Scientific Committee on Health, Environmental and Emerging Risks SCHEER

Scientific advice on "Emerging issues at the environment-social interface"

The SCHEER adopted this document by written procedure on 29 July 2019.

ABSTRACT

Following a request from the Commission, the Scientific Committee on Health, Environmental and Emerging Risks (SCHEER) was asked to peer review and validate the outcomes of an annual exercise on the foresight system for the systematic identification of emerging environmental issues. The current exercise is running in the field of "Emerging issues at the environment-social interface". The SCHEER reviewed the 10 priority issues prepared by the European Commission and replied to a set of questions on the risks and/or opportunities of the emerging issues, expected impact (positive or negative) on environment and human health and on relevance on the basis of environmental and human health impact.

Keywords: emerging issues, environment, social interface

Opinion to be cited as:

SCHEER (Scientific Committee on Health, Environmental and Emerging Risks), Scientific advice on "Emerging issues at the environment-social interface", 29 July 2019.

ACKNOWLEDGMENTS

Members of the Working Group are acknowledged for their valuable contribution to this opinion. The members of the Working Group are:

The SCHEER members:
Roberto Bertollini
Teresa Borges
Wim de Jong
Pim de Voogt
Raquel Duarte-Davidson
Peter Hoet
Rodica Mariana Ion
Renate Krätke
Demosthenes Panagiotakos
Ana Proykova
Theodoros Samaras
Marian Scott (Rapporteur)
Remy Slama
Emanuela Testai
Theo Vermeire
Marco Vighi (Chair)
Sergey Zacharov

External experts
Urbano Fra Paleo
Sophie Miquel
Belmira Neto

All Declarations of Working Group members are available at the following webpage:
http://ec.europa.eu/health/scientific_committees/experts/declarations/scheer_wg_en

About the Scientific Committees (2016-2021)

Two independent non-food Scientific Committees provide the Commission with the scientific advice it needs when preparing policy and proposals relating to consumer safety, public health and the environment. The Committees also draw the Commission's attention to the new or emerging problems which may pose an actual or potential threat.

They are: the Scientific Committee on Consumer Safety (SCCS) and the Scientific Committee on Health, Environmental and Emerging Risks (SCHEER). The Scientific Committees review and evaluate relevant scientific data and assess potential risks. Each Committee has top independent scientists from all over the world who are committed to work in the public interest.

In addition, the Commission relies upon the work of other Union bodies, such as the European Food Safety Authority (EFSA), the European Medicines Agency (EMA), the European Centre for Disease prevention and Control (ECDC) and the European Chemicals Agency (ECHA).

SCHEER

This Committee, on request of Commission services, provides Opinions on questions concerning health, environmental and emerging risks. The Committees addresses questions on:

- health and environmental risks related to pollutants in the environmental media and other biological and physical factors in relation to air quality, water, waste and soils.

- complex or multidisciplinary issues requiring a comprehensive assessment of risks to consumer safety or public health, for example antimicrobial resistance, nanotechnologies, medical devices and physical hazards such as noise and electromagnetic fields.

SCHEER members

Roberto Bertollini, Teresa Borges, Wim de Jong, Pim de Voogt, Raquel Duarte-Davidson, Peter Hoet, Rodica Mariana Ion, Renate Krätke, Demosthenes Panagiotakos, Ana Proykova, Theodoros Samaras, Marian Scott , Remy Slama, Emanuela Testai, Theo Vermeire, Marco Vighi, Sergey Zacharov

Contact:
European Commission
DG Health and Food Safety
Directorate C: Public Health, Country Knowledge, Crisis management
Unit C2 – Country Knowledge and Scientific Committees
Office: HTC 03/073 L-2920 Luxembourg
SANTE-C2-SCHEER@ec.europa.eu

ISSN ISBN
doi: ND

The Opinions of the Scientific Committees present the views of the independent scientists who are members of the committees. They do not necessarily reflect the views of the European Commission. The Opinions are published by the European Commission in their original language only.

http://ec.europa.eu/health/scientific_committees/policy/index_en.htm

TABLE OF CONTENTS

1. SUMMARY

The SCHEER was requested by DG ENV to peer review and validate the outcomes of an annual exercise on the foresight system for the systematic identification of emerging issues to human health and environment. The subject is "Emerging issues at the environment-social interface". The SCHEER reviewed the evidence provided through the characterisation of 10 priority issues delivered by DG ENV, commented on and validated the outcomes, in particular the risks and opportunities identified as well as the levels of uncertainty and scientific consensus. The SCHEER also evaluated its role in the foresight system.

In doing so, the SCHEER considered a set of key questions, including:

1. Is the emerging issue identified likely to have the risks and/or opportunities described, or others limited to human health and environment?
2. Is the described expected impact (positive or negative) on environment and human health plausible, including the expected time-frame?
3. Can the SCHEER assess and rank the relevance on the basis of environmental and human health impact of the identified emerging issues?

The validation required a broad range of expertise, including those on risk assessment, urban environment, environmental media (land, water, air and noise, climate, natural resources) and human health. DG ENV also issued further clarification that the SCHEER should focus on the environmental and human health risks and opportunities, while recognising that other risks and opportunities were also pertinent to the identified issues.

The SCHEER agreed with the main opportunities and risks identified, but identified additional opportunities and risks for each issue.

In response to question 3 above, the SCHEER members classified the issues in three classes: high, moderate, low impact for the environment and human health separately to produce a final ordering of the emerging issues.

2. MANDATE FROM THE EU COMMISSION SERVICES

2.1. Background as received from the Commission

1. Background

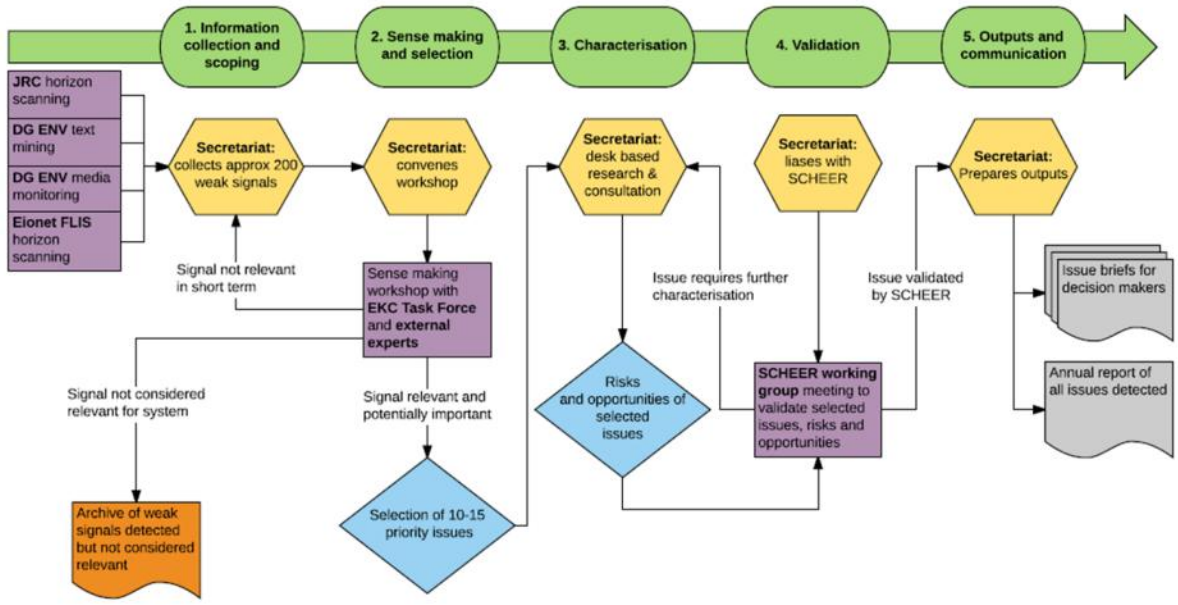
Responding to the need identified in Priority Objective 5[1] of the 7th Environmental Action Programme, ENV and its partners of the Environment Knowledge Community (EKC)[2] have established a foresight system for the systematic identification of emerging environmental issues (FORENV). This is also in line with the importance attributed to foresight and other forward-looking tools in the Better Regulation guidelines,[3] which stress that those tools "complement quantitative modelling with a system thinking and long-term approach".[4]

The EKC foresight system, FORENV, has the overall aim:

> To identify, characterise and assess emerging issues that may represent risks or opportunities to Europe's environment, and to communicate these results to policy-makers and other stakeholders, encouraging appropriate and timely actions to be taken. Ultimately the aim is to enable policy makers and other stakeholders to prevent or effectively manage emerging risks, and to ensure that opportunities are identified and exploited.

