Brief for GSDR – 2016 Update

Sustainability in a changing world: integrating human health and wellbeing, urbanisation, and ecosystem services

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There is an urgent need to address interlinked sustainability issues in a world challenged by inequality, finite resources and unprecedented changes across Earth's systems. As Future Earth Fellows[1], based on our collective expertise in a diverse range of sustainability issues,[2] here we identify a specific need to recognise and respond appropriately to the nexus between human health and **w**ellbeing[3], **u**rbanisation, and **e**cosystem services (the '**WUE nexus**'). This nexus is a priority area for research, policy and practice. In particular, it provides a useful pathway to meet the challenges of successful implementation of the Sustainable Development Goals (SDGs). In this brief, we present the following policy recommendations:

1. By emphasising urban-rural linkages, foster an integrated approach to ensure food security, food safety, and health promotion;
2. Secure resilient livelihoods for all, in particular for vulnerable groups; and
3. Integrate co-production of knowledge in science for decision-making, including the co-design of implementation frameworks, and the adoption of a nexus approach.

Introduction

Sustainability issues are interlinked.[4] Nexus thinking acknowledges this and provides a useful approach to focus on functional interdependencies between issues that are usually treated separately. Nexus thinking is emerging as a way of tackling 'super wicked' sustainability problems;[5] one example is the water-energy-food nexus.[6] With urbanisation

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[1] See Annex 1

[2] See Annex 2

[3] Wellbeing here is addressed together with human health. Health is still too often considered a side-topic in sustainability discussions and so it is necessary to emphasise the link between global environmental change and its impacts on individuals and communities in this context.

[4] E.g., the SDGs are all interlinked.

[5] 'Super wicked' problems refer to problems that are complex, multifaceted and multi-linked. The feedbacks that occur across these interconnected issues mean that the problem can be exacerbated and perverse outcomes can arise if an area or issue is tackled in isolation.

[6] Detailed information about the water-energy-food-nexus is available from the Nexus Resource Platform, www.water-energy-food.org, and the Nexus Network, www.thenexusnetwork.org. As an example, that nexus captures how attempts to

unfolding as a core sustainability challenge,[7] we argue that the nexus between human health and wellbeing, urbanisation, and ecosystem services (Figure 1) is critical.

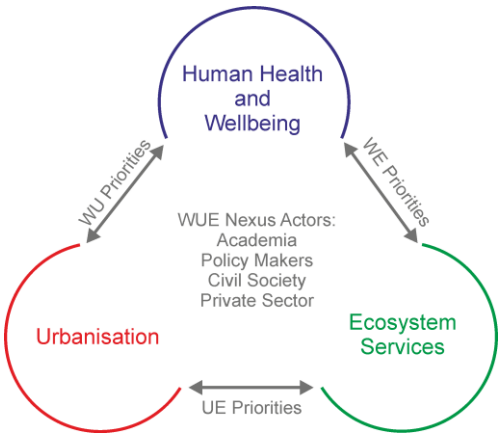

Figure 1. *The nexus of human wellbeing (W), urbanisation (U) and ecosystem services (E)*

A focus on urbanisation is not limiting the nexus to urban environments, rather, it reflects the impact of urbanisation on both urban and rural communities and the linkages between them. Food systems – an example of the crucial connections between urban and rural areas – are among our key priorities.

It is not within the scope of this brief to elaborate a comprehensive overview of the WUE nexus, and Annex 2 provides further information on areas that need to be addressed with high priority. This brief focuses on three key policy recommendations arising from consideration of the nexus.

Policy recommendation 1: By emphasising urban-rural linkages, foster an integrated approach to ensure food security, food safety, and health promotion.

