

EWUU research theme: Urban-Rural Circularity (URC)

Version 15 February 2023

Within the alliance EWUU programme Circular Society, we have defined the theme: Urban-Rural Circularity (URC), integrating our earlier research on ‘circular inclusive cities’. A focus on the interface between cities and their surroundings is essential for a successful and rapid transition to a circular society. Systemic circular solutions contribute to the sustainable development of urban-rural areas. This paper clarifies the why, how and what of this theme.

Why? The need for closing urban-rural cycles

To make circular innovations successful, urban and rural interests have to be brought together and have to be integrated. Unfortunately, the urban-rural dependency is often overlooked when trying to develop circular solutions. Instead, new circular solutions are often developed from an urban perspective only. In doing so, rural areas are perceived as providing sources for urban areas, for example food and ecosystem services, and for the disposal of their waste. This means that more systemic, integrative and sustainable circular solutions are not considered. One of the major challenges within the transition to a circular society is to close cycles regionally, connecting cities and rural areas from a systemic perspective of circular (re-)design.

Tension between cities and their surrounding rural areas is increasing. That leads to undesirable standstills in our ways of living, working and well-being. The trend of urbanization irrevocably means that surrounding agricultural activities and/or natural areas will have to change or even give way: growing cities fight with their surroundings for the same space and resources. On the other hand, the ongoing loss of biodiversity calls for more space for nature in rural areas as well as in cities, which is also the objective of the EU draft regulation for nature restoration. These growing conflicts of interest currently lead to administrative paralysis, social resistance and obstruction of systemic sustainable solutions.

Smart circular innovations can promote urban-rural (social) cohesion and the regional economy, while lowering different kinds of emissions. Local reuse of (raw) materials and products avoids emissions from transport, pollution or shortages of raw materials. Integrated urban-rural circular innovations are important pieces of the puzzle for a successful and rapid transition to a sustainable society overcoming urban rural conflicts of interests.

How? The URC approach

With our Urban Rural Circularity (URC) theme, we investigate and develop circular systems at the interface between cities and the surrounding rural areas. By integrating the social, economic and technical system perspectives, we are able to develop innovative circular solutions, such as new circular business models, and can foster behavioral change, in a regional urban-rural context. Solutions that can be used in regional area development plans.

The challenge here is to use the regional context of cities as much as possible in developing and achieving circular solutions. If successful, the regional approach can be scaled up, making our society more resilient in coping with environmental and supply challenges.

Integral and transdisciplinary research

Research on closing cycles at the interface between cities and the surrounding rural areas can only be successful with an integral approach that takes into account planetary boundaries as a precondition, as well as inclusion, equity and social integration. This needs bringing together of researchers from various knowledge disciplines, dealing with technical design, AI & data science, spatial planning, regulation, biological, chemical and physical processes, health and ecology and last-but-not-least, social processes, including insurance of inclusiveness, economics, logistics, and behavior.

Besides an integral approach, this research also requires a trans-disciplinary approach, i.e. interaction with and strong involvement of businesses, citizens, NGOs, and local/regional governments. Only such a systemic and stakeholder-inclusive approach can lead to circular solutions which are socially accepted, safe and sustainable.

The knowledge and skills needed to meet these challenges are widely available within the EWUU Alliance. Moreover, our joint scientific staff has a wide range of relevant methods, which are constantly evolving, and has extensive experience in applying them in various situations, including modelling, data analysis, (integrated) impact assessment, design, serious gaming, living labs, transition approaches and stakeholder engagement. Scientists who are good at inter- and transdisciplinary research work together with experts with great disciplinary depth. In this way, we optimize the chances of impactful solutions and create a breeding ground for new in-depth research with high societal relevance.

Research in practice

URC experts also work closely with societal stakeholders (both profit and non-profit). This takes place in specific geographical areas, in dedicated Living Lab settings where not only local stakeholders but also other relevant stakeholders (such as relevant national or international suppliers) can participate. Such a transdisciplinary way of working is necessary to apply solutions in practice, to try out new designs in pilot and demonstration projects, and to further develop and implement promising results. The already existing connections with several innovation ecosystems in the home regions of the EWUU Alliance (Brainport, De Gelderse Vallei and Utrecht Science Park) and other centres in the Netherlands and internationally will be further developed and used to build a community of knowledge and practise.

Principles

Principles we find relevant for URC research to include are:

- I. Value retention in designing circular strategies for the technological cycle. Here we use the so-called R-ladder for materials, summarized as Refuse – Rethink – Reduce – Reuse (of products and components) – Recycle. For water and organic resources (biological cycle) various hierarchies of measures can be considered including the Resource Harvest Approach – demand minimization, output (waste) minimisation (cascading, recycling), and multi-sourcing (shifting to alternative resources).
- II. Connecting technical and biological cycles.
- III. Adopting a model with a social foundation, to ensure inclusiveness, and an ecological ceiling, to respect planetary boundaries that protect Earth's life-supporting, thus defining the

operating space for the innovative circular solutions (based on interdisciplinary scientific collaboration).