FORENV is bringing together existing EU knowledge, expertise and practice on foresight and identification of emerging environmental issues. It shall provide regular and timely update to EU senior and middle management on issues which may represent opportunities and/or risks for the environment.

FORENV is based on a five-step approach, as detailed in the image below:



[1] Priority Objective 5 requests *'that (by 2020) the understanding of, and the ability to evaluate and manage, emerging environmental and climate risks are greatly improved'*. See http://ec.europa.eu/environment/action-programme/

[2] The EKC is an informal platform set up in 2015 by ENV, CLIMA, RTD, ESTAT, JRC and EEA to improve the generation and sharing of EU environmental knowledge.

[3] See the Better Regulation Toolbox (pp. 14-16), complementing the Better Regulation Guideline, SWD(2015) 111.

[4] Ibid.

The primary sources of information for the collection of information (Step 1) will be through the horizon scanning activities currently in place in the JRC, RTD and EEA/Eionet FLIS[5]; the text mining developed by ENV[6]; and the Science for Environment Policy news alert managed by ENV[7]. Commission and external experts will be involved in the sense making and prioritisation (Step 2) and in the characterisation of the priority issues (Step 3). The Scientific Committee on health, environmental and emerging risks (SCHEER) is asked to peer review and validate the process (Step 4), and the final findings will be communicated to other Commission services and senior managers for discussion and follow-up action, where appropriate (Step 5).

EKC partners are running the current exercise in the field of "Emerging issues at the environment-social interface", for which the following timing is expected:

- 200 relevant weak signals of change are collected in October and November 2018 (Step 1);
- In December 2018 and January 2019, internal (EU) and external experts will identify between 8 and 10 priority emerging issues at the environment/society interface by analysing and clustering the weak signals (Step 2);
- Between February and April 2019, the 8 (maximum) emerging issues are characterised by FORENV Secretariat on the basis of scientific literature, to highlight in particular associated opportunities and risks (Step 3);
- Between May 2019 and July 2019 SCHEER shall review the characterisation and produce its opinion (Step 4);
- In August and September 2019, a final report and related communication outputs will be produced (Step 5).

After the pilot of 2017-18, the system now runs in annual cycles.

2.2. Terms of reference

The SCHEER is requested to review and validate the outcomes of steps 1- 3 (identification of the issues and description) in the area of "Emerging issues at the environment-social interface".

For Step 4, the SCHEER is asked to review the evidence provided through the characterisation (delivered by ENV), comment on and validate the outcomes, in particular the risks and opportunities identified and the levels of uncertainty and scientific consensus.

In doing so, the SCHEER should consider a set of key questions, including:

1. Is the emerging issue identified likely to have the risks and/or opportunities described, or others limited to human health and environment?
2. Is the described expected impact (positive or negative) on environment and human health plausible, including the expected time-frame?

[5] European Environment Information and Observation Network (Eionet) for Forward Looking information and Services (FLIS). See: https://forum.eionet.europa.eu/nrc-flis

[6] Using two JRC tools: Tools for Innovation Monitoring (TIM) and Europe Media Monitor (EMM).

[7] http://ec.europa.eu/environment/integration/research/newsalert/index_en.htm

3. Can the SCHEER assess and rank the relevance on the basis of environmental and human health impact of the identified emerging issues?

2.3. Timeline

The SCHEER is expected to provide its opinion by end of July 2019.

3. CONCLUSIONS

3.1. Introduction

Environmental and social issues are intrinsically linked. On the one hand, environmental risks and environmental policy measures may affect societal groups differently, e.g. through the unequal exposure to pollution sources (in air, water, soil, through noise, chemicals, particulates) and environmental temperature, climate and weather extremes impacts and access to natural resources, but also through differing outcomes generated from environmental taxes or incentives, or the way rights to a healthy environment are guaranteed. On the other hand, social trends and movements may have a strong impact on the environment, e.g. through dietary changes, green jobs, consumer choices, the changing perception of nature, awareness raising (e.g. through social networks), demands for environmental/climate justice and environmental crimes.

EU-policy makers are faced with questions such as which emerging trends might be of highest relevance and should be followed up**.**

3.2. General comments and approach

The ten selected issues are:

1. Environment policy and social cohesion: Addressing inequalities in the transition towards a carbon-neutral circular economy
2. Diversification of consumption patterns: A potential pull for market change towards reduced overall consumption
3. Environmental risks and opportunities associated with emerging and changing dietary patterns: reducing meat consumption and alternative protein sources
4. Digitalisation as a driver for the ecological transition
5. An evolution in citizen activism, in particular by the young generation towards environmental justice and sustainability transitions
6. Rising populism and protectionism undermining international cooperation on environmental issues
7. Cities as labs for sustainability transitions- harnessing innovations through science-society partnerships
8. A new narrative for nature in an urbanised, digital world: Disconnecting and reconnecting people to their environment
9. Intensification of conflicts about natural resources and other environmental causes of migration
10. New forms and approaches to the management of knowledge, education, and skills required for sustainability transitions

They are focussed on societal and political risks and opportunities and represent very relevant challenges for society. They are connected with some of the most important and pressing issues that human society must face worldwide today (climate change, migration, rising of nationalism).

In most cases, they may entail impacts to the environment and human health, but they are predominantly societally and politically based, so that many of the identified opportunities and risks are similarly based on the social and political implications. In view of its mandate, the SCHEER has focussed on commenting on the environment and human health issues and opportunities, and in some cases identified further risks and opportunities.

In some cases, in the opinion of the SCHEER, the possible implications on human health and the environment are not the most serious aspects of the issues. Therefore, the extent of the SCHEER comments may vary over the different issues. In some cases, they are more extensive and complete, in other cases they are more superficial, considering the minor direct implications of the issue for human health and the environment.

Each issue is discussed separately; however, it is opinion of the SCHEER that many connections exist among the issues and these are also identified (Rotmans and Loorbach, 2009).

With regard to the final request concerning prioritisation and ranking, the SCHEER has based this ranking solely on human health and environmental implications. Therefore, the resulting prioritisation may differ to those based on their socio-political relevance.

3.3. Issues Identified - Risks and opportunities

Issue 1: Environment policy and social cohesion: Addressing inequalities in the transition towards a carbon-neutral circular economy

Introduction

Addressing environmental challenges, such as climate change mitigation or the transition to a low carbon economy, 'will require adopting policy measures that have some impact on collective human behaviour', while implementing transformative policies will often involve trade-offs that disproportionately affect already marginalised or vulnerable groups in society. Environmental policy measures, which are likely to be central to transitions, tend to have less impact on higher-income groups than on lower-income groups, and at the same time there is inequality in exposure to environmental health hazards such as pollution, noise and high temperatures and this closely reflects the geo-socio-demographic differences in society. At present 'the social distribution of environmental risks is not coherently tackled under environmental policies in the EU'.

As recognised in existing EU policy frameworks such as the Action Plan for a Circular Economy, there is a need for social protection in the context of the transition to a carbon-neutral circular economy.

General comments

The SCHEER is of the view that the transition toward a carbon neutral circular economy is an imperative in the short-medium time for all countries, including those which are less developed. There is no doubt that this transition will have a number of potential impacts, offering risks and opportunities to the environment and human health. The FORENV identified risks and opportunities focused specifically on the societal and political aspects. In the following sections, the SCHEER focuses on direct (and indirect) environment and human health aspects. It is clear that delivery of a carbon neutral circular economy will affect all policy areas covering environment and human health, including transport, energy, the built environment etc.

As is said in the FORENV document, pg. 6, "*Transition processes are themselves 'complex and uncertain' and are likely to lead to unexpected consequences and feedback*". It seems that investment shifts must occur to replace European traditionally carbon-based economies. Such changes may result in additional social inequalities since some elements may require incentives and disincentives. It is well-known that social inequalities are strong drivers of health variations among societies.

Focussing on the circular economy, the SCHEER already identified and discussed in a previous document (SCHEER, 2018) some emerging issues that can be linked to the circular economy. Specifically issue 5 (Chemicals in recycled material) is one example of the environmental and human health risks identified, which includes plastic and electronic wastes, demolition wastes, and new and smart technologies used for housing. The SCHEER concurs that such risks will most likely be unequally distributed across the population and that policy measures should be designed to counteract such differential impacts.

Human health and Environmental risks are often overshadowed by economic priorities. In this sense, there is a risk that this will also happen in the transition to a carbon neutral circular economy. Simply closing material loops is not enough to guarantee environmental improvement. What is additionally required to reduce environmental impact is less production and less consumption. While the circular economy seeks to deliver this outcome, once economic realities are considered, it may fail to deliver on its potential. Circular economy activities can lead to rebound by either failing to compete effectively with primary production or by lowering prices and therefore increasing and shifting consumption (Zink and Geyer, 2017). (see issue 2)

Risks and opportunities

Environment

Potential risks

Biodiversity and ecosystem quality may be directly affected (e.g. through changes in land/water use and competing uses for land/water) if economic drivers and carbon neutral transitions outweigh environmental protection.