Our rapidly urbanising world presents both challenges and opportunities for more sustainable societies. One major concern is that the emphasis on urban issues may risk further marginalising rural communities. Ensuring farmer livelihoods[8], including those of small scale producers, is a vital element of sustainable food systems. We therefore call for a renewed focus on urban-rural linkages.[9]

Food security and food safety are interrelated but not identical goals. There is therefore a clear need to consider all aspects of food safety more closely: both for producers and consumers. The use of potentially toxic chemicals in agriculture differs between regions; thus, there is need for analytical capabilities for tracking chemical residues and contaminants in food, especially in developing countries. There is also an urgent need to better consider the health implications of our food and the dual burden of malnutrition associated with nutrition transitions.[10] Particular concerns include obesity[11] and micronutrient deficiencies[12] among children. Moreover, the functional roles of food in preventing and managing health problems, beyond basic nutrition, should be a top priority in the food sector.[13] Food waste warrants continued efforts; however, the prevailing focus on the quantification in assessments needs to be complemented by qualitative analysis.[14]

improve energy sustainability via biofuels exacerbated the issue due to more pressure on food and water resources.

[7] Already more than 50% of the global population lives in urban centres, which will rise to 66% by 2050 (UN DESA 2015).

[8] Livelihood refers to "The resources used and the activities undertaken in order to live" (assets can be categorized as human, social, natural, physical, or financial) (IPCC WG2 2014).

[9] E.g., 'rural-urban partnerships' can create synergies (OECD, 2013);

[10] See e.g. Popkin et al. (2012)

[11] See e.g. Ng et al. (2014)

[12] See e.g. Swaminathan (2015)

[13] See Bigliardi & Galati (2015)

[14] E.g., the environmental impact of wasting different foods varies drastically (FAO 2013).

Policy recommendation 2: Secure resilient livelihoods for all, in particular for vulnerable groups.

Our increasingly interconnected, global social and environmental networks risk our capacity for sustainable development by exacerbating vulnerabilities.[15] Therefore, there is an urgent need for advancing quantifiable indicators for situating the concept of resilience within international developmental objectives, such as the adaptability and security of livelihoods.[16]

The ability of vulnerable populations[17] to sustain their livelihoods and wellbeing is a key component of the WUE nexus. This includes greater consideration of the urban poor, who are increasingly vulnerable to the combined impacts of climate change, environmental hazards and limited economic opportunities. Marginalisation and disenfranchisement of these groups exacerbates tenuous living conditions.[18]

Given the predicted increase in frequency and intensity of extreme weather events,[19] further progress is required for tools and indicators to advance and measure disaster risk reduction. This includes quantifying potentially reduced exposure and vulnerability to natural and man-made hazards (of currently around 200 million annual victims[20]) by improving communities' resilience through hard (e.g. infrastructures) and soft (e.g. early warning systems) measures.

Prevention of infectious diseases remains a priority.[21] For instance, the recent outbreak of the Ebola Virus Disease (EVD)[22] illustrates the unsustainable urban demographic dynamics and lack of infrastructures in countries in Africa and other developing regions. Our limited understanding of the geography and distribution of slums, coupled with inadequate access to basic health and sanitation services for urban populations, were some of the reasons that impeded a swift response at the onset of EVD. A sustainable recovery from the EVD and the prevention of similar health crises in the future requires the factoring in of urban health vulnerability and wellbeing issues to urban policy and governance. At the same time, the impact of human activities on ecosystems warrants detailed evaluation due to the close link between human health and the environment.[23]

[15] Such vulnerability can be to financial shocks, political instability, technological divides, environmental degradation, and climatic impacts.

[16] Livelihood resilience means the capacity of people to sustain and improve their opportunities and wellbeing despite disturbances (Tanner el al. 2015). Application of resilience in international development is further evolving (Barrett & Constas 2014); this also requires to better understand the system trade-offs between resilience on one hand and resource efficiency and economic welfare on the other (Kharrazi et al. 2014).

[17] Particularly high vulnerability is given where livelihoods depend on land and other natural resources (farmers, fishermen) and where capacity to migrate is limited (Ayeb-Karlsson et al. 2015).