Cooperation with the Global South

As a densely populated but highly intensive agricultural country, the Netherlands can be seen as a vibrant living lab for promising urban-rural circular solutions worldwide. For the EWUU alliance there are relevant connections with the Global South on this theme. This provides opportunities to learn from local (low-tech) solutions elsewhere that are often overlooked in our Western (high-tech) environment. At the same time, we can support international partners in making the leap to sustainability and circularity rather than investing in linear economy approaches.ⁱ Also, a loss of capacity in human talents can be mitigated.

What? Four circular challenges

The innovative aim of the URC is to develop and demonstrate new Socio-Technical Innovation approaches for circularity at the rural-urban interface, based on above three principles, combining generic knowledge and skills with local expertise. By doing so, we explore how systemic circular solutions can contribute to the sustainable development of urban-rural areas.

The following four circular challenges in urban-rural zones will be addressed within URC:

1. Connecting humans and nature in circular – nature based – solutions

Collaboration between various groups of people in urban and rural social communities is essential to creating effective and durable circular systems. Research is needed on how social inequality between urban and rural communities affects the transition to circular solutions, and how urban-rural cohesion can be re-established as part of such a transition. Psychological, behavioral and participatory research and inclusive futuring methods, among other disciplines in technical and system design, can contribute to this theme.

The social, environmental and cost benefits of circular waste-to-resource systems are often clear. However, their widespread implementation is often hampered by existing economic partnerships, governance models and demand-supply infrastructures. Those barriers may be resolved by forming new communities or attaching to existing (circular) rural-urban communities, in line with the idea of ‘commons’.

In developing urban-rural circular solutions, the use of nature based solutions (NBS) is an important area of attention. Until now, the emphasis has been on particular singular NBS and their uptake in rural, urban or coastal landscapes, as distinct silos. URC aims to support the development of NBS in interconnected urban-rural naturescapes³, to harvest the full transformative potential of NBS in regional developments.

2. Regional circular services

Alignment, as well as frictions between “the urban” and “the rural” can inspire radical circular solutions in the search for the highest value retention strategies (R strategies, Harvest Approaches). New narratives, coalitions and circular business models can emerge, such as the extension of circular (nowadays only urban) mobility solutions into rural areas by combining car sharing with autonomous driving.

3. *Closing nutrients and water cycles*

The global nutrient crisis resulted from non-cyclic use of phosphorous, nitrogen, sulphur, potassium and micronutrients (Zn, Se, ..) in the agri-food, industrial and urban processes. It leads to ecological damage, loss in agricultural productivity endangering food security, and lock-ins into regional depletion and accumulation schemes. The city of Amsterdam, for instance, has a nutrient surplus which cannot be fully deployed for city farming initiatives and may be offered to regional farming initiatives. Also transforming urban food waste on a high hierarchy level to food (urban) and feed (rural) instead of processing it to energy and nutrients (lowest hierarchy) could be an example. Systemic solutions must be developed to reconnect (urban) consumption via residual recirculation to (rural) agricultural production.

Balancing water systems and enhancing water circularity between cities and their nearby areas are needed to appropriately address climate mitigation and adaptation, resilience to floods and droughts, restoring and maintaining connected biodiverse landscapes with valuable soil and water resources, and preserving ecological as well as human health. Recovering clean fresh water and mining nutrients from waste water for reuse is part of such circular water system designs. Here we build on existing collaborations for instance the AquaConnect NWO TTW Perspectief program lead by WUR.

4. *Circular materials and energy*

Closing regional loops, especially for building materials, is needed to avoid depletion of scarce materials. The circularity of construction waste from the urban environment can be improved by connecting it to landscaping and infrastructure (roads, locks, levis, etc.) in peri-urban areas, for example. In addition: urban mining on the one hand, and (rural) bio-based production on the other can offer a meaningful interaction. However, many recycling and alternative production activities cause higher energy usage. This means that the interaction between materials and energy is an important one to assess. An NWA proposal was granted on circular and emission free renovation (PACER) under lead of TU/e.ⁱⁱ

ⁱ The Horizon Europe NATURESCAPE project, for example, seeks to prevent such pitfalls and aims at developing circular, nature based solutions together with partners from different areas of the Global South. Developed by an international consortium, led by UU.

ⁱⁱ Collaborative, Digitized and Integral Processes to Achieve Circular and Emission-Free Renovation (PACER) is joint project, granted by NWA, and led by Lianne Havinga (TU/e, Building Performance, EIRES), in collaboration with, amongst others, UU (Geo and Law), and with stakeholders as (co-financing) partners of all parts of the renovation chain.