In the context of circular economy, the SCHEER (2018) has previously identified potential environmental risks associated with recycling and re-use of materials. The SCHEER has also commented on environmental risks (and opportunities) regarding water re-use and the recycle of construction material containing asbestos, household waste containing chemicals, heavy metals (mercury) as well as issues arising from plastic waste, use of new and smart technologies for housing.

Potential opportunities

The driving force for the transition and the ultimate policy goals of a carbon neutral economy is the stabilisation of climate change (trough mitigation and adaptation), including keeping temperature rises within 1.5°C (IPCC, 2018). The immediate overarching opportunity is delivery of a lower carbon footprint and the ability to live within ecological limits with the associated planetary, ecosystem and quality of life benefits.

Human health

The possible connections of a carbon-neutral circular economy transition to human health and wellbeing have been reviewed and include health impacts of healthcare sector savings, increased presence of chemicals of concern in products which tend to accumulate at the end of life e.g. food waste, e-waste, and waste water reuse. The recycling and reuse of products and its components have been identified has having negative health impacts mostly in the occupational settings; however, risks can also occur towards the general public when using second-hand/re-used products. This is well summarised in the extract below:

WHO (2018) summarised

"Reducing the use of primary resources, maintaining the highest value of materials and products (through the recycling and reuse of products, components and materials) and moving towards greater use of renewable energy and energy efficiency have many **positive health implications**. In particular, direct and indirect benefits come from reducing the environmental impacts of manufacturing processes (and making cost savings in households and in the health sector). The potential **negative health impacts** identified relate to risks in the recycling and reuse of products, components and materials. This refers in particular to the management of chemicals of concern, such as bisphenol A (BPA) and brominated flame retardants (BFRs) in a variety of products, and to emissions from the composting of waste."

Potential risks

Carbon-neutral energy solutions might include nuclear power (entailing short and longer term risks), risks from the release of chemicals as result of over- insulation of buildings (leading to higher concentrations of radon and chemicals evaporating from building materials such as aldehydes).

Potential opportunities

The listed opportunities of the FORENV document are reasonable. However, they need to be very well managed from a political and economic point of view.

Development of short-chain economy (shorter transport chains for goods and people), not based on replacing everything by new materials but trying to repair things will create new opportunities for employment and different job types (Council of EU, 2019).

Links with other issues

The carbon neutral circular economy is regarded by the SCHEER as an overarching social, political and environmental issue and as such has connections with other identified issues in the FORENV submission including issues 2,3, 7 9 and 10.

Issue 2: Diversification of consumption patterns: A potential pull for market change towards reduced overall consumption

Introduction

The model of economic development that supports, to date, the global economy is based on the need for continuous growth of consumption. Therefore, if a pull for market change towards reduced consumption becomes a general behaviour common to a large component (or to the majority) of the population, this would lead to a reduction in the production of material goods that would require a substantial change to the model of economic development. For example, moving from a "growth" based on the increase of consumption of material goods toward a "development" based on the increase of immaterial goods (e.g. education, culture, health, etc.) measurable with indicators other than the GDP (Gross Domestic Product). This is in agreement with the different meaning of "growth" and "development" as proposed by Sen (1999).

The diversification of consumption is possible due to the innovative products/services (through for instance the servicising[8]) made available by the market and also due to personal or collective initiatives on for instance collaborative consumption.

From an ecological point of view, the growth of any population cannot be exponential and infinite. Its maximum level is determined by the resources available in the ecosystem and is called the "carrying capacity "of the system. The human species is the only one capable of growing its capacity to exploit the natural resources and, as a consequence, to increase its carrying capacity. However, in a finite world, this process cannot be infinite. Therefore, a model of economic development based on the continuous increase of consumption must change or collapse. In this context, a pull toward reduced consumption cannot be considered as a risk but as an inevitable and necessary change to our society.

The FORENV document says:

"*At the same time, being aware of sustainability issues and demonstrating a positive attitude towards sustainable products does not necessarily lead to a reduction in consumption; moreover, total consumption in the EU has not decreased."*

This may be explained by considering that a pull toward reduced consumption, as well as a sharing economy, currently involves a relatively small percentage of the European population with some characteristics (e.g. relatively high education level, high consciousness of environmental issues). What is increasingly becoming clear is that personal choices are always made in the context of a wider social and environmental determinants which influence and shape people's lifestyles, the range of choices they can make and the uptake or lack of uptake or health-promoting behaviours as for example poor diet can be a consequence of accessibility and availability. As such this issue is very strongly related to issue 1, with its relationship to existing inequalities.

Risks and opportunities

Environment

Potential risks

[8] *Servicising is generally defined market-level transitions from product-based to service-based production and consumption patterns (van der Veen et al. 2017)*

A shift towards consumption of greener products may face, on the one hand, the lack of availability of certified products marketed with eco/sustainability labelling (as e.g. organic labelling, fairly traded). The capacity of EU producers to respond to this shift and place in the market ecolabelled products might lead to the increase of costs for greener products. The offer of innovative products/services by new business models, which may lead to diversification of the current consumption patterns, may bring environmental impacts, which are still not proved as being better for the environment. Simply closing material loops is not enough to guarantee environmental improvement. What is truly required to reduce environmental impact is less production and less consumption.

Tourism is both a current but also future risk. As an industry, it is very dependent on the platform economy, particularly combining low cost flights and online marketplaces (web-platforms for booking B&B and others) which are driving an increasing tourist footprint of certain cities or locations, e.g. Dubrovnik, Venice, Barcelona, Paris,… Tourism consumes both natural and cultural heritage including historical districts, coastal areas or cultural sites, drives up CO_2 emissions, and drive intensive consumption of water, food, energy and generates a large volume of waste, which is overwhelming some areas. Beyond this it generates seasonal demographic peaks in some areas, causing an imbalance in both the economic –revenue- and demographic structure. This describes the current situation, which shows little sign of changing and is likely to continue to grow. Despite the recognition of problems related to mass tourism, a more integrated assessment of current and potential risks associated with it could provide a framework to reduce its impacts.

The overall (whether environmental, social, economic) benefits of the shared economy are still not yet fully clear. The risks of rebound effects associated with the wider availability of products /services with an estimated reduced environmental impact (e.g. recycled products, reused clothing, and repaired goods), may increase overall production, which can partially or fully offset their benefits.

Potential opportunities

By reducing overall consumption, there is the potential to reduce the overall waste, which is a relevant benefit for both the environment and human health. Opportunities identified do cover the reduction of consumption and also seek the reduction of the impact associated with consumption. Despite the fact that the reduction of consumption is more effective environmentally, the opportunities to reduce impact of consumption on environment and human health should not be overlooked.

Positive signs from consumers towards a more sustainable consumption seem to trigger organisations (companies, firms) to commit to move their portfolio into healthier products, eventually manufactured by local enterprises. Moreover, the increase of consumers' niches supporting sustainable lifestyle practices (food, clothing, housing, transportations) and reducing and sharing possessions may also open doors to more sustainable consumption patterns. Parallel to that, EU circular economy strategies and other initiatives (i.e. eco-design projects) promote best practices seeking to lower the environmental impacts of products (ECAT, 2019). Along with an increasing number of initiatives including school canteens with healthier eating options leading to less food waste, zero waste camps, scientific consortiums and EC horizons 2020/2025 collaborations working on educational programs, increased media coverage and retailer movements, such as the "Act for food" of a chain of supermarket are advocating more responsible consumption. Such initiatives are being extended to many countries and include incentives for electric mobility (municipality car fleets) and e-mobility services.

The easy access to simplified environmental information to the final consumer/user, may be promoted for instance, by the provision of intuitive options to assist the final user in the selection of best environmental alternatives (e.g. renting a car customer may choose to select the service of a conventional or an electric vehicle (green car))

The increased knowledge and use of life cycle assessment tools will lead to a more in-depth knowledge of the environmental impacts of used products throughout its full supply chain. It may be the basis for the recognition of the supply chain environmental hotspots and consequently actions to the reduction of the environmental impact of products, by several actors, as part of the supply chain.

Human Health

Potential risks

A change in consumption patterns may represent a source of stress (especially in the process of adaptation to new consumption patterns) but it can be argued that certain consumption behaviours (e.g. shopping) can lead to mental health issues as well (e.g. depression and anxiety/hyperactivity). Consumers are increasingly primed with a subtle but clear focus on new consumption patterns.

On the other hand, if a generalised reduction in consumption is extended to the majority of the population worldwide, this could result in the collapse of the present model of economic development based on consumption-growth. Therefore, alternative models should be available to ensure the transition.