[18] See e.g. McNamara et al. (2015)

[19] See IPCC AR5 (IPCC WG2 2014)

[20] 199.23 million average annual victims were reported in 2004-2013 (Guha-Sapir et al. 2015); the reported damages from natural disasters in 2004-2013 amount to an annual average of USD 162.5 billion (Guha-Sapir et al. 2015)

[21] Infectious diseases are one but not the single major health issue. Growing rise of non-communicable disease (NCD's) is observed in developing countries as well, and in many countries we see a double disease burden, with both NCD's and infectious diseases being prevalent at the same time (Popkin et al. 2012).

[22] EVD is an old disease that was contained in rural Africa for decades (WHO 2015). It became a global health issue due to its transmission chains in urban areas in 2014. The urban spread highlights the lack of community involvement at the early stage of outbreak and poor basic infrastructures (health, water supply, sanitation, waste management).

[23] E.g., land use change/ forest fragmentation is a risk factor for EVD outbreak in Africa (EFA 2015).

Policy recommendation 3: Integrate co-production of knowledge in science for decision-making, including the co-design of implementation frameworks, and the adoption of a nexus approach.

The responses of complex social-ecological issues, such as the WUE nexus, to human interventions and impacts are non-linear, partially uncertain and very hard to predict. Management and regulatory approaches however operate under the false assumption of ecological equilibrium[24] and often fail to take into account multi-sectoral interactions. The ability to adequately address the actual level of complexity and to link participatory processes, envisioned futures and decision-making is central to the development of more sustainable societies.[25] This will require the active engagement of all global citizens, to better understand how and in what context sustainable (inclusive, just, ecological, economical) outcomes are co-produced by integrative groups of practitioners, researchers, policymakers and community members. Inter- and transdisciplinary approaches facilitate knowledge co-production and co-design of practices for sustainability actions. This needs to be expedited by a citizen-centred policy that embraces a multiplicity of perspectives and modes of action to catalysing change. At the same time there is the need for systems thinking in the design and implementation of legal and institutional frameworks and a greater appreciation of the interconnected nature of the complex sustainability issues that decision-makers seek to regulate.

Nexus thinking necessarily requires a high degree of interdisciplinarity, but equally of transdisciplinarity. Transdisciplinarity is gaining considerable attention, but this is currently still much at the theoretical and conceptual level, especially in academia.[26] We emphasize that both academia and policy makers need to make progress in sustaining productive dialogues.

Issues for further consideration

People and human-environment interactions are central to the triad of **w**ellbeing, **u**rbanisation and **e**cosystems. Applying the SDGs in practice, developing effective assessment and evaluation frameworks and case study narratives for better practices in implementation are central challenges.[27] The outlined WUE nexus thinking is one potential pathway to meet these challenges.

In a globalized world, our local actions have a global impact. In the context of building capacity for a more sustainable world, further progress is necessary to understand the WUE nexus, from local to the global level.

We believe that a nexus approach is also required for issues not explicitly addressed in this brief if we are to cope with the scale of sustainability concerns that are facing us. This implies governance that is integrative across institutions and organisations, sectors, scales, levels, and geographies.

[24] Kim & Mackey (2014)

[25] This emphasizes the need to embrace and proactively confront complexity as a key attribute of progress towards sustainability. Attempts to reduce complexity and simplify contexts can lead to blind spots in our knowledge and on our agendas.

[26] See e.g. Rivera-Ferre et al. (2013)

[27] Case studies need to be understood with their own multiple conditions. Blueprint approaches aiming at simple replication of 'best practices' are unlikely to be successful. Analysing the conditions for transferability of knowledge needs to recognise and conserve the context-specificity, especially when aggregating knowledge across cases to identify 'better practices'. 'Best' versus 'better practices' is discussed, for example, by Brunner (2014), however, further progress in understanding relevance for practice is necessary.

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ANNEX 1 – The Future Earth Fellows

The Future Earth Fellows are an interdisciplinary group of around 90 early and mid-career researchers from around the world who were selected to participate in one of the Future Earth Networking Conferences for Young Scientists at Villa Vigoni in Menaggio, Italy, in 2013, 2014 and 2015. Future Earth, the International Social Science Council (ISSC), the International Council for Science (ICSU), and the German Research Foundation (DFG) sponsored these conferences. Whilst being at the scientific forefront of sustainability research, the Future Earth Fellows also bring the perspective of a new generation of researchers and professionals across a range of sectors and disciplines.

