limits to the mining of brown coal in the North Bohemia region of the Czech Republic. Territorial ecological limits established in 1991 have restricted exploration, mining and other mining-related activities beyond certain spatial limits in order to protect settlements and to improve the devastated environment. In 2015 a public debate about the preservation of the limits took place. History of the case and the po-

sitions of relevant actors will be presented to students. Students will analyse the authentic quotations of the main actors engaged in this case and investigate their underlying values, based on Schwartz's theory of universal values. Students will reflect upon the values of the actors and discuss the environmental, social, and economic aspects of the whole case.

10. Smog – high concentration of air pollutants in a large city. The Warsaw example

Artur Badyda Warsaw University of Technology (Poland),
Katarzyna Iwińska Collegium Civitas (Poland)

Keywords: *air pollution, smog, health effects, air quality management*

Abstract
In this case students investigate the problem of air pollution in the capital city of Poland (Warsaw). It is one of the extreme examples of polluted cities in Europe. Students are given data to understand links between health effects and exposure to pollutants. The problem of air pollution (and smog) is also presented from the perspectives of several stakeholders and decision makers that deal with the issue. Through the strategic analysis of decision-making processes regarding air quality, students can develop community action plan projects for future change.

11. Local referendum about the relocation of the railway station

Tomáš Chabada, Mikuláš Černík, Jan Činčera, Veronika Chvátalová
Masaryk University (Czech Republic)

Keywords: *railway station, local referendum, public participation, decision-making*

Abstract
In Brno, the second largest city in the Czech Republic, a plan to relocate the main railway station from its current position in the city centre

has been debated. Realisation of the plan would have a significant impact on the urban development of the city, as well as on public expenditures and the connection of the city to a network of high-speed trains. A local initiative has gathered signatures in order to call out a local referendum about the plan. The lesson uses this particular event as an example to discuss the instrument of local referenda in sustainable urban development. We use a role-play game to enable students to discuss positive and negative aspects of the instrument from the point of view of various actors involved in the process.

12. Urban greenery – how to include urban green areas in cities that are in desperate need of housing?

Marcus Hedblom Swedish University of Agricultural Sciences SLU (Sweden)
Luís Calafate University of Porto (Portugal)

Keywords: *ecosystem services, urban sprawl, biodiversity; densification, green infrastructure, urban green health*

Abstract
In this case students face the difficulties of preserving urban greenspace in a representative city that also needs to build infrastructure. This problem is exemplified with a real case concerning an urban forest in the city of Uppsala in Sweden. Some stakeholders argue about the need of more houses for people to live in and other stakeholders argue about the need for green areas for health, well-being, cultural values, children, biodiversity and general sustainability. The overall problem is that municipalities want to have urban green spaces for the health of their residents, at the same time there is a need to build more houses. This leads to a planning dilemma about how to avoid the global trend where cities are densified (condensed) and urban green areas are constantly reduced. The students can be involved in a role-play representing different actors in the conflict or provide group work with discussions.

13. Sustainable food consumption – mitigating food waste

Magdalena Kraszewska Collegium Civitas (Poland)

Keywords: *food waste, sustainable food consumption*

Abstract

The leading theme of this case study is food waste and its impact on the three pillars of sustainability. The ultimate aim of the class is identification of the challenges consumers encounter in their attempt to reduce food waste. During the session, participants will learn what food waste is and its impact on the economy, society and the environment, both in global and local perspectives. Next, they will come up with the solutions that may mitigate the problem. They will assess benefits and costs of specific actions against food waste, from the individual perspective with a special focus on the challenges of changing their behaviour. Implications of the consumer choices regarding the three pillars of sustainability will also be discussed. Finally, participants will be encouraged to take actions against food waste in their personal lives.

References

Argyris, C. & Schon, D. (1996) *Organisational Learning II*. New York: Addison Wesley.

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