The easy access to low cost products/services purchased online may promote excessive consumerism. Another risk is the fact that point of origin of products is frequently unknown and likely to have originated requiring long distance transport (with associated comparatively larger environmental impacts in pre-consumption stages). The positive attitude towards sustainable products shown by some consumers does not necessarily lead to a reduction in consumption.

The concern here is how to implement successful strategies to lead current consumers to shift their consumptions habits toward a healthier scheme e.g. one successful example is the increasing public awareness to diminish the use of plastic packaging. Again, to be effective, it needs to be horizontally managed from a political and economic view point, across the different sectors.

Potential opportunities

No additional opportunities identified

Links with other issues

Issues 2 and 3 are linked. At the same time, issues 2 and 3 are intrinsically linked to issue 1.

Issue 3: Environmental risks and opportunities associated with emerging and changing dietary patterns: reducing meat consumption and alternative protein sources

Introduction

Over the last decade, a trend has emerged towards the adoption of low- or no- meat diets in Europe, although with a degree of variability across countries. It is becoming increasingly common for people to report reducing their frequency of meat consumption, a behaviour which has led to the term 'flexitarianism'. However, these reported behaviours have not yet clearly translated into substantial changes in overall meat consumption in the EU, although it is projected to slightly decrease until 2030. Alongside this trend, there appears to also be a growing interest in alternative sources of protein including plant-based meat substitutes and insect-based food products. Other technological avenues to produce both animal and vegetal protein are also being pursued.

General comments

Food production requires increasingly large amounts of land and water, which may be developed at the cost of terrestrial and coastal habitats, forest land, etc. The quantity and importance of meat and other animal products (e.g. milk and cheese) in the human diet is currently hotly debated. Decreasing meat[9] consumption may reduce agricultural land and water requirements to some extent, but ecological arguments should be taken on board when changes are implemented, e.g., based on the principles of agro-ecology and conservation agriculture (Francis et al, 2008, Springmann et al,2018, Altieri et al, 2015, Hobbs et al, 2008).

Animal farming is a major source of greenhouse gasses (GHG) contributing to climate change and consequent impact on the environment. Studies suggest that reducing meat consumption could reduce GHG emissions and the burden of human diseases. Both vegetarian diets and healthier diets allowing small amounts of red meat are associated with reduced risk of diseases, particularly CHD (coronary heart disease) and type 2 diabetes. However, modelling the consequences of reduced meat consumption are complex and models should also take account factors such as nutritional balance. More attention is needed on specific dietary patterns and nutrient requirements and, because climate change is global phenomenon, country-specific effects of diet, disease patterns, GHG emission factors and even food consumption should be taken into account.

As humans -from biological view - are omnivores, there are no general health risks related to occasional consumption of meat. Reduction of red and processed meat consumption is beneficial leading to reduction of health issues related to high consumption of such food items (i.e. saturated fat found in red and processed meat are linked to cardiovascular diseases, overweight and colon cancer). On the other hand, a complete elimination of meat from the diet could be not completely healthy for specific groups of populations, e.g. children in need of essential amino acids, for which intransigent vegetarianism or veganism is not recommended.

Some demographic groups are particularly at high-risk for obesity and related diseases such as diabetes and these very groups appear to have a greater exposure to unbalance diet including high level of meat consumption.

[9] In the FORENV document the definition of "meat" is unclear. According to the Cambridge Dictionary, meat is the flesh of an animal when it is used for food. In this definition, fish, crustaceans, molluscs, insects, etc. are included. Therefore, insects cannot considered as an alternative to meat, as suggested by the FORENV document.

The high meat consumption in Europe leads to large environmental impacts and in the EU (7% world population) the consumption is 14% of the total in the World (FAO 2013). The effects of global animal farming on the environment are also under scrutiny. Driven by an increase in vegan, vegetarian and flexitarian diets in developed countries, a number of entrenched positions have emerged. The animal science and farming communities are starting to defend the nutritional benefits of meat consumption (especially in children), and downplay the environmental impacts relative to other industries. Concurrently NGOs and consumers are increasingly becoming aware of issues such as animal welfare and sustainability and holding the food and drinks industry to account.

Risks and opportunities

Environment

Potential risks

If this option is considered, large scale production of in vitro meat or protein synthesized may present new risks to the environment (e.g. due to changes in production of raw and consumption materials) and human health (e.g. due to imbalances in the diet)

It is necessary to distinguish between intensive and extensive farming, since the latter is more sustainable, as it depends on the available natural resources. An increased demand for organic products may lead to market unavailability, increase costs and lead to a potential risk related to the need of longer transportation times from production areas to consumer places.

Unknown consequences of the shift to a mainly plant based diet (or insect based) on the EU animal production sector. Possible negative side effects: part of the agricultural surfaces now used for animal forage could be converted to the production of other human food (cereals, fruit, vegetables). This change would probably reduce the total amount of pesticide use but could also produce a shift from herbicides to a higher use of insecticides and fungicides, which are potentially more dangerous, particularly for some important component of terrestrial ecosystems (e.g. pollinator insects, birds) (Fisher and Moriarty,2014; EFSA, 2009). Shifting to the use of alternative protein sources needs regulation and the recognition of consequences on the human health and the environment.

While potentially beneficial in terms of food security, the diversification in the food production system (urban farming, controlled-environment agriculture, aquaculture), also presents emerging challenges. These are due to increasing pressures on some landscapes (e.g. coastal), threats to terrestrial or riverine species, to emerging risks (use of polluted soils and potentially unsafe food, increased demand and generation of plastic waste, increased demand for water), and to an increased use in chemicals, including antibiotics, which are relevant contaminants of surface waters.

Potential opportunities

Changes in land use are one of the potential opportunities. A substantial reduction in meat consumption would reduce the need for forage production. For example, in the Po valley in Italy, one of the most important agricultural areas in Europe, about 70% of agricultural surface is used for the production of animal food. Relevant parts of this land could be used for other purposes, partly for the production of crops for direct human consumption, partly for the recovery of natural conditions, with advantages for natural ecosystems and biodiversity. However, abandoned rural land must be carefully managed in order to avoid negative effects on the land quality (Terres et al., 2013; Derér, 2018; see also issue 9).

The reduction of import of animal feed, potentially containing large quantities of contaminants, is also beneficial in terms of the demand of water in the source of feed production but needs further exploration of associated risks and opportunities for human health and the environment.

Reduction of greenhouse gases emissions is a consequence of reduction of intensive animal farming and of the lower carbon cost of production of a protein from vegetables as opposed to animals. The livestock sector is responsible, to date, for about 14 % of total anthropogenic greenhouse gases emissions (Grossi et al. 2018; FAO, 2017).

Reduction of the use of medicines and the release of other pollutants from intensive animal farming (e.g. antibiotics and other pharmaceuticals, organic matter and nutrients from animal manure), represent a benefit for the environment and consequently a potential decrease in the major issue of antibiotics resistance.

Increase in knowledge concerning the quantification of environmental impacts (but also ethical, cultural and health related) of alternative protein sources to meat, also considering the geographical origin of production.

Human Health

Potential risks

Increasing consumer awareness of the importance of healthy nutrition in relation to systemic health is one of the most important issues to drive health further and can actually be one of the levers to operate the transition at the society level. The transition is not done rapidly. Consumers are increasingly primed with a subtle but clear focus on new consumption patterns. The concern here is how to implement successful strategies to lead current consumers to shift their consumptions habits toward a healthier scheme (i.e. reduced consumption/fasting link to a decrease in ageing degenerative effects). Whilst dietary factors such as high fat, sugar diets and alcohol adversely affected brain health, food components and caloric restriction can help slow down the effect of ageing. Caloric restriction is also known to extend life span, increase resistance to age-related neurodegenerative diseases, and improve memory in healthy individuals (McEvoy et al, 2012).

The young generation which is now exposed to health, nutrition and food safety in a systematic way is going to represent the future consumers and those new/alternative consumption ways will be engrained in their consumption philosophy. The concern here is how to implement successful strategies to lead current consumers to shift their consumptions habits toward a healthier scheme (i.e. reduced consumption/fasting link to a decrease in ageing degenerative effects).

Potential opportunities

Advantages to human health of reduction in red meat consumption could include a reduction of risks associated with high fat diet and consumption of red meat e.g. cardiovascular diseases and colon cancer): this is particularly true for high-income countries and adult populations.

Improvement in meat product quality due to the improvement of animal husbandry practices. The reduced need for large quantities of meat production besides lowering the impacts associated with meat production could also bring improvements in animal welfare (ECA, 2018, EUFA 2018)

Knowledge of the drivers of lower consumption of meat by some groups could help identify paths to promote environmentally friendly options (e.g. low meat consumption) for the consumer purchasing options.