More information is available from ISSC (www.worldsocialscience.org/activities/networking-conferences-for-young-scientists/) and Future Earth (www.futureearth.org).

ANNEX 2 – Emerging priority areas

In the process of generating content for this brief, Future Earth Fellows were asked to identify one or two areas that were not sufficiently addressed in sustainability governance, research, and practice. The contributions related to three main themes – human health and wellbeing, urbanisation, and ecosystem services. These themes are identified as the wellbeing, urbanisation, and ecosystem services nexus, or WUE nexus.

The raised areas are listed in the following in the context of the WUE nexus. While this provides insights into some of the complexity of the nexus, it was not our aim here to elaborate a comprehensive frame of the WUE nexus, and consequently we did not focus on major research themes or prominent topics on policy agendas. Furthermore, the identified areas reflect the areas of expertise and/or stem from the fields of activities of the Future Earth Fellows, which spans a wide range, but is by no means a systematic cross-section of all sustainability- and development-related research.

It is a work in progress to better understand and apply the WUE nexus. Some areas need to be primarily tackled by research communities while others are equally relevant for research, policy agendas, and practice.

In this Annex, an inclusive listing of Fellows' topics are organized (in no particular order) into examples of main interconnections between each core component of the nexus as follows: Wellbeing-Urbanisation (WU), Wellbeing-Ecosystem services (WE), Urbanisation-Ecosystem services (UE), and finally, in a forth box, crosscutting issues of nexus thinking in the context of the three-pronged WUE nexus. This forth box posits that, in addition to giving higher priority to the issues outlined in the first three boxes, changes in science, policy, and practice are required if WUE nexus thinking is to become reality.

The chosen structure is beneficial to find entry points to the nexus – this considers that potential entry points will be different according to the individual disciplinary background and areas of interests of the reader. However, this structure does not mean that topics which are assigned to one of the first three boxes are limited to either the WU, WE or the UE dimension. This can be illustrated on the example of livelihood resilience, which is both a WU and a WE topic.

We do not wish to deny the importance of areas not brought in to sharp focus here, like education, energy, and water and consider those part of the WUE nexus.

WU priorities that require more attention

- Resilience of livelihoods in both rural and urban areas under new pressures and tensions created by increasing intensification in both rural and urban systems;
- The impact of trade on wellbeing in both importing and exporting countries, developing and developed countries, and on resilience of livelihoods; assessment and consideration of the presumably increasing impact of this phenomenon as urbanisation, population growth and increasing wealth create more 'space' for trade (Tukker et al. 2014) (including but not limited to food, under consideration of pro-local products initiatives);
- Tools and indicators to measure Disaster Risk Reduction by quantifying potentially reduced exposure and vulnerability to natural and man-made hazards and augmented urban resilience and recovery through hard (e.g. infrastructures) and soft (e.g. early warning systems) measures;
- Appreciation of indigenous knowledge and local culture, and more diversified understanding of processes of adaptation of traditions to new conditions and circumstances (e.g., during rural-to-urban migrations); as one example, sustainable use of natural resources by indigenous communities is important both for learning about traditional institutions that govern sustainable use, but also for recognising the possible need for regulation;
- Urban health issues such as infectious diseases, and the effect of poor geographical knowledge in particular in urban slums.