Benefit from the apparent synergies between healthier and low environmental impacts diets to promote consumers change to healthier and low impact diets, aligning also to the UN Sustainable Development goal 12 (responsible production and consumption).

Proposals for linking

Issues 2 and 3 are linked since both deal with consumption, though issue 3 is focussed on meat. Both may also be linked to issue 1.

Issue 4: Digitalisation as a driver for the ecological transition

Introduction

Digitalisation can be understood, in an environmental context, as the creation of 'ubiquitous, geospatial and intelligent systems' that use a combination of advanced digital technologies (e.g. Internet of Things (IoT), big data/analytics, sensors, artificial intelligence) to capture and process 'actionable' information in order to enhance the quality of decision-making. Digitalisation has created opportunities to achieve a more resilient and sustainable environment. Global 'digital participatory platforms' have facilitated more active and inclusive forms of debate about environmental issues, and is expected to play a greater role in setting out requirements for social justice in the development of environmental policy. Smart solutions that incorporate the use of sensors, IoT and big data are being implemented to collect real-time data and inform decision-making about regeneration, environmental protection and social equality. There is also significant interest in the potential to use IoT and big data to coordinate information and material flows in order to establish more productive circular models that support the prevention of waste, as far as possible, and create a more resource-efficient circular economy. The environmental consequences of digitalisation however, are broad, complex and uncertain (e.g. growth in energy use, change in consumer choices and consumption).

General comments

The SCHEER recognises the opportunities which increasing digitalisation ("the digital environment") presents in terms citizen engagement, improved environmental monitoring and earth observations and understanding. However, the SCHEER also recognises that there are issues, not least wider and rapid diffusion of large amounts of superficial and/or incorrect information, social inequalities in terms of who has access to digital resources and also the need for improved education to benefit, and the enormously increasing energy demand as well as the demand for raw materials (e.g. for batteries in electric cars, specific elements for mobile phones). The SCHEER proposes that this issue be described as the digital transformation since digitalisation carries with it suggestions of more managerial aspects.

Risks and opportunities

Environment

Potential risks

Digitalisation carries risks in the high use of energy and of materials like rare metals. Recycling is in most cases down-cycling. Related to this is the dependence on rare and precious metals from unstable areas of the world, stimulating crime, illegal trade, environmental destruction, spread of infectious diseases (e.g. Ebola), loss of human lives and health/environmental consequences of illegal mining. There is also the electronic waste impact (including heavy metals) and impact of ill-managed recycling and waste treatment for obsolete hardware, often far from areas of first use.

Potential opportunities

There are instruments and approaches to empower communities, while using digital technologies, such as Public Participation Geographic Information Systems (PPGIS) or, the Community-Based Disaster Risk Management (CBDRM). This will have the potential to support citizen engagement (see linked issues). There are plenty of opportunities for recycling and re-use which is generally, if managed well, beneficial to the environment.

Human health

Potential risks

In the risk identified by the FORENV document, the emphasis is on allergenicity, but other toxicological risks may be relevant. In addition, the digital transformation carries with it a high risk through provision of misinformation (fake news) on health relevant topics. Digitalisation can break the social cohesion and stimulate the feeling of desolation; it is probably very dependent on how digitalisation is organised to prevent these types of impact. There may be over-dependency on the digital transformation and potential failures could have negative consequences. Most importantly, societal trust requires that there needs to be due attention paid to privacy and ethical issues.

Potential opportunities

None perceived

Proposals for linking

Issues 4, 5 and 10 could be merged because they interact in view of knowledge and education, sustainability discussion and social activism. Social networks are more and more used to set the scene. There is also a connection with issue 7.

Issue 5: An evolution in citizen activism, in particular by the young generation towards environmental justice and sustainability transitions

Introduction

The emergence of social media platforms (related to issue 4 in the digital transformation), largely between 2000 and 2010 (such as Facebook in 2004 and Twitter in 2007), has resulted in a rise of 'new and unexpected forms of collective mobilisation and activism' in particular by 'networked young citizens'.

This emerging issue recognises that citizen activism is not at all new in itself, but that current forms of activism may be differentiated from historic activism due to the prevalence of mobile communication technologies and the emergence of networked young citizens. The most notable recent examples are the climate school strikes since autumn 2018 which have continued in early 2019, and wider issues of climate and environmental justice such as Zero Hour[10] which aims to be a 'movement of unstoppable youth organizing to protect our rights and access to the natural resources and a clean, safe, and healthy environment'

General comments

In the view of the SCHEER, citizen activism is mainly examined through the lens of the digital transformation thus excluding a broader view. This leads to neglect of the standard forms of activism, which continue to be vibrant. The emphasis on the digital dimension puts a spotlight on the role of the young, and diminishes the role of other social groups in activism, including the elderly. e.g. Spain is having a spontaneous and active movement driven by the elderly claiming for a sustainable pension system. It is also worth noting that the long history of environmental activism has resulted in their evolution to political parties, such as the green parties, increasingly important in some countries such as Germany, or from social movements to left-wing parties, such as in Spain with Podemos.

Risks and opportunities

Environment

The rapid diffusion of information obtained through digitalisation (issue 4) favours peaceful mobilization of social movements, e.g. the school strikes for climate in many European countries in 2019 that may have some positive impact on environmental policies. However, environmental regulation may also drive opposition and social mobilization, also supported by rapid communication that may develop -in some instances and members of the activism- into occasional outbreaks of violence (e.g. the movement of gilets jaunes).

Citizen science brings environmental benefits into increased environmental monitoring, potentially translating to improved environmental quality.

Human health

The SCHEER view was that this issue is unlikely to have direct effects on human health (either positive or negative). However, indirectly, citizen science (stemming from digitalisation) may generate health benefits from increased engagement with nature.

Linked issues

Issues 4, 5, 8 and 10 are connected, and related to issues presented in SCHEER (2018) in FORENV cycle 1- including participatory urban planning and green urban design.

[10] http://thisiszerohour.org/ (accessed 26/02/19)

Issue 6: Rising populism and protectionism undermining international cooperation on environmental issues

Introduction

Humanity is increasingly being exposed to environmental and climate related challenges which call for effective management through a coordinated, global response, as reflected in international agreements such as those on climate change and biodiversity (e.g. Montreal Protocol on Substances that Deplete the Ozone Layer in 1987, United Nations Framework Convention on Climate Change in 1992, or the Convention on Biological Diversity in 1992). The recent rise of populist parties in some countries (far-right and radical-left), post-truth politics, and protectionism both globally and in Europe potentially undermines international cooperation and agreements on environmental action required to tackle these issues.

General comments

The SCHEER view is that all measures to counteract or solve global environmental issues have been effective only when adopted by all, or at least the majority of countries worldwide. Relevant examples are the Stockholm Convention for the control of POPs and the Montreal Protocol on Substances that Deplete the Ozone Layer for the control of CFC. Environmental issues (e.g. water resources) are often transboundary and require both political, societal and economic cooperation.

The problem of climate change is even more complex because it is not a simple ban or reduction of the production or emission of chemicals. It involves a substantial change of the world economy and energy production. Therefore, it definitely requires a global and systemic approach to reach tangible goals.

Risks and opportunities

Environment

Potential risks

In the last decades, environmental policies in Europe have been extremely important, in some cases very innovative, changing and improving the overall environmental protection. This is, for example, the cases of the Water Framework Directive and Persistent Organic Pollutants Regulation.

A shift toward populism and nationalism has the potential to have negative consequences, not only on the control of climate change but also on the advancement of other environmental policies (e.g. the US withdrawal from Paris Agreement on Climate Change).

Negative environmental conditions may also drive transboundary migration, adding further burdens to ecosystems and indeed leading to additional conflicts, which may also be drivers of migration.

Potential opportunities

The SCHEER perceive few potential opportunities associated with this issue, but do note that emphasis on protectionism and promotion of local scale economies may favour locally produced consumer goods and food which may be translated to positive environmental effects due to lower energy consumption/transport needs.

Human health

Potential risks

The SCHEER would also support the view that some environmental risks (whether global or regional) are frequently associated with human health risks (e.g. infectious diseases, lack of hygienic conditions, stress). Climate change and insufficient access to drinking-water are likely to be important drivers.

Potential opportunities

No perceived additional opportunities.

Proposals for linking

It is the opinion of the SCHEER that issue 6 is connected directly to issue 9: Intensification of conflicts about natural resources and other environmental causes of migration.

Issue 7: Cities as labs for sustainability transitions- harnessing innovations through science-society partnerships

Introduction

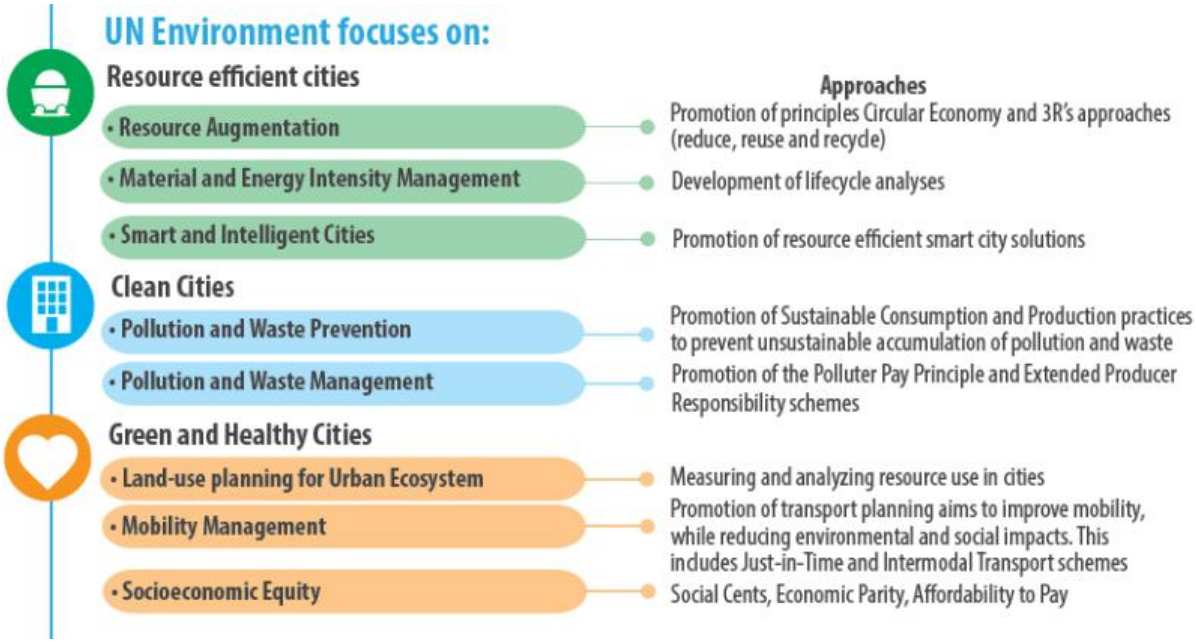
The focus of this emerging issue concerns the use of cities or parts thereof as laboratories to develop 'protected spaces' where experimental new systems can take shape (examples of ecovillages and urban living labs (ULL) are specifically mentioned), though the focus of the issue remains on the ULL. The ULL is considered as a critical form of intervention, in delivering sustainability goals for cities. Key ULL concepts include 'science-society' collaborative experiments to find novel pathways for cities (or parts thereof) to transition to environmentally sustainable, liveable and prosperous urban areas.

ULLs confine an experiment to a small, manageable scale, to provide evidence of possible solutions to environmental and socio-economic challenges.

General comments

The SCHEER debated the title of the issue specifically mentioning cities but then in the main body of the text having a focus only on ULLs, which can be interpreted in a very narrow sense. The SCHEER is of the view, that a focus on urban sustainability, cities and urban planning is essential, since increasingly more and more of the global (and European) population is based in cities.

Cities as labs for sustainability transitions can in the broadest sense be linked to sustainable cities and UNEP https://www.unenvironment.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/sustainable-cities have written extensively concerning sustainable cities, and the diagram below shows some of the areas of specific focus



There is a well recognised push towards blue/green infrastructure to mitigate climate change and smart transport developments (all of which could also support engagement with nature and with positive health benefits). The SCHEER regards the issue of sustainable cities as encompassing issues beyond ULL, which operate in a specific local context, and therefore requires insights about how solutions and findings can be upscaled beyond local. The digital transition and the concept of the smart city is being increasingly adopted with many global cities, as being part of the World Alliance for Low Carbon Cities (https://www.walcc.org/), the

Covenant of Mayors for Climate and Energy and the Smart City Alliance (https://thesmartcityalliance.eu/om/) with objectives of more efficient resource use (both natural and social/political). However, SCHEER considers that issue 7 is too much focused on urban living labs (ULL) not fully exploring the understanding that the city itself may be a laboratory, where data are generated to inform on management and intervention decisions. This can go from the scale of a building (or center), to the neighbourhood, the district, in connection with the surrounding area and with its carbon footprint area, e.g. upstream-downstream partnerships to gain water security. Other examples of sustainability transitions and innovations in an urban setting include: eco-districts, Transition towns, Circles of sustainability, Transit-oriented development, City Blueprint[11], Rainproof cities[12] (Dai et al, 2018, Isaksson and Heikkinen, 2018).

Risks and opportunities

Risks- general

A general threat to both environment and human health is whether the process of ULL gains in popularity, in a context of fixed and rather limited resources for sustainability urban science, resulting in fewer resources being allocated to large-scale (e.g., multicentric) projects, which because of an increased sample size, may have sufficient statistical power to provide valid conclusions that can be extrapolated to other cases. A collection of independently-designed city-specific experiments may not allow efficient synthesis and meta analysis. In some cases the experiment may be city specific, and not generalisable to other cities in the world. There must be room for all approaches to exist and for considerations on study size to be thoroughly discussed before the ULL is started. In the case of initiatives that are beneficial for human health and environment, there is here a great opportunity for such positive initiatives to spread more quickly within the EU.

Environment

Potential risks

Increasing urbanization is driving processes (with the creation of urban regions and megacities) that increase the complexity of managing natural resources, energy sources, quality of life and governance.

Urban planning and governance of natural resources tend to be silo-ed, so that the solution to one issue may exacerbate another issue. Environmental policy levers therefore need to become more integrated and to downscale to city level. ULLs are described as a key form of intervention, in delivering sustainability goals for cities to potentially deliver solutions to this complexity but if they are not designed to be replicated, then limited benefits will be gained.

Urbanisation may also lead to disengagement from nature (see issue 8) by citizens.

Potential opportunities

Many of the initiatives and examples cited in the FORENV document are focussed on environmental issues such as (global/urban) warming, managing natural resource, decarbonising transport, energy efficiency and green space. The SCHEER endorses these issues and identifies environmental benefits, including decarbonisation, improved recycling

[11] https://www.eip-water.eu/sites/default/files/E-Brochure%20City%20Blueprint%20(v5).pdf and https://www.eip-water.eu/City_Blueprints

[12] https://www.rainproof.nl/

(e.g. of water), better air quality, managing urban temperatures, developments in urban agriculture and better engagement with nature by citizens in an open, inclusive, and collaborative approach. The increasing development of pedestrian zones are regaining urban space for the citizens, inducing healthier behaviour with less use of car, walk and social interaction, less pollution. In most cases it started as an experiment, since business owners are always reluctant to take this direction. In this context, the green and healthy city Living labs are generally known as a way to manage innovation processes. ULLs may offer encouragement to citizens to become engaged with their environment.

Human health

Potential risks

Increased concentration of populations in the cities could bring increased risk of spreading infectious diseases. Demographic concentrations in cities may as well potentiate social inequalities through unequal access to resources and facilities.

The collection and use and potential mis-use of individual information/data requires protection of individual privacy which, if not pursued, may contribute to human health issues (e.g. access to health registries).

Potential opportunities

No additional opportunities identified

Linked issues

The SCHEER is of the view that issues 7 and 8 (A new narrative for nature in an urbanised, digital world: Disconnecting and reconnecting people to their environment) are connected and also link with issue 4 (digitalisation but in the specific sense of the growing narrative concerning smart cities),

Issue 8: A new narrative for nature in an urbanised, digital world: Disconnecting and reconnecting people to their environment

Introduction

The issue is described and set in the context of an increasingly urban population and a world that is becoming more digital, effects of which include progressively distancing and disconnecting ourselves from nature. Presently, societies and individuals are increasingly valuing the positive effects that contact with nature and biodiversity may have on us. These positive effects range from improving our mental health to strengthening our physical condition, for example, through more active lifestyles, often implied (or facilitated) by closer contact with nature. Indicators such as lower levels of obesity, blood pressure or reduced stress and depression rates, have all been observed by researchers working in this field.

There are in the opinion of the SCHEER some additional connections to issues 4, 5 and 7. In addition, there are other topics that should be discussed in this issue, specifically around urban planning and the design of the city (in order to make space for nature), conservation of biodiversity, the role of blue/green infrastructure which are only touched briefly in issue 7.