WE priorities that require more attention

- A diversified understanding of the roles of livelihood-sustaining ecosystem services for different populations, under specific consideration of the ability of vulnerable populations to sustain their livelihoods, health and wellbeing under changing conditions; adaptation to climate change (Tanner et al. 2015) is one example;
- Tools for (and limits to) measuring and monitoring ecosystem services, including those services that are explicitly linked to human health and wellbeing, e.g., the air pollution mitigation services provided by urban vegetation (Nowak et al. 2013);
- Valuation and protection of ecosystem services with critical local functions, such as coastal stabilization by native vegetation (e.g. mangroves), wildlife services such as pollination and pest control, or poverty alleviation effects of specific services for local communities (Delgado et al. 2013); needs for and trade-offs in prioritisation of ecosystem services that are of key importance for humans and all life, such as clean water;
- The role of ecosystems in reducing exposure to natural or human-made hazards and in contributing to post-disasters recovery;
- Better consideration of risks of infectious diseases outbreaks due to human activities in ecosystems, e.g., land use change is a risk factor for EVD in Africa (EFA 2015);
- Appreciation of ecosystem services that are difficult to quantify, such as the potential provision of new drugs or the role of forests for wellbeing (forest health and diversity, both species and vegetation wise, for human wellbeing is so far not well researched [Trumbore et al. 2015; Wingfield et al. 2015]);
- An integrated approach to secure food security, food safety, and health as central themes; knowledge and guidelines need to be constantly adapted to change of diets.

UE priorities that require more attention
• Ecological footprint of urban populations, under specific consideration of differences throughout the world; more transparency on and better consideration of (global) indirect material flows in economy-wide material accounting and derived indicators (e.g., material productivity, decoupling) (Giljum et al. 2014); • Assessing and fostering ecosystem services in urban environments - the science of ecosystem services is still relatively new, and methods to quantify and manage these need further development, which is particularly true for ecosystem services in urban areas (Haase et al. 2014); • New models - or revisiting old ones - of environmental governance and practices of integrated management, e.g., smart watersheds, internet of nature; • Good river basin governance upstream - fostering a culture of interdependence and exchange may facilitate the maintenance of rural livelihoods and securing services of agriculture; • Critical assessment of how the industrial food production system erodes agro-biodiversity, and development of strategies to better reflect the role of agro-biodiversity (Johns & Eyzaguirre 2006; Bharucha & Pretty 2010; Penafiel et al. 2011); • A focus on underutilised food species, especially those linked to indigenous knowledge, and a better understanding of how they can contribute to meeting food demands of urban citizens; • A more diversified understanding on how, and how well, different agricultural sectors can adapt to increasing urbanisation; • The risk that the current explicit focus on urban issues may often lead to marginalising the rural; more emphasis on the urban-rural linkages for fostering sustainability (e.g., 'rural-urban partnerships' [OECD, 2013]).

WUE nexus thinking: key enabling factors that need further progress
• Inter- and transdisciplinarity for more effective interactions with society and practice; as transdisciplinarity requires novel research methods through the co-production of knowledge, creation of an enabling environment within academia and government to foster transdisciplinarity; • Methods to co-produce knowledge and translate it into action for sustainability, in urban settings and other social-ecological systems (e.g., Childers et al 2014; Munoz-Erickson 2014); • More awareness on knowledge gaps due to unbalanced representation of ecosystems (in literature, funding schemes, projects) – e.g., uneven distribution of studies on forests in different continents/ habitats (Schmitz 2015); this calls for more diversity in working groups to overcome bias in research and decision-making, incl. language bias (e.g., results of literature review on forests in different languages differ [Schmitz 2015]); • Gender equality and equity, in all life situations, and particular implications for early career stages; • Development of robust decision-support tools to achieve the SDGs, and minimise conflicts between different SDGs; • Understanding of uncertainties in management tools needed by decision-makers or NGOs to draft policies (Naeem et al. 2015); • New modes of governance, in particular to reflect the various dimensions of ecosystem services; • Local scale action to be tested against sustainability at global scale (acceptance of necessity to do so, and possible approaches); • Integrative approaches across institutions and frameworks to counteract risks of fragmentation in international processes, e.g. more nuanced consideration is needed of the way in which international law and multilateral agreements have been

included within the SDGs;

- Mechanisms that facilitate a multiplicity of approaches to change, ranging from top-down, to bottom-up, to middle-out, rather than concentrating on only one type of approach (Cash et al. 2006); integration of grassroots approaches is a key challenge.