The dialogue concerning digitalisation is mixed in terms of the use of the digital environment changing the societal structures and behaviours ("couch potatoes"), the educational benefits (access to new experiences, 3-D interactions and gaming). Additionally, urban farming (schools, city), botanic gardens or arboretum, and the connection of urban biodiversity with the surrounding biodiversity are approaches recognised as being increasingly important. E.g. LBSAP (Local Biodiversity Strategies and Action Plan). Activities and occasional events to engage people with the natural world around them, by accessing new technologies (digital, online and mobile), and hands-on, play-orientated experiences with – and in – nature are highlighted.

Risks and opportunities

Environment

Potential risks

The conceptual differences between the risks and opportunities described in the FORENV document are unclear. Indeed, in both cases, disconnecting from nature is described as a risk that needs to be counteracted. The opportunities are not related to disconnection from nature but derive from actions aimed to reconnect with nature, including the digital changes (which have both risks and opportunities).

A risk that is understated is the loss of awareness of nature conservation, and includes lack of knowledge about ecosystem services (e.g. delivery of clean water, clean air, food sources) and how important these are for the survival of humans.

Potential opportunities

Reconnecting to nature is judged as overwhelmingly positive.

Human health

Potential risks

In the case of digitalisation, there is the potential to disconnect children from nature, with negative impacts: obesity, physical strength and vitamin D deficiency-induced diseases such as rickets, shortsightedness and asthma. The urban growth and loss of green spaces, modern sedentary, indoor lifestyle, seem to contribute to higher health morbidity, mostly in children during developmental stages.

Potential opportunities

A direct connection with nature delivers mental health benefits in all ages.

Links to other issues

Issue 7 and 8 as well as issue 6 (citizen activism) and issue 4 are closely connected.

Issue 9: Intensification of conflicts about natural resources and other environmental causes of migration

Introduction

Natural resources related to formal or informal industrial extractive activities (e.g. oil, minerals, diamonds, timber) have been frequently associated with large-scale conflicts, and local conflicts are increasingly being linked to competition for resources such as land and water. With ever increasing demand for resources, global population growth, economic development and climate change, local as well as cross-border conflicts may intensify, leading to increased conflicts induced by forced or involuntary displacement[13].

In addition to their role in fuelling conflict, climate and environmental change, affecting for example water availability and soil fertility, may also represent important causes of internal and international displacement. Accelerating climate and environmental change may lead to increased displacements in coming years.

While environmental challenges may aggravate the potential for conflict, causes of unrest are extremely complex and uncertain, including a variety of social, economic and political factors.

General comments

In the views of the SCHEER, the relevance of this issue is enormous because it deals with one of the major challenges for humanity in present time. The potential opportunities and risks identified in the issue characterisation are clear in the FORENV document however, SCHEER has identified a few potential additional risks and opportunities.

Environment

Potential risks

Increases in migration will also result, in some areas, in growing pressures on environment resources (with increasing demands for food, consumer goods, water, land and housing, etc.). Water as the primary resource for survival, is not sufficiently highlighted.

Potential opportunities

Migration leads to low density of populations in rural areas, and then induces increase biodiversity (this has been seen in some regions where long lasting conflicts led to increases in wild life stocks). However, in some cases, the uncontrolled abandonment of rural areas may lead to serious problems such as biodiversity loss, increase of fire frequency and intensity, soil erosion and desertification, loss of cultural and/or aesthetic values, reduction of landscape diversity and reduction of water provision (Rey Benayas et al, 2007; Shengfa and Xiubin, 2017). Therefore, suitable management actions and programmes must be developed to avoid that a potential opportunity for the environment would be transformed in a risk for human society and the environment (Dérer, 2018).

Human health

Potential risks

[13] In studying forced or involuntary migration—sometimes referred to as forced or involuntary displacement—a distinction is often made between conflict-induced and disaster-induced displacement. Displacement induced by conflict is typically referred to as caused by humans, whereas natural causes typically underlay displacement caused by disasters [6- Migration data portal, 2019]

Migrations may affect the resurgence of illnesses that in past decades have been substantially reduced (e.g. malaria) and introduce diseases which may be new in certain regions (through vectors dissemination). It is also predictable that the migrants may naturally gravitate to the cities searching for better living conditions and work opportunities.

Potential opportunities

No additional opportunities identified

Links to other issues

The SCHEER identified that this issue and issue 6 are strongly related.

Issue 10: New forms and approaches to the management of knowledge, education, and skills required for sustainability transitions

Introduction

Human activities continue to have far-reaching impacts on the environment (e.g. biodiversity loss, climate change, pollution, etc.) with increasing acknowledgment that a new knowledge base and forms of knowledge management, new education models and the development of new skills, and approaches for teaching these new skills across sectors, industries, and environmental-based professions are required for sustainability transitions. New skills are needed around systems thinking, interdisciplinary working and participatory governance, and there is a need to understand the benefits, costs and risks of transformational activities across systems, as 'there is a gap between established monitoring, data and indicators and the knowledge required to support transitions'.

General comments

The SCHEER have not identified additional risks or opportunities for the environment and human health. The SCHEER supports the views that different forms of education and knowledge transfer should be championed e.g. community education is necessary to disseminate knowledge at the community level, raise awareness, and promote public participation. TVET (technical and vocational education and training), should be promoted in the working place due to two trends: an aging society and the transition to a more digital society and automation that will reduce jobs in the current economy and create new jobs with new skills required. There is a need to strengthen lifelong learning to increase the opportunities of workers to adapt. Concerning STEM education, it seems to be too restrictive, and other disciplines that may provide knowledge about the contextual understanding are set aside. Thus, STSE (science, technology, society and environment) provides a better framework (Steele et al., 2012). The culture of interdisciplinarity should be strengthened within the academy, since despite being formally formulated, it is not put into practice in most of the cases.

Risks and opportunities

Although no specific risks or opportunities were identified for issue 10, the issue carries in itself a large opportunity for the environment and human health, as it describes the necessary 'new' forms and approaches to manage knowledge and education for sustainable transition. To enable transition to a healthy society in an ecological viable Earth, critical and competent citizens are required to regain the connection between ourselves and the environment (Wals, 2015). To reach this sustainable transition, not only knowledge, skills, and attitude transfers are needed but also ICT (information, communications and technologies) - based products and services to facilitate intercommunication and influence society to behave (and think) systemically.

A decade ago, it has been noted in STRN (2010) that the interaction of our societies with nature, such as climate change and loss of biodiversity requires deep structural changes in key areas of human activity, including transport, energy, agriculture, and other systems.

A new academic/scientific field– modelling sustainable transition – to assess the risks and/or opportunities to human health and environment generated from unexpected interactions has been created (Köhler, 2018).

Links to other issues

The issue is relevant and is connected with many others (e.g. Issue 4, 5 and 8).

3.4. Assessment of the relevance and prioritisation

In order to answer to the third question of the Term of Reference, instead of defining a precise ranking of the ten issues on the basis of environmental and human health impact, the procedure followed by the SCHEER was to classify the issues into three classes of high, moderate and low impact on environment and human health. For some issues it was challenging to define a precise position in a ranking from one to ten; the proposed procedure, while simpler, avoids a false precision in the ranking and controversial borderline positions.

In detail, all members of the SCHEER were asked to classify the ten issues as of high, moderate and low impact on environment and on human health. Then, a score was given to the issues according to the classification of individual colleagues (3 for high impact, 2 for moderate, 1 for low). The scores were summed up to give a total score. The range from the minimum and the maximum possible scores was divided in three classes corresponding to the final classification of the issues, reported in Table 1.

Table 1. Classification of the ten issues into the three impact classes for the environment and human health.

	Environment	Human health
High impact	1, 2, 3, 9	1, 2, 3, 9
Moderate impact	4, 6	4,6
Low impact	5, 7, 8, 10	5, 7, 8, 10

3.5. Conclusions

The SCHEER recognizes that all issues are of great importance from a social, political and economic point of view. Some of them are also of great relevance considering the potential impact (either positive or negative) that they may have on the environment and/or on human health. However, the issues are very much at the interface between social, political, and environment and human health. As a result, the risks and opportunities for environment and human health are often indirect.

The SCHEER agrees with the risk and opportunities identified, for all issues, in the FORENV document. However, a number of additional risks and opportunities, specific to the environment and human health, have been identified and described.

As for a ranking of their relevance, the following issues are considered of very high impact on both environment and human health:

1. Environment policy and social cohesion: Addressing inequalities in the transition towards a carbon-neutral circular economy
2. Diversification of consumption patterns: A potential pull for market change towards reduced overall consumption
3 Environmental risks and opportunities associated with emerging and changing dietary patterns: reducing meat consumption and alternative protein sources

9. Intensification of conflicts about natural resources and other environmental causes of migration

In particular, for issues 2 and 3 a prevailing positive impact is recognised for both environment and human health, although some possible negative consequences are possible. However, at the moment, due to the complexity of potential rebound effects associated with either the diversification/reduction of goods and food (especially meat) consumption, the impact is difficult to quantify. Issue 1 may also have mainly positive impacts. However, careful management is needed to avoid negative consequences strengthening inequalities in the transition toward a carbon-neutral circular economy.

In comparison to other issues, the impact of issue 9 is mainly negative. Even some potential opportunities may be transformed to risks if not adequately managed and this management may be particularly complex in developing countries.

4. MINORITY OPINIONS

None expressed.

5. METHODOLOGY USED

For each issue, the SCHEER members were asked to identify any additional risks and opportunities specifically focussing on human health and the environment. Finally, they were asked to consider the links between the different issues.

In terms of prioritisation, instead of defining a precise ranking of the ten issues, the SCHEER members were asked to classify the issues into three classes of high, moderate and low impact on environment and human health. Then, a score was given to the issues according to the classification of individual colleagues (3 for high impact, 2 for moderate, 1 for low). The scores were summed up to give a total score. The range from the minimum and the maximum possible scores was divided in three classes resulting in the final classification.

6. REFERENCES

Altieri, M.A., Nicholls, C.I., Henao, A., Lana, M.A., 2015. Agroecology and the design of climate change-resilient farming systems. Agron. Sustain. Dev. 35, 869–890. doi:10.1007/s13593-015-0285-2

C. Francis, G. Lieblein, S. Gliessman, T. A. Breland, N. Creamer, R. Harwood, L. Salomonsson, J. Helenius, D. Rickerl, R. Salvador, M. Wiedenhoeft, S. Simmons, P. Allen, M. Altieri, C. Flora & R. Poincelot (2008) Agroecology: The Ecology of Food Systems, Journal of Sustainable Agriculture, 22:3, 99-118, DOI: 10.1300/J064v22n03_10

Dai L, Wörner R &. van Rijswick H, (2018) Rainproof cities in the Netherlands: approaches in Dutch water governance to climate-adaptive urban planning, International Journal of Water Resources Development,34:4, 652-674, DOI: 10.1080/07900627.2017.1372273

Dérer P. (2018). Rethinking depopulation and land abandonment – the opportunity of rewilding. The Overpopulation Project. https://overpopulation-project.com/rethinking-depopulation-and-land-abandonment-the-opportunity-of-rewilding/

ECA – European Court auditors, 2018. Animal welfare in the EU: closing the gap between ambitious goals and practical implementation, available at https://www.eca.europa.eu/Lists/ECADocuments/SR18_31/SR_ANIMAL_WELFARE_EN.pdf, accessed in the 10th July 2019.

ECAT (EU Ecolabel Catalogue), 2019. Available from http://ec.europa.eu/ecat/, accessed in 29 june 2019.

EFSA (European Food Safety Authority) 2009. Guidance Document on Risk Assessment for Birds & Mammals on request from EFSA. EFSA Journal 2009; 7(12):1438. doi:10.2903/j.efsa.2009.1438. Available online: www.efsa.europa.eu

EUFA - Eurogroup for animals, 2018. Animal welfare, available at http://www.eurogroupforanimals.org/wp-content/uploads/2014/12/9.9.2015-GPP-briefing-updated-for-website.pdf, accessed in the 10th July 2019.

FAO. 2017. Global Livestock Environmental Assessment Model (GLEAM). Food and Agriculture Organization of the United Nations (FAO). Available from www.fao.org/gleam/en

FAOstat 2013. Food and Agriculture Organization of the United Nations, Statistic Division. Food Balance Sheets, available at http://www.fao.org/faostat/en/#data/FBS, accessed 10.06.2019.

Fisher D, Moriarty T. (eds.) (2014). Pesticide Risk Assessment for Pollinators. Society of Environmental Toxicology and Chemistry (SETAC). Wiley Online Library. ISBN:9781118852521

Grossi G., Goglio P., Vitali A, WilliamsAG (2018) Livestock and climate change: impact of livestock on climate and mitigation strategies Animal Frontiers, 9, 69-76

Hobbs, P. R., Sayre, K., & Gupta, R. (2008). The role of conservation agriculture in sustainable agriculture. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, *363*(1491), 543–555. doi:10.1098/rstb.2007.2169

IPCC, 2019: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press.

Isaksson K., Heikkinen S. (2018) Sustainability Transitions at the Frontline. Lock-in and Potential for Change in the Local Planning Arena Karolina. Sustainability, 10, 840

Köhler J., de Haan F., Holtz, Kubeczko G., Moallemi K., Papachristos E., Chappin E. (2018) 'Modelling Sustainability Transitions: An Assessment of Approaches and Challenges' Journal of Artificial Societies and Social Simulation 21: 8 <http://jasss.soc.surrey.ac.uk/21/1/8.html>. doi: 10.18564/jasss.3629

McEvoy, C. T. et al. (2012). Vegetarian diets, low-meat diets and health: a review. Public Health Nutrition, 15: 2287–2294.

Rey Benayas J.M., Martins A., Nicolau J.M., Schulz J.J. (2007). Abandonment of agricultural land: an overview of drivers and consequences. CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources 2007 2, No. 057, 1-14. doi: 10.1079/PAVSNNR20072057

Rotmans & Loorbach 2009 . Complexity and Transition Management. Journal of Industrial Ecology, 13, 184–196. [doi:10.1111/j.1530-9290.2009.00116.x]

SCHEER (Scientific Committee on Health, Environmental and Emerging Risks) (2018) Statement on emerging health and environmental issues (2018), 20 December 2018.

Sen A. (1999). Development as Freedom. New York: Oxford University Press. ISBN 9780198297581.

Shengfa L., Xiubin L.. 2017. Global understanding of farmland abandonment: A review and prospects. Journal of Geographical Sciences, 27 (9): 1123- 1150.

Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B.L., Lassaletta, L., De Vries, W., Vermeulen, S.J., Herrero, M., Carlson, K.M., Jonell, M., Troell, M., DeClerck, F., Gordon, L.J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., Godfray, H.C.J., Tilman, D., Rockström, J., Willett, W., n.d. Options for keeping the food system within environmental limits. Nature.doi:10.1038/s41586-018-0594-0

Steele A., Brew C.R. and Beatty, B.R. (2012). The tower builders: A consideration of STEM, STSE and ethics in science education. Australian Journal of Teacher Education, 37: 118-133

STRN (2010) A mission statement and research agenda for the Sustainability Transitions Research Network: http://www.transitionsnetwork.org/files/STRN_research_agenda_20_August_2010(2).pdf

Terres J., Nisini L., Anguiano E. (2013). Assessing the risk of farmland abandonment in the EU. JRC Scientific and policy reports. European Commission Joint Research Centre Institute for Environment and Sustainability. doi: LB-NA-25783-EN-N

van der Veen, R.A.C., Kisjes, K.H., Nikolic, *I., 2017. Exploring policy impacts for servicising in product-based markets: A generic agent-based model,* Journal of Cleaner Production, *145 1, pp. 1-13,* https://doi.org/10.1016/j.jclepro.2017.01.016

Wals A.E.J. (2015). Beyond unreasonable doubt. Education and learning for socio-ecological sustainability in the Anthropocene. Wageningen University. http://library.wur.nl/WebQuery/wurpubs/494121

WHO (2018) Circular economy and health: opportunities and risks. ISBN 9789289053341

Yip, C. (2013). Systematic review of reducing population meat consumption to reduce greenhouse gas emissions and obtain health benefits: effectiveness and models assessments. Int J Public Health, 58:

Zink, T., Geyer, R., 2017. Circular Economy Rebound, Journal of Industrial Ecology 21, 3, pp. 593-602, https://doi.org/10.1111/jiec.12545

7. LIST OF ABBREVIATIONS

BFR	Brominated flame retardant
BPA	Bisphenol A
CBDRM	Community-Based Disaster Risk Management
CFC	Chloro-fluoro carbons
CHD	Coronary heart disease
COST	European cooperation in science & technology
DG ENV	Environment Directorate-General of the European Commission
DPSIR	Driver-Pressure-State-Impact-Response
DYI	Do-It-Yourself
EEA	European Environmental Agency
EKC	Environment Knowledge Community
FORENV	Foresight system for the systematic identification of emerging environmental issues
GDP	Gross Domestic Product
GHG	Greenhouse gases
GIS	Geographic information system
ICT	Information and Communication Technologies
IoT	Internet of Things
LBSAP	Local Biodiversity Strategies and Action Plan
LED	Light-Emitting Diode
NGO	Non Governmental Organisation
PPGIS	Public Participation Geographic Information Systems
PVC	Polyvinyl chloride
SCHEER	Scientific Committee on Health, Environmental and Emerging Risks
STSE	Science, technology, society and environment
TVET	Technical and vocational education and training
UAV	Unmanned Aerial Vehicle
ULL	Urban Living Labs